

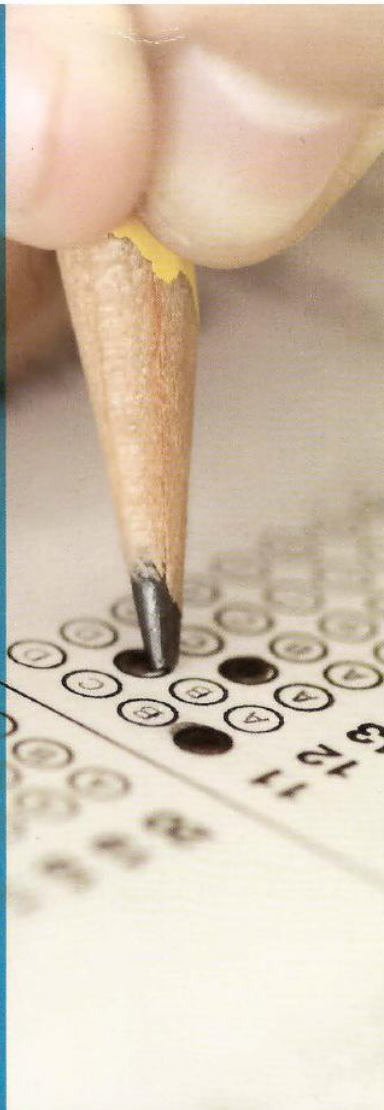
CollegeBoard

SAT®

# The Official SAT Study Guide™

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2018 EDITION



Includes:

**8** Real  
SATs

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**The Official**  
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**Study Guide**<sup>™</sup>  

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THE COLLEGE BOARD, NEW YORK

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Dear Student:

Congratulations on taking an important step toward preparing for the redesigned SAT®. *The Official SAT Study Guide™* is a tool to help you practice for the newest version of the exam. By investing in SAT practice, you are making a commitment to your college, career, and life success.


As you start to familiarize yourself with the new exam, we are excited to share with you some of the many benefits it has to offer. It is important to remember that the questions that make up the exam are modeled on the work you are already doing in school. You will recognize topics and ideas from your math, English language arts, science, history, and social studies classes. These questions are also aligned with the skills that research says matter most for college and career readiness. This means that, by practicing for the redesigned SAT, you are reinforcing the knowledge and skills that will help you excel both in your course work and in your future pursuits.

The new SAT is clearer than ever. The questions will not be tricky, nor will there be any obscure vocabulary or penalties for guessing. By being transparent about what is on the test and making materials easily available, we are providing you the foundation for successful practice. The best source of information about the SAT is found right here in the pages of this book, and you have taken an important step by equipping yourself with these key facts.

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Keep up the good work.



Cynthia B. Schmeiser  
Chief of Assessment  
The College Board

Dear Student:

I took the SAT more than 20 years ago. But even back in the prehistoric times of the early '90s, an earlier version of this book played a big role in helping me prepare not just for the SAT, but for life. For several weeks, I would wake up early on Saturday mornings, do push-ups while blasting "Eye of the Tiger," take a practice test, and review the items I found difficult. Eventually, I worked through every test in the book. By the time test day came around, I found I was just as prepared as anyone to put my best foot forward for the SAT. I also showed myself that I could develop a plan and stick to it to reach a goal, and that skill has proven essential ever since.

But you have much more than even I had at your disposal.

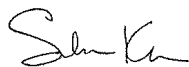
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So take a breath. Force a smile. Strike a power pose (look that up on YouTube if you don't know what a "power pose" is). Realize that your brain is like a muscle: The more you practice and get feedback, the stronger it gets. Realize that when you get a question wrong in practice, that is when your brain actually grows and strengthens. Realize that the SAT is just a measure of college readiness, and the best way to get college ready is to really hone your language and math abilities through deliberate practice. No matter how long you have until the exam, realize that you have the power to create a study plan for yourself and stick to it. This isn't about SAT prep, but life prep. And of course, the more practice, the better; so if you can, start regularly practicing with this book and the resources on Khan Academy weeks or months before the exam.

I envy you. You're at the most exciting stage of your life. Embrace the challenge. Enjoy the process. As you prepare, remember that you can arm yourself now with tools and habits that will help you be the best version of yourself, not just on the SAT but throughout your life.

And don't forget to smile!

Onward,



Sal Khan  
Founder, Khan Academy  


PART 4

**Eight Official  
Practice Tests  
with Answer  
Explanations**

# Introduction

## Time to Practice

The remainder of this book is composed of eight full SAT practice tests. Each practice test is followed by an answer sheet and answer explanations. These practice tests and explanations were written by the College Board's Assessment Design and Development team using the same processes and review standards used when writing the actual SAT. Everything from the layout of the page to the construction of the questions accurately reflects what you'll see on test day.

The practice tests will provide the most valuable insight into your performance on the actual SAT when completed in a single sitting. As such, we urge you not to leaf through these tests for question practice, but instead to take them under conditions similar to those of a real test. If you are looking for additional questions, you can find them in the Practice section of [sat.org](http://sat.org)

## Tips for Taking the Practice Tests

You'll get the most out of the practice tests if you take them under conditions that are as close as possible to those of the real test:

- Leave yourself 3 hours to complete each sample test and an additional 50 minutes to complete the SAT Essay.
- Sit at a desk or table cleared of any other papers or books. Items such as dictionaries, books, or notes won't be allowed when you take the actual SAT.
- For the math questions that allow calculators, use the calculator that you plan to use on test day.
- Set a timer or use a watch or clock to time yourself on each section.
- Tear out or make a copy of the practice test answer sheet located immediately after each practice test and fill it in just as you will on the day of the actual test.

## How to Score Your Practice Tests

For more information on how to score your practice tests, go to [sat.org/scoring](https://sat.org/scoring). As you learned earlier, your SAT results will include a number of scores that provide additional information about your achievement and readiness for college and career. The College Board has also produced a free app that will allow you to immediately score your answer sheet by taking a picture of it. This app will take much of the manual labor out of scoring a paper-and-pencil test, and we hope it will encourage you to engage in productive practice. You can find more information on the app as well as how to score your tests without the app at [sat.org/scoring](https://sat.org/scoring).

## Connection to Khan Academy

Through the College Board practice app, you'll be able to automatically score your practice tests and send those results to Khan Academy to power your personalized practice. Then, when you log on to its website ([khanacademy.org/sat](https://khanacademy.org/sat)), Khan Academy will recommend specific lessons and resources to target the skills that will most improve your score on the SAT. Since the SAT is a measure of college and career readiness, this practice will also better prepare you for success beyond the SAT.



# The SAT<sup>®</sup>

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# Practice Test #1

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**Make time to take the practice test.**  
It's one of the best ways to get ready  
for the SAT.

After you've taken the practice test, score it  
right away at [sat.org/scoring](https://sat.org/scoring).



# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is from Lydia Minatoya, *The Strangeness of Beauty*. ©1999 by Lydia Minatoya. The setting is Japan in 1920. Chie and her daughter Naomi are members of the House of Fuji, a noble family.

Akira came directly, breaking all tradition. Was that it? Had he followed form—had he asked his mother to speak to his father to approach a

Line go-between—would Chie have been more receptive?

5 He came on a winter's eve. He pounded on the door while a cold rain beat on the shuttered veranda, so at first Chie thought him only the wind. The maid knew better. Chie heard her soft scuttling footsteps, the creak of the door. Then the maid brought a  
10 calling card to the drawing room, for Chie.

Chie was reluctant to go to her guest; perhaps she was feeling too cozy. She and Naomi were reading at a low table set atop a charcoal brazier. A thick quilt spread over the sides of the table so their legs were  
15 tucked inside with the heat.

"Who is it at this hour, in this weather?" Chie questioned as she picked the name card off the maid's lacquer tray.

"Shinoda, Akira. Kobe Dental College," she read.

20 Naomi recognized the name. Chie heard a soft intake of air.

"I think you should go," said Naomi.

Akira was waiting in the entry. He was in his early twenties, slim and serious, wearing the black  
25 military-style uniform of a student. As he bowed—his hands hanging straight down, a black cap in one, a yellow oil-paper umbrella in the other—Chie glanced beyond him. In the glistening surface of the courtyard's rain-drenched paving  
30 stones, she saw his reflection like a dark double.

"Madame," said Akira, "forgive my disruption, but I come with a matter of urgency."

His voice was soft, refined. He straightened and stole a deferential peek at her face.

35 In the dim light his eyes shone with sincerity. Chie felt herself starting to like him.

"Come inside, get out of this nasty night. Surely your business can wait for a moment or two."

40 "I don't want to trouble you. Normally I would approach you more properly but I've received word of a position. I've an opportunity to go to America, as dentist for Seattle's Japanese community."

"Congratulations," Chie said with amusement.

45 "That is an opportunity, I'm sure. But how am I involved?"

Even noting Naomi's breathless reaction to the name card, Chie had no idea. Akira's message, delivered like a formal speech, filled her with maternal amusement. You know how children speak  
50 so earnestly, so hurriedly, so endearingly about things that have no importance in an adult's mind? That's how she viewed him, as a child.

It was how she viewed Naomi. Even though Naomi was eighteen and training endlessly in the arts  
55 needed to make a good marriage, Chie had made no effort to find her a husband.

Akira blushed.

“Depending on your response, I may stay in Japan. I’ve come to ask for Naomi’s hand.”

60 Suddenly Chie felt the dampness of the night.

“Does Naomi know anything of your . . . ambitions?”

“We have an understanding. Please don’t judge my candidacy by the unseemliness of this proposal. I  
65 ask directly because the use of a go-between takes much time. Either method comes down to the same thing: a matter of parental approval. If you give your consent, I become Naomi’s yoshi.\* We’ll live in the House of Fuji. Without your consent, I must go to  
70 America, to secure a new home for my bride.”

Eager to make his point, he’d been looking her full in the face. Abruptly, his voice turned gentle. “I see I’ve startled you. My humble apologies. I’ll take no more of your evening. My address is on my card. If  
75 you don’t wish to contact me, I’ll reapproach you in two weeks’ time. Until then, good night.”

He bowed and left. Taking her ease, with effortless grace, like a cat making off with a fish.

80 “Mother?” Chie heard Naomi’s low voice and turned from the door. “He has asked you?”

The sight of Naomi’s clear eyes, her dark brows gave Chie strength. Maybe his hopes were preposterous.

85 “Where did you meet such a fellow? Imagine! He thinks he can marry the Fuji heir and take her to America all in the snap of his fingers!”

Chie waited for Naomi’s ripe laughter.

Naomi was silent. She stood a full half minute looking straight into Chie’s eyes. Finally, she spoke.  
90 “I met him at my literary meeting.”

Naomi turned to go back into the house, then stopped.

“Mother.”

“Yes?”

95 “I mean to have him.”

\* a man who marries a woman of higher status and takes her family’s name

1

Which choice best describes what happens in the passage?

- A) One character argues with another character who intrudes on her home.
- B) One character receives a surprising request from another character.
- C) One character reminisces about choices she has made over the years.
- D) One character criticizes another character for pursuing an unexpected course of action.

2

Which choice best describes the developmental pattern of the passage?

- A) A careful analysis of a traditional practice
- B) A detailed depiction of a meaningful encounter
- C) A definitive response to a series of questions
- D) A cheerful recounting of an amusing anecdote

3

As used in line 1 and line 65, “directly” most nearly means

- A) frankly.
- B) confidently.
- C) without mediation.
- D) with precision.

4

Which reaction does Akira most fear from Chie?

- A) She will consider his proposal inappropriate.
- B) She will mistake his earnestness for immaturity.
- C) She will consider his unscheduled visit an imposition.
- D) She will underestimate the sincerity of his emotions.

5

Which choice provides the best evidence for the answer to the previous question?

- A) Line 33 (“His voice . . . refined”)
- B) Lines 49-51 (“You . . . mind”)
- C) Lines 63-64 (“Please . . . proposal”)
- D) Lines 71-72 (“Eager . . . face”)

6

In the passage, Akira addresses Chie with

- A) affection but not genuine love.
- B) objectivity but not complete impartiality.
- C) amusement but not mocking disparagement.
- D) respect but not utter deference.

7

The main purpose of the first paragraph is to

- A) describe a culture.
- B) criticize a tradition.
- C) question a suggestion.
- D) analyze a reaction.

8

As used in line 2, “form” most nearly means

- A) appearance.
- B) custom.
- C) structure.
- D) nature.

9

Why does Akira say his meeting with Chie is “a matter of urgency” (line 32)?

- A) He fears that his own parents will disapprove of Naomi.
- B) He worries that Naomi will reject him and marry someone else.
- C) He has been offered an attractive job in another country.
- D) He knows that Chie is unaware of his feelings for Naomi.

10

Which choice provides the best evidence for the answer to the previous question?

- A) Line 39 (“I don’t . . . you”)
- B) Lines 39-42 (“Normally . . . community”)
- C) Lines 58-59 (“Depending . . . Japan”)
- D) Lines 72-73 (“I see . . . you”)

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from Francis J. Flynn and Gabrielle S. Adams, "Money Can't Buy Love: Asymmetric Beliefs about Gift Price and Feelings of Appreciation." ©2008 by Elsevier Inc.

Every day, millions of shoppers hit the stores in full force—both online and on foot—searching frantically for the perfect gift. Last year, Americans spent over \$30 billion at retail stores in the month of December alone. Aside from purchasing holiday gifts, most people regularly buy presents for other occasions throughout the year, including weddings, birthdays, anniversaries, graduations, and baby showers. This frequent experience of gift-giving can engender ambivalent feelings in gift-givers. Many relish the opportunity to buy presents because gift-giving offers a powerful means to build stronger bonds with one's closest peers. At the same time, many dread the thought of buying gifts; they worry that their purchases will disappoint rather than delight the intended recipients.

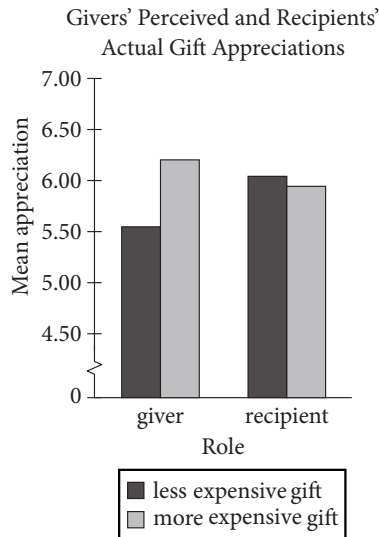
Anthropologists describe gift-giving as a positive social process, serving various political, religious, and psychological functions. Economists, however, offer a less favorable view. According to Waldfogel (1993), gift-giving represents an objective waste of resources. People buy gifts that recipients would not choose to buy on their own, or at least not spend as much money to purchase (a phenomenon referred to as "the deadweight loss of Christmas"). To wit, givers are likely to spend \$100 to purchase a gift that receivers would spend only \$80 to buy themselves. This "deadweight loss" suggests that gift-givers are not very good at predicting what gifts others will appreciate. That in itself is not surprising to social psychologists. Research has found that people often struggle to take account of others' perspectives—their insights are subject to egocentrism, social projection, and multiple attribution errors.

What is surprising is that gift-givers have considerable experience acting as both gift-givers and gift-recipients, but nevertheless tend to overspend each time they set out to purchase a meaningful gift. In the present research, we propose a unique psychological explanation for this overspending problem—i.e., that gift-givers equate how much they

spend with how much recipients will appreciate the gift (the more expensive the gift, the stronger a gift-recipient's feelings of appreciation). Although a link between gift price and feelings of appreciation might seem intuitive to gift-givers, such an assumption may be unfounded. Indeed, we propose that gift-recipients will be less inclined to base their feelings of appreciation on the magnitude of a gift than givers assume.

Why do gift-givers assume that gift price is closely linked to gift-recipients' feelings of appreciation? Perhaps givers believe that bigger (i.e., more expensive) gifts convey stronger signals of thoughtfulness and consideration. According to Camerer (1988) and others, gift-giving represents a symbolic ritual, whereby gift-givers attempt to signal their positive attitudes toward the intended recipient and their willingness to invest resources in a future relationship. In this sense, gift-givers may be motivated to spend more money on a gift in order to send a "stronger signal" to their intended recipient. As for gift-recipients, they may not construe smaller and larger gifts as representing smaller and larger signals of thoughtfulness and consideration.

The notion of gift-givers and gift-recipients being unable to account for the other party's perspective seems puzzling because people slip in and out of these roles every day, and, in some cases, multiple times in the course of the same day. Yet, despite the extensive experience that people have as both givers and receivers, they often struggle to transfer information gained from one role (e.g., as a giver) and apply it in another, complementary role (e.g., as a receiver). In theoretical terms, people fail to utilize information about their own preferences and experiences in order to produce more efficient outcomes in their exchange relations. In practical terms, people spend hundreds of dollars each year on gifts, but somehow never learn to calibrate their gift expenditures according to personal insight.



11

- The authors most likely use the examples in lines 1-9 of the passage (“Every . . . showers”) to highlight the
- A) regularity with which people shop for gifts.
  - B) recent increase in the amount of money spent on gifts.
  - C) anxiety gift shopping causes for consumers.
  - D) number of special occasions involving gift-giving.

12

- In line 10, the word “ambivalent” most nearly means
- A) unrealistic.
  - B) conflicted.
  - C) apprehensive.
  - D) supportive.

13

- The authors indicate that people value gift-giving because they feel it
- A) functions as a form of self-expression.
  - B) is an inexpensive way to show appreciation.
  - C) requires the gift-recipient to reciprocate.
  - D) can serve to strengthen a relationship.

14

- Which choice provides the best evidence for the answer to the previous question?
- A) Lines 10-13 (“Many . . . peers”)
  - B) Lines 22-23 (“People . . . own”)
  - C) Lines 31-32 (“Research . . . perspectives”)
  - D) Lines 44-47 (“Although . . . unfounded”)

15

- The “social psychologists” mentioned in paragraph 2 (lines 17-34) would likely describe the “deadweight loss” phenomenon as
- A) predictable.
  - B) questionable.
  - C) disturbing.
  - D) unprecedented.

16

- The passage indicates that the assumption made by gift-givers in lines 41-44 may be
- A) insincere.
  - B) unreasonable.
  - C) incorrect.
  - D) substantiated.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 53-55 (“Perhaps . . . consideration”)
- B) Lines 55-60 (“According . . . relationship”)
- C) Lines 63-65 (“As . . . consideration”)
- D) Lines 75-78 (“In . . . relations”)

18

As it is used in line 54, “convey” most nearly means

- A) transport.
- B) counteract.
- C) exchange.
- D) communicate.

19

The authors refer to work by Camerer and others (line 56) in order to

- A) offer an explanation.
- B) introduce an argument.
- C) question a motive.
- D) support a conclusion.

20

The graph following the passage offers evidence that gift-givers base their predictions of how much a gift will be appreciated on

- A) the appreciation level of the gift-recipients.
- B) the monetary value of the gift.
- C) their own desires for the gifts they purchase.
- D) their relationship with the gift-recipients.

21

The authors would likely attribute the differences in gift-giver and recipient mean appreciation as represented in the graph to

- A) an inability to shift perspective.
- B) an increasingly materialistic culture.
- C) a growing opposition to gift-giving.
- D) a misunderstanding of intentions.

**Questions 22-31 are based on the following passage and supplementary material.**

This passage is adapted from J. D. Watson and F. H. C. Crick, "Genetical Implications of the Structure of Deoxyribonucleic Acid." ©1953 by Nature Publishing Group. Watson and Crick deduced the structure of DNA using evidence from Rosalind Franklin and R. G. Gosling's X-ray crystallography diagrams of DNA and from Erwin Chargaff's data on the base composition of DNA.

The chemical formula of deoxyribonucleic acid (DNA) is now well established. The molecule is a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups.

To each sugar is attached a nitrogenous base, which can be of four different types. Two of the possible bases—adenine and guanine—are purines, and the other two—thymine and cytosine—are pyrimidines. So far as is known, the sequence of bases along the chain is irregular. The monomer unit, consisting of phosphate, sugar and base, is known as a nucleotide.

The first feature of our structure which is of biological interest is that it consists not of one chain, but of two. These two chains are both coiled around a common fiber axis. It has often been assumed that since there was only one chain in the chemical formula there would only be one in the structural unit. However, the density, taken with the X-ray evidence, suggests very strongly that there are two.

The other biologically important feature is the manner in which the two chains are held together. This is done by hydrogen bonds between the bases. The bases are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other. The important point is that only certain pairs of bases will fit into the structure. One member of a pair must be a purine and the other a pyrimidine in order to bridge between the two chains. If a pair consisted of two purines, for example, there would not be room for it.

We believe that the bases will be present almost entirely in their most probable forms. If this is true, the conditions for forming hydrogen bonds are more restrictive, and the only pairs of bases possible are: adenine with thymine, and guanine with cytosine. Adenine, for example, can occur on either chain; but when it does, its partner on the other chain must always be thymine.

The phosphate-sugar backbone of our model is completely regular, but any sequence of the pairs of bases can fit into the structure. It follows that in a

long molecule many different permutations are possible, and it therefore seems likely that the precise sequence of bases is the code which carries the 45  
genetical information. If the actual order of the bases on one of the pair of chains were given, one could write down the exact order of the bases on the other one, because of the specific pairing. Thus one chain is, as it were, the complement of the other, and it is 50  
this feature which suggests how the deoxyribonucleic acid molecule might duplicate itself.

The table shows, for various organisms, the percentage of each of the four types of nitrogenous bases in that organism's DNA.

Organism	Percentage of base in organism's DNA			
	adenine (%)	guanine (%)	cytosine (%)	thymine (%)
Maize	26.8	22.8	23.2	27.2
Octopus	33.2	17.6	17.6	31.6
Chicken	28.0	22.0	21.6	28.4
Rat	28.6	21.4	20.5	28.4
Human	29.3	20.7	20.0	30.0
Grasshopper	29.3	20.5	20.7	29.3
Sea urchin	32.8	17.7	17.3	32.1
Wheat	27.3	22.7	22.8	27.1
Yeast	31.3	18.7	17.1	32.9
<i>E. coli</i>	24.7	26.0	25.7	23.6

Adapted from Manju Bansal, "DNA Structure: Revisiting the Watson-Crick Double Helix." ©2003 by Current Science Association, Bangalore.



22

The authors use the word “backbone” in lines 3 and 39 to indicate that

- A) only very long chains of DNA can be taken from an organism with a spinal column.
- B) the main structure of a chain in a DNA molecule is composed of repeating units.
- C) a chain in a DNA molecule consists entirely of phosphate groups or of sugars.
- D) nitrogenous bases form the main structural unit of DNA.

23

A student claims that nitrogenous bases pair randomly with one another. Which of the following statements in the passage contradicts the student’s claim?

- A) Lines 5-6 (“To each . . . types”)
- B) Lines 9-10 (“So far . . . irregular”)
- C) Lines 23-25 (“The bases . . . other”)
- D) Lines 27-29 (“One member . . . chains”)

24

In the second paragraph (lines 12-19), what do the authors claim to be a feature of biological interest?

- A) The chemical formula of DNA
- B) The common fiber axis
- C) The X-ray evidence
- D) DNA consisting of two chains

25

The authors’ main purpose of including the information about X-ray evidence and density is to

- A) establish that DNA is the molecule that carries the genetic information.
- B) present an alternate hypothesis about the composition of a nucleotide.
- C) provide support for the authors’ claim about the number of chains in a molecule of DNA.
- D) confirm the relationship between the density of DNA and the known chemical formula of DNA.

26

Based on the passage, the authors’ statement “If a pair consisted of two purines, for example, there would not be room for it” (lines 29-30) implies that a pair

- A) of purines would be larger than the space between a sugar and a phosphate group.
- B) of purines would be larger than a pair consisting of a purine and a pyrimidine.
- C) of pyrimidines would be larger than a pair of purines.
- D) consisting of a purine and a pyrimidine would be larger than a pair of pyrimidines.

27

The authors’ use of the words “exact,” “specific,” and “complement” in lines 47-49 in the final paragraph functions mainly to

- A) confirm that the nucleotide sequences are known for most molecules of DNA.
- B) counter the claim that the sequences of bases along a chain can occur in any order.
- C) support the claim that the phosphate-sugar backbone of the authors’ model is completely regular.
- D) emphasize how one chain of DNA may serve as a template to be copied during DNA replication.

28

Based on the table and passage, which choice gives the correct percentages of the purines in yeast DNA?

- A) 17.1% and 18.7%
- B) 17.1% and 32.9%
- C) 18.7% and 31.3%
- D) 31.3% and 32.9%

29

Do the data in the table support the authors' proposed pairing of bases in DNA?

- A) Yes, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- B) Yes, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.
- C) No, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- D) No, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.

30

According to the table, which of the following pairs of base percentages in sea urchin DNA provides evidence in support of the answer to the previous question?

- A) 17.3% and 17.7%
- B) 17.3% and 32.1%
- C) 17.3% and 32.8%
- D) 17.7% and 32.8%

31

Based on the table, is the percentage of adenine in each organism's DNA the same or does it vary, and which statement made by the authors is most consistent with that data?

- A) The same; "Two of . . . pyrimidines" (lines 6-8)
- B) The same; "The important . . . structure" (lines 25-26)
- C) It varies; "Adenine . . . thymine" (lines 36-38)
- D) It varies; "It follows . . . information" (lines 41-45)

**Questions 32-41 are based on the following passage.**

This passage is adapted from Virginia Woolf, *Three Guineas*. ©1938 by Harcourt, Inc. Here, Woolf considers the situation of women in English society.

Close at hand is a bridge over the River Thames, an admirable vantage ground for us to make a survey. The river flows beneath; barges pass, laden  
 Line with timber, bursting with corn; there on one side are  
 5 the domes and spires of the city; on the other, Westminster and the Houses of Parliament. It is a place to stand on by the hour, dreaming. But not now. Now we are pressed for time. Now we are here to consider facts; now we must fix our eyes upon the  
 10 procession—the procession of the sons of educated men.

There they go, our brothers who have been educated at public schools and universities, mounting those steps, passing in and out of those  
 15 doors, ascending those pulpits, preaching, teaching, administering justice, practising medicine, transacting business, making money. It is a solemn sight always—a procession, like a caravanserai crossing a desert. . . . But now, for the past twenty  
 20 years or so, it is no longer a sight merely, a photograph, or fresco scrawled upon the walls of time, at which we can look with merely an esthetic appreciation. For there, trapesing along at the tail end of the procession, we go ourselves. And that  
 25 makes a difference. We who have looked so long at the pageant in books, or from a curtained window watched educated men leaving the house at about nine-thirty to go to an office, returning to the house at about six-thirty from an office, need look passively  
 30 no longer. We too can leave the house, can mount those steps, pass in and out of those doors, . . . make money, administer justice. . . . We who now agitate these humble pens may in another century or two speak from a pulpit. Nobody will dare contradict us  
 35 then; we shall be the mouthpieces of the divine spirit—a solemn thought, is it not? Who can say whether, as time goes on, we may not dress in military uniform, with gold lace on our breasts, swords at our sides, and something like the old  
 40 family coal-scuttle on our heads, save that that venerable object was never decorated with plumes of white horsehair. You laugh—indeed the shadow of the private house still makes those dresses look a little queer. We have worn private clothes so  
 45 long. . . . But we have not come here to laugh, or to

talk of fashions—men’s and women’s. We are here, on the bridge, to ask ourselves certain questions. And they are very important questions; and we have very little time in which to answer them. The  
 50 questions that we have to ask and to answer about that procession during this moment of transition are so important that they may well change the lives of all men and women for ever. For we have to ask ourselves, here and now, do we wish to join that  
 55 procession, or don’t we? On what terms shall we join that procession? Above all, where is it leading us, the procession of educated men? The moment is short; it may last five years; ten years, or perhaps only a matter of a few months longer. . . . But, you will  
 60 object, you have no time to think; you have your battles to fight, your rent to pay, your bazaars to organize. That excuse shall not serve you, Madam. As you know from your own experience, and there are facts that prove it, the daughters of educated men  
 65 have always done their thinking from hand to mouth; not under green lamps at study tables in the cloisters of secluded colleges. They have thought while they stirred the pot, while they rocked the cradle. It was thus that they won us the right to our  
 70 brand-new sixpence. It falls to us now to go on thinking; how are we to spend that sixpence? Think we must. Let us think in offices; in omnibuses; while we are standing in the crowd watching Coronations and Lord Mayor’s Shows; let us think . . . in the  
 75 gallery of the House of Commons; in the Law Courts; let us think at baptisms and marriages and funerals. Let us never cease from thinking—what is this “civilization” in which we find ourselves? What are these ceremonies and why should we take part in  
 80 them? What are these professions and why should we make money out of them? Where in short is it leading us, the procession of the sons of educated men?

32

The main purpose of the passage is to

- A) emphasize the value of a tradition.
- B) stress the urgency of an issue.
- C) highlight the severity of social divisions.
- D) question the feasibility of an undertaking.

33

The central claim of the passage is that

- A) educated women face a decision about how to engage with existing institutions.
- B) women can have positions of influence in English society only if they give up some of their traditional roles.
- C) the male monopoly on power in English society has had grave and continuing effects.
- D) the entry of educated women into positions of power traditionally held by men will transform those positions.

34

Woolf uses the word “we” throughout the passage mainly to

- A) reflect the growing friendliness among a group of people.
- B) advance the need for candor among a group of people.
- C) establish a sense of solidarity among a group of people.
- D) reinforce the need for respect among a group of people.

35

According to the passage, Woolf chooses the setting of the bridge because it

- A) is conducive to a mood of fanciful reflection.
- B) provides a good view of the procession of the sons of educated men.
- C) is within sight of historic episodes to which she alludes.
- D) is symbolic of the legacy of past and present sons of educated men.

36

Woolf indicates that the procession she describes in the passage

- A) has come to have more practical influence in recent years.
- B) has become a celebrated feature of English public life.
- C) includes all of the richest and most powerful men in England.
- D) has become less exclusionary in its membership in recent years.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 12-17 (“There . . . money”)
- B) Lines 17-19 (“It . . . desert”)
- C) Lines 23-24 (“For . . . ourselves”)
- D) Lines 30-34 (“We . . . pulpit”)

38

Woolf characterizes the questions in lines 53-57 (“For we . . . men”) as both

- A) controversial and threatening.
- B) weighty and unanswerable.
- C) momentous and pressing.
- D) provocative and mysterious.

39

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 46-47 (“We . . . questions”)
- B) Lines 48-49 (“And . . . them”)
- C) Line 57 (“The moment . . . short”)
- D) Line 62 (“That . . . Madam”)

40

Which choice most closely captures the meaning of the figurative “sixpence” referred to in lines 70 and 71?

- A) Tolerance
- B) Knowledge
- C) Opportunity
- D) Perspective

41

The range of places and occasions listed in lines 72-76 (“Let us . . . funerals”) mainly serves to emphasize how

- A) novel the challenge faced by women is.
- B) pervasive the need for critical reflection is.
- C) complex the political and social issues of the day are.
- D) enjoyable the career possibilities for women are.

**Questions 42-52 are based on the following passages.**

Passage 1 is adapted from Michael Slezak, "Space Mining: the Next Gold Rush?" ©2013 by New Scientist. Passage 2 is from the editors of *New Scientist*, "Taming the Final Frontier." ©2013 by New Scientist.

**Passage 1**

Follow the money and you will end up in space. That's the message from a first-of-its-kind forum on mining beyond Earth.

Line Convened in Sydney by the Australian Centre for  
5 Space Engineering Research, the event brought together mining companies, robotics experts, lunar scientists, and government agencies that are all working to make space mining a reality.

The forum comes hot on the heels of the  
10 2012 unveiling of two private asteroid-mining firms. Planetary Resources of Washington says it will launch its first prospecting telescopes in two years, while Deep Space Industries of Virginia hopes to be harvesting metals from asteroids by 2020. Another  
15 commercial venture that sprung up in 2012, Golden Spike of Colorado, will be offering trips to the moon, including to potential lunar miners.

Within a few decades, these firms may be meeting earthly demands for precious metals, such as  
20 platinum and gold, and the rare earth elements vital for personal electronics, such as yttrium and lanthanum. But like the gold rush pioneers who transformed the western United States, the first space miners won't just enrich themselves. They also hope  
25 to build an off-planet economy free of any bonds with Earth, in which the materials extracted and processed from the moon and asteroids are delivered for space-based projects.

In this scenario, water mined from other  
30 worlds could become the most desired commodity. "In the desert, what's worth more: a kilogram of gold or a kilogram of water?" asks Kris Zacny of HoneyBee Robotics in New York. "Gold is useless. Water will let you live."

35 Water ice from the moon's poles could be sent to astronauts on the International Space Station for drinking or as a radiation shield. Splitting water into oxygen and hydrogen makes spacecraft fuel, so ice-rich asteroids could become interplanetary  
40 refuelling stations.

Companies are eyeing the iron, silicon, and aluminium in lunar soil and asteroids, which could be used in 3D printers to make spare parts or machinery. Others want to turn space dirt into  
45 concrete for landing pads, shelters, and roads.

**Passage 2**

The motivation for deep-space travel is shifting from discovery to economics. The past year has seen a flurry of proposals aimed at bringing celestial riches down to Earth. No doubt this will make a few  
50 billionaires even wealthier, but we all stand to gain: the mineral bounty and spin-off technologies could enrich us all.

But before the miners start firing up their rockets, we should pause for thought. At first glance, space  
55 mining seems to sidestep most environmental concerns: there is (probably!) no life on asteroids, and thus no habitats to trash. But its consequences—both here on Earth and in space—merit careful consideration.

60 Part of this is about principles. Some will argue that space's "magnificent desolation" is not ours to despoil, just as they argue that our own planet's poles should remain pristine. Others will suggest that glutting ourselves on space's riches is not an  
65 acceptable alternative to developing more sustainable ways of earthly life.

History suggests that those will be hard lines to hold, and it may be difficult to persuade the public that such barren environments are worth preserving.  
70 After all, they exist in vast abundance, and even fewer people will experience them than have walked through Antarctica's icy landscapes.

There's also the emerging off-world economy to consider. The resources that are valuable in orbit and  
75 beyond may be very different to those we prize on Earth. Questions of their stewardship have barely been broached—and the relevant legal and regulatory framework is fragmentary, to put it mildly.

Space miners, like their earthly counterparts, are  
80 often reluctant to engage with such questions. One speaker at last week's space-mining forum in Sydney, Australia, concluded with a plea that regulation should be avoided. But miners have much to gain from a broad agreement on the for-profit  
85 exploitation of space. Without consensus, claims will be disputed, investments risky, and the gains made insecure. It is in all of our long-term interests to seek one out.

42

In lines 9-17, the author of Passage 1 mentions several companies primarily to

- A) note the technological advances that make space mining possible.
- B) provide evidence of the growing interest in space mining.
- C) emphasize the large profits to be made from space mining.
- D) highlight the diverse ways to carry out space mining operations.

43

The author of Passage 1 indicates that space mining could have which positive effect?

- A) It could yield materials important to Earth's economy.
- B) It could raise the value of some precious metals on Earth.
- C) It could create unanticipated technological innovations.
- D) It could change scientists' understanding of space resources.

44

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 18-22 ("Within . . . lanthanum")
- B) Lines 24-28 ("They . . . projects")
- C) Lines 29-30 ("In this . . . commodity")
- D) Lines 41-44 ("Companies . . . machinery")

45

As used in line 19, "demands" most nearly means

- A) offers.
- B) claims.
- C) inquiries.
- D) desires.

46

What function does the discussion of water in lines 35-40 serve in Passage 1?

- A) It continues an extended comparison that begins in the previous paragraph.
- B) It provides an unexpected answer to a question raised in the previous paragraph.
- C) It offers hypothetical examples supporting a claim made in the previous paragraph.
- D) It examines possible outcomes of a proposal put forth in the previous paragraph.

47

The central claim of Passage 2 is that space mining has positive potential but

- A) it will end up encouraging humanity's reckless treatment of the environment.
- B) its effects should be thoughtfully considered before it becomes a reality.
- C) such potential may not include replenishing key resources that are disappearing on Earth.
- D) experts disagree about the commercial viability of the discoveries it could yield.

48

As used in line 68, "hold" most nearly means

- A) maintain.
- B) grip.
- C) restrain.
- D) withstand.

49

Which statement best describes the relationship between the passages?

- A) Passage 2 refutes the central claim advanced in Passage 1.
- B) Passage 2 illustrates the phenomenon described in more general terms in Passage 1.
- C) Passage 2 argues against the practicality of the proposals put forth in Passage 1.
- D) Passage 2 expresses reservations about developments discussed in Passage 1.

50

The author of Passage 2 would most likely respond to the discussion of the future of space mining in lines 18-28, Passage 1, by claiming that such a future

- A) is inconsistent with the sustainable use of space resources.
- B) will be difficult to bring about in the absence of regulations.
- C) cannot be attained without technologies that do not yet exist.
- D) seems certain to affect Earth's economy in a negative way.

51

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 60-63 (“Some . . . pristine”)
- B) Lines 74-76 (“The resources . . . Earth”)
- C) Lines 81-83 (“One . . . avoided”)
- D) Lines 85-87 (“Without . . . insecure”)

52

Which point about the resources that will be highly valued in space is implicit in Passage 1 and explicit in Passage 2?

- A) They may be different resources from those that are valuable on Earth.
- B) They will be valuable only if they can be harvested cheaply.
- C) They are likely to be primarily precious metals and rare earth elements.
- D) They may increase in value as those same resources become rare on Earth.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



**No Test Material On This Page**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Whey to Go

Greek yogurt—a strained form of cultured yogurt—has grown enormously in popularity in the United States since it was first introduced in the country in the late 1980s.

From 2011 to 2012 alone, sales of Greek yogurt in the US increased by 50 percent. The resulting increase in Greek yogurt production has forced those involved in the business to address the detrimental effects that the yogurt-making process may be having on the environment. Fortunately, farmers and others in the

Greek yogurt business have found many methods of controlling and eliminating most environmental threats. Given these solutions as well as the many health benefits of the food, the advantages of Greek yogurt **1** outdo the potential drawbacks of its production.

[1] The main environmental problem caused by the production of Greek yogurt is the creation of acid whey as a by-product. [2] Because it requires up to four times more milk to make than conventional yogurt does, Greek yogurt produces larger amounts of acid whey, which is difficult to dispose of. [3] To address the problem of disposal, farmers have found a number of uses for acid whey. [4] They can add it to livestock feed as a protein **2** supplement, and people can make their own Greek-style yogurt at home by straining regular yogurt. [5] If it is improperly introduced into the environment, acid-whey runoff **3** can pollute waterways, depleting the oxygen content of streams and rivers as it decomposes. [6] Yogurt manufacturers, food **4** scientists; and government officials are also working together to develop additional solutions for reusing whey. **5**

1

- A) NO CHANGE
- B) defeat
- C) outperform
- D) outweigh

2

Which choice provides the most relevant detail?

- A) NO CHANGE
- B) supplement and convert it into gas to use as fuel in electricity production.
- C) supplement, while sweet whey is more desirable as a food additive for humans.
- D) supplement, which provides an important element of their diet.

3

- A) NO CHANGE
- B) can pollute waterway's,
- C) could have polluted waterways,
- D) has polluted waterway's,

4

- A) NO CHANGE
- B) scientists: and
- C) scientists, and
- D) scientists, and,

5

To make this paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 3.

6 Though these conservation methods can be costly and time-consuming, they are well worth the effort. Nutritionists consider Greek yogurt to be a healthy food: it is an excellent source of calcium and protein, serves 7 to be a digestive aid, and 8 it contains few calories in its unsweetened low- and non-fat forms. Greek yogurt is slightly lower in sugar and carbohydrates than conventional yogurt is. 9 Also, because it is more concentrated, Greek yogurt contains slightly more protein per serving, thereby helping people stay

6

The writer is considering deleting the underlined sentence. Should the writer do this?

- A) Yes, because it does not provide a transition from the previous paragraph.
- B) Yes, because it fails to support the main argument of the passage as introduced in the first paragraph.
- C) No, because it continues the explanation of how acid whey can be disposed of safely.
- D) No, because it sets up the argument in the paragraph for the benefits of Greek yogurt.

7

- A) NO CHANGE
- B) as
- C) like
- D) for

8

- A) NO CHANGE
- B) containing
- C) contains
- D) will contain

9

- A) NO CHANGE
- B) In other words,
- C) Therefore,
- D) For instance,

10 satiated for longer periods of time. These health benefits have prompted Greek yogurt's recent surge in popularity. In fact, Greek yogurt can be found in an increasing number of products such as snack food and frozen desserts. Because consumers reap the nutritional benefits of Greek yogurt and support those who make and sell 11 it, therefore farmers and businesses should continue finding safe and effective methods of producing the food.

10

- A) NO CHANGE
- B) fulfilled
- C) complacent
- D) sufficient

11

- A) NO CHANGE
- B) it, farmers
- C) it, so farmers
- D) it: farmers

Questions 12-22 are based on the following passage and supplementary material.

### Dark Snow

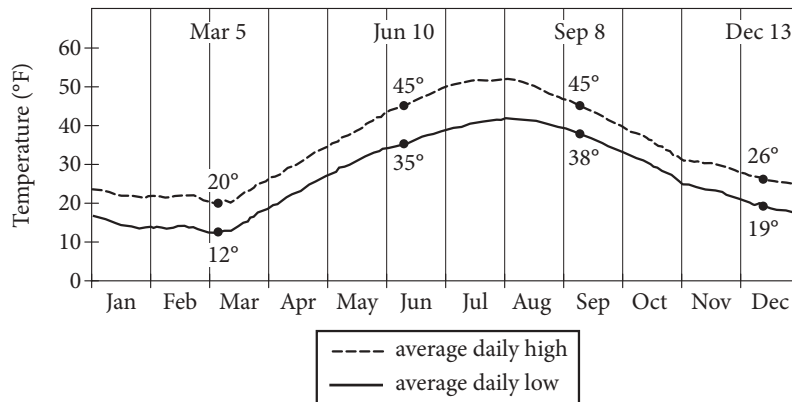
Most of Greenland's interior is covered by a thick layer of ice and compressed snow known as the Greenland Ice Sheet. The size of the ice sheet fluctuates seasonally: in summer, average daily high temperatures in Greenland can rise to slightly above 50 degrees Fahrenheit, partially melting the ice; in the winter, the sheet thickens as additional snow falls, and average daily low temperatures can drop **12** to as low as 20 degrees.

12

Which choice most accurately and effectively represents the information in the graph?

- A) NO CHANGE
- B) to 12 degrees Fahrenheit.
- C) to their lowest point on December 13.
- D) to 10 degrees Fahrenheit and stay there for months.

Average Daily High and Low Temperatures Recorded at Nuuk Weather Station, Greenland (1961—1990)



Adapted from WMO. ©2014 by World Meteorological Organization.

Typically, the ice sheet begins to show evidence of thawing in late **13** summer. This follows several weeks of higher temperatures. **14** For example, in the summer of 2012, virtually the entire Greenland Ice Sheet underwent thawing at or near its surface by mid-July, the earliest date on record. Most scientists looking for the causes of the Great Melt of 2012 have focused exclusively on rising temperatures. The summer of 2012 was the warmest in 170 years, records show. But Jason **15** Box, an associate professor of geology at Ohio State believes that another factor added to the early **16** thaw; the “dark snow” problem.

13

Which choice most effectively combines the two sentences at the underlined portion?

- A) summer, following
- B) summer, and this thawing follows
- C) summer, and such thawing follows
- D) summer and this evidence follows

14

- A) NO CHANGE
- B) However,
- C) As such,
- D) Moreover,

15

- A) NO CHANGE
- B) Box an associate professor of geology at Ohio State,
- C) Box, an associate professor of geology at Ohio State,
- D) Box, an associate professor of geology, at Ohio State

16

- A) NO CHANGE
- B) thaw; and it was
- C) thaw:
- D) thaw: being

According to Box, a leading Greenland expert, tundra fires in 2012 from as far away as North America produced great amounts of soot, some **17** of it drifted over Greenland in giant plumes of smoke and then **18** fell as particles onto the ice sheet. Scientists have long known that soot particles facilitate melting by darkening snow and ice, limiting **19** it's ability to reflect the Sun's rays. As Box explains, "Soot is an extremely powerful light absorber. It settles over the ice and captures the Sun's heat." The result is a self-reinforcing cycle. As the ice melts, the land and water under the ice become exposed, and since land and water are darker than snow, the surface absorbs even more heat, which **20** is related to the rising temperatures.

17

- A) NO CHANGE
- B) soot
- C) of which
- D) DELETE the underlined portion.

18

- A) NO CHANGE
- B) falls
- C) will fall
- D) had fallen

19

- A) NO CHANGE
- B) its
- C) there
- D) their

20

Which choice best completes the description of a self-reinforcing cycle?

- A) NO CHANGE
- B) raises the surface temperature.
- C) begins to cool at a certain point.
- D) leads to additional melting.



[1] Box’s research is important because the fires of 2012 may not be a one-time phenomenon. [2] According to scientists, rising Arctic temperatures are making northern latitudes greener and thus more fire prone. [3] The pattern Box observed in 2012 may repeat **21** itself again, with harmful effects on the Arctic ecosystem. [4] Box is currently organizing an expedition to gather this crucial information. [5] The next step for Box and his team is to travel to Greenland to perform direct sampling of the ice in order to determine just how much the soot is contributing to the melting of the ice sheet. [6] Members of the public will be able to track his team’s progress—and even help fund the expedition—through a website Box has created. **22**

**21**

- A) NO CHANGE
- B) itself,
- C) itself, with damage and
- D) itself possibly,

**22**

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 5.

Questions 23-33 are based on the following passage.

**Coworking: A Creative Solution**

When I left my office job as a website developer at a small company for a position that allowed me to work full-time from home, I thought I had it made: I gleefully traded in my suits and dress shoes for sweatpants and slippers, my frantic early-morning bagged lunch packing for a leisurely midday trip to my refrigerator. The novelty of this comfortable work-from-home life, however,

**23** soon got worn off quickly. Within a month, I found myself feeling isolated despite having frequent email and instant messaging contact with my colleagues. Having become frustrated trying to solve difficult problems,

**24** no colleagues were nearby to share ideas. It was during this time that I read an article **25** into coworking spaces.

**23**

- A) NO CHANGE
- B) was promptly worn
- C) promptly wore
- D) wore

**24**

- A) NO CHANGE
- B) colleagues were important for sharing ideas.
- C) ideas couldn't be shared with colleagues.
- D) I missed having colleagues nearby to consult.

**25**

- A) NO CHANGE
- B) about
- C) upon
- D) for

The article, published by *Forbes* magazine, explained that coworking spaces are designated locations that, for a fee, individuals can use to conduct their work. The spaces are usually stocked with standard office 26 equipment, such as photocopiers, printers, and fax machines. 27 In these locations, however, the spaces often include small meeting areas and larger rooms for hosting presentations. 28 The cost of launching a new coworking business in the United States is estimated to be approximately \$58,000.

26

- A) NO CHANGE
- B) equipment, such as:
- C) equipment such as:
- D) equipment, such as,

27

- A) NO CHANGE
- B) In addition to equipment,
- C) For these reasons,
- D) Likewise,

28

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

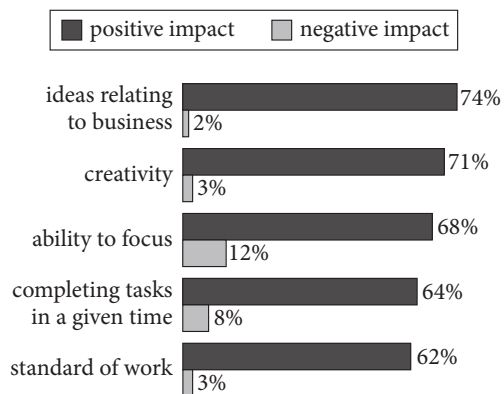
- A) Kept, because it provides a detail that supports the main topic of the paragraph.
- B) Kept, because it sets up the main topic of the paragraph that follows.
- C) Deleted, because it blurs the paragraph's main focus with a loosely related detail.
- D) Deleted, because it repeats information that has been provided in an earlier paragraph.

What most caught my interest, though, was a quotation from someone who described coworking spaces as “melting pots of creativity.” The article refers to a 2012 survey in which **29** 64 percent of respondents noted that coworking spaces prevented them from completing tasks in a given time. The article goes on to suggest that the most valuable resources provided by coworking spaces are actually the people **30** whom use them.

29

At this point, the writer wants to add specific information that supports the main topic of the paragraph.

Perceived Effect of Coworking on Business Skills



Adapted from “The 3rd Global Coworking Survey.” ©2013 by Deskmag.

Which choice most effectively completes the sentence with relevant and accurate information based on the graph above?

- A) NO CHANGE
- B) 71 percent of respondents indicated that using a coworking space increased their creativity.
- C) respondents credited coworking spaces with giving them 74 percent of their ideas relating to business.
- D) respondents revealed that their ability to focus on their work improved by 12 percent in a coworking space.

30

- A) NO CHANGE
- B) whom uses
- C) who uses
- D) who use

[1] Thus, even though I already had all the equipment I needed in my home office, I decided to try using a coworking space in my city. [2] Because I was specifically interested in coworking's reported benefits related to creativity, I chose a facility that offered a bright, open work area where I wouldn't be isolated. [3] Throughout the morning, more people appeared. [4] Periods of quiet, during which everyone worked independently, were broken up occasionally with lively conversation. **31**

I liked the experience so much that I now go to the coworking space a few times a week. Over time, I've gotten to know several of my coworking **32** colleagues: another website developer, a graphic designer, a freelance writer, and several mobile app coders. Even those of us who work in disparate fields are able to **33** share advice and help each other brainstorm. In fact, it's the diversity of their talents and experiences that makes my coworking colleagues so valuable.

**31**

The writer wants to add the following sentence to the paragraph.

After filling out a simple registration form and taking a quick tour of the facility, I took a seat at a table and got right to work on my laptop.

The best placement for the sentence is immediately

- A) before sentence 1.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 3.

**32**

- A) NO CHANGE
- B) colleagues;
- C) colleagues,
- D) colleagues

**33**

- A) NO CHANGE
- B) give some wisdom
- C) proclaim our opinions
- D) opine

Questions 34-44 are based on the following passage.

### The Consolations of Philosophy

Long viewed by many as the stereotypical useless major, philosophy is now being seen by many students and prospective employers as in fact a very useful and practical major, offering students a host of transferable skills with relevance to the modern workplace. **34** In broad terms, philosophy is the study of meaning and the values underlying thought and behavior. But **35** more pragmatically, the discipline encourages students to analyze complex material, question conventional beliefs, and express thoughts in a concise manner.

Because philosophy **36** teaching students not what to think but how to think, the age-old discipline offers consistently useful tools for academic and professional achievement. **37** A 1994 survey concluded that only 18 percent of American colleges required at least one philosophy course. **38** Therefore, between 1992 and 1996, more than 400 independent philosophy departments were eliminated from institutions.

34

- A) NO CHANGE
- B) For example,
- C) In contrast,
- D) Nevertheless,

35

- A) NO CHANGE
- B) speaking in a more pragmatic way,
- C) speaking in a way more pragmatically,
- D) in a more pragmatic-speaking way,

36

- A) NO CHANGE
- B) teaches
- C) to teach
- D) and teaching

37

Which choice most effectively sets up the information that follows?

- A) Consequently, philosophy students have been receiving an increasing number of job offers.
- B) Therefore, because of the evidence, colleges increased their offerings in philosophy.
- C) Notwithstanding the attractiveness of this course of study, students have resisted majoring in philosophy.
- D) However, despite its many utilitarian benefits, colleges have not always supported the study of philosophy.

38

- A) NO CHANGE
- B) Thus,
- C) Moreover,
- D) However,

More recently, colleges have recognized the practicality and increasing popularity of studying philosophy and have markedly increased the number of philosophy programs offered. By 2008 there were 817 programs, up from 765 a decade before. In addition, the number of four-year graduates in philosophy has grown 46 percent in a decade. Also, studies have found that those students who major in philosophy often do better than students from other majors in both verbal reasoning and analytical **39** writing. These results can be measured by standardized test scores. On the Graduate Record Examination (GRE), for example, students intending to study philosophy in graduate school **40** has scored higher than students in all but four other majors.

These days, many **41** student's majoring in philosophy have no intention of becoming philosophers; instead they plan to apply those skills to other disciplines. Law and business specifically benefit from the complicated theoretical issues raised in the study of philosophy, but philosophy can be just as useful in engineering or any field requiring complex analytic skills.

**42** That these skills are transferable across professions

39

Which choice most effectively combines the sentences at the underlined portion?

- A) writing as
- B) writing, and these results can be
- C) writing, which can also be
- D) writing when the results are

40

- A) NO CHANGE
- B) have scored
- C) scores
- D) scoring

41

- A) NO CHANGE
- B) students majoring
- C) students major
- D) student's majors

42

At this point, the writer is considering adding the following sentence.

The ancient Greek philosopher Plato, for example, wrote many of his works in the form of dialogues.

Should the writer make this addition here?

- A) Yes, because it reinforces the passage's main point about the employability of philosophy majors.
- B) Yes, because it acknowledges a common counterargument to the passage's central claim.
- C) No, because it blurs the paragraph's focus by introducing a new idea that goes unexplained.
- D) No, because it undermines the passage's claim about the employability of philosophy majors.

43 which makes them especially beneficial to twenty-first-century students. Because today's students can expect to hold multiple jobs—some of which may not even exist yet—during 44 our lifetime, studying philosophy allows them to be flexible and adaptable. High demand, advanced exam scores, and varied professional skills all argue for maintaining and enhancing philosophy courses and majors within academic institutions.

43

- A) NO CHANGE
- B) that
- C) and
- D) DELETE the underlined portion.

44

- A) NO CHANGE
- B) one's
- C) his or her
- D) their

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



**No Test Material On This Page**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

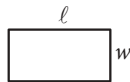
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE



$$A = \pi r^2$$

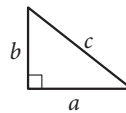
$$C = 2\pi r$$



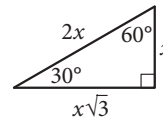
$$A = \ell w$$



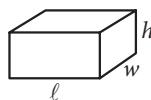
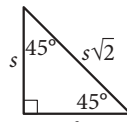
$$A = \frac{1}{2}bh$$



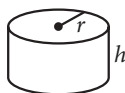
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



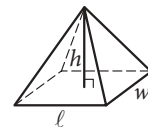
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

If  $\frac{x-1}{3} = k$  and  $k = 3$ , what is the value of  $x$ ?

- A) 2
- B) 4
- C) 9
- D) 10

2

For  $i = \sqrt{-1}$ , what is the sum  $(7 + 3i) + (-8 + 9i)$ ?

- A)  $-1 + 12i$
- B)  $-1 - 6i$
- C)  $15 + 12i$
- D)  $15 - 6i$

3

On Saturday afternoon, Armand sent  $m$  text messages each hour for 5 hours, and Tyrone sent  $p$  text messages each hour for 4 hours. Which of the following represents the total number of messages sent by Armand and Tyrone on Saturday afternoon?

- A)  $9mp$
- B)  $20mp$
- C)  $5m + 4p$
- D)  $4m + 5p$

4

Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation  $P = 108 - 23d$ , where  $P$  is the number of phones left and  $d$  is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

- A) Kathy will complete the repairs within 108 days.
- B) Kathy starts each week with 108 phones to fix.
- C) Kathy repairs phones at a rate of 108 per hour.
- D) Kathy repairs phones at a rate of 108 per day.



5

$$(x^2y - 3y^2 + 5xy^2) - (-x^2y + 3xy^2 - 3y^2)$$

Which of the following is equivalent to the expression above?

- A)  $4x^2y^2$
- B)  $8xy^2 - 6y^2$
- C)  $2x^2y + 2xy^2$
- D)  $2x^2y + 8xy^2 - 6y^2$

6

$$h = 3a + 28.6$$

A pediatrician uses the model above to estimate the height  $h$  of a boy, in inches, in terms of the boy's age  $a$ , in years, between the ages of 2 and 5. Based on the model, what is the estimated increase, in inches, of a boy's height each year?

- A) 3
- B) 5.7
- C) 9.5
- D) 14.3

7

$$m = \frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1} P$$

The formula above gives the monthly payment  $m$  needed to pay off a loan of  $P$  dollars at  $r$  percent annual interest over  $N$  months. Which of the following gives  $P$  in terms of  $m$ ,  $r$ , and  $N$ ?

- A)  $P = \frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1} m$
- B)  $P = \frac{\left(1 + \frac{r}{1,200}\right)^N - 1}{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N} m$
- C)  $P = \left(\frac{r}{1,200}\right) m$
- D)  $P = \left(\frac{1,200}{r}\right) m$



8

If  $\frac{a}{b} = 2$ , what is the value of  $\frac{4b}{a}$ ?

- A) 0
- B) 1
- C) 2
- D) 4

9

$$3x + 4y = -23$$

$$2y - x = -19$$

What is the solution  $(x, y)$  to the system of equations above?

- A)  $(-5, -2)$
- B)  $(3, -8)$
- C)  $(4, -6)$
- D)  $(9, -6)$

10

$$g(x) = ax^2 + 24$$

For the function  $g$  defined above,  $a$  is a constant and  $g(4) = 8$ . What is the value of  $g(-4)$ ?

- A) 8
- B) 0
- C) -1
- D) -8

11

$$b = 2.35 + 0.25x$$

$$c = 1.75 + 0.40x$$

In the equations above,  $b$  and  $c$  represent the price per pound, in dollars, of beef and chicken, respectively,  $x$  weeks after July 1 during last summer. What was the price per pound of beef when it was equal to the price per pound of chicken?

- A) \$2.60
- B) \$2.85
- C) \$2.95
- D) \$3.35

12

A line in the  $xy$ -plane passes through the origin and has a slope of  $\frac{1}{7}$ . Which of the following points lies on the line?

- A)  $(0, 7)$
- B)  $(1, 7)$
- C)  $(7, 7)$
- D)  $(14, 2)$



13

If  $x > 3$ , which of the following is equivalent

to  $\frac{1}{\frac{1}{x+2} + \frac{1}{x+3}}$  ?

A)  $\frac{2x+5}{x^2+5x+6}$

B)  $\frac{x^2+5x+6}{2x+5}$

C)  $2x+5$

D)  $x^2+5x+6$

14

If  $3x - y = 12$ , what is the value of  $\frac{8^x}{2^y}$  ?

A)  $2^{12}$

B)  $4^4$

C)  $8^2$

D) The value cannot be determined from the information given.

15

If  $(ax+2)(bx+7) = 15x^2 + cx + 14$  for all values of  $x$ , and  $a+b=8$ , what are the two possible values for  $c$  ?

A) 3 and 5

B) 6 and 35

C) 10 and 21

D) 31 and 41

**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer → in boxes.

Grid in result.

Answer:  $\frac{7}{12}$

7	/	1	2
•	•	•	•
0	0	0	0
1	1	•	1
2	2	2	•
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
•	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Answer: 2.5

	2	.	5
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	3
4	4	4	4
5	5	5	•
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	•
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	•
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
•	•	•	•
0	0	•	0
1	1	1	•
2	•	2	2
3	3	3	3

2	0	1	
•	•	•	•
0	•	0	0
1	1	•	1
2	•	2	2
3	3	3	3

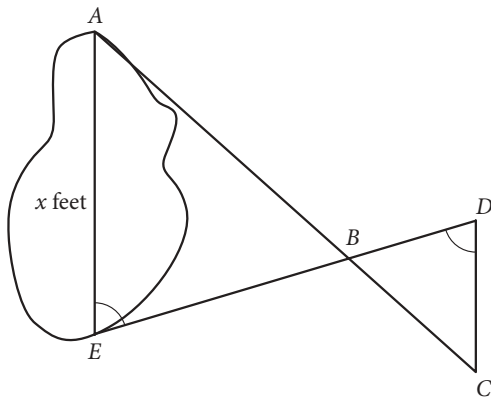
**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

If  $t > 0$  and  $t^2 - 4 = 0$ , what is the value of  $t$  ?

17



A summer camp counselor wants to find a length,  $x$ , in feet, across a lake as represented in the sketch above. The lengths represented by  $AB$ ,  $EB$ ,  $BD$ , and  $CD$  on the sketch were determined to be 1800 feet, 1400 feet, 700 feet, and 800 feet, respectively. Segments  $AC$  and  $DE$  intersect at  $B$ , and  $\angle AEB$  and  $\angle CDB$  have the same measure. What is the value of  $x$  ?

18

$$\begin{aligned}x + y &= -9 \\x + 2y &= -25\end{aligned}$$

According to the system of equations above, what is the value of  $x$  ?

19

In a right triangle, one angle measures  $x^\circ$ , where

$$\sin x^\circ = \frac{4}{5}. \text{ What is } \cos(90^\circ - x^\circ) ?$$

20

If  $a = 5\sqrt{2}$  and  $2a = \sqrt{2}x$ , what is the value of  $x$  ?

## STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**



**No Test Material On This Page**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

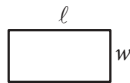
1. The use of a calculator **is permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

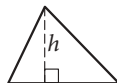


$$A = \pi r^2$$

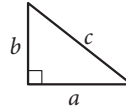
$$C = 2\pi r$$



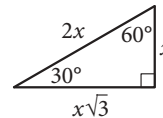
$$A = \ell w$$



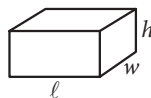
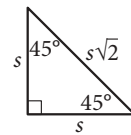
$$A = \frac{1}{2}bh$$



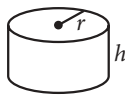
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

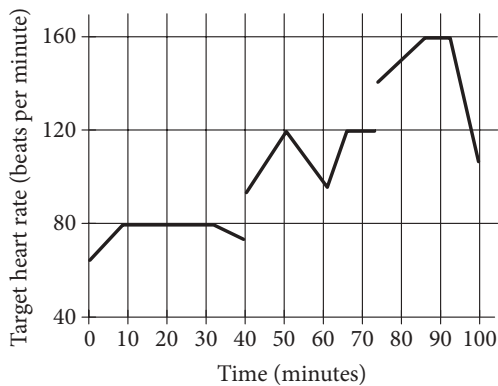
The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

John runs at different speeds as part of his training program. The graph shows his target heart rate at different times during his workout. On which interval is the target heart rate strictly increasing then strictly decreasing?



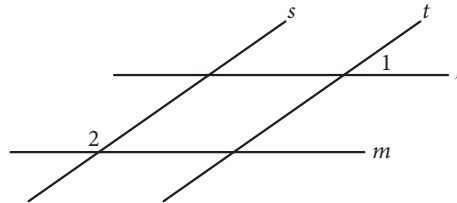
- A) Between 0 and 30 minutes
- B) Between 40 and 60 minutes
- C) Between 50 and 65 minutes
- D) Between 70 and 90 minutes

2

If  $y = kx$ , where  $k$  is a constant, and  $y = 24$  when  $x = 6$ , what is the value of  $y$  when  $x = 5$ ?

- A) 6
- B) 15
- C) 20
- D) 23

3



In the figure above, lines  $l$  and  $m$  are parallel and lines  $s$  and  $t$  are parallel. If the measure of  $\angle 1$  is  $35^\circ$ , what is the measure of  $\angle 2$ ?

- A)  $35^\circ$
- B)  $55^\circ$
- C)  $70^\circ$
- D)  $145^\circ$

4

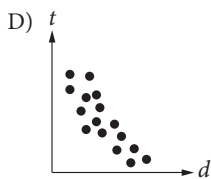
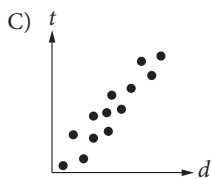
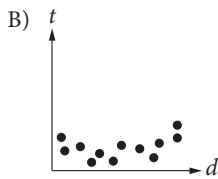
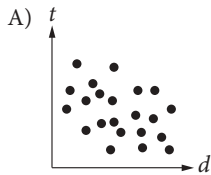
If  $16 + 4x$  is 10 more than 14, what is the value of  $8x$ ?

- A) 2
- B) 6
- C) 16
- D) 80



5

Which of the following graphs best shows a strong negative association between  $d$  and  $t$ ?



6

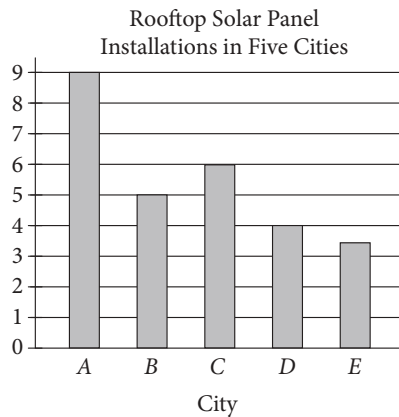
$1 \text{ decagram} = 10 \text{ grams}$ $1,000 \text{ milligrams} = 1 \text{ gram}$
--

A hospital stores one type of medicine in 2-decagram containers. Based on the information given in the box above, how many 1-milligram doses are there in one 2-decagram container?

- A) 0.002
- B) 200
- C) 2,000
- D) 20,000



7



The number of rooftops with solar panel installations in 5 cities is shown in the graph above. If the total number of installations is 27,500, what is an appropriate label for the vertical axis of the graph?

- A) Number of installations (in tens)
- B) Number of installations (in hundreds)
- C) Number of installations (in thousands)
- D) Number of installations (in tens of thousands)

8

For what value of  $n$  is  $|n - 1| + 1$  equal to 0?

- A) 0
- B) 1
- C) 2
- D) There is no such value of  $n$ .



Questions 9 and 10 refer to the following information.

$$a = 1,052 + 1.08t$$

The speed of a sound wave in air depends on the air temperature. The formula above shows the relationship between  $a$ , the speed of a sound wave, in feet per second, and  $t$ , the air temperature, in degrees Fahrenheit ( $^{\circ}\text{F}$ ).

9

Which of the following expresses the air temperature in terms of the speed of a sound wave?

- A)  $t = \frac{a - 1,052}{1.08}$   
 B)  $t = \frac{a + 1,052}{1.08}$   
 C)  $t = \frac{1,052 - a}{1.08}$   
 D)  $t = \frac{1.08}{a + 1,052}$

10

At which of the following air temperatures will the speed of a sound wave be closest to 1,000 feet per second?

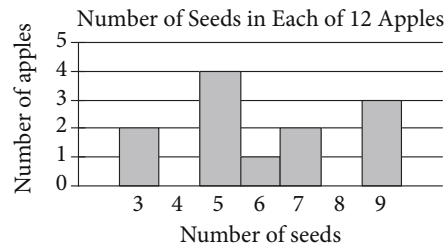
- A)  $-46^{\circ}\text{F}$   
 B)  $-48^{\circ}\text{F}$   
 C)  $-49^{\circ}\text{F}$   
 D)  $-50^{\circ}\text{F}$

11

Which of the following numbers is NOT a solution of the inequality  $3x - 5 \geq 4x - 3$  ?

- A)  $-1$   
 B)  $-2$   
 C)  $-3$   
 D)  $-5$

12



Based on the histogram above, of the following, which is closest to the average (arithmetic mean) number of seeds per apple?

- A) 4  
 B) 5  
 C) 6  
 D) 7



13

		Course			Total
		Algebra I	Geometry	Algebra II	
Gender	Female	35	53	62	150
	Male	44	59	57	160
	Total	79	112	119	310

A group of tenth-grade students responded to a survey that asked which math course they were currently enrolled in. The survey data were broken down as shown in the table above. Which of the following categories accounts for approximately 19 percent of all the survey respondents?

- A) Females taking Geometry
- B) Females taking Algebra II
- C) Males taking Geometry
- D) Males taking Algebra I

14

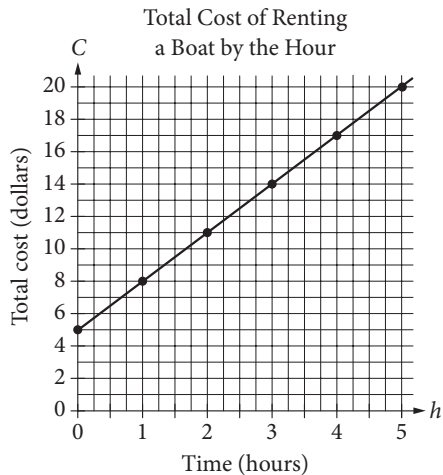
Lengths of Fish (in inches)						
8	9	9	9	10	10	11
11	12	12	12	12	13	13
13	14	14	15	15	16	24

The table above lists the lengths, to the nearest inch, of a random sample of 21 brown bullhead fish. The outlier measurement of 24 inches is an error. Of the mean, median, and range of the values listed, which will change the most if the 24-inch measurement is removed from the data?

- A) Mean
- B) Median
- C) Range
- D) They will all change by the same amount.



Questions 15 and 16 refer to the following information.



The graph above displays the total cost  $C$ , in dollars, of renting a boat for  $h$  hours.

15

What does the  $C$ -intercept represent in the graph?

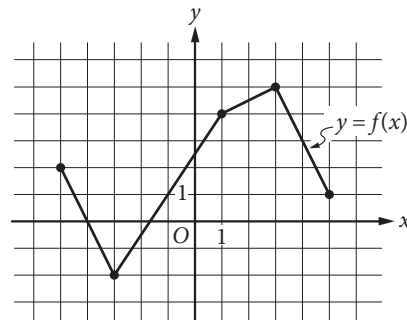
- A) The initial cost of renting the boat
- B) The total number of boats rented
- C) The total number of hours the boat is rented
- D) The increase in cost to rent the boat for each additional hour

16

Which of the following represents the relationship between  $h$  and  $C$ ?

- A)  $C = 5h$
- B)  $C = \frac{3}{4}h + 5$
- C)  $C = 3h + 5$
- D)  $h = 3C$

17



The complete graph of the function  $f$  is shown in the  $xy$ -plane above. For what value of  $x$  is the value of  $f(x)$  at its minimum?

- A)  $-5$
- B)  $-3$
- C)  $-2$
- D)  $3$





18

$$y < -x + a$$
$$y > x + b$$

In the  $xy$ -plane, if  $(0, 0)$  is a solution to the system of inequalities above, which of the following relationships between  $a$  and  $b$  must be true?

- A)  $a > b$
- B)  $b > a$
- C)  $|a| > |b|$
- D)  $a = -b$

19

A food truck sells salads for \$6.50 each and drinks for \$2.00 each. The food truck's revenue from selling a total of 209 salads and drinks in one day was \$836.50. How many salads were sold that day?

- A) 77
- B) 93
- C) 99
- D) 105



20

Alma bought a laptop computer at a store that gave a 20 percent discount off its original price. The total amount she paid to the cashier was  $p$  dollars, including an 8 percent sales tax on the discounted price. Which of the following represents the original price of the computer in terms of  $p$  ?

- A)  $0.88p$
- B)  $\frac{p}{0.88}$
- C)  $(0.8)(1.08)p$
- D)  $\frac{p}{(0.8)(1.08)}$

21

Dreams Recalled during One Week

	None	1 to 4	5 or more	Total
Group X	15	28	57	100
Group Y	21	11	68	100
Total	36	39	125	200

The data in the table above were produced by a sleep researcher studying the number of dreams people recall when asked to record their dreams for one week. Group X consisted of 100 people who observed early bedtimes, and Group Y consisted of 100 people who observed later bedtimes. If a person is chosen at random from those who recalled at least 1 dream, what is the probability that the person belonged to Group Y ?

- A)  $\frac{68}{100}$
- B)  $\frac{79}{100}$
- C)  $\frac{79}{164}$
- D)  $\frac{164}{200}$



Questions 22 and 23 refer to the following information.

Annual Budgets for Different Programs in Kansas, 2007 to 2010

Program	Year			
	2007	2008	2009	2010
Agriculture/natural resources	373,904	358,708	485,807	488,106
Education	2,164,607	2,413,984	2,274,514	3,008,036
General government	14,347,325	12,554,845	10,392,107	14,716,155
Highways and transportation	1,468,482	1,665,636	1,539,480	1,773,893
Human resources	4,051,050	4,099,067	4,618,444	5,921,379
Public safety	263,463	398,326	355,935	464,233

The table above lists the annual budget, in thousands of dollars, for each of six different state programs in Kansas from 2007 to 2010.

22

Which of the following best approximates the average rate of change in the annual budget for agriculture/natural resources in Kansas from 2008 to 2010?

- A) \$50,000,000 per year
- B) \$65,000,000 per year
- C) \$75,000,000 per year
- D) \$130,000,000 per year

23

Of the following, which program's ratio of its 2007 budget to its 2010 budget is closest to the human resources program's ratio of its 2007 budget to its 2010 budget?

- A) Agriculture/natural resources
- B) Education
- C) Highways and transportation
- D) Public safety



24

Which of the following is an equation of a circle in the  $xy$ -plane with center  $(0, 4)$  and a radius with endpoint  $\left(\frac{4}{3}, 5\right)$ ?

- A)  $x^2 + (y - 4)^2 = \frac{25}{9}$   
 B)  $x^2 + (y + 4)^2 = \frac{25}{9}$   
 C)  $x^2 + (y - 4)^2 = \frac{5}{3}$   
 D)  $x^2 + (y + 4)^2 = \frac{3}{5}$

25

$$h = -4.9t^2 + 25t$$

The equation above expresses the approximate height  $h$ , in meters, of a ball  $t$  seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground?

- A) 3.5  
 B) 4.0  
 C) 4.5  
 D) 5.0

26

Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce?

- A) 115  
 B) 120  
 C) 124  
 D) 173

27

A square field measures 10 meters by 10 meters. Ten students each mark off a randomly selected region of the field; each region is square and has side lengths of 1 meter, and no two regions overlap. The students count the earthworms contained in the soil to a depth of 5 centimeters beneath the ground's surface in each region. The results are shown in the table below.

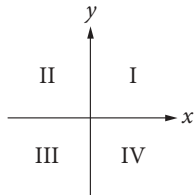
Region	Number of earthworms	Region	Number of earthworms
A	107	F	141
B	147	G	150
C	146	H	154
D	135	I	176
E	149	J	166

Which of the following is a reasonable approximation of the number of earthworms to a depth of 5 centimeters beneath the ground's surface in the entire field?

- A) 150  
 B) 1,500  
 C) 15,000  
 D) 150,000



28



If the system of inequalities  $y \geq 2x + 1$  and  $y > \frac{1}{2}x - 1$  is graphed in the  $xy$ -plane above, which quadrant contains no solutions to the system?

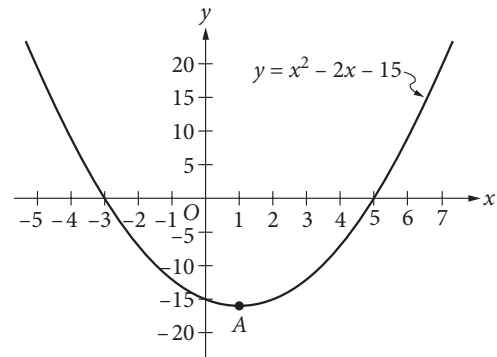
- A) Quadrant II
- B) Quadrant III
- C) Quadrant IV
- D) There are solutions in all four quadrants.

29

For a polynomial  $p(x)$ , the value of  $p(3)$  is  $-2$ . Which of the following must be true about  $p(x)$  ?

- A)  $x - 5$  is a factor of  $p(x)$ .
- B)  $x - 2$  is a factor of  $p(x)$ .
- C)  $x + 2$  is a factor of  $p(x)$ .
- D) The remainder when  $p(x)$  is divided by  $x - 3$  is  $-2$ .

30



Which of the following is an equivalent form of the equation of the graph shown in the  $xy$ -plane above, from which the coordinates of vertex  $A$  can be identified as constants in the equation?

- A)  $y = (x + 3)(x - 5)$
- B)  $y = (x - 3)(x + 5)$
- C)  $y = x(x - 2) - 15$
- D)  $y = (x - 1)^2 - 16$

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \circ & \circ & / & \circ \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result. →

Answer: $\frac{7}{12}$			
7	/	1	2
○	●	/	○
○	○	○	○
0	0	0	0
①	①	●	①
②	②	②	●
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
●	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 2.5			
2	.	5	
○	/	/	○
○	○	●	○
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	●
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3	
○	/	●	○
○	○	○	○
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	●
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	6
○	/	/	○
●	○	○	○
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	●
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	7
○	/	/	○
●	○	○	○
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	⑥
⑦	⑦	⑦	●
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

2	0	1	
○	/	/	○
○	○	○	○
0	●	0	
①	①	①	●
②	●	②	②
③	③	③	③

2	0	1	
○	/	/	○
○	○	○	○
○	○	○	○
①	①	●	①
②	●	②	②
③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

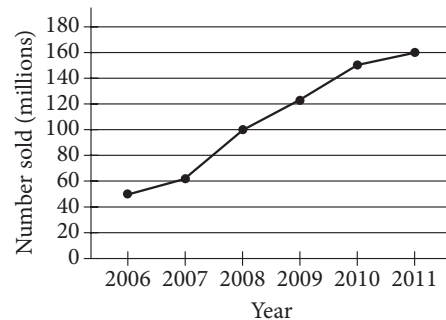
Wyatt can husk at least 12 dozen ears of corn per hour and at most 18 dozen ears of corn per hour. Based on this information, what is a possible amount of time, in hours, that it could take Wyatt to husk 72 dozen ears of corn?

32

The posted weight limit for a covered wooden bridge in Pennsylvania is 6000 pounds. A delivery truck that is carrying  $x$  identical boxes each weighing 14 pounds will pass over the bridge. If the combined weight of the empty delivery truck and its driver is 4500 pounds, what is the maximum possible value for  $x$  that will keep the combined weight of the truck, driver, and boxes below the bridge's posted weight limit?

33

Number of Portable Media Players Sold Worldwide Each Year from 2006 to 2011



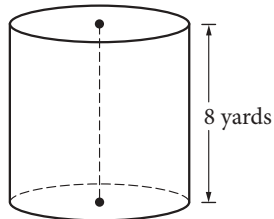
According to the line graph above, the number of portable media players sold in 2008 is what fraction of the number sold in 2011?

34

A local television station sells time slots for programs in 30-minute intervals. If the station operates 24 hours per day, every day of the week, what is the total number of 30-minute time slots the station can sell for Tuesday and Wednesday?



35



A dairy farmer uses a storage silo that is in the shape of the right circular cylinder above. If the volume of the silo is  $72\pi$  cubic yards, what is the diameter of the base of the cylinder, in yards?

36

$$h(x) = \frac{1}{(x-5)^2 + 4(x-5) + 4}$$

For what value of  $x$  is the function  $h$  above undefined?

Questions 37 and 38 refer to the following information.

Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression  $\$100(x)^t$  to find the value of the account after  $t$  years.

37

What is the value of  $x$  in the expression?

38

Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of \$100 into this account at the same time Jessica made a deposit of \$100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)

# STOP

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.



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YOUR NAME (PRINT) ..... LAST FIRST MI

TEST CENTER ..... NUMBER NAME OF TEST CENTER ROOM NUMBER

# The SAT

## GENERAL DIRECTIONS

- You may work on only one section at a time.
- If you finish a section before time is called, check your work on that section. You may NOT turn to any other section.

## MARKING ANSWERS

- Be sure to mark your answer sheet properly.



- You must use a No. 2 pencil.
- Carefully mark only one answer for each question.
- Make sure you fill the entire circle darkly and completely.
- Do not make any stray marks on your answer sheet.
- If you erase, do so completely. Incomplete erasures may be scored as intended answers.
- Use only the answer spaces that correspond to the question numbers.

## USING YOUR TEST BOOK

- You may use the test book for scratch work, but you will not receive credit for anything that you write in your test book.
- After time has been called, you may not transfer answers from your test book to your answer sheet or fill in circles.
- You may not fold or remove pages or portions of a page from this book, or take the book or answer sheet from the testing room.

## SCORING

- For each correct answer, you receive one point.
- You do not lose points for wrong answers; therefore, you should try to answer every question even if you are not sure of the correct answer.

## IMPORTANT

The codes below are unique to your test book. Copy them on your answer sheet in boxes 8 and 9 and fill in the corresponding circles exactly as shown.

<b>9</b>	<b>TEST ID</b>				
	<small>(Copy from back of test book.)</small>				

<b>8</b>	<b>FORM CODE</b>					
	<small>(Copy and grid as on back of test book.)</small>					
A	A	A	A	0	0	0
B	B	B	B	1	1	1
C	C	C	C	2	2	2
D	D	D	D	3	3	3
E	E	E	E	4	4	4
F	F	F	F	5	5	5
G	G	G	G	6	6	6
H	H	H	H	7	7	7
I	I	I	I	8	8	8
J	J	J	J	9	9	9
K	K	K	K			
L	L	L	L			
M	M	M	M			
N	N	N	N			
O	O	O	O			
P	P	P	P			
Q	Q	Q	Q			
R	R	R	R			
S	S	S	S			
T	T	T	T			
U	U	U	U			
V	V	V	V			
W	W	W	W			
X	X	X	X			
Y	Y	Y	Y			
Z	Z	Z	Z			

Follow this link for more information on scoring your practice test:  
[www.sat.org/scoring](http://www.sat.org/scoring)

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## Answer Explanations

# SAT Practice Test #1

## Section 1: Reading Test

### QUESTION 1

**Choice B is the best answer.** In the passage, a young man (Akira) asks a mother (Chie) for permission to marry her daughter (Naomi). The request was certainly surprising to the mother, as can be seen from line 47, which states that prior to Akira’s question Chie “had no idea” the request was coming.

Choice A is incorrect because the passage depicts two characters engaged in a civil conversation, with Chie being impressed with Akira’s “sincerity” and finding herself “starting to like him.” Choice C is incorrect because the passage is focused on the idea of Akira’s and Naomi’s present lives and possible futures. Choice D is incorrect because the interactions between Chie and Akira are polite, not critical; for example, Chie views Akira with “amusement,” not animosity.

### QUESTION 2

**Choice B is the best answer.** The passage centers on a night when a young man tries to get approval to marry a woman’s daughter. The passage includes detailed descriptions of setting (a “winter’s eve” and a “cold rain,” lines 5-6); character (Akira’s “soft, refined” voice, line 33; Akira’s eyes “sh[ining] with sincerity,” line 35); and plot (“Naomi was silent. She stood a full half minute looking straight into Chie’s eyes. Finally, she spoke,” lines 88-89).

Choice A is incorrect because the passage focuses on a nontraditional marriage proposal. Choice C is incorrect because the passage concludes without resolution to the question of whether Akira and Naomi will receive permission to marry. Choice D is incorrect because the passage repeatedly makes clear that for Chie, her encounter with Akira is momentous and unsettling, as when Akira acknowledges in line 73 that he has “startled” her.

---

### QUESTION 3

**Choice C is the best answer.** Akira “came directly, breaking all tradition,” (line 1) when he approached Chie and asked to marry her daughter, and he “ask[ed] directly,” without “a go-between” (line 65) or “mediation,” because doing otherwise would have taken too much time.

Choices A, B, and D are incorrect because in these contexts, “directly” does not mean in a frank, confident, or precise manner.

### QUESTION 4

**Choice A is the best answer.** Akira is very concerned Chie will find his marriage proposal inappropriate because he did not follow traditional protocol and use a “go-between” (line 65). This is clear in lines 63-64, when Akira says to Chie “Please don’t judge my candidacy by the unseemliness of this proposal.”

Choice B is incorrect because there is no evidence in the passage that Akira worries that Chie will mistake his earnestness for immaturity. Choice C is incorrect because while Akira recognizes that his unscheduled visit is a nuisance, his larger concern is that Chie will reject him due to the inappropriateness of his proposal. Choice D is incorrect because there is no evidence in the passage that Akira worries Chie will underestimate the sincerity of his emotions.

### QUESTION 5

**Choice C is the best answer.** In lines 63-64, Akira says to Chie, “Please don’t judge my candidacy by the unseemliness of this proposal.” This reveals Akira’s concern that Chie may say no to the proposal simply because Akira did not follow traditional practices.

Choices A, B, and D do not provide the best evidence for the answer to the previous question. Choice A is incorrect because line 33 merely describes Akira’s voice as “soft, refined.” Choice B is incorrect because lines 49-51 reflect Chie’s perspective, not Akira’s. Choice D is incorrect because lines 71-72 indicate only that Akira was speaking in an eager and forthright matter.

### QUESTION 6

**Choice D is the best answer** because Akira clearly treats Chie with respect, including “bow[ing]” (line 26) to her, calling her “Madame” (line 31), and looking at her with “a deferential peek” (line 34). Akira does not offer Chie utter deference, though, as he asks to marry Naomi after he concedes that he is not following protocol and admits to being a “disruption” (line 31).

Choice A is incorrect because while Akira conveys respect to Chie, there is no evidence in the passage that he feels affection for her. Choice B is incorrect because neither objectivity nor impartiality accurately describes how Akira addresses Chie. Choice C is incorrect because Akira conveys respect to Chie and takes the conversation seriously.



## QUESTION 7

**Choice D is the best answer.** The first paragraph (lines 1-4) reflects on how Akira approached Chie to ask for her daughter’s hand in marriage. In these lines, the narrator is wondering whether Chie would have been more likely to say yes to Akira’s proposal if Akira had followed tradition: “Akira came directly, breaking all tradition. Was that it? Had he followed form — had he asked his mother to speak to his father to approach a go-between — would Chie have been more receptive?” Thus, the main purpose of the first paragraph is to examine why Chie reacted a certain way to Akira’s proposal.

Choice A is incorrect because the first paragraph describes only one aspect of Japanese culture (marriage proposals) but not the culture as a whole. Choice B is incorrect because the first paragraph implies a criticism of Akira’s individual marriage proposal but not the entire tradition of Japanese marriage proposals. Choice C is incorrect because the narrator does not question a suggestion.

## QUESTION 8

**Choice B is the best answer.** In line 1, the narrator suggests that Akira’s direct approach broke “all tradition.” The narrator then wonders if Akira had “followed form,” or the tradition expected of him, would Chie have been more receptive to his proposal. In this context, following “form” thus means following a certain tradition or custom.

Choices A, C, and D are incorrect because in this context “form” does not mean the way something looks (appearance), the way it is built (structure), or its essence (nature).

## QUESTION 9

**Choice C is the best answer.** Akira states that his unexpected meeting with Chie occurred only because of a “matter of urgency,” which he explains as “an opportunity to go to America, as dentist for Seattle’s Japanese community” (lines 41-42). Akira decides to directly speak to Chie because Chie’s response to his marriage proposal affects whether Akira accepts the job offer.

Choice A is incorrect because there is no evidence in the passage that Akira is worried his parents will not approve of Naomi. Choice B is incorrect because Akira has “an understanding” with Naomi (line 63). Choice D is incorrect; while Akira may know that Chie is unaware of his feelings for Naomi, this is not what he is referring to when he mentions “a matter of urgency.”

## QUESTION 10

**Choice B is the best answer.** In lines 39-42, Akira clarifies that the “matter of urgency” is that he has “an opportunity to go to America, as dentist for Seattle’s Japanese community.” Akira needs Chie’s answer to his marriage proposal so he can decide whether to accept the job in Seattle.

---

Choices A, C, and D do not provide the best evidence for the answer to the previous question. Choice A is incorrect because in line 39 Akira apologizes for interrupting Chie's quiet evening. Choice C is incorrect because lines 58-59 address the seriousness of Akira's request, not its urgency. Choice D is incorrect because line 73 shows only that Akira's proposal has "startled" Chie and does not explain why his request is time-sensitive.

### QUESTION 11

**Choice A is the best answer.** Lines 1-9 include examples of how many people shop ("millions of shoppers"), how much money they spend ("over \$30 billion at retail stores in the month of December alone"), and the many occasions that lead to shopping for gifts ("including weddings, birthdays, anniversaries, graduations, and baby showers."). Combined, these examples show how frequently people in the US shop for gifts.

Choice B is incorrect because even though the authors mention that "\$30 billion" had been spent in retail stores in one month, that figure is never discussed as an increase (or a decrease). Choice C is incorrect because lines 1-9 provide a context for the amount of shopping that occurs in the US, but the anxiety (or "dread") it might cause is not introduced until later in the passage. Choice D is incorrect because lines 1-9 do more than highlight the number of different occasions that lead to gift-giving.

### QUESTION 12

**Choice B is the best answer.** Lines 9-10 state "This frequent experience of gift-giving can engender ambivalent feelings in gift-givers." In the subsequent sentences, those "ambivalent" feelings are further exemplified as conflicted feelings, as shopping is said to be something that "[m]any relish" (lines 10-11) and "many dread" (line 14).

Choices A, C, and D are incorrect because in this context, "ambivalent" does not mean feelings that are unrealistic, apprehensive, or supportive.

### QUESTION 13

**Choice D is the best answer.** In lines 10-13, the authors clearly state that some people believe gift-giving can help a relationship because it "offers a powerful means to build stronger bonds with one's closest peers."

Choice A is incorrect because even though the authors state that some shoppers make their choices based on "egocentrism," (line 33) there is no evidence in the passage that people view shopping as a form of self-expression. Choice B is incorrect because the passage implies that shopping is an expensive habit. Choice C is incorrect because the passage states that most people have purchased and received gifts, but it never implies that people are *required* to reciprocate the gift-giving process.

## QUESTION 14

**Choice A is the best answer.** In lines 10-13, the authors suggest that people value gift-giving because it may strengthen their relationships with others: “Many relish the opportunity to buy presents because gift-giving offers a powerful means to build stronger bonds with one’s closest peers.”

Choices B, C, and D do not provide the best evidence for the answer to the previous question. Choice B is incorrect because lines 22-23 discuss how people often buy gifts that the recipients would not purchase. Choice C is incorrect because lines 31-32 explain how gift-givers often fail to consider the recipients’ preferences. Choice D is incorrect because lines 44-47 suggest that the cost of a gift may not correlate to a recipient’s appreciation of it.

## QUESTION 15

**Choice A is the best answer.** The “deadweight loss” mentioned in the second paragraph is the significant monetary difference between what a gift-giver would pay for something and what a gift-recipient would pay for the same item. That difference would be predictable to social psychologists, whose research “has found that people often struggle to take account of others’ perspectives — their insights are subject to egocentrism, social projection, and multiple attribution errors” (lines 31-34).

Choices B, C, and D are all incorrect because lines 31-34 make clear that social psychologists would expect a disconnect between gift-givers and gift-recipients, not that they would question it, be disturbed by it, or find it surprising or unprecedented.

## QUESTION 16

**Choice C is the best answer.** Lines 41-44 suggest that gift-givers assume a correlation between the cost of a gift and how well-received it will be: “. . . gift-givers equate how much they spend with how much recipients will appreciate the gift (the more expensive the gift, the stronger a gift-recipient’s feelings of appreciation).” However, the authors suggest this assumption may be incorrect or “unfounded” (line 47), as gift-recipients “may not construe smaller and larger gifts as representing smaller and larger signals of thoughtfulness and consideration” (lines 63-65).

Choices A, B, and D are all incorrect because the passage neither states nor implies that the gift-givers’ assumption is insincere, unreasonable, or substantiated.

## QUESTION 17

**Choice C is the best answer.** Lines 63-65 suggest that the assumption made by gift-givers in lines 41-44 may be incorrect. The gift-givers assume that recipients will have a greater appreciation for costly gifts

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than for less costly gifts, but the authors suggest this relationship may be incorrect, as gift-recipients “may not construe smaller and larger gifts as representing smaller and larger signals of thoughtfulness and consideration” (lines 63-65).

Choices A and D are incorrect because lines 53-55 and 75-78 address the question of “why” gift-givers make specific assumptions rather than addressing the validity of these assumptions. Choice B is incorrect because lines 55-60 focus on the reasons people give gifts to others.

### QUESTION 18

**Choice D is the best answer.** Lines 53-55 state that “Perhaps givers believe that bigger (i.e., more expensive) gifts convey stronger signals of thoughtfulness and consideration.” In this context, saying that more expensive gifts “convey” stronger signals means the gifts send, or communicate, stronger signals to the recipients.

Choices A, B, and C are incorrect because in this context, to “convey” something does not mean to transport it (physically move something), counteract it (act in opposition to something), or exchange it (trade one thing for another).

### QUESTION 19

**Choice A is the best answer.** The paragraph examines how gift-givers believe expensive gifts are more thoughtful than less expensive gifts and will be more valued by recipients. The work of Camerer and others offers an explanation for the gift-givers’ reasoning: “gift-givers attempt to signal their positive attitudes toward the intended recipient and their willingness to invest resources in a future relationship” (lines 57-60).

Choices B, C, and D are incorrect because the theory articulated by Camerer and others is used to explain an idea put forward by the authors (“givers believe that bigger . . . gifts convey stronger signals”), not to introduce an argument, question a motive, or support a conclusion.

### QUESTION 20

**Choice B is the best answer.** The graph clearly shows that gift-givers believe that a “more valuable” gift will be more appreciated than a “less valuable gift.” According to the graph, gift-givers believe the monetary value of a gift will determine whether that gift is well received or not.

Choice A is incorrect because the graph does not suggest that gift-givers are aware of gift-recipients’ appreciation levels. Choices C and D are incorrect because neither the gift-givers’ desire for the gifts they purchase nor the gift-givers’ relationship with the gift-recipients is addressed in the graph.

## QUESTION 21

**Choice A is the best answer.** Lines 69-75 explain that while people are often both gift-givers and gift-receivers, they struggle to apply information they learned as a gift-giver to a time when they were a gift-receiver: “Yet, despite the extensive experience that people have as both givers and receivers, they often struggle to transfer information gained from one role (e.g., as a giver) and apply it in another, complementary role (e.g., as a receiver).” The authors suggest that the disconnect between how much appreciation a gift-giver thinks a gift merits and how much appreciation a gift-recipient displays for the gift may be caused by both individuals’ inability to comprehend the other’s perspective.

Choices B and C are incorrect because neither the passage nor the graph addresses the idea that society has become more materialistic or that there is a growing opposition to gift-giving. Choice D is incorrect because the passage emphasizes that gift-givers and gift-recipients fail to understand each other’s perspective, but it offers no evidence that the disconnect results only from a failure to understand the other’s intentions.

## QUESTION 22

**Choice B is the best answer.** Lines 2-4 of the passage describe DNA as “a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups.” The backbone of DNA, in other words, is the main structure of a chain made up of repeating units of sugar and phosphate.

Choice A is incorrect because the passage describes DNA on the molecular level only and never mentions the spinal column of organisms. Choice C is incorrect because the passage describes the backbone of the molecule as having “a regular alternation” of sugar and phosphate, not one or the other. Choice D is incorrect because the nitrogenous bases are not the main structural unit of DNA; rather, they are attached only to the repeating units of sugar.

## QUESTION 23

**Choice D is the best answer.** The authors explain that hydrogen bonds join together pairs of nitrogenous bases, and that these bases have a specific structure that leads to the pairing: “One member of a pair must be a purine and the other a pyrimidine in order to bridge between the two chains” (lines 27-29). Given the specific chemical properties of a nitrogenous base, it would be inaccurate to call the process random.

Choice A is incorrect because lines 5-6 describe how nitrogenous bases attach to sugar but not how those bases pair with one another. Choice B is incorrect because lines 9-10 do not contradict the student’s claim. Choice C is incorrect because lines 23-25 describe how the two molecules’ chains are linked, not what the specific pairing between nitrogenous bases is.

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## QUESTION 24

**Choice D is the best answer.** In lines 12-14 the authors state: “the first feature of our structure which is of biological interest is that it consists not of one chain, but of two.”

Choices A and B are incorrect because lines 12-14 explicitly state that it is the two chains of DNA that are of “biological interest,” not the chemical formula of DNA, nor the common fiber axis those two chains are wrapped around. Choice C is incorrect because, while the X-ray evidence did help Watson and Crick to discover that DNA consists of two chains, it was not claimed to be the feature of biological interest.

## QUESTION 25

**Choice C is the best answer.** In lines 12-14 the authors claim that DNA molecules appear to be comprised of two chains, even though “it has often been assumed . . . there would be only one” (lines 15-17). The authors support this claim with evidence compiled from an X-ray: “the density, taken with the X-ray evidence, suggests very strongly that there are two [chains]” (lines 18-19).

Choices A, B, and D are incorrect because the authors mention density and X-ray evidence to support a claim, not to establish that DNA carries genetic information, present a hypothesis about the composition of a nucleotide, or confirm a relationship between the density and chemical formula of DNA.

## QUESTION 26

**Choice B is the best answer.** The authors explain that “only certain pairs of bases will fit into the structure” (lines 25-26) of the DNA molecule. These pairs must contain “a purine and the other a pyrimidine in order to bridge between the two chains” (lines 27-29), which implies that any other pairing would not “fit into the structure” of the DNA molecule. Therefore, a pair of purines would be larger than the required purine/pyrimidine pair and would not fit into the structure of the DNA molecule.

Choice A is incorrect because this section is not discussing the distance between a sugar and phosphate group. Choice C is incorrect because the passage never makes clear the size of the pyrimidines or purines in relation to each other, only in relation to the space needed to bond the chains of the DNA molecule. Choice D is incorrect because the lines do not make an implication about the size of a pair of pyrimidines in relation to the size of a pair consisting of a purine and a pyrimidine.

## QUESTION 27

**Choice D is the best answer.** The authors explain how the DNA molecule contains a “precise sequence of bases” (lines 43-44), and that the authors can use the order of bases on one chain to determine the order of bases on the other chain: “If the actual order of the bases on one of the pair of chains were given, one could write down the exact

order of the bases on the other one, because of the specific pairing. Thus one chain is, as it were, the complement of the other, and it is this feature which suggests how the deoxyribonucleic acid molecule might duplicate itself” (lines 45-51). The authors use the words “exact,” “specific,” and “complement” in these lines to suggest that the base pairings along a DNA chain is understood and predictable, and may explain how DNA “duplicate[s] itself” (line 51).

Choice A is incorrect because the passage does not suggest that most nucleotide sequences are known. Choice B is incorrect because these lines are not discussing the random nature of the base sequence along one chain of DNA. Choice C is incorrect because the authors are describing the bases attached only to the sugar, not to the sugar-phosphate backbone.

### QUESTION 28

**Choice C is the best answer.** Lines 6-7 state that “Two of the possible bases — adenine and guanine — are purines,” and on the table the percentages of adenine and guanine in yeast DNA are listed as 31.3% and 18.7% respectively.

Choices A, B, and D are incorrect because they do not state the percentages of both purines, adenine and guanine, in yeast DNA.

### QUESTION 29

**Choice A is the best answer.** The authors state: “We believe that the bases will be present almost entirely in their most probable forms. If this is true, the conditions for forming hydrogen bonds are more restrictive, and the only pairs of bases possible are: adenine with thymine, and guanine with cytosine” (lines 31-35). The table shows that the pairs adenine/thymine and guanine/cytosine have notably similar percentages in DNA for all organisms listed.

Choice B is incorrect. Although the choice of “Yes” is correct, the explanation for that choice misrepresents the data in the table. Choices C and D are incorrect because the table does support the authors’ proposed pairing of nitrogenous bases in DNA molecules.

### QUESTION 30

**Choice A is the best answer** because it gives the percentage of cytosine (17.3%) in sea urchin DNA and the percentage of guanine (17.7%) in sea urchin DNA. Their near similar pairing supports the authors’ proposal that possible pairings of nitrogenous bases are “adenine with thymine, and guanine with cytosine” (line 35).

Choices B, C, and D do not provide the best evidence for the answer to the previous question. Choice B (cytosine and thymine), Choice C (cytosine and adenine), and Choice D (guanine and adenine) are incorrect because they show pairings of nitrogenous bases that do not compose a similar percentage of the bases in sea urchin DNA.

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### QUESTION 31

**Choice D is the best answer.** The table clearly shows that the percentage of adenine in each organism's DNA is different, ranging from 24.7% in *E.coli* to 33.2% in the octopus. That such a variability would exist is predicted in lines 41-43, which states that "in a long molecule many different permutations are possible."

Choices A and B are incorrect because the table shows that the percentage of adenine varies between 24.7% and 33.2% in different organisms. Choice C is incorrect because lines 36-38 state that adenine pairs with thymine but does not mention the variability of the base composition of DNA.

### QUESTION 32

**Choice B is the best answer.** In this passage, Woolf asks women a series of questions. Woolf wants women to consider joining "the procession of educated men" (lines 56-57) by becoming members of the workforce. Woolf stresses that this issue is urgent, as women "have very little time in which to answer [these questions]" (lines 48-49).

Choice A is incorrect because Woolf argues against the tradition of only "the sons of educated men" (lines 82-83) joining the workforce. Choice C is incorrect because Woolf is not highlighting the severity of social divisions as much as she is explaining how those divisions might be reduced (with women joining the workforce). Choice D is incorrect because Woolf does not question the feasibility of changing the workforce dynamic.

### QUESTION 33

**Choice A is the best answer.** Throughout the passage, Woolf advocates for more women to engage with existing institutions by joining the workforce: "We too can leave the house, can mount those steps [to an office], pass in and out of those doors, . . . make money, administer justice . . ." (lines 30-32). Woolf tells educated women that they are at a "moment of transition" (line 51) where they must consider their future role in the workforce.

Choice B is incorrect because even though Woolf mentions women's traditional roles (lines 68-69: "while they stirred the pot, while they rocked the cradle"), she does not suggest that women will have to give up these traditional roles to gain positions of influence. Choice C is incorrect because though Woolf wonders how "the procession of the sons of educated men" impacts women's roles, she does not argue that this male-dominated society has had grave and continuing effects. Choice D is incorrect because while Woolf suggests educated women can hold positions currently held by men, she does not suggest that women's entry into positions of power will change those positions.



### QUESTION 34

**Choice C is the best answer.** Woolf uses the word “we” to refer to herself and educated women in English society, the “daughters of educated men” (line 64). Woolf wants these women to consider participating in a changing workforce: “For there, trapesing along at the tail end of the procession [to and from work], we go ourselves” (lines 23-24). In using the word “we” throughout the passage, Woolf establishes a sense of solidarity among educated women.

Choice A is incorrect because Woolf does not use “we” to reflect on whether people in a group are friendly to one another; she is concerned with generating solidarity among women. Choice B is incorrect because though Woolf admits women have predominantly “done their thinking” within traditional female roles (lines 64-69), she does not use “we” to advocate for more candor among women. Choice D is incorrect because Woolf does not use “we” to emphasize a need for people in a group to respect one other; rather, she wants to establish a sense of solidarity among women.

### QUESTION 35

**Choice B is the best answer.** Woolf argues that the “bridge over the River Thames, [has] an admirable vantage ground for us to make a survey” (lines 1-3). The phrase “make a survey” means to carefully examine an event or activity. Woolf wants educated women to “fix [their] eyes upon the procession — the procession of the sons of educated men” (lines 9-11) walking to work.

Choice A is incorrect because while Woolf states the bridge “is a place to stand on by the hour dreaming,” she states that she is using the bridge “to consider the facts” (lines 6-9). Woolf is not using the bridge for fanciful reflection; she is analyzing “the procession of the sons of educated men” (lines 10-11). Choice C is incorrect because Woolf does not compare the bridge to historic episodes. Choice D is incorrect because Woolf does not suggest that the bridge is a symbol of a male-dominated past, but rather that it serves as a good place to watch men proceed to work.

### QUESTION 36

**Choice D is the best answer.** Woolf writes that the men who conduct the affairs of the nation (lines 15-17: “ascending those pulpits, preaching, teaching, administering justice, practising medicine, transacting business, making money”) are the same men who go to and from work in a “procession” (line 10). Woolf notes that women are joining this procession, an act that suggests the workforce has become less exclusionary: “For there, trapesing along at the tail end of the procession, we go ourselves” (lines 23-24).

Choice A is incorrect because the procession is described as “a solemn sight always” (lines 17-18), which indicates that it has always been influential. Choice B is incorrect because the passage

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does not indicate that this procession has become a celebrated feature of English life. Choice C is incorrect because the passage states only that the procession is made up of “the sons of educated men” (lines 10-11).

### QUESTION 37

**Choice C is the best answer**, as lines 23-24 suggest that the workforce has become less exclusionary. In these lines Woolf describes how women are joining the male-dominated procession that travels to and from the work place: “For there, trapesing along at the tail end of the procession, we go ourselves.”

Choices A, B, and D are incorrect because they do not provide the best evidence for the answer to the previous question. Choice A is incorrect because lines 12-17 describe the positions predominantly held by men. Choice B is incorrect because lines 17-19 use a metaphor to describe how the procession physically looks. Choice D is incorrect because lines 30-34 hypothesize about future jobs for women.

### QUESTION 38

**Choice C is the best answer.** Woolf characterizes the questions she asks in lines 53-57 as significant (“so important that they may well change the lives of all men and women for ever,” lines 52-53) and urgent (“we have very little time in which to answer them,” lines 48-49). Therefore, Woolf considers the questions posed in lines 53-57 as both momentous (significant) and pressing (urgent).

Choice A is incorrect because Woolf characterizes the questions as urgent and important, not as something that would cause controversy or fear. Choice B is incorrect because though Woolf considers the questions to be weighty (or “important”), she implies that they can be answered. Choice D is incorrect because Woolf does not imply that the questions are mysterious.

### QUESTION 39

**Choice B is the best answer.** The answer to the previous question shows how Woolf characterizes the questions posed in lines 53-57 as momentous and pressing. In lines 48-49, Woolf describes these questions as “important,” or momentous, and states that women “have very little time in which to answer them,” which shows their urgency.

Choices A, C, and D do not provide the best evidence for the answer to the previous question. Choices A and D are incorrect because lines 46-47 and line 62 suggest that women need to think about these questions and not offer trivial objections to them. Choice C is incorrect because line 57 characterizes only the need for urgency and does not mention the significance of the questions.

**QUESTION 40**

**Choice C is the best answer.** Woolf writes that women “have thought” while performing traditional roles such as cooking and caring for children (lines 67-69). Woolf argues that this “thought” has shifted women’s roles in society and earned them a “brand-new sixpence” that they need to learn how to “spend” (lines 70-71). The “sixpence” mentioned in these lines is not a literal coin. Woolf is using the “sixpence” as a metaphor, as she is suggesting women take advantage of the opportunity to join the male-dominated workforce.

Choices A, B, and D are incorrect because in this context, “sixpence” does not refer to tolerance, knowledge, or perspective.

**QUESTION 41**

**Choice B is the best answer.** In lines 72-76, Woolf repeats the phrase “let us think” to emphasize how important it is for women to critically reflect on their role in society. Woolf states this reflection can occur at any time: “Let us think in offices; in omnibuses; while we are standing in the crowd watching Coronations and Lord Mayor’s Shows; let us think . . . in the gallery of the House of Commons; in the Law Courts; let us think at baptisms and marriages and funerals.”

Choices A, C, and D are incorrect because in lines 72-76 Woolf is not emphasizing the novelty of the challenge faced by women, the complexity of social and political issues, or the enjoyable aspect of women’s career possibilities.

**QUESTION 42**

**Choice B is the best answer.** The author of Passage 1 identifies specific companies such as the “Planetary Resources of Washington,” “Deep Space Industries of Virginia,” and “Golden Spike of Colorado” to support his earlier assertion that there are many interested groups “working to make space mining a reality” (line 8).

Choices A, C, and D are incorrect because the author of Passage 1 does not mention these companies to profile the technological advances in space mining, the profit margins from space mining, or the diverse approaches to space mining.

**QUESTION 43**

**Choice A is the best answer.** The author of Passage 1 explicitly states that one benefit to space mining is access to precious metals and earth elements: “within a few decades, [space mining] may be meeting earthly demands for precious metals, such as platinum and gold, and the rare earth elements vital for personal electronics, such as yttrium and lanthanum” (lines 18-22).

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Choice B is incorrect because Passage 1 does not suggest that precious metals extracted from space may make metals more valuable on Earth. Choice C and Choice D are incorrect because Passage 1 never mentions how space mining could create unanticipated technological innovations or change scientists' understanding of space resources.

#### QUESTION 44

**Choice A is the best answer.** Lines 18-22 suggest that space mining may help meet “earthly demands for precious metals . . . and the rare earth elements vital for personal electronics.” In this statement, the author is stating materials (“metals,” “earth elements”) that may be gathered as a result of space mining, and that these materials may be important to Earth’s economy.

Choices B, C, and D do not provide the best evidence for the answer to the previous question. Choice B is incorrect because lines 24-28 focus on an “off-planet economy” but never address positive effects of space mining. Choice C is incorrect because lines 29-30 suggest the relative value of water found in space. Choice D is incorrect because lines 41-44 state that space mining companies hope to find specific resources in lunar soil and asteroids but do not address how these resources are important to Earth’s economy.

#### QUESTION 45

**Choice D is the best answer.** The author suggests in lines 19-22 that space mining may meet “earthly demands for precious metals, such as platinum and gold, and the rare earth elements vital for personal electronics.” In this sentence, “earthly demands” suggests that people want, or desire, these precious metals and rare earth elements.

Choices A, B, and C are incorrect because in this context “demands” does not mean offers, claims, or inquiries.

#### QUESTION 46

**Choice C is the best answer.** Lines 29-30 introduce the idea that water mined in space may be very valuable: “water mined from other worlds could become the most desired commodity.” Lines 35-40 support this assertion by suggesting how mined space water could be used “for drinking or as a radiation shield” (lines 36-37) or to make “spacecraft fuel” (line 38).

Choice A is incorrect because the comparison in the previous paragraph (the relative value of gold and water to someone in the desert) is not expanded upon in lines 35-40. Choice B is incorrect because the question asked in the previous paragraph is also answered in that paragraph. Choice D is incorrect because no specific proposals are made in the previous paragraph; rather, an assertion is made and a question is posed.

## QUESTION 47

**Choice B is the best answer.** The author of Passage 2 recognizes that space mining may prove beneficial to humanity, stating that “we all stand to gain: the mineral bounty and spin-off technologies could enrich us all” (lines 50-52). The author also repeatedly mentions that space mining should be carefully considered before it is implemented: “But before the miners start firing up their rockets, we should pause for thought” (lines 53-54); “But [space mining’s] consequences — both here on Earth and in space — merit careful consideration” (lines 57-59).

Choice A is incorrect because the author of Passage 2 concedes that “space mining seems to sidestep most environmental concerns” (lines 55-56) but does not imply that space mining will recklessly harm the environment, either on Earth or in space. Choice C is incorrect because the author of Passage 2 does not address any key resources that may be disappearing on Earth. Choice D is incorrect because the author of Passage 2 admits that “resources that are valuable in orbit and beyond may be very different to those we prize on Earth” (lines 74-76) but does not mention any disagreement about the commercial viabilities of space mining discoveries.

## QUESTION 48

**Choice A is the best answer.** In lines 60-66, the author presents some environmental arguments against space mining: “[space] is not ours to despoil” and we should not “[glut] ourselves on space’s riches.” The author then suggests that these environmental arguments will be hard to “hold,” or maintain, when faced with the possible monetary rewards of space mining: “History suggests that those will be hard lines to hold . . .” (line 68).

Choices B, C, and D are incorrect because in this context, “hold” does not mean grip, restrain, or withstand.

## QUESTION 49

**Choice D is the best answer.** The author of Passage 1 is excited about the possibilities of space mining and how it can yield valuable materials, such as metals and elements (lines 19-20 and lines 41-42), water ice (line 35), and space dirt (line 44). The author of Passage 2, on the other hand, recognizes the possible benefits of space mining but also states that space mining should be thoughtfully considered before being implemented. Therefore, the author of Passage 2 expresses some concerns about a concept discussed in Passage 1.

Choice A is incorrect because the author of Passage 2 does not refute the central claim of Passage 1; both authors agree there are possible benefits to space mining. Choice B is incorrect because the author of Passage 1 does not describe space mining in more general terms than does the author of Passage 2. Choice C is incorrect because the author of Passage 2 is not suggesting that the space mining proposals stated in Passage 1 are impractical.

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## QUESTION 50

**Choice B is the best answer.** In lines 18-28, the author of Passage 1 describes many of the possible economic benefits of space mining, including the building of “an off-planet economy” (line 25). The author of Passage 2 warns that there may be ramifications to implementing space mining and building an “emerging off-world economy” (line 73) without regulation: “But miners have much to gain from a broad agreement on the for-profit exploitation of space. Without consensus, claims will be disputed, investments risky, and the gains made insecure” (lines 83-87).

Choices A, C, and D are incorrect because the author of Passage 2 does not suggest that the benefits to space mining mentioned in lines 18-28 of Passage 1 are unsustainable, unachievable, or will negatively affect Earth’s economy. Rather, the author recognizes the benefits of space mining but advocates for the development of regulation procedures.

## QUESTION 51

**Choice D is the best answer.** In lines 85-87, the author of Passage 2 states that the future of space mining will prove difficult without regulations because “claims will be disputed, investments risky, and the gains made insecure.”

Choices A, B, and C are incorrect because they do not provide the best evidence for the answer to the previous question. Choice A is incorrect because lines 60-63 present some environmental concerns toward space mining. Choice B is incorrect because lines 74-76 focus on how space mining may discover valuable resources that are different from the ones found on Earth. Choice C is incorrect because lines 81-83 simply describe one person’s objections to the regulation of the space mining industry.

## QUESTION 52

**Choice A is the best answer** because both Passage 1 and Passage 2 indicate a belief that the resources most valued in space may differ from those most valued on our planet. Passage 2 says this explicitly in lines 74-76: “The resources that are valuable in orbit and beyond may be very different to those we prize on Earth.” Meanwhile Passage 1 suggests that water mined from space may be more valuable than metals or other earth elements when creating an “off-plant economy” (lines 25-30).

Choice B is incorrect because neither passage discusses, either implicitly or explicitly, the need for space mining to be inexpensive. Choice C is incorrect because Passage 2 does not specifically identify precious metals or rare earth elements but instead focuses on theoretical problems with space mining. Choice D is incorrect because diminishing resources on Earth is not discussed in Passage 2.

## Section 2: Writing and Language Test

### QUESTION 1

**Choice D is the best answer** because “outweigh” is the only choice that appropriately reflects the relationship the sentence sets up between “advantages” and “drawbacks.”

Choices A, B, and C are incorrect because each implies a competitive relationship that is inappropriate in this context.

### QUESTION 2

**Choice B is the best answer** because it offers a second action that farmers can undertake to address the problem of acid whey disposal, thus supporting the claim made in the previous sentence (“To address the problem of disposal, farmers have found a *number of uses* for acid whey”).

Choices A, C, and D are incorrect because they do not offer examples of how farmers could make use of acid whey.

### QUESTION 3

**Choice A is the best answer** because it results in a sentence that is grammatically correct and coherent. In choice A, “waterways,” the correct plural form of “waterway,” conveys the idea that acid whey could impact multiple bodies of water. Additionally, the compound verb “can pollute” suggests that acid whey presents an ongoing, potential problem.

Choices B and D are incorrect because both use the possessive form of “waterway.” Choice C is incorrect because it creates an unnecessary shift in verb tense. The present tense verb “can pollute” should be used instead, as it is consistent with the other verbs in the paragraph.

### QUESTION 4

**Choice C is the best answer** because it utilizes proper punctuation for items listed in a series. In this case those items are nouns: “Yogurt manufacturers, food scientists, and government officials.”

Choices A and B are incorrect because both fail to recognize that the items are a part of a series. Since a comma is used after “manufacturers,” a semicolon or colon should not be used after “scientists.” Choice D is incorrect because the comma after “and” is unnecessary and deviates from grammatical conventions for presenting items in a series.

### QUESTION 5

**Choice C is the best answer** because sentence 5 logically links sentence 2, which explains why Greek yogurt production yields large amounts of acid whey, and sentence 3, which mentions the need to dispose of acid whey properly.

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Choices A, B, and D are incorrect because each would result in an illogical progression of sentences for this paragraph. If sentence 5 were left where it is or placed after sentence 3, it would appear illogically after the discussion of “the problem of disposal.” If sentence 5 were placed after sentence 1, it would illogically discuss “acid-whey runoff” before the mention of acid whey being “difficult to dispose of.”

### QUESTION 6

**Choice D is the best answer** because the paragraph includes several benefits of consuming Greek yogurt, particularly in regard to nutrition and satisfying hunger, to support the sentence’s claim that the conservation efforts are “well worth the effort.” This transition echoes the passage’s earlier claim that “the advantages of Greek yogurt outweigh the potential drawbacks of its production.”

Choices A, B, and C are incorrect because they inaccurately describe the sentence in question.

### QUESTION 7

**Choice B is the best answer** because it provides a grammatically standard preposition that connects the verb “serves” and noun “digestive aid” and accurately depicts their relationship.

Choice A is incorrect because the infinitive form “to be” yields a grammatically incorrect verb construction: “serves to be.” Choices C and D are incorrect because both present options that deviate from standard English usage.

### QUESTION 8

**Choice C is the best answer** because it presents a verb tense that is consistent in the context of the sentence. The choice is also free of the redundant “it.”

Choice A is incorrect because the subject “it” creates a redundancy. Choices B and D are incorrect because they present verb tenses that are inconsistent in the context of the sentence.

### QUESTION 9

**Choice A is the best answer** because it properly introduces an additional health benefit in a series of sentences that list health benefits. “Also” is the logical and coherent choice to communicate an addition.

Choices B, C, and D are incorrect because none of the transitions they offer logically fits the content that precedes or follows the proposed choice.

### QUESTION 10

**Choice A is the best answer** because “satiated” is the only choice that communicates effectively that Greek yogurt will satisfy hunger for a longer period of time.



Choices B, C, and D are incorrect because each is improper usage in this context. A person can be “fulfilled” spiritually or in other ways, but a person who has eaten until he or she is no longer hungry cannot be described as fulfilled. Neither can he or she be described as being “complacent” or “sufficient.”

### QUESTION 11

**Choice B is the best answer** because it provides a syntactically coherent and grammatically correct sentence.

Choices A and C are incorrect because the adverbial conjunctions “therefore” and “so,” respectively, are unnecessary following “Because.” Choice D is incorrect because it results in a grammatically incomplete sentence (the part of the sentence before the colon must be an independent clause).

### QUESTION 12

**Choice B is the best answer** because the graph clearly indicates that, on March 5, average low temperatures are at their lowest point: 12 degrees Fahrenheit.

Choice A is incorrect because the phrase “as low as” suggests that the temperature falls no lower than 20 degrees Fahrenheit, but the chart shows that in January, February, and March, the temperature frequently falls below that point. Choices C and D are incorrect because the information each provides is inconsistent with the information on the chart.

### QUESTION 13

**Choice A is the best answer** because it concisely combines the two sentences while maintaining the original meaning.

Choices B, C, and D are incorrect because each is unnecessarily wordy, thus undermining one purpose of combining two sentences: to make the phrasing more concise.

### QUESTION 14

**Choice B is the best answer** because it provides a conjunctive adverb that accurately represents the relationship between the two sentences. “However” signals an exception to a case stated in the preceding sentence.

Choices A, C, and D are incorrect because each provides a transition that does not accurately represent the relationship between the two sentences, and as a result each compromises the logical coherence of these sentences.

### QUESTION 15

**Choice C is the best answer** because it provides commas to offset the nonrestrictive modifying clause “an associate professor of geology at Ohio State.”

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Choices A, B, and D are incorrect because each provides punctuation that does not adequately separate the nonrestrictive modifying clause about Jason Box from the main clause.

### QUESTION 16

**Choice C is the best answer** because the colon signals that the other factor that contributed to the early thaw is about to be provided.

Choice A is incorrect because it results in a sentence that deviates from grammatical standards: a semicolon should be used to separate two independent clauses, but in choice A the second clause only has a subject, not a verb. Choice B is incorrect because it is unnecessarily wordy. Choice D is incorrect because “being” is unnecessary and creates an incoherent clause.

### QUESTION 17

**Choice C is the best answer** because it provides the correct preposition (“of”) and relative pronoun (“which”) that together create a dependent clause following the comma.

Choices A, B, and D are incorrect because each results in a comma splice. Two independent clauses cannot be joined with only a comma.

### QUESTION 18

**Choice A is the best answer** because the verb tense is consistent with the preceding past tense verbs in the sentence, specifically “produced” and “drifted.”

Choices B, C, and D are incorrect because each utilizes a verb tense that is not consistent with the preceding past tense verbs in the sentence.

### QUESTION 19

**Choice D is the best answer** because “their” is the possessive form of a plural noun. In this case, the noun is plural: “snow and ice.”

Choices A and B are incorrect because the possessive pronoun must refer to a plural noun, “snow and ice,” rather than a singular noun. Choice C is incorrect because “there” would result in an incoherent sentence.

### QUESTION 20

**Choice D is the best answer.** The preceding sentences in the paragraph have established that a darker surface of soot-covered snow leads to more melting because this darker surface absorbs heat, whereas a whiter surface, free of soot, would deflect heat. As the passage points out, exposed land and water are also dark and cannot deflect heat the way ice and snow can. Only choice D reflects the self-reinforcing cycle that the preceding sentences already imply.

Choices A, B, and C are incorrect because the information each provides fails to support the previous claim that the “result” of the soot “is a self-reinforcing cycle.”

### QUESTION 21

**Choice B is the best answer** because it is free of redundancies.

Choices A, C, and D are incorrect because each of the three presents a redundancy: Choice A uses “repeat” and “again”; Choice C uses “damage” and “harmful effects”; and Choice D uses “may” and “possibly.”

### QUESTION 22

**Choice D is the best answer** because sentence 5 describes the information Box seeks: “to determine just how much the soot is contributing to the melting of the ice sheet.” Unless sentence 4 comes after sentence 5, readers will not know what the phrase “this crucial information” in sentence 4 refers to.

Choices A, B, and C are incorrect because each results in an illogical sentence progression. None of the sentences that would precede sentence 4 provides details that could be referred to as “this crucial information.”

### QUESTION 23

**Choice D is the best answer** because it is free of redundancies and offers the correct form of the verb “wear” in this context.

Choices A, B, and C are incorrect because all three contain a redundancy. Considering that “quickly” is a fixed part of the sentence, choice A’s “soon” and choice B and C’s “promptly” all result in redundancies. Choices A and B are also incorrect because each uses an incorrect form of the verb.

### QUESTION 24

**Choice D is the best answer** because it is the only choice that provides a grammatically standard and coherent sentence. The participial phrase “Having become frustrated. . .” functions as an adjective modifying “I,” the writer.

Choices A, B, and C are incorrect because each results in a dangling modifier. The participial phrase “Having become frustrated . . .” does not refer to choice A’s “no colleagues,” choice B’s “colleagues,” or choice C’s “ideas.” As such, all three choices yield incoherent and grammatically incorrect sentences.

### QUESTION 25

**Choice B is the best answer** because it provides the correct preposition in this context, “about.”

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Choices A, C, and D are incorrect because each provides a preposition that deviates from correct usage. One might read an article “about” coworking spaces but not an article “into,” “upon,” or “for” coworking spaces.

### QUESTION 26

**Choice A is the best answer** because it provides the correct punctuation for the dependent clause that begins with the phrase “such as.”

Choices B, C, and D are incorrect because each presents punctuation that deviates from the standard way of punctuating the phrase “such as.” When “such as” is a part of a nonrestrictive clause, as it is here, only one comma is needed to separate it from the main independent clause.

### QUESTION 27

**Choice B is the best answer** because it provides a transitional phrase, “In addition to equipment,” that accurately represents the relationship between the two sentences connected by the transitional phrase. Together, the sentences describe the key features of coworking spaces, focusing on what the spaces offer (equipment and meeting rooms).

Choices A, C, and D are incorrect because each provides a transition that does not accurately represent the relationship between the two sentences.

### QUESTION 28

**Choice C is the best answer** because the sentence is a distraction from the paragraph’s focus. Nothing in the paragraph suggests that the cost of setting up a coworking business is relevant here.

Choices A and D are incorrect because neither accurately represents the information in the paragraph. Choice B is incorrect because it does not accurately represent the information in the next paragraph.

### QUESTION 29

**Choice B is the best answer** because it logically follows the writer’s preceding statement about creativity and accurately represents the information in the graph.

Choices A, C, and D are incorrect because they present inaccurate and unsupported interpretations of the information in the graph. In addition, none of these choices provides directly relevant support for the main topic of the paragraph.

### QUESTION 30

**Choice D is the best answer** because it provides a relative pronoun and verb that create a standard and coherent sentence. The relative pronoun “who” refers to the subject “the people,” and the plural verb “use” corresponds grammatically with the plural noun “people.”

Choices A and B are incorrect because “whom” is the relative pronoun used to represent an object. The noun “people” is a subject performing an action (using the coworking space). Choices B and C are also incorrect because they display a form of the verb “to use” that does not correspond to the plural noun “people.”

### QUESTION 31

**Choice C is the best answer** because the proposed sentence offers a necessary and logical transition between sentence 2, which introduces the facility the writer chose, and sentence 3, which tells what happened at the facility “Throughout the morning.”

Choices A, B, and D are incorrect because each would result in an illogical progression of sentences.

### QUESTION 32

**Choice A is the best answer** because the punctuation it provides results in a grammatically standard and coherent sentence. When an independent clause is followed by a list, a colon is used to link the two.

Choice B is incorrect because the punctuation creates a fragment (a semicolon should be used to link two independent clauses).

Choice C is incorrect because its use of the comma creates a series in which “several of my coworking colleagues” are distinguished from the “website developer” and others, although the logic of the sentence would suggest that they are the same. Choice D is incorrect because it lacks the punctuation necessary to link the independent clause and the list.

### QUESTION 33

**Choice A is the best answer** because it provides a phrase that is consistent with standard English usage and also maintains the tone and style of the passage.

Choice B is incorrect because “give some wisdom” deviates from standard English usage and presents a somewhat colloquial phrase in a text that is generally free of colloquialisms. Choices C and D are incorrect because both are inconsistent with the tone of the passage as well as its purpose. The focus of the paragraph is on sharing, not on proclaiming opinions.

### QUESTION 34

**Choice A is the best answer** because it offers a phrase that introduces a basic definition of philosophy and thereby fits the sentence.

Choices B, C, and D are incorrect because each offers a transition that does not suit the purpose of the sentence.

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### QUESTION 35

**Choice A is the best answer** because it offers the most succinct comparison between the basic definition of philosophy and the fact that students can gain specific, practical skills from the study of philosophy. There is no need to include the participle “speaking” in this sentence, as it is clear from context that the writer is offering a different perspective.

Choices B, C, and D are incorrect because they provide options that are unnecessarily wordy.

### QUESTION 36

**Choice B is the best answer** because it provides a verb that creates a grammatically complete, standard, and coherent sentence.

Choices A, C, and D are incorrect because each results in a grammatically incomplete and incoherent sentence.

### QUESTION 37

**Choice D is the best answer** because it most effectively sets up the information in the following sentences, which state that (according to information from the 1990s) “only 18 percent of American colleges required at least one philosophy course,” and “more than 400 independent philosophy departments were eliminated” from colleges. These details are most logically linked to the claim that “colleges have not always supported the study of philosophy.”

Choices A, B, and C are incorrect because none of these effectively sets up the information that follows, which is about colleges’ failure to support the study of philosophy.

### QUESTION 38

**Choice C is the best answer** because it provides a transition that logically connects the information in the previous sentence to the information in this one. Both sentences provide evidence of colleges’ lack of support of philosophy programs, so the adverb “Moreover,” which means “In addition,” accurately captures the relationship between the two sentences.

Choices A, B, and D are incorrect because each presents a transition that does not accurately depict or support the relationship between the two sentences. The second sentence is not a result of the first (“Therefore,” “Thus”), and the sentences do not provide a contrast (“However”).

### QUESTION 39

**Choice A is the best answer** because it succinctly expresses the idea that “students who major in philosophy often do better . . . as measured by standardized test scores.”

Choices B and D are incorrect because they introduce a redundancy and a vague term, “results.” The first part of the sentence mentions a research finding or conclusion but does not directly address any “results,” so it is confusing to refer to “these results” and indicate that they “can be” or “are measured by standardized test scores.” The best way to express the idea is simply to say that some students “often do better” than some other students “in both verbal reasoning and analytical writing as measured by standardized test scores.” Choice C is incorrect because there is no indication that multiple criteria are used to evaluate students’ “verbal reasoning and analytical writing”: test scores and something else. Only test scores are mentioned.

#### QUESTION 40

**Choice B is the best answer** because it provides subject-verb agreement and thus creates a grammatically correct and coherent sentence.

Choice A is incorrect because the verb “has scored” does not correspond with the plural subject “students.” Similarly, Choice C is incorrect because the verb “scores” would correspond with a singular subject, but not the plural subject present in this sentence. Choice D is incorrect because it results in a grammatically incomplete and incoherent sentence.

#### QUESTION 41

**Choice B is the best answer** because it provides a coherent and grammatically standard sentence.

Choices A and D are incorrect because both present “students” in the possessive form, whereas the sentence establishes “students” as the subject (“many students . . . have”). Choice C is incorrect because the verb form it proposes results in an incomplete and incoherent sentence.

#### QUESTION 42

**Choice C is the best answer** because it accurately depicts how inserting this sentence would affect the overall paragraph. The fact that Plato used the dialogue form has little relevance to the preceding claim about the usefulness of a philosophy background.

Choices A and B are incorrect because the proposed sentence interrupts the progression of reasoning in the paragraph. Choice D is incorrect because, as with Choice A, Plato’s works have nothing to do with “the employability of philosophy majors.”

#### QUESTION 43

**Choice D is the best answer** because it creates a complete and coherent sentence.

Choices A, B, and C are incorrect because each inserts an unnecessary relative pronoun or conjunction, resulting in a sentence without a main verb.

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## QUESTION 44

**Choice D is the best answer** because it provides a possessive pronoun that is consistent with the sentence's plural subject "students," thus creating a grammatically sound sentence.

Choices A, B, and C are incorrect because each proposes a possessive pronoun that is inconsistent with the plural noun "students," the established subject of the sentence.

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice D is correct.** Since  $k = 3$ , one can substitute 3 for  $k$  in the equation  $\frac{x-1}{3} = k$ , which gives  $\frac{x-1}{3} = 3$ . Multiplying both sides of  $\frac{x-1}{3} = 3$  by 3 gives  $x - 1 = 9$  and then adding 1 to both sides of  $x - 1 = 9$  gives  $x = 10$ .

Choices A, B, and C are incorrect because the result of subtracting 1 from the value and dividing by 3 is not the given value of  $k$ , which is 3.

### QUESTION 2

**Choice A is correct.** To calculate  $(7 + 3i + (-8 + 9i))$ , add the real parts of each complex number,  $7 + (-8) = -1$ , and then add the imaginary parts,  $3i + 9i = 12i$ . The result is  $-1 + 12i$ .

Choices B, C, and D are incorrect and likely result from common errors that arise when adding complex numbers. For example, choice B is the result of adding  $3i$  and  $-9i$ , and choice C is the result of adding 7 and 8.

### QUESTION 3

**Choice C is correct.** The total number of text messages sent by Armand can be found by multiplying his rate of texting, in number of text messages sent per hour, by the total number of hours he spent sending them; that is  $m$  texts/hour  $\times$  5 hours =  $5m$  texts. Similarly, the total number of text messages sent by Tyrone is his hourly rate of texting multiplied by the 4 hours he spent texting:  $p$  texts/hour  $\times$  4 hours =  $4p$  texts. The total number of text messages sent by Armand and Tyrone is the sum of the total number of messages sent by Armand and the total number of messages sent by Tyrone:  $5m + 4p$ .

Choice A is incorrect and arises from adding the coefficients and multiplying the variables of  $5m$  and  $4p$ . Choice B is incorrect and is the result of multiplying  $5m$  and  $4p$ . The total number of messages sent by Armand and Tyrone should be the sum of  $5m$  and  $4p$ , not the product of these terms. Choice D is incorrect because it multiplies Armand's number of hours spent texting by Tyrone's hourly rate of



texting, and vice versa. This mix-up results in an expression that does not equal the total number of messages sent by Armand and Tyrone.

#### QUESTION 4

**Choice B is correct.** The value 108 in the equation is the value of  $P$  in  $P = 108 - 23d$  when  $d = 0$ . When  $d = 0$ , Kathy has worked 0 days that week. In other words, 108 is the number of phones left before Kathy has started work for the week. Therefore, the meaning of the value 108 in the equation is that Kathy starts each week with 108 phones to fix.

Choice A is incorrect because Kathy will complete the repairs when  $P = 0$ . Since  $P = 108 - 23d$ , this will occur when  $0 = 108 - 23d$  or when  $d = \frac{108}{23}$ , not when  $d = 108$ . Therefore, the value 108 in the equation does not represent the number of days it will take Kathy to complete the repairs. Choices C and D are incorrect because the number 23 in  $P = 108 - 23d$  indicates that the number of phones left will decrease by 23 for each increase in the value of  $d$  by 1; in other words, Kathy is repairing phones at a rate of 23 per day, not 108 per hour (choice C) or 108 per day (choice D).

#### QUESTION 5

**Choice C is correct.** Only like terms, with the same variables and exponents, can be combined to determine the answer as shown here:

$$\begin{aligned} & (x^2y - 3y^2 + 5xy^2 - (-x^2y + 3xy^2 - 3y^2)) \\ &= (x^2y - (-x^2y) + (-3y^2 - (-3y^2)) + (5xy^2 - 3xy^2)) \\ &= 2x^2y + 0 + 2xy^2 \\ &= 2x^2y + 2xy^2 \end{aligned}$$

Choices A, B, and D are incorrect and are the result of common calculation errors or of incorrectly combining like and unlike terms.

#### QUESTION 6

**Choice A is correct.** In the equation  $h = 3a + 28.6$ , if  $a$ , the age of the boy, increases by 1, then  $h$  becomes  $h = 3(a + 1) + 28.6 = 3a + 3 + 28.6 = 3a + 28.6 + 3$ . Therefore, the model estimates that the boy's height increases by 3 inches each year.

Alternatively: The height,  $h$ , is a linear function of the age,  $a$ , of the boy. The coefficient 3 can be interpreted as the rate of change of the function; in this case, the rate of change can be described as a change of 3 inches in height for every additional year in age.

Choices B, C, and D are incorrect and are likely the result of dividing 28.6 by 5, 3, and 2, respectively. The number 28.6 is the estimated height, in inches, of a newborn boy. However, dividing 28.6 by 5, 3, or 2 has no meaning in the context of this question.

### QUESTION 7

**Choice B is correct.** Since the right-hand side of the equation is

$P$  times the expression  $\frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1}$ , multiplying both

sides of the equation by the reciprocal of this expression results

in  $\frac{\left(1 + \frac{r}{1,200}\right)^N - 1}{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N} m = P$ .

Choice A is incorrect and is the result of multiplying both sides of the

equation by the rational expression  $\frac{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}{\left(1 + \frac{r}{1,200}\right)^N - 1}$  rather than

by the reciprocal of this expression  $\frac{\left(1 + \frac{r}{1,200}\right)^N - 1}{\left(\frac{r}{1,200}\right)\left(1 + \frac{r}{1,200}\right)^N}$ . Choices C

and D are incorrect and are likely the result of errors while trying to solve for  $P$ .

### QUESTION 8

**Choice C is correct.** Since  $\frac{a}{b} = 2$ , it follows that  $\frac{b}{a} = \frac{1}{2}$ . Multiplying both

sides of the equation by 4 gives  $4\left(\frac{b}{a}\right) = 4\left(\frac{1}{2}\right)$ , or  $\frac{4b}{a} = 2$ .

Choice A is incorrect because if  $\frac{4b}{a} = 0$ , then  $\frac{a}{b}$  would be undefined.

Choice B is incorrect because if  $\frac{4b}{a} = 1$ , then  $\frac{a}{b} = 4$ . Choice D is

incorrect because if  $\frac{4b}{a} = 4$ , then  $\frac{a}{b} = 1$ .

### QUESTION 9

**Choice B is correct.** Adding  $x$  and 19 to both sides of  $2y - x = -19$  gives  $x = 2y + 19$ . Then, substituting  $2y + 19$  for  $x$  in  $3x + 4y = -23$  gives  $3(2y + 19) + 4y = -23$ . This last equation is equivalent to  $10y + 57 = -23$ . Solving  $10y + 57 = -23$  gives  $y = -8$ . Finally, substituting  $-8$  for  $y$  in  $2y - x = -19$  gives  $2(-8) - x = -19$ , or  $x = 3$ . Therefore, the solution  $(x, y)$  to the given system of equations is  $(3, -8)$ .

Choices A, C, and D are incorrect because when the given values of  $x$  and  $y$  are substituted in  $2y - x = -19$ , the value of the left side of the equation does not equal  $-19$ .

### QUESTION 10

**Choice A is correct.** Since  $g$  is an even function,  $g(-4) = g(4) = 8$ .

Alternatively: First find the value of  $a$ , and then find  $g(-4)$ .

Since  $g(4) = 8$ , substituting 4 for  $x$  and 8 for  $g(x)$  gives

$8 = a(4)^2 + 24 = 16a + 24$ . Solving this last equation gives  $a = -1$ .

Thus  $g(x) = -x^2 + 24$ , from which it follows that

$g(-4) = -(-4)^2 + 24$ ;  $g(-4) = -16 + 24$ ; and  $g(-4) = 8$ .

Choices B, C, and D are incorrect because  $g$  is a function and there can only be one value of  $g(-4)$ .

### QUESTION 11

**Choice D is correct.** To determine the price per pound of beef when it was equal to the price per pound of chicken, determine the value of  $x$  (the number of weeks after July 1) when the two prices were equal. The prices were equal when  $b = c$ ; that is, when  $2.35 + 0.25x = 1.75 + 0.40x$ . This last equation is equivalent to  $0.60 = 0.15x$ , and so  $x = \frac{0.60}{0.15} = 4$ . Then to determine  $b$ , the price per pound of beef, substitute 4 for  $x$  in  $b = 2.35 + 0.25x$ , which gives  $b = 2.35 + 0.25(4) = 3.35$  dollars per pound.

Choice A is incorrect. It results from substituting the value 1, not 4, for  $x$  in  $b = 2.35 + 0.25x$ . Choice B is incorrect. It results from substituting the value 2, not 4, for  $x$  in  $b = 2.35 + 0.25x$ . Choice C is incorrect. It results from substituting the value 3, not 4, for  $x$  in  $c = 1.75 + 0.40x$ .

### QUESTION 12

**Choice D is correct.** In the  $xy$ -plane, all lines that pass through the origin are of the form  $y = mx$ , where  $m$  is the slope of the line.

Therefore, the equation of this line is  $y = \frac{1}{7}x$ , or  $x = 7y$ . A point with coordinates  $(a, b)$  will lie on the line if and only if  $a = 7b$ . Of the given choices, only choice D,  $(14, 2)$ , satisfies this condition:  $14 = 7(2)$ .

Choice A is incorrect because the line determined by the origin  $(0, 0)$  and  $(0, 7)$  is the vertical line with equation  $x = 0$ ; that is, the  $y$ -axis.

The slope of the  $y$ -axis is undefined, not  $\frac{1}{7}$ . Therefore, the point  $(0, 7)$  does not lie on the line that passes the origin and has slope  $\frac{1}{7}$ .

Choices B and C are incorrect because neither of the ordered pairs has a  $y$ -coordinate that is  $\frac{1}{7}$  the value of the corresponding  $x$ -coordinate.

### QUESTION 13

**Choice B is correct.** To rewrite  $\frac{1}{\frac{1}{x+2} + \frac{1}{x+3}}$ , multiply

by  $\frac{(x+2)(x+3)}{(x+2)(x+3)}$ . This results in the expression  $\frac{(x+2)(x+3)}{(x+2) + (x+3)}$ , which is equivalent to the expression in choice B.

Choices A, C, and D are incorrect and could be the result of common algebraic errors that arise while manipulating a complex fraction.

### QUESTION 14

**Choice A is correct.** One approach is to express  $\frac{8^x}{2^y}$  so that the numerator and denominator are expressed with the same base. Since 2 and 8 are both powers of 2, substituting  $2^3$  for 8 in the numerator

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of  $\frac{8^x}{2^y}$  gives  $\frac{(2^3)^x}{2^y}$ , which can be rewritten as  $\frac{2^{3x}}{2^y}$ . Since the numerator and denominator of  $\frac{2^{3x}}{2^y}$  have a common base, this expression can be rewritten as  $2^{3x-y}$ . It is given that  $3x - y = 12$ , so one can substitute 12 for the exponent,  $3x - y$ , given that the expression  $\frac{8^x}{2^y}$  is equal to  $2^{12}$ .

Choice B is incorrect. The expression  $\frac{8^x}{2^y}$  can be rewritten as  $\frac{2^{3x}}{2^y}$ , or  $2^{3x-y}$ . If the value of  $2^{3x-y}$  is  $4^4$ , which can be rewritten as 28, then  $2^{3x-y} = 2^8$ , which results in  $3x - y = 8$ , not 12. Choice C is incorrect. If the value of  $\frac{8^x}{2^y}$  is  $8^2$ , then  $2^{3x-y} = 8^2$ , which results in  $3x - y = 6$ , not 12. Choice D is incorrect because the value of  $\frac{8^x}{2^y}$  can be determined.

### QUESTION 15

**Choice D is correct.** One can find the possible values of  $a$  and  $b$  in  $(ax + 2)(bx + 7)$  by using the given equation  $a + b = 8$  and finding another equation that relates the variables  $a$  and  $b$ . Since  $(ax + 2)(bx + 7) = 15x^2 + cx + 14$ , one can expand the left side of the equation to obtain  $abx^2 + 7ax + 2bx + 14 = 15x^2 + cx + 14$ . Since  $ab$  is the coefficient of  $x^2$  on the left side of the equation and 15 is the coefficient of  $x^2$  on the right side of the equation, it must be true that  $ab = 15$ . Since  $a + b = 8$ , it follows that  $b = 8 - a$ . Thus,  $ab = 15$  can be rewritten as  $a(8 - a) = 15$ , which in turn can be rewritten as  $a^2 - 8a + 15 = 0$ . Factoring gives  $(a - 3)(a - 5) = 0$ . Thus, either  $a = 3$  and  $b = 5$ , or  $a = 5$  and  $b = 3$ . If  $a = 3$  and  $b = 5$ , then  $(ax + 2)(bx + 7) = (3x + 2)(5x + 7) = 15x^2 + 31x + 14$ . Thus, one of the possible values of  $c$  is 31. If  $a = 5$  and  $b = 3$ , then  $(ax + 2)(bx + 7) = (5x + 2)(3x + 7) = 15x^2 + 41x + 14$ . Thus, another possible value for  $c$  is 41. Therefore, the two possible values for  $c$  are 31 and 41.

Choice A is incorrect; the numbers 3 and 5 are possible values for  $a$  and  $b$ , but not possible values for  $c$ . Choice B is incorrect; if  $a = 5$  and  $b = 3$ , then 6 and 35 are the coefficients of  $x$  when the expression  $(5x + 2)(3x + 7)$  is expanded as  $15x^2 + 35x + 6x + 14$ . However, when the coefficients of  $x$  are 6 and 35, the value of  $c$  is 41 and not 6 and 35. Choice C is incorrect; if  $a = 3$  and  $b = 5$ , then 10 and 21 are the coefficients of  $x$  when the expression  $(3x + 2)(5x + 7)$  is expanded as  $15x^2 + 21x + 10x + 14$ . However, when the coefficients of  $x$  are 10 and 21, the value of  $c$  is 31 and not 10 and 21.

### QUESTION 16

**The correct answer is 2.** To solve for  $t$ , factor the left side of  $t^2 - 4 = 0$ , giving  $(t - 2)(t + 2) = 0$ . Therefore, either  $t - 2 = 0$  or  $t + 2 = 0$ . If  $t - 2 = 0$ , then  $t = 2$ , and if  $t + 2 = 0$ , then  $t = -2$ . Since it is given that  $t > 0$ , the value of  $t$  must be 2.

Another way to solve for  $t$  is to add 4 to both sides of  $t^2 - 4 = 0$ , giving  $t^2 = 4$ . Then, taking the square root of the left and the right side of the equation gives  $t = \pm\sqrt{4} = \pm 2$ . Since it is given that  $t > 0$ , the value of  $t$  must be 2.

## QUESTION 17

**The correct answer is 1600.** It is given that  $\angle AEB$  and  $\angle CDB$  have the same measure. Since  $\angle ABE$  and  $\angle CBD$  are vertical angles, they have the same measure. Therefore, triangle  $EAB$  is similar to triangle  $DCB$  because the triangles have two pairs of congruent corresponding angles (angle-angle criterion for similarity of triangles). Since the triangles are similar, the corresponding sides are in the same proportion; thus  $\frac{CD}{x} = \frac{BD}{EB}$ . Substituting the given values of 800 for  $CD$ , 700 for  $BD$ , and 1400 for  $EB$  in  $\frac{CD}{x} = \frac{BD}{EB}$  gives  $\frac{800}{x} = \frac{700}{1400}$ . Therefore,  $x = \frac{800(1400)}{700} = 1600$ .

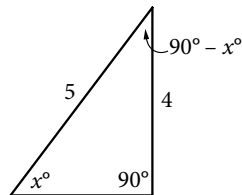
## QUESTION 18

**The correct answer is 7.** Subtracting the left and right sides of  $x + y = -9$  from the corresponding sides of  $x + 2y = -25$  gives  $(x + 2y) - (x + y) = -25 - (-9)$ , which is equivalent to  $y = -16$ . Substituting  $-16$  for  $y$  in  $x + y = -9$  gives  $x + (-16) = -9$ , which is equivalent to  $x = -9 - (-16) = 7$ .

## QUESTION 19

**The correct answer is  $\frac{4}{5}$  or 0.8.** By the complementary angle relationship for sine and cosine,  $\sin(x^\circ) = \cos(90^\circ - x^\circ)$ . Therefore,  $\cos(90^\circ - x^\circ) = \frac{4}{5}$ . Either the fraction  $\frac{4}{5}$  or its decimal equivalent, 0.8, may be gridded as the correct answer.

Alternatively, one can construct a right triangle that has an angle of measure  $x^\circ$  such that  $\sin(x^\circ) = \frac{4}{5}$ , as shown in the figure below, where  $\sin(x^\circ)$  is equal to the ratio of the length of the side opposite the angle measuring  $x^\circ$  to the length of the hypotenuse, or  $\frac{4}{5}$ .



Since two of the angles of the triangle are of measure  $x^\circ$  and  $90^\circ$ , the third angle must have the measure  $180^\circ - 90^\circ - x^\circ = 90^\circ - x^\circ$ . From the figure,  $\cos(90^\circ - x^\circ)$ , which is equal to the ratio of the length of the side adjacent to the angle measuring  $90^\circ - x^\circ$  to the hypotenuse, is also  $\frac{4}{5}$ .

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## QUESTION 20

**The correct answer is 100.** Since  $a = 5\sqrt{2}$ , one can substitute  $5\sqrt{2}$  for  $a$  in  $2a = \sqrt{2x}$ , giving  $10\sqrt{2} = \sqrt{2x}$ . Squaring each side of  $10\sqrt{2} = \sqrt{2x}$  gives  $(10\sqrt{2})^2 = (\sqrt{2x})^2$ , which simplifies to  $(10)^2(\sqrt{2})^2 = (\sqrt{2x})^2$ , or  $200 = 2x$ . This gives  $x = 100$ . To verify, substitute 100 for  $x$  and  $5\sqrt{2}$  for  $a$  in the equation  $2a = \sqrt{2x}$ , which yields  $2(5\sqrt{2}) = \sqrt{2(100)}$ ; this is true since  $2(5\sqrt{2}) = 10\sqrt{2}$  and  $\sqrt{2(100)} = \sqrt{2}\sqrt{100} = 10\sqrt{2}$ .

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice B is correct.** On the graph, a line segment with a positive slope represents an interval over which the target heart rate is strictly increasing as time passes. A horizontal line segment represents an interval over which there is no change in the target heart rate as time passes, and a line segment with a negative slope represents an interval over which the target heart rate is strictly decreasing as time passes. Over the interval between 40 and 60 minutes, the graph consists of a line segment with a positive slope followed by a line segment with a negative slope, with no horizontal line segment in between, indicating that the target heart rate is strictly increasing then strictly decreasing.

Choice A is incorrect because the graph over the interval between 0 and 30 minutes contains a horizontal line segment, indicating a period in which there was no change in the target heart rate. Choice C is incorrect because the graph over the interval between 50 and 65 minutes consists of a line segment with a negative slope followed by a line segment with a positive slope, indicating that the target heart rate is strictly decreasing then strictly increasing. Choice D is incorrect because the graph over the interval between 70 and 90 minutes contains horizontal line segments and no segment with a negative slope.

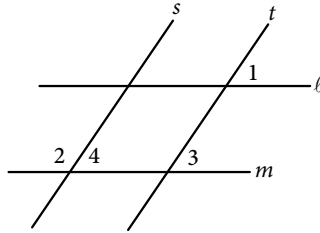
### QUESTION 2

**Choice C is correct.** Substituting 6 for  $x$  and 24 for  $y$  in  $y = kx$  gives  $24 = (k)(6)$ , which gives  $k = 4$ . Hence,  $y = 4x$ . Therefore, when  $x = 5$ , the value of  $y$  is  $(4)(5) = 20$ . None of the other choices for  $y$  is correct because  $y$  is a function of  $x$ , and so there is only one  $y$ -value for a given  $x$ -value.

Choices A, B, and D are incorrect. Choice A is the result of substituting 6 for  $y$  and substituting 5 for  $x$  in the equation  $y = kx$ , when solving for  $k$ . Choice B results from substituting 3 for  $k$  and 5 for  $x$  in the equation  $y = kx$ , when solving for  $y$ . Choice D results from using  $y = k + x$  instead of  $y = kx$ .

## QUESTION 3

**Choice D is correct.** Consider the measures of  $\angle 3$  and  $\angle 4$  in the figure below.



The measure of  $\angle 3$  is equal to the measure of  $\angle 1$  because they are corresponding angles for the parallel lines  $l$  and  $m$  intersected by the transversal line  $t$ . Similarly, the measure of  $\angle 3$  is equal to the measure of  $\angle 4$  because they are corresponding angles for the parallel lines  $s$  and  $t$  intersected by the transversal line  $m$ . Since the measure of  $\angle 1$  is  $35^\circ$ , the measures of  $\angle 3$  and  $\angle 4$  are also  $35^\circ$ . Since  $\angle 4$  and  $\angle 2$  are supplementary angles, the sum of the measures of these two angles is  $180^\circ$ . Therefore, the measure of  $\angle 2$  is  $180^\circ - 35^\circ = 145^\circ$ .

Choice A is incorrect because  $35^\circ$  is the measure of  $\angle 1$ , and  $\angle 1$  is not congruent to  $\angle 2$ . Choice B is incorrect because it is the measure of the complementary angle of  $\angle 1$ , and  $\angle 1$  and  $\angle 2$  are not complementary angles. Choice C is incorrect because it is double the measure of  $\angle 1$ , which cannot be inferred from the information given.

## QUESTION 4

**Choice C is correct.** The description “ $16 + 4x$  is 10 more than 14” can be written as the equation  $16 + 4x = 10 + 14$ , which is equivalent to  $16 + 4x = 24$ . Subtracting 16 from each side of  $16 + 4x = 24$  gives  $4x = 8$ . Since  $8x$  is 2 times  $4x$ , multiplying both sides of  $4x = 8$  by 2 gives  $8x = 16$ . Therefore, the value of  $8x$  is 16.

Choice A is incorrect because it is the value of  $x$ , not  $8x$ . Choices B and D are incorrect and may be the result of errors made when solving the equation  $16 + 4x = 10 + 14$  for  $x$ . For example, choice D could be the result of subtracting 16 from the left side of the equation and adding 16 to the right side of the equation  $16 + 4x = 10 + 14$ , giving  $4x = 40$  and  $8x = 80$ .

## QUESTION 5

**Choice D is correct.** A graph with a strong negative association between  $d$  and  $t$  would have the points on the graph closely aligned with a line that has a negative slope. The more closely the points on a graph are aligned with a line, the stronger the association between  $d$  and  $t$ , and a negative slope indicates a negative association. Of the four graphs, the points on graph D are most closely aligned with a line with a negative slope. Therefore, the graph in choice D has the strongest negative association between  $d$  and  $t$ .

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Choice A is incorrect because the points are more scattered than the points in choice D, indicating a weaker negative association between  $d$  and  $t$ . Choice B is incorrect because the points are aligned to either a curve or possibly a line with a small positive slope. Choice C is incorrect because the points are aligned to a line with a positive slope, indicating a positive association between  $d$  and  $t$ .

### QUESTION 6

**Choice D is correct.** Since there are 10 grams in 1 decagram, there are  $2 \times 10 = 20$  grams in 2 decagrams. Since there are 1,000 milligrams in 1 gram, there are  $20 \times 1,000 = 20,000$  milligrams in 20 grams. Therefore, 20,000 1-milligram doses of the medicine can be stored in a 2-decagram container.

Choice A is incorrect; 0.002 is the number of grams in 2 milligrams. Choice B is incorrect; it could result from multiplying by 1,000 and dividing by 10 instead of multiplying by both 1,000 and 10 when converting from decagrams to milligrams. Choice C is incorrect; 2,000 is the number of milligrams in 2 grams, not the number of milligrams in 2 decagrams.

### QUESTION 7

**Choice C is correct.** Let  $x$  represent the number of installations that each unit on the  $y$ -axis represents. Then  $9x$ ,  $5x$ ,  $6x$ ,  $4x$ , and  $3.5x$  are the number of rooftops with solar panel installations in cities A, B, C, D, and E, respectively. Since the total number of rooftops is 27,500, it follows that  $9x + 5x + 6x + 4x + 3.5x = 27,500$ , which simplifies to  $27.5x = 27,500$ . Thus,  $x = 1,000$ . Therefore, an appropriate label for the  $y$ -axis is "Number of installations (in thousands)."

Choices A, B, and D are incorrect and may result from errors when setting up and calculating the units for the  $y$ -axis.

### QUESTION 8

**Choice D is correct.** If the value of  $|n - 1| + 1$  is equal to 0, then  $|n - 1| + 1 = 0$ . Subtracting 1 from both sides of this equation gives  $|n - 1| = -1$ . The expression  $|n - 1|$  on the left side of the equation is the absolute value of  $n - 1$ , and the absolute value of a quantity can never be negative. Thus  $|n - 1| = -1$  has no solution. Therefore, there are no values for  $n$  for which the value of  $|n - 1| + 1$  is equal to 0.

Choice A is incorrect because  $|0 - 1| + 1 = 1 + 1 = 2$ , not 0. Choice B is incorrect because  $|1 - 1| + 1 = 0 + 1 = 1$ , not 0. Choice C is incorrect because  $|2 - 1| + 1 = 1 + 1 = 2$ , not 0.

### QUESTION 9

**Choice A is correct.** Subtracting 1,052 from both sides of the equation  $a = 1,052 + 1.08t$  gives  $a - 1,052 = 1.08t$ . Then dividing both sides of  $a - 1,052 = 1.08t$  by 1.08 gives  $t = \frac{a - 1,052}{1.08}$ .



Choices B, C, and D are incorrect and could arise from errors in rewriting  $a = 1,052 + 1.08t$ . For example, choice B could result if 1,052 is added to the left side of  $a = 1,052 + 1.08t$  and subtracted from the right side, and then both sides are divided by 1.08.

### QUESTION 10

**Choice B is correct.** The air temperature at which the speed of a sound wave is closest to 1,000 feet per second can be found by substituting 1,000 for  $a$  and then solving for  $t$  in the given formula. Substituting 1,000 for  $a$  in the equation  $a = 1,052 + 1.08t$  gives  $1,000 = 1,052 + 1.08t$ . Subtracting 1,052 from both sides of the equation  $1,000 = 1,052 + 1.08t$  and then dividing both sides of the equation by 1.08 yields  $t = \frac{-52}{1.08} \approx -48.15$ . Of the choices given,  $-48^\circ\text{F}$  is closest to  $-48.15^\circ\text{F}$ .

Choices A, C, and D are incorrect and might arise from errors made when substituting 1,000 for  $a$  or solving for  $t$  in the equation  $a = 1,052 + 1.08t$  or in rounding the result to the nearest integer. For example, choice C could be the result of rounding  $-48.15$  to  $-49$  instead of  $-48$ .

### QUESTION 11

**Choice A is correct.** Subtracting  $3x$  and adding 3 to both sides of  $3x - 5 \geq 4x - 3$  gives  $-2 \geq x$ . Therefore,  $x$  is a solution to  $3x - 5 \geq 4x - 3$  if and only if  $x$  is less than or equal to  $-2$  and  $x$  is NOT a solution to  $3x - 5 \geq 4x - 3$  if and only if  $x$  is greater than  $-2$ . Of the choices given, only  $-1$  is greater than  $-2$  and, therefore, cannot be a value of  $x$ .

Choices B, C, and D are incorrect because each is a value of  $x$  that is less than or equal to  $-2$  and, therefore, could be a solution to the inequality.

### QUESTION 12

**Choice C is correct.** The average number of seeds per apple is the total number of seeds in the 12 apples divided by the number of apples, which is 12. On the graph, the horizontal axis is the number of seeds per apple and the height of each bar is the number of apples with the corresponding number of seeds. The first bar on the left indicates that 2 apples have 3 seeds each, the second bar indicates that 4 apples have 5 seeds each, the third bar indicates that 1 apple has 6 seeds, the fourth bar indicates that 2 apples have 7 seeds each, and the fifth bar indicates that 3 apples have 9 seeds each. Thus, the total number of seeds for the 12 apples is  $2 \times 3 + (4 \times 5) + (1 \times 6) + (2 \times 7) + (3 \times 9) = 73$ , and the average number of seeds per apple is  $\frac{73}{12} = 6.08$ . Of the choices given, 6 is closest to 6.08.

Choice A is incorrect; it is the number of apples represented by the tallest bar but is not the average number of seeds for the 12 apples. Choice B is incorrect; it is the number of seeds per apple corresponding to the tallest bar, but is not the average number of seeds for the 12 apples. Choice D is incorrect; a student might choose this value by correctly calculating the average number of seeds, 6.08, but incorrectly rounding up to 7.

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### QUESTION 13

**Choice C is correct.** From the table, there was a total of 310 survey respondents, and 19% of all survey respondents is equivalent to  $\frac{19}{100} \times 310 = 58.9$  respondents. Of the choices given, 59, the number of males taking Geometry, is closest to 58.9 respondents.

Choices A, B, and D are incorrect because the number of males taking Geometry is closer to 58.9 (which is 19% of 310) than the number of respondents in each of these categories.

### QUESTION 14

**Choice C is correct.** The range of the lengths of the 21 fish represented in the table is  $24 - 8 = 16$  inches, and the range of the remaining 20 lengths after the 24-inch measurement is removed is  $16 - 8 = 8$  inches. Therefore, after the 24-inch measurement is removed, the change in range, 8 inches, is much greater than the change in the mean or median.

Choice A is incorrect. Let  $m$  be the mean of the lengths, in inches, of the 21 fish. Then the sum of the lengths, in inches, of the 21 fish is  $21m$ . After the 24-inch measurement is removed, the sum of the lengths, in inches, of the remaining 20 fish is  $21m - 24$ , and the mean length, in inches, of these 20 fish is  $\frac{21m - 24}{20}$ , which is a change of  $\frac{24 - m}{20}$  inches. Since  $m$  must be between the smallest and largest measurements of the 21 fish, it follows that  $8 < m < 24$ , from which it can be seen that the change in the mean, in inches, is between  $\frac{24 - 24}{20} = 0$  and  $\frac{24 - 8}{20} = \frac{4}{5}$ , and so must be less than the change in the range, 8 inches. Choice B is incorrect because the median length of the 21 fish represented in the table is 12, and after the 24-inch measurement is removed, the median of the remaining 20 lengths is also 12. Therefore, the change in the median (0) is less than the change in the range (8). Choice D is incorrect because the changes in the mean, median, and range of the measurements are different.

### QUESTION 15

**Choice A is correct.** The total cost  $C$  of renting a boat is the sum of the initial cost to rent the boat plus the product of the cost per hour and the number of hours,  $h$ , that the boat is rented. The  $C$ -intercept is the point on the  $C$ -axis where  $h$ , the number of hours the boat is rented, is 0. Therefore, the  $C$ -intercept is the initial cost of renting the boat.

Choice B is incorrect because the graph represents the cost of renting only one boat. Choice C is incorrect because the total number of hours of rental is represented by  $h$ -values, each of which corresponds to the first coordinate of a point on the graph not the  $C$ -intercept of the graph. Choice D is incorrect because the increase in cost for each additional hour is given by the slope of the line, not by the  $C$ -intercept.

### QUESTION 16

**Choice C is correct.** If  $m$  is the slope and  $b$  is the  $C$ -intercept of the line, the relationship between  $h$  and  $C$  can be represented by  $C = mh + b$ . The  $C$ -intercept of the line is 5. Since the points  $(0, 5)$  and  $(1, 8)$  lie on the line, the slope of the line is  $\frac{8-5}{1-0} = \frac{3}{1} = 3$ . Therefore, the relationship between  $h$  and  $C$  can be represented by  $C = 3h + 5$ , the slope-intercept equation of the line.

Choices A and D are incorrect because each of these equations represents a line that passes through the origin  $(0, 0)$ . However,  $C$  is not equal to zero when  $h = 0$ . Choice B is incorrect and may result from errors made when reading the scale on each axis as related to calculating the slope.

### QUESTION 17

**Choice B is correct.** The minimum value of the function corresponds to the  $y$ -coordinate of the point on the graph that has the smallest  $y$ -coordinate on the graph. Since the smallest  $y$ -coordinate belongs to the point with coordinates  $(-3, -2)$ , the minimum value of the graph is  $f(-3) = -2$ . Therefore, the minimum value of  $f(x)$  is at  $x = -3$ .

Choice A is incorrect;  $-5$  is the least value for an  $x$ -coordinate, not the  $y$ -coordinate, of a point on the graph of  $y = f(x)$ . Choice C is incorrect; it is the minimum value of  $f$ , not the value of  $x$  that corresponds to the minimum of  $f$ . Choice D is incorrect; it is the value of  $x$  for which the value of  $f(x)$  has its maximum, not minimum.

### QUESTION 18

**Choice A is correct.** Since  $(0, 0)$  is a solution to the system of inequalities, substituting 0 for  $x$  and 0 for  $y$  in the given system must result in two true inequalities. After this substitution,  $y < -x + a$  becomes  $0 < a$ , and  $y > x + b$  becomes  $0 > b$ . Hence,  $a$  is positive and  $b$  is negative. Therefore,  $a > b$ .

Choice B is incorrect because  $b > a$  cannot be true if  $b$  is negative and  $a$  is positive. Choice C is incorrect because it is possible to find an example where  $(0, 0)$  is a solution to the system, but  $|a| < |b|$ ; for example, if  $a = 6$  and  $b = -7$ . Choice D is incorrect because the equation  $a = -b$  doesn't have to be true; for example,  $(0, 0)$  is a solution to the system of inequalities if  $a = 1$  and  $b = -2$ .

### QUESTION 19

**Choice B is correct.** To determine the number of salads sold, write and solve a system of two equations. Let  $x$  equal the number of salads sold and let  $y$  equal the number of drinks sold. Since a total of 209 salads and drinks were sold, the equation  $x + y = 209$  must hold. Since salads cost \$6.50 each, drinks cost \$2.00 each, and the total revenue from selling  $x$  salads and  $y$  drinks was \$836.50,

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the equation  $6.50x + 2.00y = 836.50$  must also hold. The equation  $x + y = 209$  is equivalent to  $2x + 2y = 418$ , and subtracting  $(2x + 2y)$  from the left-hand side and subtracting 418 from the right-hand side of  $6.50x + 2.00y = 836.50$  gives  $4.5x = 418.50$ . Therefore, the number of salads sold,  $x$ , was  $x = \frac{418.50}{4.50} = 93$ .

Choices A, C, and D are incorrect and could result from errors in writing the equations and solving the system of equations. For example, choice C could have been obtained by dividing the total revenue, \$836.50, by the total price of a salad and a drink, \$8.50, and then rounding up.

## QUESTION 20

**Choice D is correct.** Let  $x$  be the original price of the computer, in dollars. The discounted price is 20 percent off the original price, so  $x - 0.2x = 0.8x$  is the discounted price, in dollars. The sales tax is 8 percent of the discounted price, so  $0.08(0.8x)$  represents the sales tax Alma paid. The price  $p$ , in dollars, that Alma paid the cashiers is the sum of the discounted price and the tax:  $p = 0.8x + (0.08)(0.8x)$  which can be rewritten as  $p = 1.08(0.8x)$ . Therefore, the original price,  $x$ , of the computer, in dollars, can be written as  $\frac{p}{0.8)(1.08)}$  in terms of  $p$ .

Choices A, B, and C are incorrect. The expression in choice A represents 88% of the amount Alma paid to the cashier, and can be obtained by subtracting the discount of 20% from the original price and adding the sales tax of 8%. However, this is incorrect because 8% of the tax is over the discounted price, not the original one. The expression in choice B is the result of adding the factors associated with the discount and sales tax, 0.8 and .08, rather than multiplying them. The expression in choice C results from assigning  $p$  to represent the original price of the laptop, rather than to the amount Alma paid to the cashier.

## QUESTION 21

**Choice C is correct.** The probability that a person from Group Y who recalled at least 1 dream was chosen at random from the group of all people who recalled at least 1 dream is equal to the number of people in Group Y who recalled at least 1 dream divided by the total number of people in the two groups who recalled at least 1 dream. The number of people in Group Y who recalled at least 1 dream is the sum of the 11 people in Group Y who recalled 1 to 4 dreams and the 68 people in Group Y who recalled 5 or more dreams:  $11 + 68 = 79$ . The total number of people who recalled at least 1 dream is the sum of the 79 people in Group Y who recalled at least 1 dream, the 28 people in Group X who recalled 1 to 4 dreams, and the 57 people in Group X who recalled 5 or more dreams:  $79 + 28 + 57 = 164$ . Therefore, the probability is  $\frac{79}{164}$ .

Choice A is incorrect; it is the probability of choosing at random a person from Group Y who recalled 5 or more dreams. Choice B is incorrect; it is the probability of choosing at random a person from Group Y who recalled at least 1 dream. Choice D is incorrect; it is

the probability of choosing at random a person from the two groups combined who recalled at least 1 dream.

## QUESTION 22

**Choice B is correct.** The amounts given in the table are in thousands of dollars. Therefore, the amount in the annual budget for agriculture/natural resources is actually \$488,106,000 in 2010 and \$358,708,000 in 2008. Therefore, the change in the budgeted amount is  $\$488,106,000 - \$358,708,000 = \$129,398,000$ . Hence, the average change in the annual budget for agriculture/natural resources from 2008 to 2010 is  $\frac{\$129,398,000}{2} = \$64,699,000$  per year. Of the options given, this average rate of change is closest to \$65,000,000 per year.

Choices A and C are incorrect and may result from errors in setting up or calculating the average rate of change. Choice D is incorrect; \$130,000,000 is the approximate total change in the annual budget for agriculture/natural resources from 2008 to 2010, not the average rate of change from 2008 to 2010.

## QUESTION 23

**Choice B is correct.** The human resources budget in 2007 was 4,051,050 thousand dollars, and the human resources budget in 2010 was 5,921,379 thousand dollars. Therefore, the ratio of the 2007 budget to the 2010 budget is slightly greater than  $\frac{4}{6} = \frac{2}{3}$ . Similar estimates for agriculture/natural resources give a ratio of the 2007 budget to the 2010 budget of slightly greater than  $\frac{3}{4}$ ; for education, a ratio of slightly greater than  $\frac{2}{3}$ ; for highways and transportation, a ratio of slightly less than  $\frac{5}{6}$ ; and for public safety, a ratio of slightly greater than  $\frac{5}{9}$ . Therefore, of the given choices, education's ratio of the 2007 budget to the 2010 budget is closest to that of human resources.

Choices A, C, and D are incorrect because the ratio of the 2007 budget to 2010 budget for each of the programs given in these choices is further from the corresponding ratio for human resources than the corresponding ratio for education.

## QUESTION 24

**Choice A is correct.** The equation of a circle can be written as  $(x - h)^2 + (y - k)^2 = r^2$  where  $(h, k)$  are the coordinates of the center of the circle and  $r$  is the radius of the circle. Since the coordinates of the center of the circle are  $(0, 4)$ , the equation of the circle is  $x^2 + (y - 4)^2 = r^2$ . The radius of the circle is the distance from the center,  $(0, 4)$ , to the given endpoint of a radius,  $(\frac{4}{3}, 5)$ . By the distance formula,  $r^2 = (\frac{4}{3} - 0)^2 + (5 - 4)^2 = \frac{25}{9}$ . Therefore, an equation of the given circle is  $x^2 + (y - 4)^2 = \frac{25}{9}$ .

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Choices B and D are incorrect. The equations given in these choices represent a circle with center  $(0, -4)$ , not  $(0, 4)$ . Choice C is incorrect; it results from using  $r$  instead of  $r^2$  in the equation for the circle.

### QUESTION 25

**Choice D is correct.** When the ball hits the ground, its height is 0 meters. Substituting 0 for  $h$  in  $h = -4.9t^2 + 25t$  gives  $0 = -4.9t^2 + 25t$ , which can be rewritten as  $0 = t(-4.9t + 25)$ . Thus, the possible values of  $t$  are  $t = 0$  and  $t = \frac{25}{4.9} \approx 5.1$ . The time  $t = 0$  seconds corresponds to the time the ball is launched from the ground, and the time  $t \approx 5.1$  seconds corresponds to the time after launch that the ball hits the ground. Of the given choices, 5.0 seconds is closest to 5.1 seconds, so the ball returns to the ground approximately 5.0 seconds after it is launched.

Choice A, B, and C are incorrect and could arise from conceptual or computation errors while solving  $0 = -4.9t^2 + 25t$  for  $t$ .

### QUESTION 26

**Choice B is correct.** Let  $x$  represent the number of pears produced by the Type B trees. Type A trees produce 20 percent more pears than Type B trees, or  $x$ , which can be represented as  $x + 0.20x = 1.20x$  pears. Since Type A trees produce 144 pears, it follows that  $1.20x = 144$ . Thus  $x = \frac{144}{1.20} = 120$ . Therefore, the Type B trees produced 120 pears.

Choice A is incorrect because while 144 is reduced by approximately 20 percent, increasing 115 by 20 percent gives 138, not 144. Choice C is incorrect; it results from subtracting 20 from the number of pears produced by the Type A trees. Choice D is incorrect; it results from adding 20 percent of the number of pears produced by Type A trees to the number of pears produced by Type A trees.

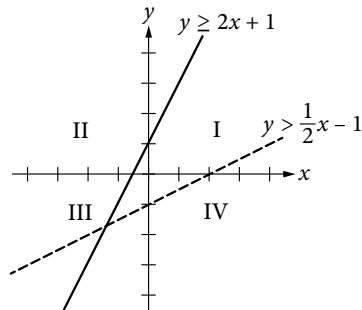
### QUESTION 27

**Choice C is correct.** The area of the field is 100 square meters. Each 1-meter-by-1-meter square has an area of 1 square meter. Thus, on average, the earthworm counts to a depth of 5 centimeters for each of the regions investigated by the students should be about  $\frac{1}{100}$  of the total number of earthworms to a depth of 5 centimeters in the entire field. Since the counts for the smaller regions are from 107 to 176, the estimate for the entire field should be between 10,700 and 17,600. Therefore, of the given choices, 15,000 is a reasonable estimate for the number of earthworms to a depth of 5 centimeters in the entire field.

Choice A is incorrect; 150 is the approximate number of earthworms in 1 square meter. Choice B is incorrect; it results from using 10 square meters as the area of the field. Choice D is incorrect; it results from using 1,000 square meters as the area of the field.

## QUESTION 28

**Choice C is correct.** To determine which quadrant does not contain any solutions to the system of inequalities, graph the inequalities. Graph the inequality  $y \geq 2x + 1$  by drawing a line through the y-intercept (0, 1) and the point (1, 3), as shown. The solutions to this inequality are all points contained on and above this line. Graph the inequality  $y > \frac{1}{2}x - 1$  by drawing a dashed line through the y-intercept (0, -1) and the point (2, 0), as shown. The solutions to this inequality are all points above this dashed line.



The solution to the system of inequalities is the intersection of the regions above the graphs of both lines. It can be seen that the solutions only include points in quadrants I, II, and III and do not include any points in quadrant IV.

Choices A and B are incorrect because quadrants II and III contain solutions to the system of inequalities, as shown in the figure above. Choice D is incorrect because there are no solutions in quadrant IV.

## QUESTION 29

**Choice D is correct.** If the polynomial  $p(x)$  is divided by  $x - 3$ , the result can be written as  $\frac{p(x)}{x-3} = q(x) + \frac{r}{x-3}$ , where  $q(x)$  is a polynomial and  $r$  is the remainder. Since  $x - 3$  is a degree 1 polynomial, the remainder is a real number. Hence,  $p(x)$  can be written as  $p(x) = (x - 3)q(x) + r$ , where  $r$  is a real number. It is given that  $p(3) = -2$  so it must be true that  $-2 = p(3) = (3 - 3)q(3) + r = (0)q(3) + r = r$ . Therefore, the remainder when  $p(x)$  is divided by  $x - 3$  is  $-2$ .

Choice A is incorrect because  $p(3) = -2$  does not imply that  $p(5) = 0$ . Choices B and C are incorrect because the remainder  $-2$  or its opposite,  $2$ , need not be a root of  $p(x)$ .

## QUESTION 30

**Choice D is correct.** Any quadratic function  $q$  can be written in the form  $q(x) = a(x - h)^2 + k$ , where  $a$ ,  $h$ , and  $k$  are constants and  $(h, k)$  is the vertex of the parabola when  $q$  is graphed in the coordinate plane. This form can be reached by completing the square in the expression that defines  $q$ . The equation of the graph is  $y = x^2 - 2x - 15$ .

---

Since the coefficient of  $x$  is  $-2$ , this equation can be written in terms of  $(x - 1)^2 = x^2 - 2x + 1$  as follows:  $y = x^2 - 2x - 15 = (x^2 - 2x + 1) - 16 = (x - 1)^2 - 16$ . From this form of the equation, the coefficients of the vertex can be read as  $(1, -16)$ .

Choices A and C are incorrect because the coordinates of the vertex A do not appear as constants in these equations. Choice B is incorrect because it is not equivalent to the given equation.

### QUESTION 31

**The correct answer is any number between 4 and 6, inclusive.** Since Wyatt can husk at least 12 dozen ears of corn per hour, it will take him no more than  $\frac{72}{12} = 6$  hours to husk 72 dozen ears of corn. On the other hand, since Wyatt can husk at most 18 dozen ears of corn per hour, it will take him at least  $\frac{72}{18} = 4$  hours to husk 72 dozen ears of corn.

Therefore, the possible times it could take Wyatt to husk 72 dozen ears of corn are 4 hours to 6 hours, inclusive. Any number between 4 and 6, inclusive, can be gridded as the correct answer.

### QUESTION 32

**The correct answer is 107.** Since the weight of the empty truck and its driver is 4500 pounds and each box weighs 14 pounds, the weight, in pounds, of the delivery truck, its driver, and  $x$  boxes is  $4500 + 14x$ . This weight is below the bridge's posted weight limit of 6000 pounds if  $4500 + 14x < 6000$ . Subtracting 4500 from both sides of this inequality and then dividing both sides by 14 yields  $x < \frac{1500}{14}$  or  $x < 107\frac{1}{7}$ . Since the number of packages must be an integer, the maximum possible value for  $x$  that will keep the combined weight of the truck, its driver, and the  $x$  identical boxes below the bridge's posted weight limit is 107.

### QUESTION 33

**The correct answer is  $\frac{5}{8}$  or .625.** Based on the line graph, the number of portable media players sold in 2008 was 100 million, and the number of portable media players sold in 2011 was 160 million. Therefore, the number of portable media players sold in 2008 is  $\frac{100 \text{ million}}{160 \text{ million}}$  of the portable media players sold in 2011. This fraction reduces to  $\frac{5}{8}$ . Either  $\frac{5}{8}$  or its decimal equivalent, .625, may be gridded as the correct answer.



**QUESTION 34**

**The correct answer is 96.** Since each day has a total of 24 hours of time slots available for the station to sell, there is a total of 48 hours of time slots available to sell on Tuesday and Wednesday. Each time slot is a 30-minute interval, which is equal to a  $\frac{1}{2}$ -hour interval. Therefore,

there are  $\frac{48 \text{ hours}}{\frac{1}{2} \text{ hours/time slot}} = 96$  time slots of 30 minutes for the station to sell on Tuesday and Wednesday.

**QUESTION 35**

**The correct answer is 6.** The volume of a cylinder is  $\pi r^2 h$ , where  $r$  is the radius of the base of the cylinder and  $h$  is the height of the cylinder. Since the storage silo is a cylinder with volume  $72\pi$  cubic yards and height 8 yards, it follows that  $72\pi = \pi r^2(8)$ , where  $r$  is the radius of the base of the cylinder, in yards. Dividing both sides of the equation  $72\pi = \pi r^2(8)$  by  $8\pi$  gives  $r^2 = 9$ , and so the radius of the base of the cylinder is 3 yards. Therefore, the diameter of the base of the cylinder is 6 yards.

**QUESTION 36**

**The correct answer is 3.** The function  $h(x)$  is undefined when the denominator of  $\frac{1}{(x-5)^2 + 4(x-5) + 4}$  is equal to zero. The expression  $(x-5)^2 + 4(x-5) + 4$  is a perfect square:  $(x-5)^2 + 4(x-5) + 4 = ((x-5) + 2)^2$ , which can be rewritten as  $(x-3)^2$ . The expression  $(x-3)^2$  is equal to zero if and only if  $x = 3$ . Therefore, the value of  $x$  for which  $h(x)$  is undefined is 3.

**QUESTION 37**

**The correct answer is 1.02.** The initial deposit earns 2 percent interest compounded annually. Thus at the end of 1 year, the new value of the account is the initial deposit of \$100 plus 2 percent of the initial deposit:  $\$100 + \frac{2}{100}(\$100) = \$100(1.02)$ . Since the interest is compounded annually, the value at the end of each succeeding year is the sum of the previous year's value plus 2 percent of the previous year's value. This is again equivalent to multiplying the previous year's value by 1.02. Thus, after 2 years, the value will be  $\$100(1.02)(1.02) = \$100(1.02)^2$ ; after 3 years, the value will be  $\$100(1.02)^3$ ; and after  $t$  years, the value will be  $\$100(1.02)^t$ . Therefore, in the formula for the value for Jessica's account after  $t$  years,  $\$100(x)^t$ , the value of  $x$  must be 1.02.

---

### QUESTION 38

**The correct answer is 6.11.** Jessica made an initial deposit of \$100 into her account. The interest on her account is 2 percent compounded annually, so after 10 years, the value of her initial deposit has been multiplied 10 times by the factor  $1 + 0.02 = 1.02$ . Hence, after 10 years, Jessica's deposit is worth  $\$100(1.02)^{10} = \$121.899$  to the nearest tenth of a cent. Tyshaun made an initial deposit of \$100 into his account. The interest on his account is 2.5 percent compounded annually, so after 10 years, the value of his initial deposit has been multiplied 10 times by the factor  $1 + 0.025 = 1.025$ . Hence, after 10 years, Tyshaun's deposit is worth  $\$100(1.025)^{10} = \$128.008$  to the nearest tenth of a cent. Hence, Jessica's initial deposit earned \$21.899 and Tyshaun's initial deposit earned \$28.008. Therefore, to the nearest cent, Tyshaun's initial deposit earned \$6.11 more than Jessica's initial deposit.

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# Practice Test #2

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is from Charlotte Brontë, *The Professor*, originally published in 1857.

No man likes to acknowledge that he has made a mistake in the choice of his profession, and every man, worthy of the name, will row long against wind and tide before he allows himself to cry out, “I am  
 5 baffled!” and submits to be floated passively back to land. From the first week of my residence in X— I felt my occupation irksome. The thing itself—the work of copying and translating business-letters— was a dry and tedious task enough, but had that been  
 10 all, I should long have borne with the nuisance; I am not of an impatient nature, and influenced by the double desire of getting my living and justifying to myself and others the resolution I had taken to become a tradesman, I should have endured in  
 15 silence the rust and cramp of my best faculties; I should not have whispered, even inwardly, that I longed for liberty; I should have pent in every sigh by which my heart might have ventured to intimate its distress under the closeness, smoke, monotony, and  
 20 joyless tumult of Bigben Close, and its panting desire for freer and fresher scenes; I should have set up the image of Duty, the fetish of Perseverance, in my small bedroom at Mrs. King’s lodgings, and they two should have been my household gods, from which

25 my darling, my cherished-in-secret, Imagination, the tender and the mighty, should never, either by softness or strength, have severed me. But this was not all; the antipathy which had sprung up between myself and my employer striking deeper root and spreading denser shade daily, excluded me from every glimpse of the sunshine of life; and I began to feel like a plant growing in humid darkness out of the slimy walls of a well.

Antipathy is the only word which can express the  
 35 feeling Edward Crimsworth had for me—a feeling, in a great measure, involuntary, and which was liable to be excited by every, the most trifling movement, look, or word of mine. My southern accent annoyed him; the degree of education evinced in my language  
 40 irritated him; my punctuality, industry, and accuracy, fixed his dislike, and gave it the high flavour and poignant relish of envy; he feared that I too should one day make a successful tradesman. Had I been in anything inferior to him, he would not  
 45 have hated me so thoroughly, but I knew all that he knew, and, what was worse, he suspected that I kept the padlock of silence on mental wealth in which he was no sharer. If he could have once placed me in a ridiculous or mortifying position, he would have  
 50 forgiven me much, but I was guarded by three faculties—Caution, Tact, Observation; and prowling and prying as was Edward’s malignity, it could never baffle the lynx-eyes of these, my natural sentinels. Day by day did his malice watch my tact, hoping it  
 55 would sleep, and prepared to steal snake-like on its slumber; but tact, if it be genuine, never sleeps.

I had received my first quarter's wages, and was returning to my lodgings, possessed heart and soul with the pleasant feeling that the master who had paid me grudged every penny of that hard-earned pittance—(I had long ceased to regard Mr. Crimsworth as my brother—he was a hard, grinding master; he wished to be an inexorable tyrant: that was all). Thoughts, not varied but strong, occupied my mind; two voices spoke within me; again and again they uttered the same monotonous phrases. One said: "William, your life is intolerable." The other: "What can you do to alter it?" I walked fast, for it was a cold, frosty night in January; as I approached my lodgings, I turned from a general view of my affairs to the particular speculation as to whether my fire would be out; looking towards the window of my sitting-room, I saw no cheering red gleam.

1

Which choice best summarizes the passage?

- A) A character describes his dislike for his new job and considers the reasons why.
- B) Two characters employed in the same office become increasingly competitive.
- C) A young man regrets privately a choice that he defends publicly.
- D) A new employee experiences optimism, then frustration, and finally despair.

2

The main purpose of the opening sentence of the passage is to

- A) establish the narrator's perspective on a controversy.
- B) provide context useful in understanding the narrator's emotional state.
- C) offer a symbolic representation of Edward Crimsworth's plight.
- D) contrast the narrator's good intentions with his malicious conduct.

3

During the course of the first paragraph, the narrator's focus shifts from

- A) recollection of past confidence to acknowledgment of present self-doubt.
- B) reflection on his expectations of life as a tradesman to his desire for another job.
- C) generalization about job dissatisfaction to the specifics of his own situation.
- D) evaluation of factors making him unhappy to identification of alternatives.

4

The references to "shade" and "darkness" at the end of the first paragraph mainly have which effect?

- A) They evoke the narrator's sense of dismay.
- B) They reflect the narrator's sinister thoughts.
- C) They capture the narrator's fear of confinement.
- D) They reveal the narrator's longing for rest.

5

The passage indicates that Edward Crimsworth's behavior was mainly caused by his

- A) impatience with the narrator's high spirits.
- B) scorn of the narrator's humble background.
- C) indignation at the narrator's rash actions.
- D) jealousy of the narrator's apparent superiority.

6

The passage indicates that when the narrator began working for Edward Crimsworth, he viewed Crimsworth as a

- A) harmless rival.
- B) sympathetic ally.
- C) perceptive judge.
- D) demanding mentor.

7

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 28-31 (“the antipathy . . . life”)
- B) Lines 38-40 (“My southern . . . irritated him”)
- C) Lines 54-56 (“Day . . . slumber”)
- D) Lines 61-62 (“I had . . . brother”)

8

At the end of the second paragraph, the comparisons of abstract qualities to a lynx and a snake mainly have the effect of

- A) contrasting two hypothetical courses of action.
- B) conveying the ferocity of a resolution.
- C) suggesting the likelihood of an altercation.
- D) illustrating the nature of an adversarial relationship.

9

The passage indicates that, after a long day of work, the narrator sometimes found his living quarters to be

- A) treacherous.
- B) dreary.
- C) predictable.
- D) intolerable.

10

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 17-21 (“I should . . . scenes”)
- B) Lines 21-23 (“I should . . . lodgings”)
- C) Lines 64-67 (“Thoughts . . . phrases”)
- D) Lines 68-74 (“I walked . . . gleam”)



**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from Iain King, “Can Economics Be Ethical?” ©2013 by Prospect Publishing.

Recent debates about the economy have rediscovered the question, “is that right?”, where “right” means more than just profits or efficiency.

Line Some argue that because the free markets allow  
5 for personal choice, they are already ethical. Others have accepted the ethical critique and embraced corporate social responsibility. But before we can label any market outcome as “immoral,” or sneer at economists who try to put a price on being ethical,  
10 we need to be clear on what we are talking about.

There are different views on where ethics should apply when someone makes an economic decision. Consider Adam Smith, widely regarded as the founder of modern economics. He was a moral  
15 philosopher who believed sympathy for others was the basis for ethics (we would call it empathy nowadays). But one of his key insights in *The Wealth of Nations* was that acting on this empathy could be counter-productive—he observed people becoming  
20 better off when they put their own empathy aside, and interacted in a self-interested way. Smith justifies selfish behavior by the outcome. Whenever planners use cost-benefit analysis to justify a new railway line, or someone retrains to boost his or her earning  
25 power, or a shopper buys one to get one free, they are using the same approach: empathizing with someone, and seeking an outcome that makes that person as well off as possible—although the person they are empathizing with may be themselves in the  
30 future.

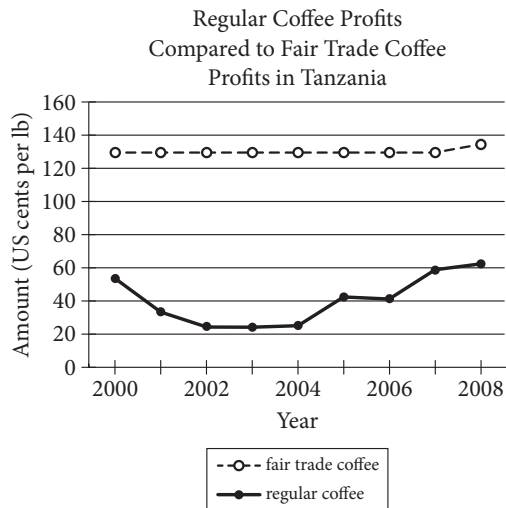
Instead of judging consequences, Aristotle said ethics was about having the right character—displaying virtues like courage and honesty. It is a view put into practice whenever  
35 business leaders are chosen for their good character. But it is a hard philosophy to teach—just how much loyalty should you show to a manufacturer that keeps losing money? Show too little and you’re a “greed is good” corporate raider; too much and you’re wasting  
40 money on unproductive capital. Aristotle thought there was a golden mean between the two extremes, and finding it was a matter of fine judgment. But if ethics is about character, it’s not clear what those characteristics should be.

45 There is yet another approach: instead of rooting ethics in character or the consequences of actions, we can focus on our actions themselves. From this perspective some things are right, some wrong—we should buy fair trade goods, we shouldn’t tell lies in  
50 advertisements. Ethics becomes a list of commandments, a catalog of “dos” and “don’ts.” When a finance official refuses to devalue a currency because they have promised not to, they are defining ethics this way. According to this approach  
55 devaluation can still be bad, even if it would make everybody better off.

Many moral dilemmas arise when these three versions pull in different directions but clashes are not inevitable. Take fair trade coffee (coffee that is  
60 sold with a certification that indicates the farmers and workers who produced it were paid a fair wage), for example: buying it might have good consequences, be virtuous, and also be the right way to act in a flawed market. Common ground like this  
65 suggests that, even without agreement on where ethics applies, ethical economics is still possible.

Whenever we feel queasy about “perfect” competitive markets, the problem is often rooted in a phony conception of people. The model of man on  
70 which classical economics is based—an entirely rational and selfish being—is a parody, as John Stuart Mill, the philosopher who pioneered the model, accepted. Most people—even economists—now accept that this “economic man” is a fiction.  
75 We behave like a herd; we fear losses more than we hope for gains; rarely can our brains process all the relevant facts.

These human quirks mean we can never make purely “rational” decisions. A new wave of behavioral  
80 economists, aided by neuroscientists, is trying to understand our psychology, both alone and in groups, so they can anticipate our decisions in the marketplace more accurately. But psychology can also help us understand why we react in disgust at  
85 economic injustice, or accept a moral law as universal. Which means that the relatively new science of human behavior might also define ethics for us. Ethical economics would then emerge from one of the least likely places: economists themselves.



Adapted from the Fair Trade Vancouver website.

11

The main purpose of the passage is to

- A) consider an ethical dilemma posed by cost-benefit analysis.
- B) describe a psychology study of ethical economic behavior.
- C) argue that the free market prohibits ethical economics.
- D) examine ways of evaluating the ethics of economics.

12

In the passage, the author anticipates which of the following objections to criticizing the ethics of free markets?

- A) Smith's association of free markets with ethical behavior still applies today.
- B) Free markets are the best way to generate high profits, so ethics are a secondary consideration.
- C) Free markets are ethical because they are made possible by devalued currency.
- D) Free markets are ethical because they enable individuals to make choices.

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 4-5 ("Some . . . ethical")
- B) Lines 7-10 ("But . . . about")
- C) Lines 21-22 ("Smith . . . outcome")
- D) Lines 52-54 ("When . . . way")

14

As used in line 6, “embraced” most nearly means

- A) lovingly held.
- B) readily adopted.
- C) eagerly hugged.
- D) reluctantly used.

15

The main purpose of the fifth paragraph (lines 45-56) is to

- A) develop a counterargument to the claim that greed is good.
- B) provide support for the idea that ethics is about character.
- C) describe a third approach to defining ethical economics.
- D) illustrate that one’s actions are a result of one’s character.

16

As used in line 58, “clashes” most nearly means

- A) conflicts.
- B) mismatches.
- C) collisions.
- D) brawls.

17

Which choice best supports the author’s claim that there is common ground shared by the different approaches to ethics described in the passage?

- A) Lines 11-12 (“There . . . decision”)
- B) Lines 47-50 (“From . . . advertisements”)
- C) Lines 59-64 (“Take . . . market”)
- D) Lines 75-77 (“We . . . facts”)

18

The main idea of the final paragraph is that

- A) human quirks make it difficult to predict people’s ethical decisions accurately.
- B) people universally react with disgust when faced with economic injustice.
- C) understanding human psychology may help to define ethics in economics.
- D) economists themselves will be responsible for reforming the free market.

19

Data in the graph about per-pound coffee profits in Tanzania most strongly support which of the following statements?

- A) Fair trade coffee consistently earned greater profits than regular coffee earned.
- B) The profits earned from regular coffee did not fluctuate.
- C) Fair trade coffee profits increased between 2004 and 2006.
- D) Fair trade and regular coffee were earning equal profits by 2008.

20

Data in the graph indicate that the greatest difference between per-pound profits from fair trade coffee and those from regular coffee occurred during which period?

- A) 2000 to 2002
- B) 2002 to 2004
- C) 2004 to 2005
- D) 2006 to 2008

21

Data in the graph provide most direct support for which idea in the passage?

- A) Acting on empathy can be counterproductive.
- B) Ethical economics is defined by character.
- C) Ethical economics is still possible.
- D) People fear losses more than they hope for gains.

**Questions 22-32 are based on the following passages.**

Passage 1 is adapted from Nicholas Carr, "Author Nicholas Carr: The Web Shatters Focus, Rewires Brains." ©2010 by Condé Nast. Passage 2 is from Steven Pinker, "Mind over Mass Media." ©2010 by The New York Times Company.

**Passage 1**

The mental consequences of our online info-crunching are not universally bad.

Certain cognitive skills are strengthened by our use of computers and the Net. These tend to involve  
 Line 5 more primitive mental functions, such as hand-eye coordination, reflex response, and the processing of visual cues. One much-cited study of video gaming revealed that after just 10 days of playing action games on computers, a group of young people had  
 10 significantly boosted the speed with which they could shift their visual focus between various images and tasks.

It's likely that Web browsing also strengthens brain functions related to fast-paced problem  
 15 solving, particularly when it requires spotting patterns in a welter of data. A British study of the way women search for medical information online indicated that an experienced Internet user can, at least in some cases, assess the trustworthiness and  
 20 probable value of a Web page in a matter of seconds. The more we practice surfing and scanning, the more adept our brain becomes at those tasks.

But it would be a serious mistake to look narrowly at such benefits and conclude that the Web is making  
 25 us smarter. In a *Science* article published in early 2009, prominent developmental psychologist Patricia Greenfield reviewed more than 40 studies of the effects of various types of media on intelligence and learning ability. She concluded that "every medium  
 30 develops some cognitive skills at the expense of others." Our growing use of the Net and other screen-based technologies, she wrote, has led to the "widespread and sophisticated development of visual-spatial skills." But those gains go hand in hand  
 35 with a weakening of our capacity for the kind of "deep processing" that underpins "mindful knowledge acquisition, inductive analysis, critical thinking, imagination, and reflection."

We know that the human brain is highly  
 40 plastic; neurons and synapses change as circumstances change. When we adapt to a new cultural phenomenon, including the use of a new

medium, we end up with a different brain, says Michael Merzenich, a pioneer of the field of neuroplasticity. That means our online habits continue to reverberate in the workings of our brain cells even when we're not at a computer. We're exercising the neural circuits devoted to skimming and multitasking while ignoring those used for reading and thinking deeply.

### Passage 2

Critics of new media sometimes use science itself to press their case, citing research that shows how "experience can change the brain." But cognitive neuroscientists roll their eyes at such talk. Yes, every time we learn a fact or skill the wiring of the brain changes; it's not as if the information is stored in the pancreas. But the existence of neural plasticity does not mean the brain is a blob of clay pounded into shape by experience.

Experience does not revamp the basic information-processing capacities of the brain. Speed-reading programs have long claimed to do just that, but the verdict was rendered by Woody Allen after he read Leo Tolstoy's famously long novel *War and Peace* in one sitting: "It was about Russia." Genuine multitasking, too, has been exposed as a myth, not just by laboratory studies but by the familiar sight of an SUV undulating between lanes as the driver cuts deals on his cell phone.

Moreover, the effects of experience are highly specific to the experiences themselves. If you train people to do one thing (recognize shapes, solve math puzzles, find hidden words), they get better at doing that thing, but almost nothing else. Music doesn't make you better at math, conjugating Latin doesn't make you more logical, brain-training games don't make you smarter. Accomplished people don't bulk up their brains with intellectual calisthenics; they immerse themselves in their fields. Novelists read lots of novels, scientists read lots of science.

The effects of consuming electronic media are likely to be far more limited than the panic implies. Media critics write as if the brain takes on the qualities of whatever it consumes, the informational equivalent of "you are what you eat." As with ancient peoples who believed that eating fierce animals made them fierce, they assume that watching quick cuts in rock videos turns your mental life into quick cuts or that reading bullet points and online postings turns your thoughts into bullet points and online postings.

22

The author of Passage 1 indicates which of the following about the use of screen-based technologies?

- A) It should be thoroughly studied.
- B) It makes the brain increasingly rigid.
- C) It has some positive effects.
- D) It should be widely encouraged.

23

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-4 ("Certain . . . Net")
- B) Lines 23-25 ("But . . . smarter")
- C) Lines 25-29 ("In a . . . ability")
- D) Lines 29-31 ("She . . . others")

24

The author of Passage 1 indicates that becoming adept at using the Internet can

- A) make people complacent about their health.
- B) undermine the ability to think deeply.
- C) increase people's social contacts.
- D) improve people's self-confidence.

25

As used in line 40, "plastic" most nearly means

- A) creative.
- B) artificial.
- C) malleable.
- D) sculptural.

26

The author of Passage 2 refers to the novel *War and Peace* primarily to suggest that Woody Allen

- A) did not like Tolstoy’s writing style.
- B) could not comprehend the novel by speed-reading it.
- C) had become quite skilled at multitasking.
- D) regretted having read such a long novel.

27

According to the author of Passage 2, what do novelists and scientists have in common?

- A) They take risks when they pursue knowledge.
- B) They are eager to improve their minds.
- C) They are curious about other subjects.
- D) They become absorbed in their own fields.

28

The analogy in the final sentence of Passage 2 has primarily which effect?

- A) It uses ornate language to illustrate a difficult concept.
- B) It employs humor to soften a severe opinion of human behavior.
- C) It alludes to the past to evoke a nostalgic response.
- D) It criticizes the view of a particular group.

29

The main purpose of each passage is to

- A) compare brain function in those who play games on the Internet and those who browse on it.
- B) report on the problem-solving skills of individuals with varying levels of Internet experience.
- C) take a position on increasing financial support for studies related to technology and intelligence.
- D) make an argument about the effects of electronic media use on the brain.

30

Which choice best describes the relationship between the two passages?

- A) Passage 2 relates first-hand experiences that contrast with the clinical approach in Passage 1.
- B) Passage 2 critiques the conclusions drawn from the research discussed in Passage 1.
- C) Passage 2 takes a high-level view of a result that Passage 1 examines in depth.
- D) Passage 2 predicts the negative reactions that the findings discussed in Passage 1 might produce.

31

On which of the following points would the authors of both passages most likely agree?

- A) Computer-savvy children tend to demonstrate better hand-eye coordination than do their parents.
- B) Those who criticize consumers of electronic media tend to overreact in their criticism.
- C) Improved visual-spatial skills do not generalize to improved skills in other areas.
- D) Internet users are unlikely to prefer reading onscreen text to reading actual books.

32

Which choice provides the best evidence that the author of Passage 2 would agree to some extent with the claim attributed to Michael Merzenich in lines 41-43, Passage 1?

- A) Lines 51-53 (“Critics . . . brain”)
- B) Lines 54-56 (“Yes . . . changes”)
- C) Lines 57-59 (“But . . . experience”)
- D) Lines 83-84 (“Media . . . consumes”)

**Questions 33-42 are based on the following passage.**

This passage is adapted from Elizabeth Cady Stanton's address to the 1869 Woman Suffrage Convention in Washington, DC.

I urge a sixteenth amendment, because "manhood suffrage," or a man's government, is civil, religious, and social disorganization. The male element is a  
 Line destructive force, stern, selfish, aggrandizing, loving  
 5 war, violence, conquest, acquisition, breeding in the material and moral world alike discord, disorder, disease, and death. See what a record of blood and cruelty the pages of history reveal! Through what  
 10 slavery, slaughter, and sacrifice, through what inquisitions and imprisonments, pains and persecutions, black codes and gloomy creeds, the soul of humanity has struggled for the centuries, while mercy has veiled her face and all hearts have been dead alike to love and hope!  
 15 The male element has held high carnival thus far; it has fairly run riot from the beginning, overpowering the feminine element everywhere, crushing out all the diviner qualities in human nature, until we know but little of true manhood and  
 20 womanhood, of the latter comparatively nothing, for it has scarce been recognized as a power until within the last century. Society is but the reflection of man himself, untempered by woman's thought; the hard iron rule we feel alike in the church, the state, and the  
 25 home. No one need wonder at the disorganization, at the fragmentary condition of everything, when we remember that man, who represents but half a complete being, with but half an idea on every subject, has undertaken the absolute control of all  
 30 sublunary matters.  
 People object to the demands of those whom they choose to call the strong-minded, because they say "the right of suffrage will make the women masculine." That is just the difficulty in which we are  
 35 involved today. Though disfranchised, we have few women in the best sense; we have simply so many reflections, varieties, and dilutions of the masculine gender. The strong, natural characteristics of womanhood are repressed and ignored in

40 dependence, for so long as man feeds woman she will try to please the giver and adapt herself to his condition. To keep a foothold in society, woman must be as near like man as possible, reflect his ideas, opinions, virtues, motives, prejudices, and vices. She  
 45 must respect his statutes, though they strip her of every inalienable right, and conflict with that higher law written by the finger of God on her own soul. . . .  
 . . . [M]an has been molding woman to his ideas by direct and positive influences, while she, if not a  
 50 negation, has used indirect means to control him, and in most cases developed the very characteristics both in him and herself that needed repression. And now man himself stands appalled at the results of his own excesses, and mourns in bitterness that  
 55 falsehood, selfishness, and violence are the law of life. The need of this hour is not territory, gold mines, railroads, or specie payments but a new evangel of womanhood, to exalt purity, virtue, morality, true religion, to lift man up into the higher realms of  
 60 thought and action.

We ask woman's enfranchisement, as the first step toward the recognition of that essential element in government that can only secure the health, strength, and prosperity of the nation. Whatever is done to lift  
 65 woman to her true position will help to usher in a new day of peace and perfection for the race.

In speaking of the masculine element, I do not wish to be understood to say that all men are hard, selfish, and brutal, for many of the most beautiful  
 70 spirits the world has known have been clothed with manhood; but I refer to those characteristics, though often marked in woman, that distinguish what is called the stronger sex. For example, the love of acquisition and conquest, the very pioneers of  
 75 civilization, when expended on the earth, the sea, the elements, the riches and forces of nature, are powers of destruction when used to subjugate one man to another or to sacrifice nations to ambition.

Here that great conservator of woman's love, if  
 80 permitted to assert itself, as it naturally would in freedom against oppression, violence, and war, would hold all these destructive forces in check, for woman knows the cost of life better than man does, and not with her consent would one drop of blood  
 85 ever be shed, one life sacrificed in vain.

33

The central problem that Stanton describes in the passage is that women have been

- A) denied equal educational opportunities, which has kept them from reaching their potential.
- B) prevented from exerting their positive influence on men, which has led to societal breakdown.
- C) prevented from voting, which has resulted in poor candidates winning important elections.
- D) blocked by men from serving as legislators, which has allowed the creation of unjust laws.

34

Stanton uses the phrase “high carnival” (line 15) mainly to emphasize what she sees as the

- A) utter domination of women by men.
- B) freewheeling spirit of the age.
- C) scandalous decline in moral values.
- D) growing power of women in society.

35

Stanton claims that which of the following was a relatively recent historical development?

- A) The control of society by men
- B) The spread of war and injustice
- C) The domination of domestic life by men
- D) The acknowledgment of women’s true character

36

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-7 (“The male . . . death”)
- B) Lines 15-22 (“The male . . . century”)
- C) Lines 22-25 (“Society . . . home”)
- D) Lines 48-52 (“[M]an . . . repression”)

37

As used in line 24, “rule” most nearly refers to

- A) a general guideline.
- B) a controlling force.
- C) an established habit.
- D) a procedural method.

38

It can reasonably be inferred that “the strong-minded” (line 32) was a term generally intended to

- A) praise women who fight for their long-denied rights.
- B) identify women who demonstrate intellectual skill.
- C) criticize women who enter male-dominated professions.
- D) condemn women who agitate for the vote for their sex.

39

As used in line 36, “best” most nearly means

- A) superior.
- B) excellent.
- C) genuine.
- D) rarest.

40

Stanton contends that the situation she describes in the passage has become so dire that even men have begun to

- A) lament the problems they have created.
- B) join the call for woman suffrage.
- C) consider women their social equals.
- D) ask women how to improve civic life.



41

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 25-30 (“No one . . . matters”)
- B) Lines 53-55 (“And now . . . life”)
- C) Lines 56-60 (“The need . . . action”)
- D) Lines 61-64 (“We ask . . . nation”)

42

The sixth paragraph (lines 67-78) is primarily concerned with establishing a contrast between

- A) men and women.
- B) the spiritual world and the material world.
- C) bad men and good men.
- D) men and masculine traits.

**Questions 43-52 are based on the following passage and supplementary material.**

This passage is adapted from Geoffrey Giller, “Long a Mystery, How 500-Meter-High Undersea Waves Form Is Revealed.” ©2014 by Scientific American.

Some of the largest ocean waves in the world are nearly impossible to see. Unlike other large waves, these rollers, called internal waves, do not ride the ocean surface. Instead, they move underwater, undetectable without the use of satellite imagery or sophisticated monitoring equipment. Despite their hidden nature, internal waves are fundamental parts of ocean water dynamics, transferring heat to the ocean depths and bringing up cold water from below. And they can reach staggering heights—some as tall as skyscrapers.

Because these waves are involved in ocean mixing and thus the transfer of heat, understanding them is crucial to global climate modeling, says Tom Peacock, a researcher at the Massachusetts Institute of Technology. Most models fail to take internal waves into account. “If we want to have more and more accurate climate models, we have to be able to capture processes such as this,” Peacock says.

Peacock and his colleagues tried to do just that. Their study, published in November in *Geophysical Research Letters*, focused on internal waves generated in the Luzon Strait, which separates Taiwan and the Philippines. Internal waves in this region, thought to be some of the largest in the world, can reach about 500 meters high. “That’s the same height as the Freedom Tower that’s just been built in New York,” Peacock says.

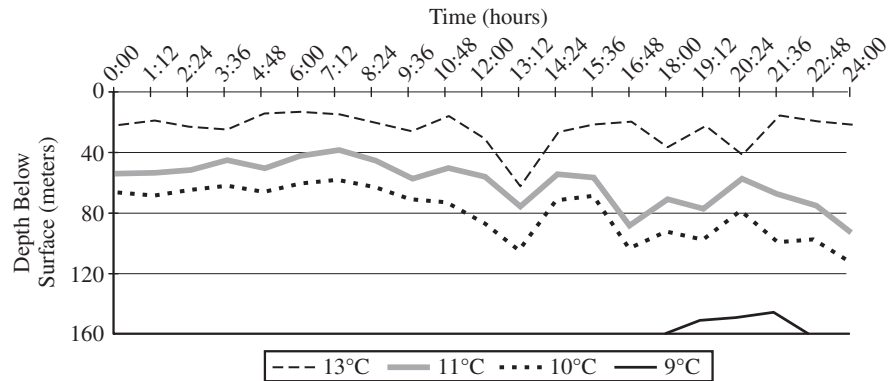
Although scientists knew of this phenomenon in the South China Sea and beyond, they didn’t know exactly how internal waves formed. To find out, Peacock and a team of researchers from M.I.T. and Woods Hole Oceanographic Institution worked with France’s National Center for Scientific Research using a giant facility there called the Coriolis Platform. The rotating platform, about 15 meters (49.2 feet) in diameter, turns at variable speeds and can simulate Earth’s rotation. It also has walls, which means scientists can fill it with water and create accurate, large-scale simulations of various oceanographic scenarios.

Peacock and his team built a carbon-fiber resin scale model of the Luzon Strait, including the islands and surrounding ocean floor topography. Then they filled the platform with water of varying salinity to replicate the different densities found at the strait, with denser, saltier water below and lighter, less briny water above. Small particles were added to the solution and illuminated with lights from below in order to track how the liquid moved. Finally, they re-created tides using two large plungers to see how the internal waves themselves formed.

The Luzon Strait’s underwater topography, with a distinct double-ridge shape, turns out to be responsible for generating the underwater waves. As the tide rises and falls and water moves through the strait, colder, denser water is pushed up over the ridges into warmer, less dense layers above. This action results in bumps of colder water trailed by warmer water that generate an internal wave. As these waves move toward land, they become steeper—much the same way waves at the beach become taller before they hit the shore—until they break on a continental shelf.

The researchers were also able to devise a mathematical model that describes the movement and formation of these waves. Whereas the model is specific to the Luzon Strait, it can still help researchers understand how internal waves are generated in other places around the world. Eventually, this information will be incorporated into global climate models, making them more accurate. “It’s very clear, within the context of these [global climate] models, that internal waves play a role in driving ocean circulations,” Peacock says.

CHANGES IN DEPTH OF ISOTHERMS\*  
IN AN INTERNAL WAVE OVER A 24-HOUR PERIOD



\* Bands of water of constant temperatures

Adapted from Justin Small et al., "Internal Solitons in the Ocean: Prediction from SAR." ©1998 by Oceanography, Defence Evaluation and Research Agency.

43

The first paragraph serves mainly to

- A) explain how a scientific device is used.
- B) note a common misconception about an event.
- C) describe a natural phenomenon and address its importance.
- D) present a recent study and summarize its findings.

44

As used in line 19, "capture" is closest in meaning to

- A) control.
- B) record.
- C) secure.
- D) absorb.

45

According to Peacock, the ability to monitor internal waves is significant primarily because

- A) it will allow scientists to verify the maximum height of such waves.
- B) it will allow researchers to shift their focus to improving the quality of satellite images.
- C) the study of wave patterns will enable regions to predict and prevent coastal damage.
- D) the study of such waves will inform the development of key scientific models.

46

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-2 ("Some . . . see")
- B) Lines 4-6 ("they . . . equipment")
- C) Lines 17-19 ("If . . . this")
- D) Lines 24-26 ("Internal . . . high")

47

As used in line 65, “devise” most nearly means

- A) create.
- B) solve.
- C) imagine.
- D) begin.

48

Based on information in the passage, it can reasonably be inferred that all internal waves

- A) reach approximately the same height even though the locations and depths of continental shelves vary.
- B) may be caused by similar factors but are influenced by the distinct topographies of different regions.
- C) can be traced to inconsistencies in the tidal patterns of deep ocean water located near islands.
- D) are generated by the movement of dense water over a relatively flat section of the ocean floor.

49

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 29-31 (“Although . . . formed”)
- B) Lines 56-58 (“As the . . . it”)
- C) Lines 61-64 (“As these . . . shelf”)
- D) Lines 67-70 (“Whereas . . . world”)

50

In the graph, which isotherm displays an increase in depth below the surface during the period 19:12 to 20:24?

- A) 9°C
- B) 10°C
- C) 11°C
- D) 13°C

51

Which concept is supported by the passage and by the information in the graph?

- A) Internal waves cause water of varying salinity to mix.
- B) Internal waves push denser water above layers of less dense water.
- C) Internal waves push bands of cold water above bands of warmer water.
- D) Internal waves do not rise to break the ocean’s surface.

52

How does the graph support the author’s point that internal waves affect ocean water dynamics?

- A) It demonstrates that wave movement forces warmer water down to depths that typically are colder.
- B) It reveals the degree to which an internal wave affects the density of deep layers of cold water.
- C) It illustrates the change in surface temperature that takes place during an isolated series of deep waves.
- D) It shows that multiple waves rising near the surface of the ocean disrupt the flow of normal tides.

## STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

**No Test Material On This Page**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Librarians Help Navigate in the Digital Age

In recent years, public libraries in the United States have experienced **1** reducing in their operating funds due to cuts imposed at the federal, state, and local government levels. **2** However, library staffing has been cut by almost four percent since 2008, and the demand for librarians continues to decrease, even though half of public libraries report that they have an insufficient number of staff to meet their patrons’ needs. Employment in all job sectors in the United States is projected to grow by fourteen percent over the next

**1**

- A) NO CHANGE
- B) reductions
- C) deducting
- D) deducts

**2**

- A) NO CHANGE
- B) Consequently,
- C) Nevertheless,
- D) Previously,

decade, yet the expected growth rate for librarians is predicted to be only seven percent, or half of the overall rate. This trend, combined with the increasing accessibility of information via the Internet, **3** has led some to claim that librarianship is in decline as a profession. As public libraries adapt to rapid technological advances in information distribution, librarians' roles are actually expanding.

The share of library materials that is in nonprint formats **4** is increasing steadily; in 2010, at least 18.5 million e-books were available **5** for them to circulate. As a result, librarians must now be proficient curators of electronic information, compiling, **6** catalog, and updating these collections. But perhaps even more importantly, librarians function as first responders for their communities' computer needs. Since

3

- A) NO CHANGE
- B) have
- C) which have
- D) which has

4

At this point, the writer is considering adding the following information.

—e-books, audio and video materials, and online journals—

Should the writer make this addition here?

- A) Yes, because it provides specific examples of the materials discussed in the sentence.
- B) Yes, because it illustrates the reason for the increase mentioned later in the sentence.
- C) No, because it interrupts the flow of the sentence by supplying irrelevant information.
- D) No, because it weakens the focus of the passage by discussing a subject other than librarians.

5

- A) NO CHANGE
- B) to be circulated by them.
- C) for their circulating.
- D) for circulation.

6

- A) NO CHANGE
- B) librarians cataloging,
- C) to catalog,
- D) cataloging,

one of the fastest growing library services is public access computer use, there is great demand for computer instruction. **7** In fact, librarians' training now includes courses on research and Internet search methods. Many of whom teach classes in Internet navigation, database and software use, and digital information literacy. While these classes are particularly helpful to young students developing basic research skills, **8** but adult patrons can also benefit from librarian assistance in that they can acquire job-relevant computer skills. **9** Free to all who utilize their services, public libraries and librarians are especially valuable, because they offer free resources that may be difficult to find elsewhere, such as help with online job

7

Which choice most effectively combines the underlined sentences?

- A) In fact, librarians' training now includes courses on research and Internet search methods; many librarians teach classes in Internet navigation, database and software use, and digital information literacy is taught by them.
- B) In fact, many librarians, whose training now includes courses on research and Internet search methods, teach classes in Internet navigation, database and software use, and digital information literacy.
- C) Training now includes courses on research and Internet search methods; many librarians, in fact, are teaching classes in Internet navigation, database and software use, and digital information literacy.
- D) Including courses on research and Internet search methods in their training is, in fact, why many librarians teach classes in Internet navigation, database and software use, and digital information literacy.

8

- A) NO CHANGE
- B) and
- C) for
- D) DELETE the underlined portion.

9

Which choice most effectively sets up the examples given at the end of the sentence?

- A) NO CHANGE
- B) During periods of economic recession,
- C) Although their value cannot be measured,
- D) When it comes to the free services libraries provide,



searches as well as résumé and job material development. An overwhelming number of public libraries also report that they provide help with electronic government resources related to income taxes, **10** law troubles, and retirement programs.

In sum, the Internet does not replace the need for librarians, and librarians are hardly obsolete. **11** Like books, librarians have been around for a long time, but the Internet is extremely useful for many types of research.

**10**

- A) NO CHANGE
- B) legal issues,
- C) concerns related to law courts,
- D) matters for the law courts,

**11**

Which choice most clearly ends the passage with a restatement of the writer's primary claim?

- A) NO CHANGE
- B) Although their roles have diminished significantly, librarians will continue to be employed by public libraries for the foreseeable future.
- C) The growth of electronic information has led to a diversification of librarians' skills and services, positioning them as savvy resource specialists for patrons.
- D) However, given their extensive training and skills, librarians who have been displaced by budget cuts have many other possible avenues of employment.

Questions 12-22 are based on the following passage.

### Tiny Exhibit, Big Impact

— 1 —

The first time I visited the Art Institute of Chicago, I expected to be impressed by its famous large paintings.

**12** On one hand, I couldn't wait to view **13** painter, Georges Seurat's, 10-foot-wide *A Sunday Afternoon on the Island of La Grande Jatte* in its full size. It took me by surprise, then, when my favorite exhibit at the museum was one of **14** it's tiniest; the Thorne Miniature Rooms.

**12**

- A) NO CHANGE
- B) For instance,
- C) However,
- D) Similarly,

**13**

- A) NO CHANGE
- B) painter, Georges Seurat's
- C) painter Georges Seurat's,
- D) painter Georges Seurat's

**14**

- A) NO CHANGE
- B) its tiniest;
- C) its tiniest:
- D) it's tiniest,

— 2 —

Viewing the exhibit, I was amazed by the intricate details of some of the more ornately decorated rooms. I marveled at a replica of a salon (a formal living room) dating back to the reign of French king Louis XV.

**15** Built into the dark paneled walls are bookshelves stocked with leather-bound volumes. The couch and chairs, in keeping with the style of the time, are characterized by elegantly curved arms and **16** legs, they are covered in luxurious velvet. A dime-sized portrait of a French aristocratic woman hangs in a golden frame.

— 3 —

This exhibit showcases sixty-eight miniature rooms inserted into a wall at eye level. Each furnished room consists of three walls; the fourth wall is a glass pane through which museumgoers observe. The rooms and their furnishings were painstakingly created to scale at 1/12th their actual size, so that one inch in the exhibit correlates with one foot in real life. A couch, for example, is seven inches long, and **17** that is based on a seven-foot-long couch. Each room represents a distinctive style of European, American, or Asian interior design from the thirteenth to twentieth centuries.

**15**

At this point, the writer is considering adding the following sentence.

Some scholars argue that the excesses of King Louis XV's reign contributed significantly to the conditions that resulted in the French Revolution.

Should the writer make this addition here?

- A) Yes, because it provides historical context for the Thorne Miniature Rooms exhibit.
- B) Yes, because it explains why salons are often ornately decorated.
- C) No, because it interrupts the paragraph's description of the miniature salon.
- D) No, because it implies that the interior designer of the salon had political motivations.

**16**

- A) NO CHANGE
- B) legs, the couch and chairs
- C) legs and
- D) legs,

**17**

Which choice gives a second supporting example that is most similar to the example already in the sentence?

- A) NO CHANGE
- B) a tea cup is about a quarter of an inch.
- C) there are even tiny cushions on some.
- D) household items are also on this scale.

— 4 —

The plainer rooms are more sparsely **18** furnished. Their architectural features, furnishings, and decorations are just as true to the periods they represent. One of my favorite rooms in the whole exhibit, in fact, is an 1885 summer kitchen. The room is simple but spacious, with a small sink and counter along one wall, a cast-iron wood stove and some hanging pots and pans against another wall, and **19** a small table under a window of the third wall. Aside from a few simple wooden chairs placed near the edges of the room, the floor is open and obviously well worn.

18

Which choice most effectively combines the sentences at the underlined portion?

- A) furnished by their
- B) furnished, but their
- C) furnished: their
- D) furnished, whereas

19

Which choice most closely matches the stylistic pattern established earlier in the sentence?

- A) NO CHANGE
- B) a small table is under the third wall's window.
- C) the third wall has a window and small table.
- D) the third wall has a small table against it and a window.

— 5 —

As I walked through the exhibit, I overheard a **20** visitors' remark, "You know, that grandfather clock actually runs. Its glass door swings open, and the clock can be wound up." **21** Dotted with pin-sized knobs, another visitor noticed my fascination with a tiny writing desk and its drawers. "All of those little drawers pull out. And you see that hutch? Can you believe it has a secret compartment?" Given the exquisite craftsmanship and level of detail I'd already seen, I certainly could.

**Question 22** asks about the previous passage as a whole.

**20**

- A) NO CHANGE
- B) visitors remarking,
- C) visitor remarked,
- D) visitor remark,

**21**

- A) NO CHANGE
- B) Another visitor, dotted with pin-sized knobs, noticed my fascination with a tiny writing desk and its drawers.
- C) Another visitor dotted with pin-sized knobs noticed my fascination with a tiny writing desk and its drawers.
- D) Another visitor noticed my fascination with a tiny writing desk and its drawers, dotted with pin-sized knobs.

**Think about the previous passage as a whole as you answer question 22.**

**22**

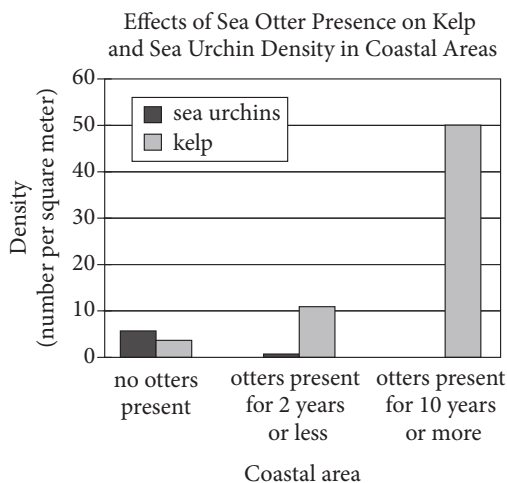
To make the passage most logical, paragraph 2 should be placed

- A) where it is now.
- B) after paragraph 3.
- C) after paragraph 4.
- D) after paragraph 5.

Questions 23-33 are based on the following passage and supplementary material.

### Environmentalist Otters

It has long been known that the sea otters **23** living along the West Coast of North America help keep kelp forests in their habitat healthy and vital. They do this by feeding on sea urchins and other herbivorous invertebrates that graze voraciously on kelp. With sea otters to keep the population of sea urchins in check, kelp forests can flourish. In fact, **24** two years or less of sea otters can completely eliminate sea urchins in a coastal area (see chart).



Adapted from David O. Duggins, "Kelp Beds and Sea Otters: An Experimental Approach." ©1980 by the Ecological Society of America.

Without sea otters present, **25** nevertheless, kelp forests run the danger of becoming barren stretches of coastal wasteland known as urchin barrens.

23

- A) NO CHANGE
- B) living along the West Coast of North America, they help
- C) that live along the West Coast of North America and help to
- D) that live along the West Coast of North America, where they help

24

Which choice offers an accurate interpretation of the data in the chart?

- A) NO CHANGE
- B) even two years or less of sea otter presence can reduce the sea urchin threat
- C) kelp density increases proportionally as sea urchin density increases
- D) even after sea otters were present for ten years or more, kelp density was still lower than sea urchin density

25

- A) NO CHANGE
- B) however,
- C) hence,
- D) likewise,

[1] What was less well-known, until recently at least, was how this relationship among sea otters, sea urchins, and kelp forests might help fight global warming. [2] The amount of carbon dioxide in the atmosphere has increased 40 percent **26**. [3] A recent study by two professors at the University of California, Santa Cruz, Chris Wilmers and James Estes, **27** suggests, that kelp forests protected by sea otters can absorb as much as twelve times the amount of carbon dioxide from the atmosphere as those where sea urchins are allowed to **28** devour the kelp. [4] Like **29** their terrestrial plant cousins, kelp removes carbon dioxide from the atmosphere, turning it into sugar fuel through photosynthesis, and releases oxygen back into the air.

26

At this point, the writer is considering adding the following information.

since the start of the Industrial Revolution, resulting in a rise in global temperatures

Should the writer make this addition here?

- A) Yes, because it establishes the relationship between the level of carbon dioxide in the atmosphere and global warming.
- B) Yes, because it explains the key role sea otters, sea urchins, and kelp forests play in combating global warming.
- C) No, because it contradicts the claim made in the previous paragraph that sea otters help keep kelp forests healthy.
- D) No, because it mentions the Industrial Revolution, blurring the focus of the paragraph.

27

- A) NO CHANGE
- B) suggests—that
- C) suggests, “that
- D) suggests that

28

- A) NO CHANGE
- B) dispatch
- C) overindulge on
- D) dispose of

29

- A) NO CHANGE
- B) they’re
- C) its
- D) it’s

[5] Scientists knew this but did not recognize **30** how large a role they played in helping kelp forests to significantly decrease the amount of carbon dioxide in the atmosphere. [6] Far from making no difference to the ecosystem, the presence of otters was found to increase the carbon storage of kelp forests by 4.4 to 8.7 megatons annually, offsetting the amount of carbon dioxide emitted by three million to six million passenger cars each year. **31**

Wilmers and Estes caution, however, that **32** having more otters will not automatically solve the problem of higher levels of carbon dioxide in the air. But they suggest that the presence of otters provides a good model of how carbon can be sequestered, **33** or removed; from the atmosphere through the management of animal populations. If ecologists can better understand what kinds of impacts animals might have on the environment, Wilmers contends, “there might be opportunities for win-win conservation scenarios, whereby animal species are protected or enhanced, and carbon gets sequestered.”

30

- A) NO CHANGE
- B) how large a role that it played
- C) how large a role sea otters played
- D) that they played such a large role

31

Where is the most logical place in this paragraph to add the following sentence?

What Wilmers and Estes discovered in their study, therefore, surprised them.

- A) After sentence 1
- B) After sentence 3
- C) After sentence 4
- D) After sentence 5

32

- A) NO CHANGE
- B) increasing the otter population
- C) the otters multiplying
- D) having more otters than other locations

33

- A) NO CHANGE
- B) or removed from,
- C) or, removed from,
- D) or removed, from



Questions 34-44 are based on the following passage.

### A Quick Fix in a Throwaway Culture

Planned obsolescence, a practice **34** at which products are designed to have a limited period of **35** usefulness, has been a cornerstone of manufacturing strategy for the past 80 years. This approach increases sales, but it also stands in **36** austere contrast to a time when goods were produced to be durable. Planned obsolescence wastes materials as well as energy in making and shipping new products. It also reinforces the belief that it is easier to replace goods than to mend them, as repair shops are rare and **37** repair methods are often specialized. In 2009, an enterprising movement, the Repair Café, challenged this widely accepted belief.

**34**

- A) NO CHANGE
- B) from which
- C) so that
- D) whereby

**35**

- A) NO CHANGE
- B) usefulness—
- C) usefulness;
- D) usefulness

**36**

- A) NO CHANGE
- B) egregious
- C) unmitigated
- D) stark

**37**

Which choice provides information that best supports the claim made by this sentence?

- A) NO CHANGE
- B) obsolete goods can become collectible items.
- C) no one knows whether something will fall into disrepair again.
- D) new designs often have “bugs” that must be worked out.

[1] More like a **38** fair then an actual café, the first Repair Café took place in Amsterdam, the Netherlands. [2] It was the brainchild of former journalist Martine Postma, **39** wanting to take a practical stand in a throwaway culture. [3] Her goals were **40** straightforward, however: reduce waste, maintain and perpetuate knowledge and skills, and strengthen community. [4] Participants bring all manner of damaged articles—clothing, appliances, furniture, and more—to be repaired by a staff of volunteer specialists including tailors, electricians, and carpenters. [5] Since the inaugural Repair Café, others have been hosted in theater foyers, community centers, hotels, and auditoriums. [6] While **41** they await for service, patrons can enjoy coffee and snacks and mingle with their neighbors in need. **42**

38

- A) NO CHANGE
- B) fair than
- C) fare than
- D) fair, then

39

- A) NO CHANGE
- B) whom wants
- C) who wanted
- D) she wanted

40

- A) NO CHANGE
- B) straightforward, therefore:
- C) straightforward, nonetheless:
- D) straightforward:

41

- A) NO CHANGE
- B) awaiting
- C) they waited
- D) waiting

42

To make this paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) before sentence 1.
- C) after sentence 3.
- D) after sentence 6.

Though only about 3 percent of the Netherlands' municipal waste ends up in landfills, Repair Cafés still raise awareness about what may otherwise be mindless acts of waste by providing a venue for people to share and learn valuable skills that are in danger of being lost. **43** It is easy to classify old but fixable items as “junk” in an era that places great emphasis on the next big thing. In helping people consider how the goods they use on a daily basis work and are made, Repair Cafés restore a sense of relationship between human beings and material goods.

Though the concept remained a local trend at first, international Repair Cafés, all affiliated with the Dutch Repair Café via its website, have since arisen in France, Germany, South Africa, the United States, and other countries **44** on top of that. The original provides a central source for start-up tips and tools, as well as marketing advice to new Repair Cafés. As a result, the Repair Café has become a global network united by common ideals. Ironically, innovators are now looking back to old ways of doing things and applying them in today's cities in an effort to transform the way people relate to and think about the goods they consume.

43

At this point, the writer is considering adding the following sentence.

As the number of corporate and service-based jobs has increased, the need for people who work with their hands has diminished.

Should the writer make this addition here?

- A) Yes, because it provides an example of specific repair skills being lost.
- B) Yes, because it elaborates on the statistic about the Netherlands' municipal waste.
- C) No, because it blurs the paragraph's focus by introducing a topic that is not further explained.
- D) No, because it contradicts the claims made in the rest of the paragraph.

44

- A) NO CHANGE
- B) in addition.
- C) likewise.
- D) DELETE the underlined portion, and end the sentence with a period.

## STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

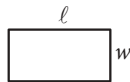
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

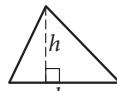


$$A = \pi r^2$$

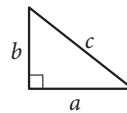
$$C = 2\pi r$$



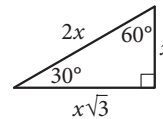
$$A = \ell w$$



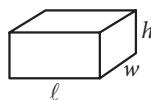
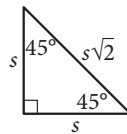
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



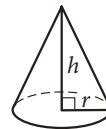
$$V = \ell wh$$



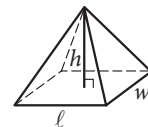
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

If  $5x + 6 = 10$ , what is the value of  $10x + 3$  ?

- A) 4
- B) 9
- C) 11
- D) 20

2

$$\begin{aligned}x + y &= 0 \\ 3x - 2y &= 10\end{aligned}$$

Which of the following ordered pairs  $(x, y)$  satisfies the system of equations above?

- A)  $(3, -2)$
- B)  $(2, -2)$
- C)  $(-2, 2)$
- D)  $(-2, -2)$

3

A landscaping company estimates the price of a job, in dollars, using the expression  $60 + 12nh$ , where  $n$  is the number of landscapers who will be working and  $h$  is the total number of hours the job will take using  $n$  landscapers. Which of the following is the best interpretation of the number 12 in the expression?

- A) The company charges \$12 per hour for each landscaper.
- B) A minimum of 12 landscapers will work on each job.
- C) The price of every job increases by \$12 every hour.
- D) Each landscaper works 12 hours a day.

4

$$9a^4 + 12a^2b^2 + 4b^4$$

Which of the following is equivalent to the expression shown above?

- A)  $(3a^2 + 2b^2)^2$
- B)  $(3a + 2b)^4$
- C)  $(9a^2 + 4b^2)^2$
- D)  $(9a + 4b)^4$



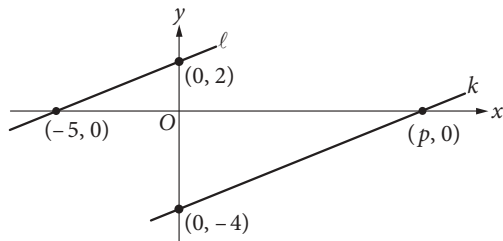
5

$$\sqrt{2k^2 + 17} - x = 0$$

If  $k > 0$  and  $x = 7$  in the equation above, what is the value of  $k$ ?

- A) 2
- B) 3
- C) 4
- D) 5

6



In the  $xy$ -plane above, line  $\ell$  is parallel to line  $k$ . What is the value of  $p$ ?

- A) 4
- B) 5
- C) 8
- D) 10

7

If  $\frac{x^{a^2}}{x^{b^2}} = x^{16}$ ,  $x > 1$ , and  $a + b = 2$ , what is the value

of  $a - b$ ?

- A) 8
- B) 14
- C) 16
- D) 18

8

$$nA = 360$$

The measure  $A$ , in degrees, of an exterior angle of a regular polygon is related to the number of sides,  $n$ , of the polygon by the formula above. If the measure of an exterior angle of a regular polygon is greater than  $50^\circ$ , what is the greatest number of sides it can have?

- A) 5
- B) 6
- C) 7
- D) 8



9

The graph of a line in the  $xy$ -plane has slope 2 and contains the point  $(1, 8)$ . The graph of a second line passes through the points  $(1, 2)$  and  $(2, 1)$ . If the two lines intersect at the point  $(a, b)$ , what is the value of  $a + b$  ?

- A) 4
- B) 3
- C) -1
- D) -4

10

Which of the following equations has a graph in the  $xy$ -plane for which  $y$  is always greater than or equal to  $-1$  ?

- A)  $y = |x| - 2$
- B)  $y = x^2 - 2$
- C)  $y = (x - 2)^2$
- D)  $y = x^3 - 2$

11

Which of the following complex numbers is equivalent to  $\frac{3 - 5i}{8 + 2i}$  ? (Note:  $i = \sqrt{-1}$ )

- A)  $\frac{3}{8} - \frac{5i}{2}$
- B)  $\frac{3}{8} + \frac{5i}{2}$
- C)  $\frac{7}{34} - \frac{23i}{34}$
- D)  $\frac{7}{34} + \frac{23i}{34}$

12

$$R = \frac{F}{N + F}$$

A website uses the formula above to calculate a seller's rating,  $R$ , based on the number of favorable reviews,  $F$ , and unfavorable reviews,  $N$ . Which of the following expresses the number of favorable reviews in terms of the other variables?

- A)  $F = \frac{RN}{R - 1}$
- B)  $F = \frac{RN}{1 - R}$
- C)  $F = \frac{N}{1 - R}$
- D)  $F = \frac{N}{R - 1}$



13

What is the sum of all values of  $m$  that satisfy  $2m^2 - 16m + 8 = 0$  ?

- A)  $-8$
- B)  $-4\sqrt{3}$
- C)  $4\sqrt{3}$
- D)  $8$

14

A radioactive substance decays at an annual rate of 13 percent. If the initial amount of the substance is 325 grams, which of the following functions  $f$  models the remaining amount of the substance, in grams,  $t$  years later?

- A)  $f(t) = 325(0.87)^t$
- B)  $f(t) = 325(0.13)^t$
- C)  $f(t) = 0.87(325)^t$
- D)  $f(t) = 0.13(325)^t$

15

The expression  $\frac{5x-2}{x+3}$  is equivalent to which of the following?

- A)  $\frac{5-2}{3}$
- B)  $5 - \frac{2}{3}$
- C)  $5 - \frac{2}{x+3}$
- D)  $5 - \frac{17}{x+3}$



**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$				Answer: 2.5			
7	/	1	2	2	.	5	
●	●	●	●	●	●	●	
0	0	0	0	0	0	0	
①	①	●	①	①	①	①	
②	②	②	●	②	●	②	
③	③	③	③	③	③	③	
④	④	④	④	④	④	④	
⑤	⑤	⑤	⑤	⑤	⑤	●	
⑥	⑥	⑥	⑥	⑥	⑥	⑥	
●	⑦	⑦	⑦	⑦	⑦	⑦	
⑧	⑧	⑧	⑧	⑧	⑧	⑧	
⑨	⑨	⑨	⑨	⑨	⑨	⑨	

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3	.	6	6	6	.	6	6	7
●	●	●	●	●	●	●	●	●		
0	0	0	0	0	0	0	0	0		
①	①	①	①	①	①	①	①	①		
②	●	②	②	②	②	②	②	②		
③	③	③	③	③	③	③	③	③		
④	④	④	④	④	④	④	④	④		
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤		
⑥	⑥	⑥	⑥	●	●	⑥	●	●		
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦		
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧		

Answer: 201 – either position is correct

2	0	1	2	0	1
●	●	●	●	●	●
0	●	0	0	●	0
①	①	①	①	①	①
②	●	②	●	②	②
③	③	③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

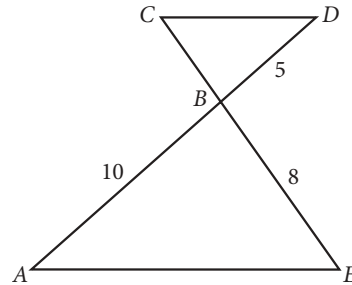
The sales manager of a company awarded a total of \$3000 in bonuses to the most productive salespeople. The bonuses were awarded in amounts of \$250 or \$750. If at least one \$250 bonus and at least one \$750 bonus were awarded, what is one possible number of \$250 bonuses awarded?

17

$$2x(3x + 5) + 3(3x + 5) = ax^2 + bx + c$$

In the equation above,  $a$ ,  $b$ , and  $c$  are constants. If the equation is true for all values of  $x$ , what is the value of  $b$ ?

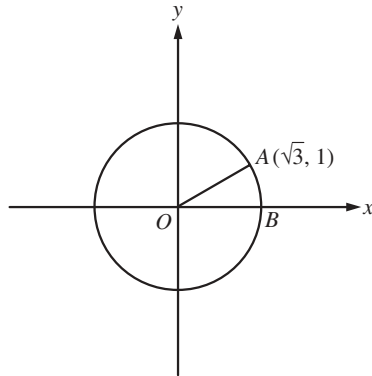
18



In the figure above,  $\overline{AE} \parallel \overline{CD}$  and segment  $AD$  intersects segment  $CE$  at  $B$ . What is the length of segment  $CE$ ?



19



In the  $xy$ -plane above,  $O$  is the center of the circle, and the measure of  $\angle AOB$  is  $\frac{\pi}{a}$  radians. What is the value of  $a$  ?

20

$$ax + by = 12$$

$$2x + 8y = 60$$

In the system of equations above,  $a$  and  $b$  are constants. If the system has infinitely many solutions, what is the value of  $\frac{a}{b}$  ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

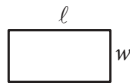
1. The use of a calculator **is permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

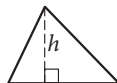


$$A = \pi r^2$$

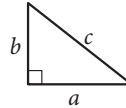
$$C = 2\pi r$$



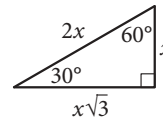
$$A = \ell w$$



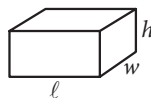
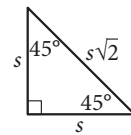
$$A = \frac{1}{2}bh$$



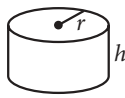
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

A musician has a new song available for downloading or streaming. The musician earns \$0.09 each time the song is downloaded and \$0.002 each time the song is streamed. Which of the following expressions represents the amount, in dollars, that the musician earns if the song is downloaded  $d$  times and streamed  $s$  times?

- A)  $0.002d + 0.09s$
- B)  $0.002d - 0.09s$
- C)  $0.09d + 0.002s$
- D)  $0.09d - 0.002s$

2

A quality control manager at a factory selects 7 lightbulbs at random for inspection out of every 400 lightbulbs produced. At this rate, how many lightbulbs will be inspected if the factory produces 20,000 lightbulbs?

- A) 300
- B) 350
- C) 400
- D) 450

3

$$\ell = 24 + 3.5m$$

One end of a spring is attached to a ceiling. When an object of mass  $m$  kilograms is attached to the other end of the spring, the spring stretches to a length of  $\ell$  centimeters as shown in the equation above. What is  $m$  when  $\ell$  is 73?

- A) 14
- B) 27.7
- C) 73
- D) 279.5



Questions 4 and 5 refer to the following information.

The amount of money a performer earns is directly proportional to the number of people attending the performance. The performer earns \$120 at a performance where 8 people attend.

4

How much money will the performer earn when 20 people attend a performance?

- A) \$960
- B) \$480
- C) \$300
- D) \$240

5

The performer uses 43% of the money earned to pay the costs involved in putting on each performance. The rest of the money earned is the performer's profit. What is the profit the performer makes at a performance where 8 people attend?

- A) \$51.60
- B) \$57.00
- C) \$68.40
- D) \$77.00

6

When 4 times the number  $x$  is added to 12, the result is 8. What number results when 2 times  $x$  is added to 7?

- A) -1
- B) 5
- C) 8
- D) 9

7

$$y = x^2 - 6x + 8$$

The equation above represents a parabola in the  $xy$ -plane. Which of the following equivalent forms of the equation displays the  $x$ -intercepts of the parabola as constants or coefficients?

- A)  $y - 8 = x^2 - 6x$
- B)  $y + 1 = (x - 3)^2$
- C)  $y = x(x - 6) + 8$
- D)  $y = (x - 2)(x - 4)$



8

In a video game, each player starts the game with  $k$  points and loses 2 points each time a task is not completed. If a player who gains no additional points and fails to complete 100 tasks has a score of 200 points, what is the value of  $k$  ?

- A) 0
- B) 150
- C) 250
- D) 400

9

A worker uses a forklift to move boxes that weigh either 40 pounds or 65 pounds each. Let  $x$  be the number of 40-pound boxes and  $y$  be the number of 65-pound boxes. The forklift can carry up to either 45 boxes or a weight of 2,400 pounds. Which of the following systems of inequalities represents this relationship?

- A)  $\begin{cases} 40x + 65y \leq 2,400 \\ x + y \leq 45 \end{cases}$
- B)  $\begin{cases} \frac{x}{40} + \frac{y}{65} \leq 2,400 \\ x + y \leq 45 \end{cases}$
- C)  $\begin{cases} 40x + 65y \leq 45 \\ x + y \leq 2,400 \end{cases}$
- D)  $\begin{cases} x + y \leq 2,400 \\ 40x + 65y \leq 2,400 \end{cases}$

10

A function  $f$  satisfies  $f(2) = 3$  and  $f(3) = 5$ . A function  $g$  satisfies  $g(3) = 2$  and  $g(5) = 6$ . What is the value of  $f(g(3))$  ?

- A) 2
- B) 3
- C) 5
- D) 6

11

Number of hours Tony plans to read the novel per day	3
Number of parts in the novel	8
Number of chapters in the novel	239
Number of words Tony reads per minute	250
Number of pages in the novel	1,078
Number of words in the novel	349,168

Tony is planning to read a novel. The table above shows information about the novel, Tony's reading speed, and the amount of time he plans to spend reading the novel each day. If Tony reads at the rates given in the table, which of the following is closest to the number of days it would take Tony to read the entire novel?

- A) 6
- B) 8
- C) 23
- D) 324



12

On January 1, 2000, there were 175,000 tons of trash in a landfill that had a capacity of 325,000 tons. Each year since then, the amount of trash in the landfill increased by 7,500 tons. If  $y$  represents the time, in years, after January 1, 2000, which of the following inequalities describes the set of years where the landfill is at or above capacity?

- A)  $325,000 - 7,500 \leq y$
- B)  $325,000 \leq 7,500y$
- C)  $150,000 \geq 7,500y$
- D)  $175,000 + 7,500y \geq 325,000$

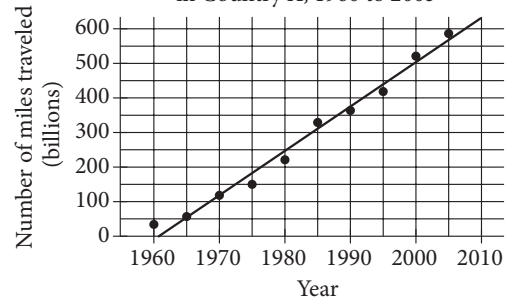
13

A researcher conducted a survey to determine whether people in a certain large town prefer watching sports on television to attending the sporting event. The researcher asked 117 people who visited a local restaurant on a Saturday, and 7 people refused to respond. Which of the following factors makes it least likely that a reliable conclusion can be drawn about the sports-watching preferences of all people in the town?

- A) Sample size
- B) Population size
- C) The number of people who refused to respond
- D) Where the survey was given

14

Miles Traveled by Air Passengers  
in Country X, 1960 to 2005



According to the line of best fit in the scatterplot above, which of the following best approximates the year in which the number of miles traveled by air passengers in Country X was estimated to be 550 billion?

- A) 1997
- B) 2000
- C) 2003
- D) 2008





15

The distance traveled by Earth in one orbit around the Sun is about 580,000,000 miles. Earth makes one complete orbit around the Sun in one year. Of the following, which is closest to the average speed of Earth, in miles per hour, as it orbits the Sun?

- A) 66,000
- B) 93,000
- C) 210,000
- D) 420,000

16

Results on the Bar Exam of Law School Graduates

	Passed bar exam	Did not pass bar exam
Took review course	18	82
Did not take review course	7	93

The table above summarizes the results of 200 law school graduates who took the bar exam. If one of the surveyed graduates who passed the bar exam is chosen at random for an interview, what is the probability that the person chosen did not take the review course?

- A)  $\frac{18}{25}$
- B)  $\frac{7}{25}$
- C)  $\frac{25}{200}$
- D)  $\frac{7}{200}$

17

The atomic weight of an unknown element, in atomic mass units (amu), is approximately 20% less than that of calcium. The atomic weight of calcium is 40 amu. Which of the following best approximates the atomic weight, in amu, of the unknown element?

- A) 8
- B) 20
- C) 32
- D) 48

18

A survey was taken of the value of homes in a county, and it was found that the mean home value was \$165,000 and the median home value was \$125,000. Which of the following situations could explain the difference between the mean and median home values in the county?

- A) The homes have values that are close to each other.
- B) There are a few homes that are valued much less than the rest.
- C) There are a few homes that are valued much more than the rest.
- D) Many of the homes have values between \$125,000 and \$165,000.



**Questions 19 and 20 refer to the following information.**

A sociologist chose 300 students at random from each of two schools and asked each student how many siblings he or she has. The results are shown in the table below.

Students' Sibling Survey

Number of siblings	Lincoln School	Washington School
0	120	140
1	80	110
2	60	30
3	30	10
4	10	10

There are a total of 2,400 students at Lincoln School and 3,300 students at Washington School.

19

What is the median number of siblings for all the students surveyed?

- A) 0
- B) 1
- C) 2
- D) 3

20

Based on the survey data, which of the following most accurately compares the expected total number of students with 4 siblings at the two schools?

- A) The total number of students with 4 siblings is expected to be equal at the two schools.
- B) The total number of students with 4 siblings at Lincoln School is expected to be 30 more than at Washington School.
- C) The total number of students with 4 siblings at Washington School is expected to be 30 more than at Lincoln School.
- D) The total number of students with 4 siblings at Washington School is expected to be 900 more than at Lincoln School.

21

A project manager estimates that a project will take  $x$  hours to complete, where  $x > 100$ . The goal is for the estimate to be within 10 hours of the time it will actually take to complete the project. If the manager meets the goal and it takes  $y$  hours to complete the project, which of the following inequalities represents the relationship between the estimated time and the actual completion time?

- A)  $x + y < 10$
- B)  $y > x + 10$
- C)  $y < x - 10$
- D)  $-10 < y - x < 10$



Questions 22 and 23 refer to the following information.

$$I = \frac{P}{4\pi r^2}$$

At a large distance  $r$  from a radio antenna, the intensity of the radio signal  $I$  is related to the power of the signal  $P$  by the formula above.

22

Which of the following expresses the square of the distance from the radio antenna in terms of the intensity of the radio signal and the power of the signal?

- A)  $r^2 = \frac{IP}{4\pi}$
- B)  $r^2 = \frac{P}{4\pi I}$
- C)  $r^2 = \frac{4\pi I}{P}$
- D)  $r^2 = \frac{I}{4\pi P}$

23

For the same signal emitted by a radio antenna, Observer A measures its intensity to be 16 times the intensity measured by Observer B. The distance of Observer A from the radio antenna is what fraction of the distance of Observer B from the radio antenna?

- A)  $\frac{1}{4}$
- B)  $\frac{1}{16}$
- C)  $\frac{1}{64}$
- D)  $\frac{1}{256}$

24

$$x^2 + y^2 + 4x - 2y = -1$$

The equation of a circle in the  $xy$ -plane is shown above. What is the radius of the circle?

- A) 2
- B) 3
- C) 4
- D) 9

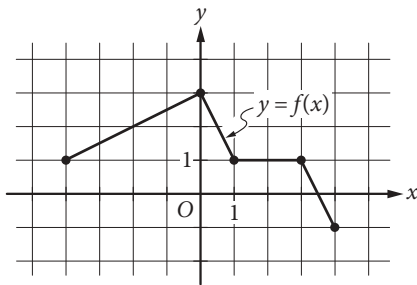


25

The graph of the linear function  $f$  has intercepts at  $(a, 0)$  and  $(0, b)$  in the  $xy$ -plane. If  $a + b = 0$  and  $a \neq b$ , which of the following is true about the slope of the graph of  $f$ ?

- A) It is positive.
- B) It is negative.
- C) It equals zero.
- D) It is undefined.

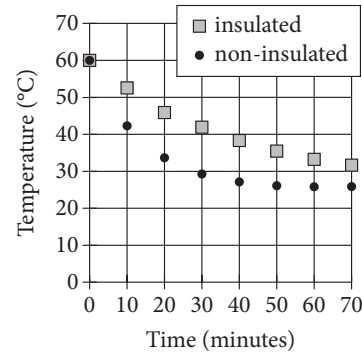
26



The complete graph of the function  $f$  is shown in the  $xy$ -plane above. Which of the following are equal to 1?

- I.  $f(-4)$
  - II.  $f\left(\frac{3}{2}\right)$
  - III.  $f(3)$
- A) III only
  - B) I and III only
  - C) II and III only
  - D) I, II, and III

27

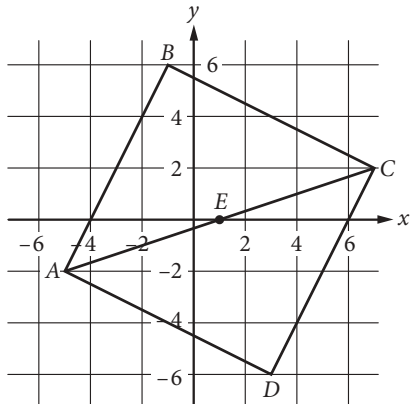


Two samples of water of equal mass are heated to 60 degrees Celsius ( $^{\circ}\text{C}$ ). One sample is poured into an insulated container, and the other sample is poured into a non-insulated container. The samples are then left for 70 minutes to cool in a room having a temperature of  $25^{\circ}\text{C}$ . The graph above shows the temperature of each sample at 10-minute intervals. Which of the following statements correctly compares the average rates at which the temperatures of the two samples change?

- A) In every 10-minute interval, the magnitude of the rate of change of temperature of the insulated sample is greater than that of the non-insulated sample.
- B) In every 10-minute interval, the magnitude of the rate of change of temperature of the non-insulated sample is greater than that of the insulated sample.
- C) In the intervals from 0 to 10 minutes and from 10 to 20 minutes, the rates of change of temperature of the insulated sample are of greater magnitude, whereas in the intervals from 40 to 50 minutes and from 50 to 60 minutes, the rates of change of temperature of the non-insulated sample are of greater magnitude.
- D) In the intervals from 0 to 10 minutes and from 10 to 20 minutes, the rates of change of temperature of the non-insulated sample are of greater magnitude, whereas in the intervals from 40 to 50 minutes and from 50 to 60 minutes, the rates of change of temperature of the insulated sample are of greater magnitude.



28



In the  $xy$ -plane above,  $ABCD$  is a square and point  $E$  is the center of the square. The coordinates of points  $C$  and  $E$  are  $(7, 2)$  and  $(1, 0)$ , respectively. Which of the following is an equation of the line that passes through points  $B$  and  $D$ ?

- A)  $y = -3x - 1$
- B)  $y = -3(x - 1)$
- C)  $y = -\frac{1}{3}x + 4$
- D)  $y = -\frac{1}{3}x - 1$

29

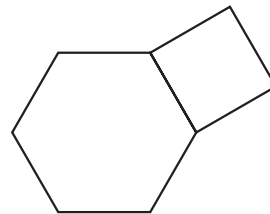
$$y = 3$$

$$y = ax^2 + b$$

In the system of equations above,  $a$  and  $b$  are constants. For which of the following values of  $a$  and  $b$  does the system of equations have exactly two real solutions?

- A)  $a = -2, b = 2$
- B)  $a = -2, b = 4$
- C)  $a = 2, b = 4$
- D)  $a = 4, b = 3$

30



The figure above shows a regular hexagon with sides of length  $a$  and a square with sides of length  $a$ . If the area of the hexagon is  $384\sqrt{3}$  square inches, what is the area, in square inches, of the square?

- A) 256
- B) 192
- C)  $64\sqrt{3}$
- D)  $16\sqrt{3}$

**DIRECTIONS**

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$			
7	/	1	2
●	●	●	●
0	0	0	0
①	①	●	①
②	②	②	●
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
●	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 2.5			
2	.	5	
●	●	●	●
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	●
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3	
●	●	●	●
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	●
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	6
●	●	●	●
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	●
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	7
●	●	●	●
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	⑥
⑦	⑦	⑦	●
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

2	0	1	
●	●	●	●
0	●	0	0
①	①	①	●
②	●	②	②
③	③	③	③

2	0	1	
●	●	●	●
0	●	0	0
①	①	●	①
②	●	②	②
③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

A coastal geologist estimates that a certain country's beaches are eroding at a rate of 1.5 feet per year. According to the geologist's estimate, how long will it take, in years, for the country's beaches to erode by 21 feet?

32

If  $h$  hours and 30 minutes is equal to 450 minutes, what is the value of  $h$  ?

33

In the  $xy$ -plane, the point  $(3, 6)$  lies on the graph of the function  $f(x) = 3x^2 - bx + 12$ . What is the value of  $b$  ?

34

In one semester, Doug and Laura spent a combined 250 hours in the tutoring lab. If Doug spent 40 more hours in the lab than Laura did, how many hours did Laura spend in the lab?

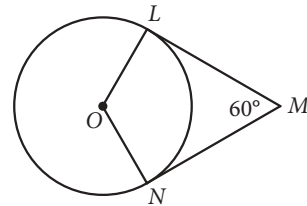


35

$$a = 18t + 15$$

Jane made an initial deposit to a savings account. Each week thereafter she deposited a fixed amount to the account. The equation above models the amount  $a$ , in dollars, that Jane has deposited after  $t$  weekly deposits. According to the model, how many dollars was Jane's initial deposit? (Disregard the \$ sign when gridding your answer.)

36



In the figure above, point  $O$  is the center of the circle, line segments  $LM$  and  $MN$  are tangent to the circle at points  $L$  and  $N$ , respectively, and the segments intersect at point  $M$  as shown. If the circumference of the circle is 96, what is the length of minor arc  $\widehat{LN}$  ?





Questions 37 and 38 refer to the following information.

A botanist is cultivating a rare species of plant in a controlled environment and currently has 3000 of these plants. The population of this species that the botanist expects to grow next year,  $N_{\text{next year}}$ , can be estimated from the number of plants this year,  $N_{\text{this year}}$ , by the equation below.

$$N_{\text{next year}} = N_{\text{this year}} + 0.2\left(N_{\text{this year}}\right)\left(1 - \frac{N_{\text{this year}}}{K}\right)$$

The constant  $K$  in this formula is the number of plants the environment is able to support.

37

According to the formula, what will be the number of plants two years from now if  $K = 4000$ ? (Round your answer to the nearest whole number.)

38

The botanist would like to increase the number of plants that the environment can support so that the population of the species will increase more rapidly. If the botanist's goal is that the number of plants will increase from 3000 this year to 3360 next year, how many plants must the modified environment support?

**STOP**

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.

YOUR NAME (PRINT) ..... LAST ..... FIRST ..... MI .....

TEST CENTER ..... NUMBER ..... NAME OF TEST CENTER ..... ROOM NUMBER .....

# The SAT

## GENERAL DIRECTIONS

- You may work on only one section at a time.
- If you finish a section before time is called, check your work on that section. You may NOT turn to any other section.

## MARKING ANSWERS

- Be sure to mark your answer sheet properly.



- You must use a No. 2 pencil.
- Carefully mark only one answer for each question.
- Make sure you fill the entire circle darkly and completely.
- Do not make any stray marks on your answer sheet.
- If you erase, do so completely. Incomplete erasures may be scored as intended answers.
- Use only the answer spaces that correspond to the question numbers.

## USING YOUR TEST BOOK

- You may use the test book for scratch work, but you will not receive credit for anything that you write in your test book.
- After time has been called, you may not transfer answers from your test book to your answer sheet or fill in circles.
- You may not fold or remove pages or portions of a page from this book, or take the book or answer sheet from the testing room.

## SCORING

- For each correct answer, you receive one point.
- You do not lose points for wrong answers; therefore, you should try to answer every question even if you are not sure of the correct answer.

## IMPORTANT

The codes below are unique to your test book. Copy them on your answer sheet in boxes 8 and 9 and fill in the corresponding circles exactly as shown.

<b>9</b>	<b>TEST ID</b>				
	<small>(Copy from back of test book.)</small>				

<b>8</b>	<b>FORM CODE</b>					
	<small>(Copy and grid as on back of test book.)</small>					
A	A	A	A	0	0	0
B	B	B	B	1	1	1
C	C	C	C	2	2	2
D	D	D	D	3	3	3
E	E	E	E	4	4	4
F	F	F	F	5	5	5
G	G	G	G	6	6	6
H	H	H	H	7	7	7
I	I	I	I	8	8	8
J	J	J	J	9	9	9
K	K	K	K			
L	L	L	L			
M	M	M	M			
N	N	N	N			
O	O	O	O			
P	P	P	P			
Q	Q	Q	Q			
R	R	R	R			
S	S	S	S			
T	T	T	T			
U	U	U	U			
V	V	V	V			
W	W	W	W			
X	X	X	X			
Y	Y	Y	Y			
Z	Z	Z	Z			

Follow this link for more information on scoring your practice test:  
[www.sat.org/scoring](http://www.sat.org/scoring)

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**DO NOT OPEN THIS BOOK UNTIL THE SUPERVISOR TELLS YOU TO DO SO.**

## Answer Explanations

# SAT Practice Test #2

## Section 1: Reading Test

### QUESTION 1

**Choice A is the best answer.** The narrator admits that his job is “irksome” (line 7) and reflects on the reasons for his dislike. The narrator admits that his work is a “dry and tedious task” (line 9) and that he has a poor relationship with his superior: “the antipathy which had sprung up between myself and my employer striking deeper root and spreading denser shade daily, excluded me from every glimpse of the sunshine of life” (lines 28-31).

Choices B, C, and D are incorrect because the narrator does not become increasingly competitive with his employer, publicly defend his choice of occupation, or exhibit optimism about his job.

### QUESTION 2

**Choice B is the best answer.** The first sentence of the passage explains that people do not like to admit when they’ve chosen the wrong profession and that they will continue in their profession for a while before admitting their unhappiness. This statement mirrors the narrator’s own situation, as the narrator admits he finds his own occupation “irksome” (line 7) but that he might “long have borne with the nuisance” (line 10) if not for his poor relationship with his employer.

Choices A, C, and D are incorrect because the first sentence does not discuss a controversy, focus on the narrator’s employer, Edward Crimsworth, or provide any evidence of malicious conduct.

### QUESTION 3

**Choice C is the best answer.** The first paragraph shifts from a general discussion of how people deal with choosing an occupation they later regret (lines 1-6) to the narrator’s description of his own dissatisfaction with his occupation (lines 6-33).

Choices A, B, and D are incorrect because the first paragraph does not focus on the narrator’s self-doubt, his expectations of life as a tradesman, or his identification of alternatives to his current occupation.

---

## QUESTION 4

**Choice A is the best answer.** In lines 27-33, the narrator is describing the hostile relationship between him and his superior, Edward Crimsworth. This relationship causes the narrator to feel like he lives in the “shade” and in “humid darkness.” These words evoke the narrator’s feelings of dismay toward his current occupation and his poor relationship with his superior — factors that cause him to live without “the sunshine of life.”

Choices B, C, and D are incorrect because the words “shade” and “darkness” do not reflect the narrator’s sinister thoughts, his fear of confinement, or his longing for rest.

## QUESTION 5

**Choice D is the best answer.** The narrator states that Crimsworth dislikes him because the narrator may “one day make a successful tradesman” (line 43). Crimsworth recognizes that the narrator is not “inferior to him” but rather more intelligent, someone who keeps “the padlock of silence on mental wealth in which [Crimsworth] was no sharer” (lines 44-48). Crimsworth feels inferior to the narrator and is jealous of the narrator’s intellectual and professional abilities.

Choices A and C are incorrect because the narrator is not described as exhibiting “high spirits” or “rash actions,” but “Caution, Tact, [and] Observation” (line 51). Choice B is incorrect because the narrator’s “humble background” is not discussed.

## QUESTION 6

**Choice B is the best answer.** Lines 61-62 state that the narrator “had long ceased to regard Mr. Crimsworth as my brother.” In these lines, the term “brother” means friend or ally, which suggests that the narrator and Crimsworth were once friendly toward one another.

Choices A, C, and D are incorrect because the narrator originally viewed Crimsworth as a friend, or ally, and later as a hostile superior; he never viewed Crimsworth as a harmless rival, perceptive judge, or demanding mentor.

## QUESTION 7

**Choice D is the best answer.** In lines 61-62, the narrator states that he once regarded Mr. Crimsworth as his “brother.” This statement provides evidence that the narrator originally viewed Crimsworth as a sympathetic ally.

Choices A, B, and C do not provide the best evidence for the claim that Crimsworth was a sympathetic ally. Rather, choices A, B, and C provide evidence of the hostile relationship that currently exists between the narrator and Crimsworth.

## QUESTION 8

**Choice D is the best answer.** In lines 48-53, the narrator states that he exhibited “Caution, Tact, [and] Observation” at work and watched Mr. Crimsworth with “lynx-eyes.” The narrator acknowledges that Crimsworth was “prepared to steal snake-like” if he caught the narrator acting without tact or being disrespectful toward his superiors (lines 53-56). Thus, Crimsworth was trying to find a reason to place the narrator “in a ridiculous or mortifying position” (lines 49-50) by accusing the narrator of acting unprofessionally. The use of the lynx and snake serve to emphasize the narrator and Crimsworth’s adversarial, or hostile, relationship.

Choices A and B are incorrect because the description of the lynx and snake does not contrast two hypothetical courses of action or convey a resolution. Choice C is incorrect because while lines 48-56 suggest that Crimsworth is trying to find a reason to fault the narrator’s work, they do not imply that an altercation, or heated dispute, between the narrator and Crimsworth is likely to occur.

## QUESTION 9

**Choice B is the best answer.** Lines 73-74 state that the narrator noticed there was no “cheering red gleam” of fire in his sitting-room fireplace. The lack of a “cheering,” or comforting, fire suggests that the narrator sometimes found his lodgings to be dreary or bleak.

Choices A and D are incorrect because the narrator does not find his living quarters to be treacherous or intolerable. Choice C is incorrect because while the narrator is walking home he speculates about the presence of a fire in his sitting-room’s fireplace (lines 69-74), which suggests that he could not predict the state of his living quarters.

## QUESTION 10

**Choice D is the best answer.** In lines 68-74, the narrator states that he did not see the “cheering” glow of a fire in his sitting-room fireplace. This statement provides evidence that the narrator views his lodgings as dreary or bleak.

Choices A, B, and C do not provide the best evidence that the narrator views his lodgings as dreary. Choices A and C are incorrect because they do not provide the narrator’s opinion of his lodgings, and choice B is incorrect because lines 21-23 describe the narrator’s lodgings only as “small.”

## QUESTION 11

**Choice D is the best answer.** In lines 11-12, the author introduces the main purpose of the passage, which is to examine the “different views on where ethics should apply when someone makes an economic decision.” The passage examines what historical figures Adam Smith, Aristotle, and John Stuart Mill believed about the relationship between ethics and economics.

---

Choices A, B, and C are incorrect because they identify certain points addressed in the passage (cost-benefit analysis, ethical economic behavior, and the role of the free market), but do not describe the passage's main purpose.

### QUESTION 12

**Choice D is the best answer.** In lines 4-5, the author suggests that people object to criticizing ethics in free markets because they believe free markets are inherently ethical, and therefore, the role of ethics in free markets is unnecessary to study. In the opinion of the critics, free markets are ethical because they allow individuals to make their own choices about which goods to purchase and which goods to sell.

Choices A and B are incorrect because they are not objections that criticize the ethics of free markets. Choice C is incorrect because the author does not present the opinion that free markets depend on devalued currency.

### QUESTION 13

**Choice A is the best answer.** In lines 4-5, the author states that some people believe that free markets are "already ethical" because they "allow for personal choice." This statement provides evidence that some people believe criticizing the ethics of free markets is unnecessary because free markets permit individuals to make their own choices.

Choices B, C, and D are incorrect because they do not provide the best evidence of an objection to a critique of the ethics of free markets.

### QUESTION 14

**Choice B is the best answer.** In lines 6-7, the author states that people "have accepted the ethical critique and embraced corporate social responsibility." In this context, people "embrace," or readily adopt, corporate social responsibility by acting in a certain way.

Choices A, C, and D are incorrect because in this context "embraced" does not mean lovingly held, eagerly hugged, or reluctantly used.

### QUESTION 15

**Choice C is the best answer.** The third and fourth paragraphs of the passage present Adam Smith's and Aristotle's different approaches to defining ethics in economics. The fifth paragraph offers a third approach to defining ethical economics, how "instead of rooting ethics in character or the consequences of actions, we can focus on our actions themselves. From this perspective some things are right, some wrong" (lines 45-48).

Choice A is incorrect because the fifth paragraph does not develop a counterargument. Choices B and D are incorrect because although "character" is briefly mentioned in the fifth paragraph, its relationship to ethics is examined in the fourth paragraph.

**QUESTION 16**

**Choice A is the best answer.** In lines 57-59, the author states that “Many moral dilemmas arise when these three versions pull in different directions but clashes are not inevitable.” In this context, the three different perspectives on ethical economics may “clash,” or conflict, with one another.

Choices B, C, and D are incorrect because in this context “clashes” does not mean mismatches, collisions, or brawls.

**QUESTION 17**

**Choice C is the best answer.** In lines 59-64, the author states, “Take fair trade coffee . . . for example: buying it might have good consequences, be virtuous, and also be the right way to act in a flawed market.” The author is suggesting that in the example of fair trade coffee, all three perspectives about ethical economics — Adam Smith’s belief in consequences dictating action, Aristotle’s emphasis on character, and the third approach emphasizing the virtue of good actions — can be applied. These three approaches share “common ground” (line 64), as they all can be applied to the example of fair trade coffee without contradicting one another.

Choices A, B, and D are incorrect because they do not show how the three different approaches to ethical economics share common ground. Choice A simply states that there are “different views on ethics” in economics, choice B explains the third ethical economics approach, and choice D suggests that people “behave like a herd” when considering economics.

**QUESTION 18**

**Choice C is the best answer.** In lines 83-88, the author states that psychology can help “define ethics for us,” which can help explain why people “react in disgust at economic injustice, or accept a moral law as universal.”

Choices A and B are incorrect because they identify topics discussed in the final paragraph (human quirks and people’s reaction to economic injustice) but not its main idea. Choice D is incorrect because the final paragraph does not suggest that economists may be responsible for reforming the free market.

**QUESTION 19**

**Choice A is the best answer.** The data in the graph show that in Tanzania between the years 2000 and 2008, fair trade coffee profits were around \$1.30 per pound, while profits of regular coffee were in the approximate range of 20–60 cents per pound.

Choices B, C, and D are incorrect because they are not supported by information in the graph.

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## QUESTION 20

**Choice B is the best answer.** The data in the graph indicate that between 2002 and 2004 the difference in per-pound profits between fair trade and regular coffee was about \$1. In this time period, fair trade coffee was valued at around \$1.30 per pound and regular coffee was valued at around 20 cents per pound. The graph also shows that regular coffee recorded the lowest profits between the years 2002 and 2004, while fair trade coffee remained relatively stable throughout the entire eight-year span (2000 to 2008).

Choices A, C, and D are incorrect because they do not indicate the greatest difference between per-pound profits for fair trade and regular coffee.

## QUESTION 21

**Choice C is the best answer.** In lines 59-61, the author defines fair trade coffee as “coffee that is sold with a certification that indicates the farmers and workers who produced it were paid a fair wage.” This definition suggests that purchasing fair trade coffee is an ethically responsible choice, and the fact that fair trade coffee is being produced and is profitable suggests that ethical economics is still a consideration. The graph’s data support this claim by showing how fair trade coffee was more than twice as profitable as regular coffee.

Choice A is incorrect because the graph suggests that people acting on empathy (by buying fair trade coffee) is productive for fair trade coffee farmers and workers. Choices B and D are incorrect because the graph does not provide support for the idea that character or people’s fears factor into economic choices.

## QUESTION 22

**Choice C is the best answer.** The author of Passage 1 indicates that people can benefit from using screen-based technologies as these technologies strengthen “certain cognitive skills” (line 3) and the “brain functions related to fast-paced problem solving” (lines 14-15).

Choice A is incorrect because the author of Passage 1 cites numerous studies of screen-based technologies. Choice B is incorrect because it is not supported by Passage 1, and choice D is incorrect because while the author mentions some benefits to screen-based technologies, he does not encourage their use.

## QUESTION 23

**Choice A is the best answer.** In lines 3-4, the author of Passage 1 provides evidence that the use of screen-based technologies has some positive effects: “Certain cognitive skills are strengthened by our use of computers and the Net.”

Choices B, C, and D are incorrect because they do not provide the best evidence that the use of screen-based technologies has some positive effects. Choices B, C, and D introduce and describe the author’s reservations about screen-based technologies.



## QUESTION 24

**Choice B is the best answer.** The author of Passage 1 cites Patricia Greenfield’s study, which found that people’s use of screen-based technologies weakened their ability to acquire knowledge, perform “inductive analysis” and “critical thinking,” and be imaginative and reflective (lines 34-38). The author of Passage 1 concludes that the use of screen-based technologies interferes with people’s ability to think “deeply” (lines 47-50).

Choices A, C, and D are incorrect because the author of Passage 1 does not address how using the Internet affects people’s health, social contacts, or self-confidence.

## QUESTION 25

**Choice C is the best answer.** In lines 39-41, the author states, “We know that the human brain is highly plastic; neurons and synapses change as circumstances change.” In this context, the brain is “plastic” because it is malleable, or able to change.

Choices A, B, and D are incorrect because in this context “plastic” does not mean creative, artificial, or sculptural.

## QUESTION 26

**Choice B is the best answer.** In lines 60-65, the author of Passage 2 explains how speed-reading does not “revamp,” or alter, how the brain processes information. He supports this statement by explaining how Woody Allen’s reading of *War and Peace* in one sitting caused him to describe the novel as “about Russia.” Woody Allen was not able to comprehend the “famously long” novel by speed-reading it.

Choices A and D are incorrect because Woody Allen’s description of *War and Peace* does not suggest he disliked Tolstoy’s writing style or that he regretted reading the book. Choice C is incorrect because the anecdote about Woody Allen is unrelated to multitasking.

## QUESTION 27

**Choice D is the best answer.** The author of Passage 2 states that people like novelists and scientists improve in their profession by “immers[ing] themselves in their fields” (line 79). Both novelists and scientists, in other words, become absorbed in their areas of expertise.

Choices A and C are incorrect because the author of Passage 2 does not suggest that novelists and scientists both take risks when they pursue knowledge or are curious about other subjects. Choice B is incorrect because the author of Passage 2 states that “accomplished people” don’t perform “intellectual calisthenics,” or exercises that improve their minds (lines 77-78).

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## QUESTION 28

**Choice D is the best answer.** In lines 83-90, the author of Passage 2 criticizes media critics for their alarmist writing: “Media critics write as if the brain takes on the qualities of whatever it consumes, the informational equivalent of ‘you are what you eat.’” The author then compares media critics’ “you are what you eat” mentality to ancient people’s belief that “eating fierce animals made them fierce.” The author uses this analogy to discredit media critics’ belief that consumption of electronic media alters the brain.

Choices A, B, and C are incorrect because the final sentence of Passage 2 does not use ornate language, employ humor, or evoke nostalgia for the past.

## QUESTION 29

**Choice D is the best answer.** The author of Passage 1 argues that online and other screen-based technologies affect people’s abilities to think deeply (lines 47-50). The author of Passage 2 argues that the effects of consuming electronic media are less drastic than media critics suggest (lines 81-82).

Choices A and B are incorrect because they discuss points made in the passages but not the main purpose of the passages. Choice C is incorrect because neither passage argues in favor of increasing financial support for certain studies.

## QUESTION 30

**Choice B is the best answer.** The author of Passage 1 cites scientific research that suggests online and screen-based technologies have a negative effect on the brain (lines 25-38). The author of Passage 2 is critical of the research highlighted in Passage 1: “Critics of new media sometimes use science itself to press their case, citing research that shows how ‘experience can change the brain.’ But cognitive neuroscientists roll their eyes at such talk” (lines 51-54).

Choices A, C, and D are incorrect because they do not accurately describe the relationship between the two passages. Passage 1 does not take a clinical approach to the topic. Passage 2 does not take a high-level view of a finding examined in depth in Passage 1, nor does it predict negative reactions to the findings discussed in paragraph 1.

## QUESTION 31

**Choice C is the best answer.** In Passage 1, the author cites psychologist Patricia Greenfield’s finding that “every medium develops some cognitive skills at the expense of others” (lines 29-31). In Passage 2, the author states “If you train people to do one thing (recognize shapes, solve math puzzles, find hidden words), they get better at doing that thing, but almost nothing else” (lines 71-74). Both authors would agree that an improvement in one cognitive area, such as visual-spatial skills, would not result in improved skills in other areas.

Choice A is incorrect because hand-eye coordination is not discussed in Passage 2. Choice B is incorrect because Passage 1 does not suggest that critics of electronic media tend to overreact. Choice D is incorrect because neither passage discusses whether Internet users prefer reading printed texts or digital texts.

### QUESTION 32

**Choice B is the best answer.** In Passage 1, the author cites Michael Merzenich’s claim that when people adapt to a new cultural phenomenon, including the use of a new medium, we end up with a “different brain” (lines 41-43). The author of Passage 2 somewhat agrees with Merzenich’s claim by stating, “Yes, every time we learn a fact or skill the wiring of the brain changes” (lines 54-56).

Choices A, C, and D do not provide the best evidence that the author of Passage 2 would agree to some extent with Merzenich’s claim. Choices A and D are incorrect because the claims are attributed to critics of new media. Choice C is incorrect because it shows that the author of Passage 2 does not completely agree with Merzenich’s claim about brain plasticity.

### QUESTION 33

**Choice B is the best answer.** In lines 15-30, Stanton argues that men make all the decisions in “the church, the state, and the home.” This absolute power has led to a disorganized society, a “fragmentary condition of everything.” Stanton confirms this claim when she states that society needs women to “lift man up into the higher realms of thought and action” (lines 59-60).

Choices A and D are incorrect because Stanton does not focus on women’s lack of equal educational opportunities or inability to hold political positions. Choice C is incorrect because although Stanton implies women are not allowed to vote, she never mentions that “poor candidates” are winning elections.

### QUESTION 34

**Choice A is the best answer.** Stanton argues that women are repressed in society because men hold “high carnival,” or have all the power, and make the rules in “the church, the state, and the home” (lines 15-30). Stanton claims that men have total control over women, “overpowering the feminine element everywhere” (line 17).

Choices B, C, and D are incorrect because Stanton does not use the term “high carnival” to emphasize that the time period is freewheeling, or unrestricted; that there has been a scandalous decline in moral values; or that the power of women is growing.

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### QUESTION 35

**Choice D is the best answer.** In lines 15-22, Stanton states that men's absolute rule in society is "crushing out all the diviner qualities in human nature," such that society knows very "little of true manhood and womanhood." Stanton argues that society knows less about womanhood than manhood, because womanhood has "scarce been recognized as a power until within the last century." This statement indicates that society's acknowledgment of "womanhood," or women's true character, is a fairly recent historical development.

Choices A, B, and C are incorrect because Stanton describes men's control of society, their domination of the domestic sphere, and the prevalence of war and injustice as long-established realities.

### QUESTION 36

**Choice B is the best answer.** In lines 15-22, Stanton provides evidence for the claim that society's acknowledgment of "womanhood," or women's true character, is a fairly recent historical development: "[womanhood] has scarce been recognized as a power until within the last century."

Choices A, C, and D are incorrect because they do not provide the best evidence that society's acknowledgment of "womanhood," or women's true character, is a fairly recent historical development. Rather, choices A, C, and D discuss men's character, power, and influence.

### QUESTION 37

**Choice B is the best answer.** In lines 22-25, Stanton states, "Society is but the reflection of man himself, untempered by woman's thought; the hard iron rule we feel alike in the church, the state, and the home." In this context, man's "rule" in "the church, the state, and the home" means that men have a controlling force in all areas of society.

Choices A, C, and D are incorrect because in this context "rule" does not mean a general guideline, an established habit, or a procedural method.

### QUESTION 38

**Choice D is the best answer.** In lines 31-34, Stanton argues that people use the term "the strong-minded" to refer to women who advocate for "the right of suffrage," or the right to vote in elections. In this context, people use the term "the strong-minded" to criticize female suffragists, as they believe voting will make women too "masculine."

Choices A and B are incorrect because Stanton does not suggest that people use the term "the strong-minded" as a compliment. Choice C is incorrect because Stanton suggests that "the strong-minded" is a term used to criticize women who want to vote, not those who enter male-dominated professions.

**QUESTION 39**

**Choice C is the best answer.** In lines 35-38, Stanton states that society contains hardly any women in the “best sense,” and clarifies that too many women are “reflections, varieties, and dilutions of the masculine gender.” Stanton is suggesting that there are few “best,” or genuine, women who are not completely influenced or controlled by men.

Choices A, B, and D are incorrect because in this context “best” does not mean superior, excellent, or rarest.

**QUESTION 40**

**Choice A is the best answer.** In lines 53-55, Stanton argues that man “mourns,” or regrets, how his power has caused “falsehood, selfishness, and violence” to become the “law” of society. Stanton is arguing that men are lamenting, or expressing regret about, how their governance has created problems.

Choices B, C, and D are incorrect because Stanton does not suggest that men are advocating for women’s right to vote or for female equality, nor are they requesting women’s opinions about improving civic life.

**QUESTION 41**

**Choice B is the best answer.** In lines 53-55, Stanton provides evidence that men are lamenting the problems they have created, as they recognize that their actions have caused “falsehood, selfishness, and violence [to become] the law of life.”

Choices A, C, and D are incorrect because they do not provide the best evidence that men are lamenting the problems they have created. Choice A explains society’s current fragmentation. Choices C and D present Stanton’s main argument for women’s enfranchisement.

**QUESTION 42**

**Choice D is the best answer.** In the sixth paragraph, Stanton differentiates between men and masculine traits. Stanton argues that masculine traits or “characteristics,” such as a “love of acquisition and conquest,” serve to “subjugate one man to another” (lines 67-78). Stanton is suggesting that some masculine traits position men within certain power structures.

Choices A and B are incorrect because the sixth paragraph does not primarily establish a contrast between men and women or between the spiritual and material worlds. Choice C is incorrect because although Stanton argues that not “all men are hard, selfish, and brutal,” she does not discuss what constitutes a “good” man.

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### QUESTION 43

**Choice C is the best answer.** In the first paragraph, the author identifies the natural phenomenon “internal waves” (line 3), and explains why they are important: “internal waves are fundamental parts of ocean water dynamics, transferring heat to the ocean depths and bringing up cold water from below” (lines 7-9).

Choices A, B, and D are incorrect because they do not identify the main purpose of the first paragraph, as that paragraph does not focus on a scientific device, a common misconception, or a recent study.

### QUESTION 44

**Choice B is the best answer.** In lines 17-19, researcher Tom Peacock argues that in order to create precise global climate models, scientists must be able to “capture processes” such as how internal waves are formed. In this context, to “capture” a process means to record it for scientific study.

Choices A, C, and D are incorrect because in this context “capture” does not mean to control, secure, or absorb.

### QUESTION 45

**Choice D is the best answer.** In lines 17-19, researcher Tom Peacock argues that scientists need to “capture processes” of internal waves to develop “more and more accurate climate models.” Peacock is suggesting that studying internal waves will inform the development of scientific models.

Choices A, B, and C are incorrect because Peacock does not state that monitoring internal waves will allow people to verify wave heights, improve satellite image quality, or prevent coastal damage.

### QUESTION 46

**Choice C is the best answer.** In lines 17-19, researcher Tom Peacock provides evidence that studying internal waves will inform the development of key scientific models, such as “more accurate climate models.”

Choices A, B, and D are incorrect because they do not provide the best evidence that studying internal waves will inform the development of key scientific models; rather, they provide general information about internal waves.

### QUESTION 47

**Choice A is the best answer.** In lines 65-67, the author notes that Tom Peacock and his team “were able to devise a mathematical model that describes the movement and formation of these waves.” In this context, the researchers devised, or created, a mathematical model.

Choices B, C, and D are incorrect because in this context “devise” does not mean to solve, imagine, or begin.

**QUESTION 48**

**Choice B is the best answer.** Tom Peacock and his team created a model of the “Luzon’s Strait’s underwater topography” and determined that its “distinct double-ridge shape . . . [is] responsible for generating the underwater [internal] waves” (lines 53-55). The author notes that this model describes only internal waves in the Luzon Strait but that the team’s findings may “help researchers understand how internal waves are generated in other places around the world” (lines 67-70). The author’s claim suggests that while internal waves in the Luzon Strait are “some of the largest in the world” (line 25) due to the region’s topography, internal waves occurring in other regions may be caused by some similar factors.

Choice A is incorrect because the author notes that the internal waves in the Luzon Strait are “some of the largest in the world” (line 25), which suggests that internal waves reach varying heights. Choices C and D are incorrect because they are not supported by the researchers’ findings.

**QUESTION 49**

**Choice D is the best answer.** In lines 67-70, the author provides evidence that, while the researchers’ findings suggest the internal waves in the Luzon Strait are influenced by the region’s topography, the findings may “help researchers understand how internal waves are generated in other places around the world.” This statement suggests that all internal waves may be caused by some similar factors.

Choices A, B, and C are incorrect because they do not provide the best evidence that internal waves are caused by similar factors but influenced by the distinct topographies of different regions. Rather, choices A, B, and C reference general information about internal waves or focus solely on those that occur in the Luzon Strait.

**QUESTION 50**

**Choice D is the best answer.** During the period 19:12 to 20:24, the graph shows the 13°C isotherm increasing in depth from about 20 to 40 meters.

Choices A, B, and C are incorrect because during the time period 19:12 to 20:24 the 9°C, 10°C, and 11°C isotherms all decreased in depth.

**QUESTION 51**

**Choice D is the best answer.** In lines 3-6, the author notes that internal waves “do not ride the ocean surface” but “move underwater, undetectable without the use of satellite imagery or sophisticated monitoring equipment.” The graph shows that the isotherms in an internal wave never reach the ocean’s surface, as the isotherms do not record a depth of 0.

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Choice A is incorrect because the graph provides no information about salinity. Choice B is incorrect because the graph shows layers of less dense water (which, based on the passage, are warmer) riding above layers of denser water (which, based on the passage, are cooler). Choice C is incorrect because the graph shows that internal waves push isotherms of warmer water above bands of colder water.

## QUESTION 52

**Choice A is the best answer.** In lines 7-9, the author notes that internal waves are “fundamental parts of ocean water dynamics” because they transfer “heat to the ocean depths and brin[g] up cold water from below.” The graph shows an internal wave forcing the warm isotherms to depths that typically are colder. For example, at 13:12, the internal wave transfers “heat to the ocean depths” by forcing the 10°C, 11°C, and 13°C isotherms to depths that typically are colder.

Choices B, C, and D are incorrect because the graph does not show how internal waves affect the ocean’s density, surface temperature, or tide flow.

## Section 2: Writing and Language Test

### QUESTION 1

**Choice B is the best answer** because it provides a noun, “reductions,” yielding a grammatically complete and coherent sentence.

Choices A, C, and D are incorrect because each provides a verb or gerund, while the underlined portion calls for a noun.

### QUESTION 2

**Choice B is the best answer** because it offers a transitional adverb, “Consequently,” that communicates a cause-effect relationship between the funding reduction identified in the previous sentence and the staffing decrease described in this sentence.

Choices A, C, and D are incorrect because each misidentifies the relationship between the preceding sentence and the sentence of which it is a part.

### QUESTION 3

**Choice A is the best answer** because the singular verb “has” agrees with the singular noun “trend” that appears earlier in the sentence.

Choices B, C, and D are incorrect because the plural verb “have” does not agree with the singular subject “trend,” and the relative pronoun “which” unnecessarily interrupts the direct relationship between “trend” and the verb.



**QUESTION 4**

**Choice A is the best answer** because it states accurately why the proposed clause should be added to the sentence. Without these specific examples, readers have only a vague sense of what “nonprint” formats might be.

Choices B, C, and D are incorrect because each represents a misinterpretation of the relationship between the proposed clause to be added and the surrounding text in the passage.

**QUESTION 5**

**Choice D is the best answer** because it includes only the preposition and noun that the sentence requires.

Choices A, B, and C are incorrect because each includes an unnecessary pronoun, either “them” or “their.” The sentence contains no referents that would circulate e-books.

**QUESTION 6**

**Choice D is the best answer** because the verb form “cataloging” parallels the other verbs in the series.

Choices A, B, and C are incorrect because each interrupts the parallel structure in the verb series, either through an incorrect verb form or with an unnecessary subject.

**QUESTION 7**

**Choice B is the best answer** because it consolidates references to the subject, “librarians,” by placing the relative pronoun “whose” immediately following “librarians.” This results in a logical flow of information within the sentence.

Choices A, C, and D are incorrect because each fails to place “librarians” as the main subject of the sentence without redundancy, resulting in a convoluted sentence whose relevance to the preceding and subsequent sentences is unclear.

**QUESTION 8**

**Choice D is the best answer** because no conjunction is necessary to communicate the relationship between the clauses in the sentence. The conjunction “While” at the beginning of the sentence already creates a comparison.

Choices A, B, and C are incorrect because each provides an unnecessary coordinating conjunction.

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## QUESTION 9

**Choice B is the best answer** because it mentions time periods when the free services described later in the sentence are particularly useful to library patrons.

Choices A, C, and D are incorrect because each creates redundancy or awkwardness in the remainder of the sentence.

## QUESTION 10

**Choice B is the best answer** because it is concise; it is also consistent with the formal language in the rest of the sentence and the passage overall.

Choices A, C, and D are incorrect because each is either unnecessarily wordy or uses colloquial language that does not correspond with the tone of the passage.

## QUESTION 11

**Choice C is the best answer** because it restates the writer's primary argument, which may be found at the end of the first paragraph: "As public libraries adapt to rapid technological advances in information distribution, librarians' roles are actually expanding."

Choices A, B, and D are incorrect because they do not paraphrase the writer's primary claim.

## QUESTION 12

**Choice B is the best answer** because it clarifies that the sentence, which mentions a specific large-scale painting at the Art Institute of Chicago, is an example supporting the preceding claim about large-scale paintings.

Choices A, C, and D are incorrect because they propose transitional words or phrases that do not accurately represent the relationship between the preceding sentence and the sentence containing the underlined portion.

## QUESTION 13

**Choice D is the best answer** because no punctuation is necessary in the underlined phrase.

Choices A, B, and C are incorrect because each separates parts of the noun phrase "painter Georges Seurat's 10-foot-wide *A Sunday Afternoon on the Island of La Grande Jatte*" from one another with one or more unnecessary commas.

## QUESTION 14

**Choice C is the best answer** because it provides the appropriate possessive form, "its," and a colon to introduce the identifying phrase that follows.

Choices A, B, and D are incorrect because none contains both the appropriate possessive form of “it” and the punctuation that creates a grammatically standard sentence.

### QUESTION 15

**Choice C is the best answer** because an analysis of the consequences of King Louis XV’s reign is irrelevant to the paragraph.

Choices A, B, and D are incorrect because each represents a misinterpretation of the relationship between the proposed sentence to be added and the main point of the paragraph.

### QUESTION 16

**Choice C is the best answer** because it provides a coordinating conjunction, “and,” to connect the two verb phrases “are characterized” and “are covered.”

Choices A, B, and D are incorrect because each lacks the conjunction needed to connect the two verb phrases “are characterized” and “are covered.”

### QUESTION 17

**Choice B is the best answer** because it offers an example of an additional household item, a “tea cup,” with a specific measurement that is one-twelfth of its actual size.

Choices A, C, D are incorrect because, compared to the example preceding the underlined portion, each is vague and fails to offer a specific measurement of an additional household item.

### QUESTION 18

**Choice B is the best answer** because it provides correct punctuation and the coordinating conjunction “but,” which acknowledges the possible contrast between being “sparsely furnished” and displaying “just as true” period details.

Choices A, C, and D are incorrect because each communicates an illogical relationship between the phrases that precede and follow the underlined portion.

### QUESTION 19

**Choice A is the best answer** because it provides a clause that is the most similar to the two preceding clauses, which both end with a reference to a specific wall.

Choices B, C, and D are incorrect because each deviates from the stylistic pattern of the preceding two clauses.

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## QUESTION 20

**Choice D is the best answer** because the article “a” requires the singular noun “visitor,” and the simple present verb “remark” is the appropriate verb tense in this context.

Choices A, B, and C are incorrect because each contains either a noun or verb that does not fit the context.

## QUESTION 21

**Choice D is the best answer** because it identifies the drawers, rather than the visitor, as being “dotted with pin-sized knobs.”

Choices A, B, and C are incorrect because all three contain dangling modifiers that obscure the relationship between the visitor, the drawers, and the pin-sized knobs.

## QUESTION 22

**Choice B is the best answer** because paragraph 3 offers an overview of the exhibit and so serves to introduce the specific aspects of particular miniature rooms described in paragraphs 2 and 4.

Choices A, C, and D are incorrect because each proposes a placement of paragraph 2 that prevents the passage from developing in a logical sequence.

## QUESTION 23

**Choice A is the best answer** because it correctly completes the noun phrase that begins with “sea otters,” and directly follows the noun phrase with the verb “help.”

Choices B, C, and D are incorrect because each separates the noun “otters” from the verb “help” in a way that results in a grammatically incomplete sentence.

## QUESTION 24

**Choice B is the best answer** because the data in the chart show lower sea urchin density in areas where sea otters have lived for two years or less than in areas where no otters are present.

Choices A, C, and D are incorrect because none accurately describes the data in the chart.

## QUESTION 25

**Choice B is the best answer** because the conjunctive adverb “however” accurately communicates the contrast between an environment shaped by the presence of sea otters, described in the preceding sentence, and an environment shaped by the absence of sea otters, described in this sentence.

Choices A, C, and D are incorrect because each presents a conjunctive adverb that does not accurately depict the relationship between the preceding sentence and the sentence with the underlined word.

### QUESTION 26

**Choice A is the best answer** because the additional information usefully connects the carbon dioxide levels mentioned in this sentence with the global warming mentioned in the previous sentence.

Choices B, C, and D are incorrect because each misinterprets the relationship between the proposed information and the main points of the paragraph and the passage.

### QUESTION 27

**Choice D is the best answer** because it offers the verb “suggests” followed directly by its object, a that-clause, without interruption.

Choices A, B, and C are incorrect because each contains punctuation that unnecessarily separates the study from its findings — that is, separates the verb from its object.

### QUESTION 28

**Choice A is the best answer** because it accurately reflects the fact that sea urchins “graze voraciously on kelp,” as stated in the first paragraph, and it also maintains the tone of the passage.

Choices B, C, and D are incorrect because each offers a term that does not accurately describe the behavior of sea otters.

### QUESTION 29

**Choice C is the best answer** because the possessive singular pronoun “its” corresponds with the referent “kelp,” which appears later in the sentence, and with the possessive relationship between the pronoun and the “terrestrial plant cousins.”

Choices A, B, and D are incorrect because none provides a pronoun that is both singular and possessive.

### QUESTION 30

**Choice C is the best answer** because it provides the noun “sea otters” to identify who or what “played a role.”

Choices A, B, and D are incorrect because each provides a pronoun that makes no sense in the context of the paragraph and the passage, which is about the role sea otters play — not the role scientists play or the role kelp plays.

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### QUESTION 31

**Choice D is the best answer** because sentence 5 indicates that sea otters' importance in decreasing atmospheric carbon dioxide was not known, and the sentence to be added indicates that a surprise will follow. Sentence 6 provides that surprise: sea otters have a large impact on the amount of carbon dioxide kelp can remove from the atmosphere.

Choices A, B, and C are incorrect because each interrupts the logical flow of ideas in the paragraph.

### QUESTION 32

**Choice B is the best answer** because its clear wording and formal tone correspond with the passage's established style.

Choices A, C, and D are incorrect because each contains vague language that is inconsistent with the passage's clear wording and formal tone.

### QUESTION 33

**Choice D is the best answer** because it provides punctuation that appropriately identifies "removed" as the definition of "sequestered."

Choices A, B, and C are incorrect because each contains punctuation that obscures the relationship between "sequestered," "removed," and the text that follows.

### QUESTION 34

**Choice D is the best answer** because it provides a conjunction that correctly identifies the relationship between "a practice" and the actions involved in the practice.

Choices A, B, and C are incorrect because each contains a conjunction that miscommunicates the relationship between the text that precedes and follows the underlined portion.

### QUESTION 35

**Choice A is the best answer** because it provides a comma to close the appositive clause "a practice whereby products are designed to have a limited period of usefulness," which also begins with a comma.

Choices B, C, and D are incorrect because each provides closing punctuation inconsistent with the punctuation at the beginning of the clause.

### QUESTION 36

**Choice D is the best answer** because it provides an adjective that accurately describes the clear "contrast" between products "designed to have a limited period of usefulness" and those "produced to be durable."

Choices A, B, and C are incorrect because none provides an adjective that appropriately modifies "contrast" in the context of the paragraph.

**QUESTION 37**

**Choice A is the best answer** because by mentioning the “specialized” methods used in repair shops, it suggests that repairing goods is seen as a specialty rather than as a common activity. This connects logically with the “rare” repair shops introduced just before the underlined portion.

Choices B, C, and D are incorrect because none provides information that supports the claim made in the sentence.

**QUESTION 38**

**Choice B is the best answer** because it provides the correct spelling of the noun “fair,” meaning exhibition, and uses the correct word “than” to create the comparison between a “fair” and a “café.”

Choices A, C, and D are incorrect because each contains a misspelling of either “fair” or “than.”

**QUESTION 39**

**Choice C is the best answer** because it offers a relative pronoun that properly links the noun “Martine Postma” with the appropriate verb “wanted.”

Choices A, B, and D are incorrect because none contains a pronoun that is appropriate for the referent and placement of the clause.

**QUESTION 40**

**Choice D is the best answer** because it provides the most concise phrasing and links the sentence appropriately to the previous sentence.

Choices A, B, and C are incorrect because each provides an unnecessary adverb that obscures the relationship between this sentence and the previous one.

**QUESTION 41**

**Choice D is the best answer** because the gerund “waiting” corresponds with the preposition “for” and the present tense used in the rest of the sentence.

Choices A, B, and C are incorrect because each contains a verb form not used with the preposition “for.”

**QUESTION 42**

**Choice C is the best answer** because it appropriately places sentence 5, which describes the places Repair Cafés can be found today, between a sentence that gives the first Repair Café’s location and purpose and a statement about current customers and how they use Repair Cafés.

Choices A, B, and D are incorrect because each creates a paragraph with an inappropriate shift in verb tense and, therefore, an illogical sequence of information.

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### QUESTION 43

**Choice C is the best answer** because it accurately states that the issue of “corporate and service-based jobs” is not particularly relevant at this point in the paragraph. The focus here is on repairing objects in a “throwaway culture,” not jobs.

Choices A, B, and D are incorrect because each misinterprets the relationship between the proposed text and the information in the paragraph.

### QUESTION 44

**Choice D is the best answer** because the phrase “and other countries” communicates the fact that there are additional items not being named that could be added to the list; no other wording is required to clarify that point.

Choices A, B, and C are incorrect because each presents a word or phrase that results in a redundancy with “and other countries.”

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice C is correct.** Subtracting 6 from each side of  $5x + 6 = 10$  yields  $5x = 4$ . Dividing both sides of  $5x = 4$  by 5 yields  $x = \frac{4}{5}$ . The value of  $x$  can now be substituted into the expression  $10x + 3$ , giving  $10\left(\frac{4}{5}\right) + 3 = 11$ .

Alternatively, the expression  $10x + 3$  can be rewritten as  $2(5x + 6) - 9$ , and 10 can be substituted for  $5x + 6$ , giving  $2(10) - 9 = 11$ .

Choices A, B, and D are incorrect. Each of these choices leads to  $5x + 6 \neq 10$ , contradicting the given equation,  $5x + 6 = 10$ . For example, choice A is incorrect because if the value of  $10x + 3$  were 4, then it would follow that  $x = 0.1$ , and the value of  $5x + 6$  would be 6.5, not 10.

### QUESTION 2

**Choice B is correct.** Multiplying each side of  $x + y = 0$  by 2 gives  $2x + 2y = 0$ . Then, adding the corresponding sides of  $2x + 2y = 0$  and  $3x - 2y = 10$  gives  $5x = 10$ . Dividing each side of  $5x = 10$  by 5 gives  $x = 2$ . Finally, substituting 2 for  $x$  in  $x + y = 0$  gives  $2 + y = 0$ , or  $y = -2$ . Therefore, the solution to the given system of equations is  $(2, -2)$ .

Alternatively, the equation  $x + y = 0$  can be rewritten as  $x = -y$ , and substituting  $x$  for  $-y$  in  $3x - 2y = 10$  gives  $5x = 10$ , or  $x = 2$ . The value of  $y$  can then be found in the same way as before.

Choices A, C, and D are incorrect because when the given values of  $x$  and  $y$  are substituted into  $x + y = 0$  and  $3x - 2y = 10$ , either one or both of the equations are not true. These answers may result from sign errors or other computational errors.



### QUESTION 3

**Choice A is correct.** The price of the job, in dollars, is calculated using the expression  $60 + 12nh$ , where 60 is a fixed price and  $12nh$  depends on the number of landscapers,  $n$ , working the job and the number of hours,  $h$ , the job takes those  $n$  landscapers. Since  $nh$  is the total number of hours of work done when  $n$  landscapers work  $h$  hours, the cost of the job increases by \$12 for each hour each landscaper works. Therefore, of the choices given, the best interpretation of the number 12 is that the company charges \$12 per hour for each landscaper.

Choice B is incorrect because the number of landscapers that will work each job is represented by  $n$  in the equation, not by the number 12. Choice C is incorrect because the price of the job increases by  $12n$  dollars each hour, which will not equal 12 dollars unless  $n = 1$ . Choice D is incorrect because the total number of hours each landscaper works is equal to  $h$ . The number of hours each landscaper works in a day is not provided.

### QUESTION 4

**Choice A is correct.** If a polynomial expression is in the form  $(x)^2 + 2(x)(y) + (y)^2$ , then it is equivalent to  $(x + y)^2$ . Because  $9a^4 + 12a^2b^2 + 4b^4 = (3a^2)^2 + 2(3a^2)(2b^2) + (2b^2)^2$ , it can be rewritten as  $(3a^2 + 2b^2)^2$ .

Choice B is incorrect. The expression  $(3a + 2b)^4$  is equivalent to the product  $(3a + 2b)(3a + 2b)(3a + 2b)(3a + 2b)$ . This product will contain the term  $4(3a)^3(2b) = 216a^3b$ . However, the given polynomial,  $9a^4 + 12a^2b^2 + 4b^4$ , does not contain the term  $216a^3b$ . Therefore,  $9a^4 + 12a^2b^2 + 4b^4 \neq (3a + 2b)^4$ . Choice C is incorrect. The expression  $(9a^2 + 4b^2)^2$  is equivalent to the product  $(9a^2 + 4b^2)(9a^2 + 4b^2)$ . This product will contain the term  $(9a^2)(9a^2) = 81a^4$ . However, the given polynomial,  $9a^4 + 12a^2b^2 + 4b^4$ , does not contain the term  $81a^4$ . Therefore,  $9a^4 + 12a^2b^2 + 4b^4 \neq (9a^2 + 4b^2)^2$ . Choice D is incorrect. The expression  $(9a + 4b)^4$  is equivalent to the product  $(9a + 4b)(9a + 4b)(9a + 4b)(9a + 4b)$ . This product will contain the term  $(9a)(9a)(9a)(9a) = 6,561a^4$ . However, the given polynomial,  $9a^4 + 12a^2b^2 + 4b^4$ , does not contain the term  $6,561a^4$ . Therefore,  $9a^4 + 12a^2b^2 + 4b^4 \neq (9a + 4b)^4$ .

### QUESTION 5

**Choice C is correct.** Since  $\sqrt{2k^2 + 17} - x = 0$ , and  $x = 7$ , one can substitute 7 for  $x$ , which gives  $\sqrt{2k^2 + 17} - 7 = 0$ . Adding 7 to each side of  $\sqrt{2k^2 + 17} - 7 = 0$  gives  $\sqrt{2k^2 + 17} = 7$ . Squaring each side of  $\sqrt{2k^2 + 17} = 7$  will remove the square root symbol:  $(\sqrt{2k^2 + 17})^2 = (7)^2$ , or  $2k^2 + 17 = 49$ . Then subtracting 17 from each side of  $2k^2 + 17 = 49$  gives  $2k^2 = 49 - 17 = 32$ , and dividing each side of  $2k^2 = 32$  by 2 gives  $k^2 = 16$ . Finally, taking the square root of each side of  $k^2 = 16$  gives  $k = \pm 4$ , and since the problem states that  $k > 0$ , it follows that  $k = 4$ .

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Since the sides of an equation were squared while solving  $\sqrt{2k^2 + 17} - 7 = 0$ , it is possible that an extraneous root was produced. However, substituting 4 for  $k$  in  $\sqrt{2k^2 + 17} - 7 = 0$  confirms that 4 is a solution for  $k$ :  $\sqrt{2(4)^2 + 17} - 7 = \sqrt{32 + 17} - 7 = \sqrt{49} - 7 = 7 - 7 = 0$ .

Choices A, B, and D are incorrect because substituting any of these values for  $k$  in  $\sqrt{2k^2 + 17} - 7 = 0$  does not yield a true statement.

### QUESTION 6

**Choice D is correct.** Since lines  $\ell$  and  $k$  are parallel, the lines have the same slope. The slope  $m$  of a line that passes through two points  $(x_1, y_1)$  and  $(x_2, y_2)$  can be found as  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Line  $\ell$  passes through the points  $(0, 2)$  and  $(-5, 0)$ , so its slope is  $\frac{0 - 2}{-5 - 0}$ , which is  $\frac{2}{5}$ . The slope of line  $k$  must also be  $\frac{2}{5}$ . Since line  $k$  has slope  $\frac{2}{5}$  and passes through the points  $(p, 0)$  and  $(0, -4)$ , it follows that  $\frac{-4 - 0}{0 - p} = \frac{2}{5}$ , or  $\frac{4}{p} = \frac{2}{5}$ . Multiplying each side of  $\frac{4}{p} = \frac{2}{5}$  by  $5p$  gives  $20 = 2p$ , and therefore,  $p = 10$ .

Choices A, B, and C are incorrect and may result from conceptual or calculation errors.

### QUESTION 7

**Choice A is correct.** Since the numerator and denominator of  $\frac{x^{a^2}}{x^{b^2}}$  have a common base, it follows by the laws of exponents that this expression can be rewritten as  $x^{a^2 - b^2}$ . Thus, the equation  $\frac{x^{a^2}}{x^{b^2}} = x^{16}$  can be rewritten as  $x^{a^2 - b^2} = x^{16}$ . Because the equivalent expressions have the common base  $x$ , and  $x > 1$ , it follows that the exponents of the two expressions must also be equivalent. Hence, the equation  $a^2 - b^2 = 16$  must be true. The left-hand side of this new equation is a difference of squares, and so it can be factored:  $(a + b)(a - b) = 16$ . It is given that  $(a + b) = 2$ ; substituting 2 for the factor  $(a + b)$  gives  $2(a - b) = 16$ . Finally, dividing both sides of  $2(a - b) = 16$  by 2 gives  $a - b = 8$ .

Choices B, C, and D are incorrect and may result from errors in applying the laws of exponents or errors in solving the equation  $a^2 - b^2 = 16$ .

### QUESTION 8

**Choice C is correct.** The relationship between  $n$  and  $A$  is given by the equation  $nA = 360$ . Since  $n$  is the number of sides of a polygon,  $n$  must be a positive integer, and so  $nA = 360$  can be rewritten as  $A = \frac{360}{n}$ .

If the value of  $A$  is greater than 50, it follows that  $\frac{360}{n} > 50$  is a true statement. Thus,  $50n < 360$ , or  $n < \frac{360}{50} = 7.2$ . Since  $n$  must be an integer, the greatest possible value of  $n$  is 7.

Choices A and B are incorrect. These are possible values for  $n$ , the number of sides of a regular polygon, if  $A > 50$ , but neither is the greatest possible value of  $n$ . Choice D is incorrect. If  $A < 50$ , then  $n = 8$  is the least possible value of  $n$ , the number of sides of a regular polygon. However, the question asks for the greatest possible value of  $n$  if  $A > 50$ , which is  $n = 7$ .

## QUESTION 9

**Choice B is correct.** Since the slope of the first line is 2, an equation of this line can be written in the form  $y = 2x + c$ , where  $c$  is the  $y$ -intercept of the line. Since the line contains the point  $(1, 8)$ , one can substitute 1 for  $x$  and 8 for  $y$  in  $y = 2x + c$ , which gives  $8 = 2(1) + c$ , or  $c = 6$ . Thus, an equation of the first line is  $y = 2x + 6$ . The slope of the second line is equal to  $\frac{1-2}{2-1}$  or  $-1$ . Thus, an equation of the second line can be written in the form  $y = -x + d$ , where  $d$  is the  $y$ -intercept of the line. Substituting 2 for  $x$  and 1 for  $y$  gives  $1 = -2 + d$ , or  $d = 3$ . Thus, an equation of the second line is  $y = -x + 3$ .

Since  $a$  is the  $x$ -coordinate and  $b$  is the  $y$ -coordinate of the intersection point of the two lines, one can substitute  $a$  for  $x$  and  $b$  for  $y$  in the two equations, giving the system  $b = 2a + 6$  and  $b = -a + 3$ . Thus,  $a$  can be found by solving the equation  $2a + 6 = -a + 3$ , which gives  $a = -1$ . Finally, substituting  $-1$  for  $a$  into the equation  $b = -a + 3$  gives  $b = -(-1) + 3$ , or  $b = 4$ . Therefore, the value of  $a + b$  is 3.

Alternatively, since the second line passes through the points  $(1, 2)$  and  $(2, 1)$ , an equation for the second line is  $x + y = 3$ . Thus, the intersection point of the first line and the second line,  $(a, b)$  lies on the line with equation  $x + y = 3$ . It follows that  $a + b = 3$ .

Choices A and C are incorrect and may result from finding the value of only  $a$  or  $b$ , but not calculating the value of  $a + b$ . Choice D is incorrect and may result from a computation error in finding equations of the two lines or in solving the resulting system of equations.

## QUESTION 10

**Choice C is correct.** Since the square of any real number is nonnegative, every point on the graph of the quadratic equation  $y = (x - 2)^2$  in the  $xy$ -plane has a nonnegative  $y$ -coordinate. Thus,  $y \geq 0$  for every point on the graph. Therefore, the equation  $y = (x - 2)^2$  has a graph for which  $y$  is always greater than or equal to  $-1$ .

Choices A, B, and D are incorrect because the graph of each of these equations in the  $xy$ -plane has a  $y$ -intercept at  $(0, -2)$ . Therefore, each of these equations contains at least one point where  $y$  is less than  $-1$ .

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## QUESTION 11

**Choice C is correct.** To perform the division  $\frac{3-5i}{8+2i}$ , multiply the numerator and denominator of  $\frac{3-5i}{8+2i}$  by the conjugate of the denominator,  $8-2i$ . This gives  $\frac{(3-5i)(8-2i)}{(8+2i)(8-2i)} = \frac{24-6i-40i+(-5i)(-2i)}{8^2-(2i)^2}$ . Since  $i^2 = -1$ , this can be simplified to  $\frac{24-6i-40i-10}{64+4} = \frac{14-46i}{68}$ , which then simplifies to  $\frac{7}{34} - \frac{23i}{34}$ .

Choices A and B are incorrect and may result from misconceptions about fractions. For example,  $\frac{a+b}{c+d}$  is equal to  $\frac{a}{c+d} + \frac{b}{c+d}$ , not  $\frac{a}{c} + \frac{b}{d}$ . Choice D is incorrect and may result from a calculation error.

## QUESTION 12

**Choice B is correct.** Multiplying each side of  $R = \frac{F}{N+F}$  by  $N+F$  gives  $R(N+F) = F$ , which can be rewritten as  $RN + RF = F$ . Subtracting  $RF$  from each side of  $RN + RF = F$  gives  $RN = F - RF$ , which can be factored as  $RN = F(1 - R)$ . Finally, dividing each side of  $RN = F(1 - R)$  by  $1 - R$ , expresses  $F$  in terms of the other variables:  $F = \frac{RN}{1-R}$ .

Choices A, C, and D are incorrect and may result from calculation errors when rewriting the given equation.

## QUESTION 13

**Choice D is correct.** The problem asks for the sum of the solutions of the quadratic equation  $2m^2 - 16m + 8 = 0$ . Dividing each side of the equation by 2 gives  $m^2 - 8m + 4 = 0$ . Applying the quadratic formula to  $m^2 - 8m + 4 = 0$  gives  $m = \frac{8 \pm \sqrt{(-8)^2 - 4(1)(4)}}{2(1)}$ , which simplifies to  $m = 4 \pm 2\sqrt{3}$ . Thus the two solutions are  $4 + 2\sqrt{3}$  and  $4 - 2\sqrt{3}$ , and the sum of the solutions is 8.

Alternatively, the structure of the equation can be used to solve the problem. Dividing both sides of the equation  $2m^2 - 16m + 8 = 0$  by 2 gives  $m^2 - 8m + 4 = 0$ . If the solutions of  $m^2 - 8m + 4 = 0$  are  $s_1$  and  $s_2$ , then the expression  $m^2 - 8m + 4$  can be rewritten as  $(m - s_1)(m - s_2)$ . Multiplying the two binomials gives  $m^2 - (s_1 + s_2)m + s_1 \cdot s_2$ . Since the expressions  $m^2 - 8m + 4$  and  $m^2 - (s_1 + s_2)m + s_1 \cdot s_2$  are equivalent, it follows that  $s_1 + s_2 = 8$ .

Choices A, B, and C are incorrect and may result from calculation errors when applying the quadratic formula or a sign error when determining the sum of the roots of a quadratic equation from its coefficients.

**QUESTION 14**

**Choice A is correct.** Each year, the amount of the radioactive substance is reduced by 13 percent from the prior year's amount; that is, each year, 87 percent of the previous year's amount remains. Since the initial amount of the radioactive substance was 325 grams, after 1 year,  $325(0.87)$  grams remains; after 2 years  $325(0.87)(0.87) = 325(0.87)^2$  grams remains; and after  $t$  years,  $325(0.87)^t$  grams remains. Therefore, the function  $f(t) = 325(0.87)^t$  models the remaining amount of the substance, in grams, after  $t$  years.

Choice B is incorrect and may result from confusing the amount of the substance remaining with the decay rate. Choices C and D are incorrect and may result from confusing the original amount of the substance and the decay rate.

**QUESTION 15**

**Choice D is correct.** The given expression can be rewritten as

$$\begin{aligned} \frac{5x-2}{x+3} &= \frac{(5x+15) - 15 - 2}{x+3} \\ &= \frac{5(x+3) - 17}{x+3} \\ &= \frac{5(x+3)}{x+3} - \frac{17}{x+3} \\ &= 5 - \frac{17}{x+3} \end{aligned}$$

Therefore, the expression  $\frac{5x-2}{x+3}$  can be rewritten as  $5 - \frac{17}{x+3}$ .

Choices A, B, and C are incorrect and may result from a computation or simplification error such as incorrectly canceling out the  $x$  in the expression  $\frac{5x-2}{x+3}$ .

**QUESTION 16**

**The correct answer is 3, 6, or 9.** Let  $x$  be the number of \$250 bonuses awarded, and let  $y$  be the number of \$750 bonuses awarded. Since \$3000 in bonuses were awarded, and this included at least one \$250 bonus and one \$750 bonus, it follows that  $250x + 750y = 3000$ , where  $x$  and  $y$  are positive integers. Dividing each side of  $250x + 750y = 3000$  by 250 gives  $x + 3y = 12$ , where  $x$  and  $y$  are positive integers. Since  $3y$  and 12 are each divisible by 3, it follows that  $x = 12 - 3y$  must also be divisible by 3. If  $x = 3$ , then  $y = 3$ ; if  $x = 6$ , then  $y = 2$ ; and if  $x = 9$ , then  $y = 1$ . If  $x = 12$ , then  $y = 0$ , but this is not possible since there was at least one \$750 bonus awarded. Therefore, the possible numbers of \$250 bonuses awarded are 3, 6, and 9. Any of the numbers 3, 6, or 9 may be gridded as the correct answer.

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### QUESTION 17

**The correct answer is 19.** Since  $2x(3x + 5) + 3(3x + 5) = ax^2 + bx + c$  for all values of  $x$ , the two sides of the equation are equal, and the value of  $b$  can be determined by simplifying the left-hand side of the equation and writing it in the same form as the right-hand side. Using the distributive property, the equation becomes  $(6x^2 + 10x) + (9x + 15) = ax^2 + bx + c$ . Combining like terms gives  $6x^2 + 19x + 15 = ax^2 + bx + c$ . The value of  $b$  is the coefficient of  $x$ , which is 19.

### QUESTION 18

**The correct answer is 12.** Angles  $ABE$  and  $DBC$  are vertical angles and thus have the same measure. Since segment  $AE$  is parallel to segment  $CD$ , angles  $A$  and  $D$  are of the same measure by the alternate interior angle theorem. Thus, by the angle-angle theorem, triangle  $ABE$  is similar to triangle  $DBC$ , with vertices  $A$ ,  $B$ , and  $E$  corresponding to vertices  $D$ ,  $B$ , and  $C$ , respectively. Thus,  $\frac{AB}{DB} = \frac{EB}{CB}$ , or  $\frac{10}{5} = \frac{8}{CB}$ . It follows that  $CB = 4$ , and so  $CE = CB + BE = 4 + 8 = 12$ .

### QUESTION 19

**The correct answer is 6.** By the distance formula, the length of radius  $OA$  is  $\sqrt{(\sqrt{3})^2 + 1^2} = \sqrt{3 + 1} = 2$ . Thus,  $\sin(\angle AOB) = \frac{1}{2}$ . Therefore, the measure of  $\angle AOB$  is  $30^\circ$ , which is equal to  $30\left(\frac{\pi}{180}\right) = \frac{\pi}{6}$  radians. Hence, the value of  $a$  is 6.

### QUESTION 20

**The correct answer is  $\frac{2}{8}$  or  $\frac{1}{4}$  or .25.** In order for a system of two linear equations to have infinitely many solutions, the two equations must be equivalent. Thus, the equation  $ax + by = 12$  must be equivalent to the equation  $2x + 8y = 60$ . Multiplying each side of  $ax + by = 12$  by 5 gives  $5ax + 5by = 60$ , which must be equivalent to  $2x + 8y = 60$ . Since the right-hand sides of  $5ax + 5by = 60$  and  $2x + 8y = 60$  are the same, equating coefficients gives  $5a = 2$ , or  $a = \frac{2}{5}$ , and  $5b = 8$ , or  $b = \frac{8}{5}$ . Therefore, the value of  $\frac{a}{b} = \left(\frac{2}{5}\right) \div \left(\frac{8}{5}\right)$ , which is equal to  $\frac{1}{4}$ . Either the fraction  $1/4$  or its equivalent decimal, .25, may be gridded as the correct answer.

Alternatively, since  $ax + by = 12$  is equivalent to  $2x + 8y = 60$ , the equation  $ax + by = 12$  is equal to  $2x + 8y = 60$  multiplied on each side by the same constant. Since multiplying  $2x + 8y = 60$  by a constant does not change the ratio of the coefficient of  $x$  to the coefficient of  $y$ , it follows that  $\frac{a}{b} = \frac{2}{8} = \frac{1}{4}$ .

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice C is correct.** Since the musician earns \$0.09 for each download, the musician earns  $0.09d$  dollars when the song is downloaded  $d$  times. Similarly, since the musician earns \$0.002 each time the song is streamed, the musician earns  $0.002s$  dollars when the song is streamed  $s$  times. Therefore, the musician earns a total of  $0.09d + 0.002s$  dollars when the song is downloaded  $d$  times and streamed  $s$  times.

Choice A is incorrect because the earnings for each download and the earnings for time streamed are interchanged in the expression. Choices B and D are incorrect because in both answer choices, the musician will lose money when a song is either downloaded or streamed. However, the musician only earns money, not loses money, when the song is downloaded or streamed.

### QUESTION 2

**Choice B is correct.** The quality control manager selects 7 lightbulbs at random for inspection out of every 400 lightbulbs produced.

A quantity of 20,000 lightbulbs is equal to  $\frac{20,000}{400} = 50$  batches of 400 lightbulbs. Therefore, at the rate of 7 lightbulbs per 400 lightbulbs produced, the quality control manager will inspect a total of  $50 \times 7 = 350$  lightbulbs.

Choices A, C, and D are incorrect and may result from calculation errors or misunderstanding of the proportional relationship.

### QUESTION 3

**Choice A is correct.** The value of  $m$  when  $\ell$  is 73 can be found by substituting the 73 for  $\ell$  in  $\ell = 24 + 3.5m$  and then solving for  $m$ . The resulting equation is  $73 = 24 + 3.5m$ ; subtracting 24 from each side gives  $49 = 3.5m$ . Then, dividing each side of  $49 = 3.5m$  by 3.5 gives  $14 = m$ . Therefore, when  $\ell$  is 73,  $m$  is 14.

Choice B is incorrect and may result from adding 24 to 73, instead of subtracting 24 from 73, when solving  $73 = 24 + 3.5m$ . Choice C is incorrect because 73 is the given value for  $\ell$ , not for  $m$ . Choice D is incorrect and may result from substituting 73 for  $m$ , instead of for  $\ell$ , in the equation  $\ell = 24 + 3.5m$ .

### QUESTION 4

**Choice C is correct.** The amount of money the performer earns is directly proportional to the number of people who attend the performance. Thus, by the definition of direct proportionality,  $M = kP$ , where  $M$  is the amount of money the performer earns, in dollars,  $P$  is the number of people who attend the performance, and  $k$  is a constant.

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Since the performer earns \$120 when 8 people attend the performance, one can substitute 120 for  $M$  and 8 for  $P$ , giving  $120 = 8k$ . Hence,  $k = 15$ , and the relationship between the number of people who attend the performance and the amount of money, in dollars, the performer earns is  $M = 15P$ . Therefore, when 20 people attend the performance, the performer earns  $15(20) = 300$  dollars.

Choices A, B, and D are incorrect and may result from either misconceptions about proportional relationships or computational errors.

### QUESTION 5

**Choice C is correct.** If 43% of the money earned is used to pay for costs, then the rest, 57%, is profit. A performance where 8 people attend earns the performer \$120, and 57% of \$120 is  $\$120 \times 0.57 = \$68.40$ .

Choice A is incorrect. The amount \$51.60 is 43% of the money earned from a performance where 8 people attend, which is the cost of putting on the performance, not the profit from the performance. Choice B is incorrect. It is given that 57% of the money earned is profit, but 57% of \$120 is not equal to \$57.00. Choice D is incorrect. The profit can be found by subtracting 43% of \$120 from \$120, but 43% of \$120 is \$51.60, not \$43.00. Thus, the profit is  $\$120 - \$51.60 = \$68.40$ , not  $\$120 - \$43.00 = \$77.00$ .

### QUESTION 6

**Choice B is correct.** When 4 times the number  $x$  is added to 12, the result is  $12 + 4x$ . Since this result is equal to 8, the equation  $12 + 4x = 8$  must be true. Subtracting 12 from each side of  $12 + 4x = 8$  gives  $4x = -4$ , and then dividing both sides of  $4x = -4$  by 4 gives  $x = -1$ . Therefore, 2 times  $x$  added to 7, or  $7 + 2x$ , is equal to  $7 + 2(-1) = 5$ .

Choice A is incorrect because  $-1$  is the value of  $x$ , not the value of  $7 + 2x$ . Choices C and D are incorrect and may result from calculation errors.

### QUESTION 7

**Choice D is correct.** The  $x$ -intercepts of the parabola represented by  $y = x^2 - 6x + 8$  in the  $xy$ -plane are the values of  $x$  for which  $y$  is equal to 0. The factored form of the equation,  $y = (x - 2)(x - 4)$ , shows that  $y$  equals 0 if and only if  $x = 2$  or  $x = 4$ . Thus, the factored form,  $y = (x - 2)(x - 4)$ , displays the  $x$ -intercepts of the parabola as the constants 2 and 4.

Choices A, B, and C are incorrect because none of these forms shows the  $x$ -intercepts 2 and 4 as constants or coefficients.

### QUESTION 8

**Choice D is correct.** Since a player starts with  $k$  points and loses 2 points each time a task is not completed, the player's score will be  $k - 2n$  after  $n$  tasks are not completed (and no additional points are gained). Since a player who fails to complete 100 tasks has a score of 200 points, the equation  $200 = k - 100(2)$  must be true. This equation can be solved by adding 200 to each side, giving  $k = 400$ .



Choices A, B, and C are incorrect and may result from errors in setting up or solving the equation relating the player's score to the number of tasks the player fails to complete. For example, choice A may result from subtracting 200 from the left-hand side of  $200 = k - 100(2)$  and adding 200 to the right-hand side.

### QUESTION 9

**Choice A is correct.** Since  $x$  is the number of 40-pound boxes,  $40x$  is the total weight, in pounds, of the 40-pound boxes; and since  $y$  is the number of 65-pound boxes,  $65y$  is the total weight, in pounds, of the 65-pound boxes. The combined weight of the boxes is therefore  $40x + 65y$ , and the total number of boxes is  $x + y$ . Since the forklift can carry up to 45 boxes or up to 2,400 pounds, the inequalities that represent these relationships are  $40x + 65y \leq 2,400$  and  $x + y \leq 45$ .

Choice B is incorrect. The second inequality correctly represents the maximum number of boxes on the forklift, but the first inequality divides, rather than multiplies, the number of boxes by their respective weights. Choice C is incorrect. The combined weight of the boxes,  $40x + 65y$ , must be less than or equal to 2,400 pounds, not 45; the total number of boxes,  $x + y$ , must be less than or equal to 45, not 2,400. Choice D is incorrect. The second inequality correctly represents the maximum weight, in pounds, of the boxes on the forklift, but the total number of boxes,  $x + y$ , must be less than or equal to 45, not 2,400.

### QUESTION 10

**Choice B is correct.** It is given that  $g(3) = 2$ . Therefore, to find the value of  $f(g(3))$ , substitute 2 for  $g(3)$ :  $f(g(3)) = f(2) = 3$ .

Choices A, C, and D are incorrect and may result from misunderstandings about function notation.

### QUESTION 11

**Choice B is correct.** Tony reads 250 words per minute, and he plans to read for 3 hours, which is 180 minutes, each day. Thus, Tony is planning to read  $250 \times 180 = 45,000$  words of the novel per day. Since the novel has 349,168 words, it will take Tony  $\frac{349,168}{45,000} \approx 7.76$  days of reading to finish the novel. That is, it will take Tony 7 full days of reading and most of an 8th day of reading to finish the novel. Therefore, it will take Tony 8 days to finish the novel.

Choice A is incorrect and may result from an incorrect calculation or incorrectly using the numbers provided in the table. Choice C is incorrect and may result from taking the total number of words in the novel divided by the rate Tony reads per hour. Choice D is incorrect and may result from taking the total number of words in the novel divided by the number of pages in the novel.

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## QUESTION 12

**Choice D is correct.** Since there were 175,000 tons of trash in the landfill on January 1, 2000, and the amount of trash in the landfill increased by 7,500 tons each year after that date, the amount of trash, in tons, in the landfill  $y$  years after January 1, 2000, can be expressed as  $175,000 + 7,500y$ . The landfill has a capacity of 325,000 tons. Therefore, the set of years where the amount of trash in the landfill is at (equal to) or above (greater than) capacity is described by the inequality  $175,000 + 7,500y \geq 325,000$ .

Choice A is incorrect. This inequality does not account for the 175,000 tons of trash in the landfill on January 1, 2000, nor does it accurately account for the 7,500 tons of trash that are added to the landfill each year after January 1, 2000. Choice B is incorrect. This inequality does not account for the 175,000 tons of trash in the landfill on January 1, 2000. Choice C is incorrect. This inequality represents the set of years where the amount of trash in the landfill is at or below capacity.

## QUESTION 13

**Choice D is correct.** Survey research is an efficient way to estimate the preferences of a large population. In order to reliably generalize the results of survey research to a larger population, the participants should be randomly selected from all people in that population. Since this survey was conducted with a population that was not randomly selected, the results are not reliably representative of all people in the town. Therefore, of the given factors, where the survey was given makes it least likely that a reliable conclusion can be drawn about the sports-watching preferences of all people in the town.

Choice A is incorrect. In general, larger sample sizes are preferred over smaller sample sizes. However, a sample size of 117 people would have allowed a reliable conclusion about the population if the participants had been selected at random. Choice B is incorrect. Whether the population is large or small, a large enough sample taken from the population is reliably generalizable if the participants are selected at random from that population. Thus, a reliable conclusion could have been drawn about the population if the 117 survey participants had been selected at random. Choice C is incorrect. When giving a survey, participants are not forced to respond. Even though some people refused to respond, a reliable conclusion could have been drawn about the population if the participants had been selected at random.

## QUESTION 14

**Choice C is correct.** According to the graph, the horizontal line that represents 550 billion miles traveled intersects the line of best fit at a point whose horizontal coordinate is between 2000 and 2005, and slightly closer to 2005 than to 2000. Therefore, of the choices given, 2003 best approximates the year in which the number of miles traveled by air passengers in Country X was estimated to be 550 billion.

Choice A is incorrect. According to the line of best fit, in 1997 the estimated number of miles traveled by air passengers in Country X was about 450 billion, not 550 billion. Choice B is incorrect. According to the line of best fit, in 2000 the estimated number of miles traveled by air passengers in Country X was about 500 billion, not 550 billion. Choice D is incorrect. According to the line of best fit, in 2008 the estimated number of miles traveled by air passengers in Country X was about 600 billion, not 550 billion.

### QUESTION 15

**Choice A is correct.** The number of miles Earth travels in its one-year orbit of the Sun is 580,000,000. Because there are about 365 days per year, the number of miles Earth travels per day is  $\frac{580,000,000}{365} \approx 1,589,041$ . There are 24 hours in one day, so Earth travels at  $\frac{1,589,041}{24} \approx 66,210$  miles per hour. Therefore, of the choices given, 66,000 miles per hour is closest to the average speed of Earth as it orbits the Sun.

Choices B, C, and D are incorrect and may result from calculation errors.

### QUESTION 16

**Choice B is correct.** According to the table, there are  $18 + 7 = 25$  graduates who passed the bar exam, and 7 of them did not take the review course. Therefore, if one of the surveyed graduates who passed the bar exam is chosen at random, the probability that the person chosen did not take the review course is  $\frac{7}{25}$ .

Choices A, C, and D are incorrect. Each of these choices represents a different probability from the conditional probability that the question asks for. Choice A represents the following probability. If one of the surveyed graduates who passed the bar exam is chosen at random, the probability that the person chosen did take the review course is  $\frac{18}{25}$ .

Choice C represents the following probability. If one of the surveyed graduates is chosen at random, the probability that the person chosen passed the bar exam is  $\frac{25}{200}$ . Choice D represents the following probability. If one of the surveyed graduates is chosen at random, the probability that the person chosen passed the exam and took the review course is  $\frac{7}{200}$ .

### QUESTION 17

**Choice C is correct.** To find the atomic weight of an unknown element that is 20% less than the atomic weight of calcium, multiply the atomic weight, in amu, of calcium by  $(1 - 0.20)$ . This gives  $40(1 - 0.20) = (40)(0.8) = 32$ .

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Choice A is incorrect. This value is 20% of the atomic weight of calcium, not an atomic weight 20% less than that atomic weight of calcium. Choice B is incorrect. This value is 20 amu less, not 20% less, than the atomic weight of calcium. Choice D is incorrect. This value is 20% more, not 20% less, than the atomic weight of calcium.

### QUESTION 18

**Choice C is correct.** The mean and median values of a data set are equal when there is a symmetrical distribution. For example, a normal distribution is symmetrical. If the mean and the median values are not equal, then the distribution is not symmetrical. Outliers are a small group of values that are significantly smaller or larger than the other values in the data. When there are outliers in the data, the mean will be pulled in their direction (either smaller or larger) while the median remains the same. The example in the question has a mean that is larger than the median, and so an appropriate conjecture is that large outliers are present in the data; that is, that there are a few homes that are valued much more than the rest.

Choice A is incorrect because a set of home values that are close to each other will have median and mean values that are also close to each other. Choice B is incorrect because outliers with small values will tend to make the mean lower than the median. Choice D is incorrect because a set of data where many homes are valued between \$125,000 and \$165,000 will likely have both a mean and a median between \$125,000 and \$165,000.

### QUESTION 19

**Choice B is correct.** The median of a data set is the middle value when the data points are sorted in either ascending or descending order. There are a total of 600 data points provided, so the median will be the average of the 300th and 301st data points. When the data points are sorted in order:

- Values 1 through 260 will be 0.
- Values 261 through 450 will be 1.
- Values 451 through 540 will be 2.
- Values 541 through 580 will be 3.
- Values 581 through 600 will be 4.

Therefore, both the 300th and 301st values are 1, and hence the median is 1.

Choices A, C, and D are incorrect and may result from either a calculation error or a conceptual error.

## QUESTION 20

**Choice C is correct.** When survey participants are selected at random from a larger population, the sample statistics calculated from the survey can be generalized to the larger population. Since 10 of 300 students surveyed at Lincoln School have 4 siblings, one can estimate that this same ratio holds for all 2,400 students at Lincoln School. Also, since 10 of 300 students surveyed at Washington School have 4 siblings, one can estimate that this same ratio holds for all 3,300 students at Washington School.

Therefore, approximately  $\frac{10}{300} \times 2,400 = 80$  students at Lincoln School and  $\frac{10}{300} \times 3,300 = 110$  students at Washington School are expected to have 4 siblings. Thus, the total number of students with 4 siblings at Washington School is expected to be  $110 - 80 = 30$  more than the total number of students with 4 siblings at Lincoln School.

Choices A, B, and D are incorrect and may result from either conceptual or calculation errors. For example, choice A is incorrect; even though there is the same ratio of survey participants from Lincoln School and Washington School with 4 siblings, the two schools have a different total number of students, and thus, a different expected total number of students with 4 siblings.

## QUESTION 21

**Choice D is correct.** The difference between the number of hours the project takes,  $y$ , and the number of hours the project was estimated to take,  $x$ , is  $|y - x|$ . If the goal is met, the difference is less than 10, which can be represented as  $|y - x| < 10$ , or  $-10 < y - x < 10$ .

Choice A is incorrect. This inequality states that the estimated number of hours plus the actual number of hours is less than 10, which cannot be true because the estimate is greater than 100.

Choice B is incorrect. This inequality states that the actual number of hours is greater than the estimated number of hours plus 10, which could be true only if the goal of being within 10 hours of the estimate were not met. Choice C is incorrect. This inequality states that the actual number of hours is less than the estimated number of hours minus 10, which could be true only if the goal of being within 10 hours of the estimate were not met.

## QUESTION 22

**Choice B is correct.** To rearrange the formula  $I = \frac{P}{4\pi r^2}$  in terms of  $r^2$ , first multiply each side of the equation by  $r^2$ . This yields  $r^2 I = \frac{P}{4\pi}$ . Then dividing each side of  $r^2 I = \frac{P}{4\pi}$  by  $I$  gives  $r^2 = \frac{P}{4\pi I}$ .

Choices A, C, and D are incorrect and may result from algebraic errors during the rearrangement of the formula.

### QUESTION 23

**Choice A is correct.** If  $I_A$  is the intensity measured by Observer A from a distance of  $r_A$  and  $I_B$  is the intensity measured by Observer B from a distance of  $r_B$ , then  $I_A = 16I_B$ . Using the formula  $I = \frac{P}{4\pi r^2}$ , the intensity measured by Observer A is  $I_A = \frac{P}{4\pi r_A^2}$ , which can also be written in terms of  $I_B$  as  $I_A = 16I_B = 16 \left( \frac{P}{4\pi r_B^2} \right)$ . Setting the right-hand sides of these two equations equal to each other gives  $\frac{P}{4\pi r_A^2} = 16 \left( \frac{P}{4\pi r_B^2} \right)$ , which relates the distance of Observer A from the radio antenna to the distance of Observer B from the radio antenna. Canceling the common factor  $\frac{P}{4\pi}$  and rearranging the equation gives  $r_B^2 = 16r_A^2$ . Taking the square root of each side of  $r_B^2 = 16r_A^2$  gives  $r_B = 4r_A$ , and then dividing each side by 4 yields  $r_A = \frac{1}{4} r_B$ . Therefore, the distance of Observer A from the radio antenna is  $\frac{1}{4}$  the distance of Observer B from the radio antenna.

Choices B, C, and D are incorrect and may result from errors in deriving or using the formula  $\frac{P}{4\pi r_A^2} = (16) \left( \frac{P}{4\pi r_B^2} \right)$ .

### QUESTION 24

**Choice A is correct.** The equation of a circle with center  $(h, k)$  and radius  $r$  is  $(x - h)^2 + (y - k)^2 = r^2$ . To put the equation  $x^2 + y^2 + 4x - 2y = -1$  in this form, complete the square as follows:

$$\begin{aligned}x^2 + y^2 + 4x - 2y &= -1 \\(x^2 + 4x) + (y^2 - 2y) &= -1 \\(x^2 + 4x + 4) - 4 + (y^2 - 2y + 1) - 1 &= -1 \\(x + 2)^2 + (y - 1)^2 - 4 - 1 &= -1 \\(x + 2)^2 + (y - 1)^2 &= 4 = 2^2\end{aligned}$$

Therefore, the radius of the circle is 2.

Choice C is incorrect because it is the square of the radius, not the radius. Choices B and D are incorrect and may result from errors in rewriting the given equation in standard form.

### QUESTION 25

**Choice A is correct.** In the  $xy$ -plane, the slope  $m$  of the line that passes through the points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Thus, if the graph of the linear function  $f$  has intercepts at  $(a, 0)$  and  $(0, b)$ , then the slope of the line that is the graph of  $y = f(x)$  is  $m = \frac{0 - b}{a - 0} = -\frac{b}{a}$ . It is given that  $a + b = 0$ , and so  $a = -b$ . Finally, substituting  $-b$  for  $a$  in  $m = -\frac{b}{a}$  gives  $m = -\frac{b}{-b} = 1$ , which is positive.

Choices B, C, and D are incorrect and may result from a conceptual misunderstanding or a calculation error.

### QUESTION 26

**Choice D is correct.** The definition of the graph of a function  $f$  in the  $xy$ -plane is the set of all points  $(x, f(x))$ . Thus, for  $-4 \leq a \leq 4$ , the value of  $f(a)$  is 1 if and only if the unique point on the graph of  $f$  with  $x$ -coordinate  $a$  has  $y$ -coordinate equal to 1. The points on the graph of  $f$  with  $x$ -coordinates  $-4$ ,  $\frac{3}{2}$ , and 3 are, respectively,  $(-4, 1)$ ,  $(\frac{3}{2}, 1)$ , and  $(3, 1)$ . Therefore, all of the values of  $f$  given in I, II, and III are equal to 1.

Choices A, B, and C are incorrect because they each omit at least one value of  $x$  for which  $f(x) = 1$ .

### QUESTION 27

**Choice D is correct.** According to the graph, in the interval from 0 to 10 minutes, the non-insulated sample decreased in temperature by about  $18^\circ\text{C}$ , while the insulated sample decreased by about  $8^\circ\text{C}$ ; in the interval from 10 to 20 minutes, the non-insulated sample decreased in temperature by about  $9^\circ\text{C}$ , while the insulated sample decreased by about  $5^\circ\text{C}$ ; in the interval from 40 to 50 minutes, the non-insulated sample decreased in temperature by about  $1^\circ\text{C}$ , while the insulated sample decreased by about  $3^\circ\text{C}$ ; and in the interval from 50 to 60 minutes, the non-insulated sample decreased in temperature by about  $1^\circ\text{C}$ , while the insulated sample decreased by about  $2^\circ\text{C}$ . The description in choice D accurately summarizes these rates of temperature change over the given intervals. (Note that since the two samples of water have equal mass and so must lose the same amount of heat to cool from  $60^\circ\text{C}$  to  $25^\circ\text{C}$ , the faster cooling of the non-insulated sample at the start of the cooling process must be balanced out by faster cooling of the insulated sample at the end of the cooling process.)

Choices A, B, and C are incorrect. None of these descriptions accurately compares the rates of temperature change shown in the graph for the 10-minute intervals.

### QUESTION 28

**Choice B is correct.** In the  $xy$ -plane, the slope  $m$  of the line that passes through the points  $(x_1, y_1)$  and  $(x_2, y_2)$  is  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Thus, the slope of the line through the points  $E(1, 0)$  and  $C(7, 2)$  is  $\frac{2 - 0}{7 - 1}$ , which simplifies to  $\frac{2}{6} = \frac{1}{3}$ . Therefore, diagonal  $AC$  has a slope of  $\frac{1}{3}$ . The other diagonal of the square is a segment of the line that passes through points  $B$  and  $D$ . The diagonals of a square are perpendicular, and so the product of the slopes of the diagonals is equal to  $-1$ . Thus, the slope of the line that passes through  $B$  and  $D$  is  $-3$  because  $\frac{1}{3}(-3) = -1$ .

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Hence, an equation of the line that passes through  $B$  and  $D$  can be written as  $y = -3x + b$ , where  $b$  is the  $y$ -intercept of the line. Since diagonal  $BD$  will pass through the center of the square,  $E(1, 0)$ , the equation  $0 = -3(1) + b$  holds. Solving this equation for  $b$  gives  $b = 3$ . Therefore, an equation of the line that passes through points  $B$  and  $D$  is  $y = -3x + 3$ , which can be rewritten as  $y = -3(x - 1)$ .

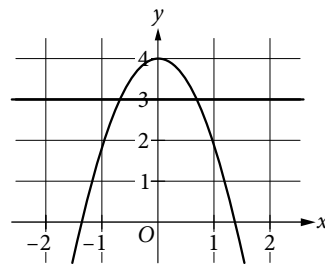
Choices A, C, and D are incorrect and may result from a conceptual error or a calculation error.

### QUESTION 29

**Choice B is correct.** Substituting 3 for  $y$  in  $y = ax^2 + b$  gives  $3 = ax^2 + b$ , which can be rewritten as  $3 - b = ax^2$ . Since  $y = 3$  is one of the equations in the given system, any solution  $x$  of  $3 - b = ax^2$  corresponds to the solution  $(x, 3)$  of the given system. Since the square of a real number is always nonnegative, and a positive number has two square roots, the equation  $3 - b = ax^2$  will have two solutions for  $x$  if and only if (1)  $a > 0$  and  $b < 3$  or (2)  $a < 0$  and  $b > 3$ . Of the values for  $a$  and  $b$  given in the choices, only  $a = -2$ ,  $b = 4$  satisfy one of these pairs of conditions.

Alternatively, if  $a = -2$  and  $b = 4$ , then the second equation would be  $y = -2x^2 + 4$ . The graph of this quadratic equation in the  $xy$ -plane is a parabola with  $y$ -intercept  $(0, 4)$  that opens downward. The graph of the first equation,  $y = 3$ , is the horizontal line that contains the point  $(0, 3)$ . As shown below, these two graphs have two points of intersection, and therefore, this system of equations has exactly two real solutions.

Graphing shows that none of the other three choices produces a system with exactly two real solutions.)



Choices A, C, and D are incorrect and may result from calculation or conceptual errors.



**QUESTION 30**

**Choice A is correct.** The regular hexagon can be divided into 6 equilateral triangles of side length  $a$  by drawing the six segments from the center of the regular hexagon to each of its 6 vertices. Since the area of the hexagon is  $384\sqrt{3}$  square inches, the area of each equilateral triangle will be  $\frac{384\sqrt{3}}{6} = 64\sqrt{3}$  square inches.

Drawing any altitude of an equilateral triangle divides it into two  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles. If the side length of the equilateral triangle is  $a$ , then the hypotenuse of each  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle is  $a$ , and the altitude of the equilateral triangle will be the side opposite the  $60^\circ$  angle in each of the  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles. Thus, the altitude of the equilateral triangle is  $\frac{\sqrt{3}}{2}a$ , and the area of the equilateral triangle is  $\frac{1}{2}(a)\left(\frac{\sqrt{3}}{2}a\right) = \frac{\sqrt{3}}{4}a^2$ . Since the area of each equilateral triangle is  $64\sqrt{3}$  square inches, it follows that  $a^2 = \frac{4}{\sqrt{3}}64\sqrt{3} = 256$  square inches.

And since the area of the square with side length  $a$  is  $a^2$ , it follows that the square has area 256 square inches.

Choices B, C, and D are incorrect and may result from calculation or conceptual errors.

**QUESTION 31**

**The correct answer is 14.** Since the coastal geologist estimates that the country's beaches are eroding at a rate of 1.5 feet every year, they will erode by  $1.5x$  feet in  $x$  years. Thus, if the beaches erode by 21 feet in  $x$  years, the equation  $1.5x = 21$  must hold. The value of  $x$  is then  $\frac{21}{1.5} = 14$ . Therefore, according to the geologist's estimate, it will take 14 years for the country's beaches to erode by 21 feet.

**QUESTION 32**

**The correct answer is 7.** There are 60 minutes in each hour, and so there are  $60h$  minutes in  $h$  hours. Since  $h$  hours and 30 minutes is equal to 450 minutes, it follows that  $60h + 30 = 450$ . This equation can be simplified to  $60h = 420$ , and so the value of  $h$  is  $\frac{420}{60} = 7$ .

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### QUESTION 33

**The correct answer is 11.** It is given that the function  $f(x)$  passes through the point  $(3, 6)$ . Thus, if  $x = 3$ , the value of  $f(x)$  is 6 (since the graph of  $f$  in the  $xy$ -plane is the set of all points  $(x, f(x))$ ). Substituting 3 for  $x$  and 6 for  $f(x)$  in  $f(x) = 3x^2 - bx + 12$  gives  $6 = 3(3)^2 - b(3) + 12$ . Performing the operations on the right-hand side of this equation gives  $6 = 3(9) - 3b + 12 = 27 - 3b + 12 = 39 - 3b$ . Subtracting 39 from each side of  $6 = 39 - 3b$  gives  $-33 = -3b$ , and then dividing each side of  $-3b = -33$  by  $-3$  gives the value of  $b$  as 11.

### QUESTION 34

**The correct answer is 105.** Let  $D$  be the number of hours Doug spent in the tutoring lab, and let  $L$  be the number of hours Laura spent in the tutoring lab. Since Doug and Laura spent a combined total of 250 hours in the tutoring lab, the equation  $D + L = 250$  holds. The number of hours Doug spent in the lab is 40 more than the number of hours Laura spent in the lab, and so the equation  $D = L + 40$  holds. Substituting  $L + 40$  for  $D$  in  $D + L = 250$  gives  $(L + 40) + L = 250$ , or  $40 + 2L = 250$ . Solving this equation gives  $L = 105$ . Therefore, Laura spent 105 hours in the tutoring lab.

### QUESTION 35

**The correct answer is 15.** The amount,  $a$ , that Jane has deposited after  $t$  fixed weekly deposits is equal to the initial deposit plus the total amount of money Jane has deposited in the  $t$  fixed weekly deposits. This amount  $a$  is given to be  $a = 18t + 15$ . The amount she deposited in the  $t$  fixed weekly deposits is the amount of the weekly deposit times  $t$ ; hence, this amount must be given by the term  $18t$  in  $a = 18t + 15$  (and so Jane must have deposited 18 dollars each week after the initial deposit). Therefore, the amount of Jane's original deposit, in dollars, is  $a - 18t = 15$ .

### QUESTION 36

**The correct answer is 32.** Since segments  $LM$  and  $MN$  are tangent to the circle at points  $L$  and  $N$ , respectively, angles  $OLM$  and  $ONM$  are right angles. Thus, in quadrilateral  $OLMN$ , the measure of angle  $O$  is  $360^\circ - (90^\circ + 60^\circ + 90^\circ) = 120^\circ$ . Thus, in the circle, central angle  $O$  cuts off  $\frac{120}{360} = \frac{1}{3}$  of the circumference; that is, minor arc  $LN$  is  $\frac{1}{3}$  of the circumference. Since the circumference is 96, the length of minor arc  $LN$  is  $\frac{1}{3} \times 96 = 32$ .

**QUESTION 37**

**The correct answer is 3284.** According to the formula, the number of plants one year from now will be  $3000 + 0.2(3000)\left(1 - \frac{3000}{4000}\right)$ , which is equal to 3150. Then, using the formula again, the number of plants two years from now will be  $3150 + 0.2(3150)\left(1 - \frac{3150}{4000}\right)$ , which is 3283.875. Rounding this value to the nearest whole number gives 3284.

**QUESTION 38**

**The correct answer is 7500.** If the number of plants is to be increased from 3000 this year to 3360 next year, then the number of plants that the environment can support,  $K$ , must satisfy the equation  $3360 = 3000 + 0.2(3000)\left(1 - \frac{3000}{K}\right)$ . Dividing both sides of this equation by 3000 gives  $1.12 = 1 + 0.2\left(1 - \frac{3000}{K}\right)$ , and therefore, it must be true that  $0.2\left(1 - \frac{3000}{K}\right) = 0.12$ , or equivalently,  $1 - \frac{3000}{K} = 0.6$ . It follows that  $\frac{3000}{K} = 0.4$ , and so  $K = \frac{3000}{0.4} = 7500$ .



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# Practice Test #3

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from Saki, "The Scharz-Metterklume Method." Originally published in 1911.

Line Lady Carlotta stepped out on to the platform of  
the small wayside station and took a turn or two up  
and down its uninteresting length, to kill time till the  
train should be pleased to proceed on its way. Then,  
5 in the roadway beyond, she saw a horse struggling  
with a more than ample load, and a carter of the sort  
that seems to bear a sullen hatred against the animal  
that helps him to earn a living. Lady Carlotta  
promptly betook her to the roadway, and put rather a  
10 different complexion on the struggle. Certain of her  
acquaintances were wont to give her plentiful  
admonition as to the undesirability of interfering on  
behalf of a distressed animal, such interference being  
"none of her business." Only once had she put the  
15 doctrine of non-interference into practice, when one  
of its most eloquent exponents had been besieged for  
nearly three hours in a small and extremely  
uncomfortable may-tree by an angry boar-pig, while  
Lady Carlotta, on the other side of the fence, had  
20 proceeded with the water-colour sketch she was  
engaged on, and refused to interfere between the  
boar and his prisoner. It is to be feared that she lost  
the friendship of the ultimately rescued lady. On this  
occasion she merely lost the train, which gave way to  
25 the first sign of impatience it had shown throughout  
the journey, and steamed off without her. She bore  
the desertion with philosophical indifference; her

friends and relations were thoroughly well used to  
the fact of her luggage arriving without her.  
30 She wired a vague non-committal message to her  
destination to say that she was coming on "by  
another train." Before she had time to think what her  
next move might be she was confronted by an  
imposingly attired lady, who seemed to be taking a  
35 prolonged mental inventory of her clothes and looks.  
"You must be Miss Hope, the governess I've come  
to meet," said the apparition, in a tone that admitted  
of very little argument.  
"Very well, if I must I must," said Lady Carlotta to  
40 herself with dangerous meekness.  
"I am Mrs. Quabarl," continued the lady; "and  
where, pray, is your luggage?"  
"It's gone astray," said the alleged governess,  
falling in with the excellent rule of life that the absent  
45 are always to blame; the luggage had, in point of fact,  
behaved with perfect correctitude. "I've just  
telegraphed about it," she added, with a nearer  
approach to truth.  
"How provoking," said Mrs. Quabarl; "these  
50 railway companies are so careless. However, my  
maid can lend you things for the night," and she led  
the way to her car.  
During the drive to the Quabarl mansion  
Lady Carlotta was impressively introduced to the  
55 nature of the charge that had been thrust upon her;  
she learned that Claude and Wilfrid were delicate,  
sensitive young people, that Irene had the artistic  
temperament highly developed, and that Viola was



something or other else of a mould equally  
60 commonplace among children of that class and type  
in the twentieth century.

“I wish them not only to be TAUGHT,” said Mrs. Quabarl, “but INTERESTED in what they learn. In their history lessons, for instance, you must try to  
65 make them feel that they are being introduced to the life-stories of men and women who really lived, not merely committing a mass of names and dates to memory. French, of course, I shall expect you to talk at meal-times several days in the week.”

70 “I shall talk French four days of the week and Russian in the remaining three.”

“Russian? My dear Miss Hope, no one in the house speaks or understands Russian.”

75 “That will not embarrass me in the least,” said Lady Carlotta coldly.

Mrs. Quabarl, to use a colloquial expression, was knocked off her perch. She was one of those imperfectly self-assured individuals who are magnificent and autocratic as long as they are not  
80 seriously opposed. The least show of unexpected resistance goes a long way towards rendering them cowed and apologetic. When the new governess failed to express wondering admiration of the large newly-purchased and expensive car, and lightly  
85 alluded to the superior advantages of one or two makes which had just been put on the market, the discomfiture of her patroness became almost abject. Her feelings were those which might have animated a general of ancient warfaring days, on beholding his  
90 heaviest battle-elephant ignominiously driven off the field by slingers and javelin throwers.

1

Which choice best summarizes the passage?

- A) A woman weighs the positive and negative aspects of accepting a new job.
- B) A woman does not correct a stranger who mistakes her for someone else.
- C) A woman impersonates someone else to seek revenge on an acquaintance.
- D) A woman takes an immediate dislike to her new employer.

2

In line 2, “turn” most nearly means

- A) slight movement.
- B) change in rotation.
- C) short walk.
- D) course correction.

3

The passage most clearly implies that other people regarded Lady Carlotta as

- A) outspoken.
- B) tactful.
- C) ambitious.
- D) unfriendly.

4

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 10-14 (“Certain . . . business”)
- B) Lines 22-23 (“It is . . . lady”)
- C) Lines 23-26 (“On this . . . her”)
- D) Lines 30-32 (“She . . . train”)

5

The description of how Lady Carlotta “put the doctrine of non-interference into practice” (lines 14-15) mainly serves to

- A) foreshadow her capacity for deception.
- B) illustrate the subtle cruelty in her nature.
- C) provide a humorous insight into her character.
- D) explain a surprising change in her behavior.

6

In line 55, “charge” most nearly means

- A) responsibility.
- B) attack.
- C) fee.
- D) expense.

7

The narrator indicates that Claude, Wilfrid, Irene, and Viola are

- A) similar to many of their peers.
- B) unusually creative and intelligent.
- C) hostile to the idea of a governess.
- D) more educated than others of their age.

8

The narrator implies that Mrs. Quabarl favors a form of education that emphasizes

- A) traditional values.
- B) active engagement.
- C) artistic experimentation.
- D) factual retention.

9

As presented in the passage, Mrs. Quabarl is best described as

- A) superficially kind but actually selfish.
- B) outwardly imposing but easily defied.
- C) socially successful but irrationally bitter.
- D) naturally generous but frequently imprudent.

10

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 49-50 (“How . . . careless”)
- B) Lines 62-68 (“I wish . . . memory”)
- C) Lines 70-73 (“I shall . . . Russian”)
- D) Lines 77-82 (“She was . . . apologetic”)

**Questions 11-20 are based on the following passage and supplementary material.**

This passage is adapted from Taras Grescoe, *Straphanger: Saving Our Cities and Ourselves from the Automobile*. ©2012 by Taras Grescoe.

Though there are 600 million cars on the planet, and counting, there are also seven billion people, which means that for the vast majority of us getting  
 Line around involves taking buses, ferryboats, commuter  
 5 trains, streetcars, and subways. In other words, traveling to work, school, or the market means being a straphanger: somebody who, by choice or necessity, relies on public transport, rather than a privately owned automobile.

10 Half the population of New York, Toronto, and London do not own cars. Public transport is how most of the people of Asia and Africa, the world's most populous continents, travel. Every day, subway systems carry 155 million passengers, thirty-four  
 15 times the number carried by all the world's airplanes, and the global public transport market is now valued at \$428 billion annually. A century and a half after the invention of the internal combustion engine, private car ownership is still an anomaly.

20 And yet public transportation, in many minds, is the opposite of glamour—a squalid last resort for those with one too many impaired driving charges, too poor to afford insurance, or too decrepit to get behind the wheel of a car. In much of North  
 25 America, they are right: taking transit is a depressing experience. Anybody who has waited far too long on a street corner for the privilege of boarding a lurching, overcrowded bus, or wrestled luggage onto subways and shuttles to get to a big city airport,  
 30 knows that transit on this continent tends to be underfunded, ill-maintained, and ill-planned. Given the opportunity, who wouldn't drive? Hopping in a car almost always gets you to your destination more quickly.

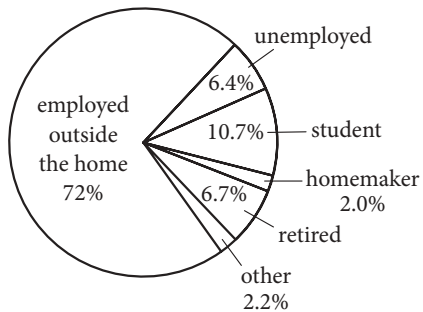
35 It doesn't have to be like this. Done right, public transport can be faster, more comfortable, and cheaper than the private automobile. In Shanghai, German-made magnetic levitation trains skim over elevated tracks at 266 miles an hour, whisking people  
 40 to the airport at a third of the speed of sound. In provincial French towns, electric-powered streetcars run silently on rubber tires, sliding through narrow streets along a single guide rail set into cobblestones. From Spain to Sweden, Wi-Fi equipped high-speed  
 45 trains seamlessly connect with highly ramified metro

networks, allowing commuters to work on laptops as they prepare for same-day meetings in once distant capital cities. In Latin America, China, and India, working people board fast-loading buses that move  
 50 like subway trains along dedicated busways, leaving the sedans and SUVs of the rich mired in dawn-to-dusk traffic jams. And some cities have transformed their streets into cycle-path freeways, making giant strides in public health and safety and  
 55 the sheer livability of their neighborhoods—in the process turning the workaday bicycle into a viable form of mass transit.

If you credit the demographers, this transit trend has legs. The “Millennials,” who reached adulthood  
 60 around the turn of the century and now outnumber baby boomers, tend to favor cities over suburbs, and are far more willing than their parents to ride buses and subways. Part of the reason is their ease with iPads, MP3 players, Kindles, and smartphones: you  
 65 can get some serious texting done when you're not driving, and earbuds offer effective insulation from all but the most extreme commuting annoyances. Even though there are more teenagers in the country than ever, only ten million have a driver's license  
 70 (versus twelve million a generation ago). Baby boomers may have been raised in Leave It to Beaver suburbs, but as they retire, a significant contingent is favoring older cities and compact towns where they have the option of walking and riding bikes. Seniors,  
 75 too, are more likely to use transit, and by 2025, there will be 64 million Americans over the age of sixty-five. Already, dwellings in older neighborhoods in Washington, D.C., Atlanta, and Denver, especially those near light-rail or subway stations, are  
 80 commanding enormous price premiums over suburban homes. The experience of European and Asian cities shows that if you make buses, subways, and trains convenient, comfortable, fast, and safe, a surprisingly large percentage of citizens will opt to  
 85 ride rather than drive.

**Figure 1**

Primary Occupation of Public Transportation Passengers in US Cities

**Figure 2**

Purpose of Public Transportation Trips in US Cities

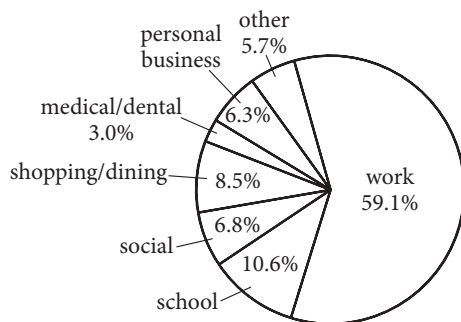


Figure 1 and figure 2 are adapted from the American Public Transportation Association, "A Profile of Public Transportation Passenger Demographics and Travel Characteristics Reported in On-Board Surveys." ©2007 by American Public Transportation Association.

11

What function does the third paragraph (lines 20-34) serve in the passage as a whole?

- A) It acknowledges that a practice favored by the author of the passage has some limitations.
- B) It illustrates with detail the arguments made in the first two paragraphs of the passage.
- C) It gives an overview of a problem that has not been sufficiently addressed by the experts mentioned in the passage.
- D) It advocates for abandoning a practice for which the passage as a whole provides mostly favorable data.

12

Which choice does the author explicitly cite as an advantage of automobile travel in North America?

- A) Environmental impact
- B) Convenience
- C) Speed
- D) Cost

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 5-9 ("In . . . automobile")
- B) Lines 20-24 ("And . . . car")
- C) Lines 24-26 ("In . . . experience")
- D) Lines 32-34 ("Hopping . . . quickly")

14

The central idea of the fourth paragraph (lines 35-57) is that

- A) European countries excel at public transportation.
- B) some public transportation systems are superior to travel by private automobile.
- C) Americans should mimic foreign public transportation systems when possible.
- D) much international public transportation is engineered for passengers to work while on board.

15

Which choice provides the best evidence for the answer to the previous question?

- A) Line 35 (“It . . . this”)
- B) Lines 35-37 (“Done . . . automobile”)
- C) Lines 37-40 (“In . . . sound”)
- D) Lines 44-48 (“From . . . cities”)

16

As used in line 58, “credit” most nearly means

- A) endow.
- B) attribute.
- C) believe.
- D) honor.

17

As used in line 61, “favor” most nearly means

- A) indulge.
- B) prefer.
- C) resemble.
- D) serve.

18

Which choice best supports the conclusion that public transportation is compatible with the use of personal electronic devices?

- A) Lines 59-63 (“The . . . subways”)
- B) Lines 63-67 (“Part . . . annoyances”)
- C) Lines 68-70 (“Even . . . ago”)
- D) Lines 77-81 (“Already . . . homes”)

19

Which choice is supported by the data in the first figure?

- A) The number of students using public transportation is greater than the number of retirees using public transportation.
- B) The number of employed people using public transportation and the number of unemployed people using public transportation is roughly the same.
- C) People employed outside the home are less likely to use public transportation than are homemakers.
- D) Unemployed people use public transportation less often than do people employed outside the home.

20

Taken together, the two figures suggest that most people who use public transportation

- A) are employed outside the home and take public transportation to work.
- B) are employed outside the home but take public transportation primarily in order to run errands.
- C) use public transportation during the week but use their private cars on weekends.
- D) use public transportation only until they are able to afford to buy a car.

**Questions 21-30 are based on the following passage.**

This passage is adapted from Thor Hanson, *Feathers*. ©2011 by Thor Hanson. Scientists have long debated how the ancestors of birds evolved the ability to fly. The ground-up theory assumes they were fleet-footed ground dwellers that captured prey by leaping and flapping their upper limbs. The tree-down theory assumes they were tree climbers that leapt and glided among branches.

At field sites around the world, Ken Dial saw a pattern in how young pheasants, quail, tinamous, and other ground birds ran along behind their  
 Line 5 parents. “They jumped up like popcorn,” he said, describing how they would flap their half-formed wings and take short hops into the air. So when a group of graduate students challenged him to come up with new data on the age-old ground-up-tree-down debate, he designed a project  
 10 to see what clues might lie in how baby game birds learned to fly.

Ken settled on the Chukar Partridge as a model species, but he might not have made his discovery without a key piece of advice from the local  
 15 rancher in Montana who was supplying him with birds. When the cowboy stopped by to see how things were going, Ken showed him his nice, tidy laboratory setup and explained how the birds’ first hops and flights would be measured. The rancher  
 20 was incredulous. “He took one look and said, in pretty colorful language, ‘What are those birds doing on the ground? They hate to be on the ground! Give them something to climb on!’” At first it seemed unnatural—ground birds don’t like the ground? But  
 25 as he thought about it Ken realized that all the species he’d watched in the wild preferred to rest on ledges, low branches, or other elevated perches where they were safe from predators. They really only used the ground for feeding and traveling. So he brought  
 30 in some hay bales for the Chukars to perch on and then left his son in charge of feeding and data collection while he went away on a short work trip.

Barely a teenager at the time, young Terry Dial was visibly upset when his father got back. “I asked  
 35 him how it went,” Ken recalled, “and he said,

“Terrible! The birds are cheating!” Instead of flying up to their perches, the baby Chukars were using their legs. Time and again Terry had watched them run right up the side of a hay bale, flapping all the  
 40 while. Ken dashed out to see for himself, and that was the “aha” moment. “The birds were using their wings and legs cooperatively,” he told me, and that single observation opened up a world of possibilities.

Working together with Terry (who has since gone  
 45 on to study animal locomotion), Ken came up with a series of ingenious experiments, filming the birds as they raced up textured ramps tilted at increasing angles. As the incline increased, the partridges began to flap, but they angled their wings differently from  
 50 birds in flight. They aimed their flapping down and backward, using the force not for lift but to keep their feet firmly pressed against the ramp. “It’s like the spoiler on the back of a race car,” he explained, which is a very apt analogy. In Formula One racing,  
 55 spoilers are the big aerodynamic fins that push the cars downward as they speed along, increasing traction and handling. The birds were doing the very same thing with their wings to help them scramble up otherwise impossible slopes.

Ken called the technique WAIR, for wing-assisted  
 60 incline running, and went on to document it in a wide range of species. It not only allowed young birds to climb vertical surfaces within the first few weeks of life but also gave adults an energy-efficient  
 65 alternative to flying. In the Chukar experiments, adults regularly used WAIR to ascend ramps steeper than 90 degrees, essentially running up the wall and onto the ceiling.

In an evolutionary context, WAIR takes on  
 70 surprising explanatory powers. With one fell swoop, the Dials came up with a viable origin for the flapping flight stroke of birds (something gliding animals don’t do and thus a shortcoming of the tree-down theory) and an aerodynamic function for  
 75 half-formed wings (one of the main drawbacks to the ground-up hypothesis).

21

Which choice best reflects the overall sequence of events in the passage?

- A) An experiment is proposed but proves unworkable; a less ambitious experiment is attempted, and it yields data that give rise to a new set of questions.
- B) A new discovery leads to reconsideration of a theory; a classic study is adapted, and the results are summarized.
- C) An anomaly is observed and simulated experimentally; the results are compared with previous findings, and a novel hypothesis is proposed.
- D) An unexpected finding arises during the early phase of a study; the study is modified in response to this finding, and the results are interpreted and evaluated.

22

As used in line 7, “challenged” most nearly means

- A) dared.
- B) required.
- C) disputed with.
- D) competed with.

23

Which statement best captures Ken Dial’s central assumption in setting up his research?

- A) The acquisition of flight in young birds sheds light on the acquisition of flight in their evolutionary ancestors.
- B) The tendency of certain young birds to jump erratically is a somewhat recent evolved behavior.
- C) Young birds in a controlled research setting are less likely than birds in the wild to require perches when at rest.
- D) Ground-dwelling and tree-climbing predecessors to birds evolved in parallel.

24

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-4 (“At field . . . parents”)
- B) Lines 6-11 (“So when . . . fly”)
- C) Lines 16-19 (“When . . . measured”)
- D) Lines 23-24 (“At first . . . the ground”)

25

In the second paragraph (lines 12-32), the incident involving the local rancher mainly serves to

- A) reveal Ken Dial’s motivation for undertaking his project.
- B) underscore certain differences between laboratory and field research.
- C) show how an unanticipated piece of information influenced Ken Dial’s research.
- D) introduce a key contributor to the tree-down theory.

26

After Ken Dial had his “aha’ moment” (line 41), he

- A) tried to train the birds to fly to their perches.
- B) studied videos to determine why the birds no longer hopped.
- C) observed how the birds dealt with gradually steeper inclines.
- D) consulted with other researchers who had studied Chukar Partridges.

27

The passage identifies which of the following as a factor that facilitated the baby Chukars’ traction on steep ramps?

- A) The speed with which they climbed
- B) The position of their flapping wings
- C) The alternation of wing and foot movement
- D) Their continual hopping motions

28

As used in line 61, “document” most nearly means

- A) portray.
- B) record.
- C) publish.
- D) process.

29

What can reasonably be inferred about gliding animals from the passage?

- A) Their young tend to hop along beside their parents instead of flying beside them.
- B) Their method of locomotion is similar to that of ground birds.
- C) They use the ground for feeding more often than for perching.
- D) They do not use a flapping stroke to aid in climbing slopes.

30

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 4-6 (“They jumped . . . air”)
- B) Lines 28-29 (“They really . . . traveling”)
- C) Lines 57-59 (“The birds . . . slopes”)
- D) Lines 72-74 (“something . . . theory”)

**Questions 31-41 are based on the following passages.**

Passage 1 is adapted from Talleyrand et al., *Report on Public Instruction*. Originally published in 1791. Passage 2 is adapted from Mary Wollstonecraft, *A Vindication of the Rights of Woman*. Originally published in 1792. Talleyrand was a French diplomat; the *Report* was a plan for national education. Wollstonecraft, a British novelist and political writer, wrote *Vindication* in response to Talleyrand.

**Passage 1**

That half the human race is excluded by the other half from any participation in government; that they are native by birth but foreign by law in the very land where they were born; and that they are  
 5 property-owners yet have no direct influence or representation: are all political phenomena apparently impossible to explain on abstract principle. But on another level of ideas, the question changes and may be easily resolved. The purpose of  
 10 all these institutions must be the happiness of the greatest number. Everything that leads us farther from this purpose is in error; everything that brings us closer is truth. If the exclusion from public employments decreed against women leads to a  
 15 greater sum of mutual happiness for the two sexes, then this becomes a law that all Societies have been compelled to acknowledge and sanction.

Any other ambition would be a reversal of our primary destinies; and it will never be in women’s  
 20 interest to change the assignment they have received.

It seems to us incontestable that our common happiness, above all that of women, requires that they never aspire to the exercise of political rights and functions. Here we must seek their interests in  
 25 the wishes of nature. Is it not apparent, that their delicate constitutions, their peaceful inclinations, and the many duties of motherhood, set them apart from strenuous habits and onerous duties, and summon them to gentle occupations and the cares of the  
 30 home? And is it not evident that the great conserving principle of Societies, which makes the division of powers a source of harmony, has been expressed and revealed by nature itself, when it divided the functions of the two sexes in so obviously distinct a  
 35 manner? This is sufficient; we need not invoke principles that are inapplicable to the question. Let us not make rivals of life’s companions. You must, you truly must allow the persistence of a union that no interest, no rivalry, can possibly undo. Understand  
 40 that the good of all demands this of you.



**Passage 2**

Contending for the rights of woman, my main argument is built on this simple principle, that if she be not prepared by education to become the companion of man, she will stop the progress of  
 45 knowledge and virtue; for truth must be common to all, or it will be inefficacious with respect to its influence on general practice. And how can woman be expected to co-operate unless she know why she ought to be virtuous? unless freedom strengthen her  
 50 reason till she comprehend her duty, and see in what manner it is connected with her real good? If children are to be educated to understand the true principle of patriotism, their mother must be a patriot; and the love of mankind, from which an  
 55 orderly train of virtues spring, can only be produced by considering the moral and civil interest of mankind; but the education and situation of woman, at present, shuts her out from such investigations. . . .

Consider, sir, dispassionately, these  
 60 observations—for a glimpse of this truth seemed to open before you when you observed, “that to see one half of the human race excluded by the other from all participation of government, was a political  
 phenomenon that, according to abstract principles, it  
 65 was impossible to explain.” If so, on what does your constitution rest? If the abstract rights of man will bear discussion and explanation, those of woman, by a parity of reasoning, will not shrink from the same test: though a different opinion prevails in this  
 70 country, built on the very arguments which you use to justify the oppression of woman—prescription.

Consider—I address you as a legislator—whether, when men contend for their freedom, and to be allowed to judge for themselves respecting their  
 75 own happiness, it be not inconsistent and unjust to subjugate women, even though you firmly believe that you are acting in the manner best calculated to promote their happiness? Who made man the exclusive judge, if woman partake with him the gift  
 80 of reason?

In this style, argue tyrants of every denomination, from the weak king to the weak father of a family; they are all eager to crush reason; yet always assert that they usurp its throne only to be  
 85 useful. Do you not act a similar part, when you force all women, by denying them civil and political rights, to remain immured in their families groping in the dark?

31

As used in line 21, “common” most nearly means

- A) average.
- B) shared.
- C) coarse.
- D) similar.

32

It can be inferred that the authors of Passage 1 believe that running a household and raising children

- A) are rewarding for men as well as for women.
- B) yield less value for society than do the roles performed by men.
- C) entail very few activities that are difficult or unpleasant.
- D) require skills similar to those needed to run a country or a business.

33

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 4-6 (“they are . . . representation”)
- B) Lines 13-17 (“If the . . . sanction”)
- C) Lines 25-30 (“Is it . . . home”)
- D) Lines 30-35 (“And . . . manner”)

34

According to the author of Passage 2, in order for society to progress, women must

- A) enjoy personal happiness and financial security.
- B) follow all currently prescribed social rules.
- C) replace men as figures of power and authority.
- D) receive an education comparable to that of men.

35

As used in line 50, “reason” most nearly means

- A) motive.
- B) sanity.
- C) intellect.
- D) explanation.

36

In Passage 2, the author claims that freedoms granted by society’s leaders have

- A) privileged one gender over the other.
- B) resulted in a general reduction in individual virtue.
- C) caused arguments about the nature of happiness.
- D) ensured equality for all people.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 41-45 (“Contending . . . virtue”)
- B) Lines 45-47 (“truth . . . practice”)
- C) Lines 65-66 (“If so . . . rest”)
- D) Lines 72-78 (“Consider . . . happiness”)

38

In lines 61-65, the author of Passage 2 refers to a statement made in Passage 1 in order to

- A) call into question the qualifications of the authors of Passage 1 regarding gender issues.
- B) dispute the assertion made about women in the first sentence of Passage 1.
- C) develop her argument by highlighting what she sees as flawed reasoning in Passage 1.
- D) validate the concluding declarations made by the authors of Passage 1 about gender roles.

39

Which best describes the overall relationship between Passage 1 and Passage 2?

- A) Passage 2 strongly challenges the point of view in Passage 1.
- B) Passage 2 draws alternative conclusions from the evidence presented in Passage 1.
- C) Passage 2 elaborates on the proposal presented in Passage 1.
- D) Passage 2 restates in different terms the argument presented in Passage 1.

40

The authors of both passages would most likely agree with which of the following statements about women in the eighteenth century?

- A) Their natural preferences were the same as those of men.
- B) They needed a good education to be successful in society.
- C) They were just as happy in life as men were.
- D) They generally enjoyed fewer rights than men did.

41

How would the authors of Passage 1 most likely respond to the points made in the final paragraph of Passage 2?

- A) Women are not naturally suited for the exercise of civil and political rights.
- B) Men and women possess similar degrees of reasoning ability.
- C) Women do not need to remain confined to their traditional family duties.
- D) The principles of natural law should not be invoked when considering gender roles.

**Questions 42-52 are based on the following passage and supplementary material.**

This passage is adapted from Richard J. Sharpe and Lisa Heyden, "Honey Bee Colony Collapse Disorder is Possibly Caused by a Dietary Pyrethrum Deficiency." ©2009 by Elsevier Ltd. Colony collapse disorder is characterized by the disappearance of adult worker bees from hives.

Honey bees are hosts to the pathogenic large ectoparasitic mite *Varroa destructor* (Varroa mites). These mites feed on bee hemolymph (blood) and can kill bees directly or by increasing their susceptibility to secondary infection with fungi, bacteria or viruses. Little is known about the natural defenses that keep the mite infections under control.

Pyrethrums are a group of flowering plants which include *Chrysanthemum coccineum*, *Chrysanthemum cinerariifolium*, *Chrysanthemum marschalli*, and related species. These plants produce potent insecticides with anti-mite activity. The naturally occurring insecticides are known as pyrethrums. A synonym for the naturally occurring pyrethrums is pyrethrin and synthetic analogues of pyrethrums are known as pyrethroids. In fact, the human mite infestation known as scabies (*Sarcoptes scabiei*) is treated with a topical pyrethrum cream.

We suspect that the bees of commercial bee colonies which are fed mono-crops are nutritionally deficient. In particular, we postulate that the problem is a diet deficient in anti-mite toxins: pyrethrums, and possibly other nutrients which are inherent in such plants. Without, at least, intermittent feeding on the pyrethrum producing plants, bee colonies are susceptible to mite infestations which can become fatal either directly or due to a secondary infection of immunocompromised or nutritionally deficient bees. This secondary infection can be viral, bacterial or fungal and may be due to one or more pathogens. In addition, immunocompromised or nutritionally deficient bees may be further weakened when commercially produced insecticides are introduced into their hives by bee keepers in an effort to fight mite infestation. We further postulate that the proper dosage necessary to prevent mite infestation may be better left to the bees, who may seek out or avoid pyrethrum containing plants depending on the amount necessary to defend against mites and the amount already consumed by the bees, which in higher doses could be potentially toxic to them.

This hypothesis can best be tested by a trial wherein a small number of commercial honey bee colonies are offered a number of pyrethrum producing plants, as well as a typical bee food source such as clover, while controls are offered only the clover. Mites could then be introduced to each hive with note made as to the choice of the bees, and the effects of the mite parasites on the experimental colonies versus control colonies.

It might be beneficial to test wild-type honey bee colonies in this manner as well, in case there could be some genetic difference between them that affects the bees' preferences for pyrethrum producing flowers.

**Pathogen Occurrence in Honey Bee Colonies With and Without Colony Collapse Disorder**

Pathogen	Percent of colonies affected by pathogen	
	Colonies with colony collapse disorder (%)	Colonies without colony collapse disorder (%)
Viruses		
IAPV	83	5
KBV	100	76
Fungi		
<i>Nosema apis</i>	90	48
<i>Nosema ceranae</i>	100	81
All four pathogens	77	0

Adapted from Diana L. Cox-Foster et al., "A Metagenomic Survey of Microbes in Honey Bee Colony Collapse Disorder." ©2007 by American Association for the Advancement of Science.

The table above shows, for colonies with colony collapse disorder and for colonies without colony collapse disorder, the percent of colonies having honey bees infected by each of four pathogens and by all four pathogens together.

42

How do the words “can,” “may,” and “could” in the third paragraph (lines 19-41) help establish the tone of the paragraph?

- A) They create an optimistic tone that makes clear the authors are hopeful about the effects of their research on colony collapse disorder.
- B) They create a dubious tone that makes clear the authors do not have confidence in the usefulness of the research described.
- C) They create a tentative tone that makes clear the authors suspect but do not know that their hypothesis is correct.
- D) They create a critical tone that makes clear the authors are skeptical of claims that pyrethrums are inherent in mono-crops.

43

In line 42, the authors state that a certain hypothesis “can best be tested by a trial.” Based on the passage, which of the following is a hypothesis the authors suggest be tested in a trial?

- A) Honeybees that are exposed to both pyrethrums and mites are likely to develop a secondary infection by a virus, a bacterium, or a fungus.
- B) Beekeepers who feed their honeybee colonies a diet of a single crop need to increase the use of insecticides to prevent mite infestations.
- C) A honeybee diet that includes pyrethrums results in honeybee colonies that are more resistant to mite infestations.
- D) Humans are more susceptible to varroa mites as a result of consuming nutritionally deficient food crops.

44

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-5 (“These mites . . . viruses”)
- B) Lines 16-18 (“In fact . . . cream”)
- C) Lines 19-21 (“We suspect . . . deficient”)
- D) Lines 24-28 (“Without . . . bees”)

45

The passage most strongly suggests that beekeepers’ attempts to fight mite infestations with commercially produced insecticides have what unintentional effect?

- A) They increase certain mite populations.
- B) They kill some beneficial forms of bacteria.
- C) They destroy bees’ primary food source.
- D) They further harm the health of some bees.

46

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-2 (“Honey bees . . . mites”)
- B) Lines 6-7 (“Little . . . control”)
- C) Lines 31-35 (“In addition . . . infestation”)
- D) Lines 47-50 (“Mites . . . control colonies”)

47

As used in line 35, “postulate” most nearly means to

- A) make an unfounded assumption.
- B) put forth an idea or claim.
- C) question a belief or theory.
- D) conclude based on firm evidence.

48

The main purpose of the fourth paragraph (lines 42-50) is to

- A) summarize the results of an experiment that confirmed the authors’ hypothesis about the role of clover in the diets of wild-type honeybees.
- B) propose an experiment to investigate how different diets affect commercial honeybee colonies’ susceptibility to mite infestations.
- C) provide a comparative nutritional analysis of the honey produced by the experimental colonies and by the control colonies.
- D) predict the most likely outcome of an unfinished experiment summarized in the third paragraph (lines 19-41).

49

An unstated assumption made by the authors about clover is that the plants

- A) do not produce pyrethrums.
- B) are members of the *Chrysanthemum* genus.
- C) are usually located near wild-type honeybee colonies.
- D) will not be a good food source for honeybees in the control colonies.

50

Based on data in the table, in what percent of colonies with colony collapse disorder were the honeybees infected by all four pathogens?

- A) 0 percent
- B) 77 percent
- C) 83 percent
- D) 100 percent

51

Based on data in the table, which of the four pathogens infected the highest percentage of honeybee colonies without colony collapse disorder?

- A) IAPV
- B) KBV
- C) *Nosema apis*
- D) *Nosema ceranae*

52

Do the data in the table provide support for the authors' claim that infection with varroa mites increases a honeybee's susceptibility to secondary infections?

- A) Yes, because the data provide evidence that infection with a pathogen caused the colonies to undergo colony collapse disorder.
- B) Yes, because for each pathogen, the percent of colonies infected is greater for colonies with colony collapse disorder than for colonies without colony collapse disorder.
- C) No, because the data do not provide evidence about bacteria as a cause of colony collapse disorder.
- D) No, because the data do not indicate whether the honeybees had been infected with mites.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Shed Some Light on the Workplace

Studies have shown that employees are happier, **1** healthier, and more productive when they work in an environment **2** in which temperatures are carefully controlled. New buildings may be designed with these studies in mind, but many older buildings were not, resulting in spaces that often depend primarily on artificial lighting. While employers may balk at the expense of reconfiguring such buildings to increase the amount of natural light, the investment has been shown to be well worth it in the long run—for both employees and employers.

1

- A) NO CHANGE
- B) healthy, and more
- C) healthier, and they are
- D) healthier, being more

2

- Which choice provides the most appropriate introduction to the passage?
- A) NO CHANGE
  - B) that affords them adequate amounts of natural light.
  - C) that is thoroughly sealed to prevent energy loss.
  - D) in which they feel comfortable asking managers for special accommodations.

For one thing, lack of exposure to natural light has a significant impact on employees' health. A study conducted in 2013 by Northwestern University in Chicago showed that inadequate natural light could result in eye strain, headaches, and fatigue, as well as interference with the body's circadian rhythms. **3** Circadian rhythms, which are controlled by the **4** bodies biological clocks, influence body temperature, hormone release, cycles of sleep and wakefulness, and other bodily functions. Disruptions of circadian rhythms have been linked to sleep disorders, diabetes, depression, and bipolar disorder. Like any other health problems, these ailments can increase employee absenteeism, which, in turn, **5** is costly for employers. Employees who feel less than 100 percent and are sleep deprived are also less prone to work at their maximal productivity. One company in California **6** gained a huge boost in its employees' morale when it moved from an artificially lit distribution facility to one with natural illumination.

3

At this point, the writer is considering adding the following sentence.

Workers in offices with windows sleep an average of 46 minutes more per night than workers in offices without windows.

Should the writer make this addition here?

- A) Yes, because it supplies quantitative data that will be examined in the rest of the paragraph.
- B) Yes, because it explains the nature of the bodily functions referred to in the next sentence.
- C) No, because it interrupts the discussion of circadian rhythms.
- D) No, because it does not take into account whether workers were exposed to sunlight outside the office.

4

- A) NO CHANGE
- B) bodies' biological clocks',
- C) body's biological clocks,
- D) body's biological clock's,

5

- A) NO CHANGE
- B) are
- C) is being
- D) have been

6

Which choice best supports the statement made in the previous sentence?

- A) NO CHANGE
- B) saw a 5 percent increase in productivity
- C) saved a great deal on its operational costs
- D) invested large amounts of time and capital

7 Artificial light sources are also costly aside from lowering worker productivity. They typically constitute anywhere from 25 to 50 percent of a building's energy use. When a plant in Seattle, Washington, was redesigned for more natural light, the company was able to enjoy annual electricity cost reductions of \$500,000 8 each year.

7

In context, which choice best combines the underlined sentences?

- A) Aside from lowering worker productivity, artificial light sources are also costly, typically constituting anywhere from 25 to 50 percent of a building's energy use.
- B) The cost of artificial light sources, aside from lowering worker productivity, typically constitutes anywhere from 25 to 50 percent of a building's energy use.
- C) Typically constituting 25 to 50 percent of a building's energy use, artificial light sources lower worker productivity and are costly.
- D) Artificial lights, which lower worker productivity and are costly, typically constitute anywhere from 25 to 50 percent of a building's energy use.

8

- A) NO CHANGE
- B) every year.
- C) per year.
- D) DELETE the underlined portion and end the sentence with a period.



Among the possibilities to reconfigure a building's lighting is the installation of full-pane windows to allow the greatest degree of sunlight to reach office interiors.

**9** Thus, businesses can install light tubes, **10** these are pipes placed in workplace roofs to capture and funnel sunlight down into a building's interior. Glass walls and dividers can also be used to replace solid walls as a means **11** through distributing natural light more freely. Considering the enormous costs of artificial lighting, both in terms of money and productivity, investment in such improvements should be a natural choice for businesses.

9

- A) NO CHANGE
- B) Nevertheless,
- C) Alternatively,
- D) Finally,

10

- A) NO CHANGE
- B) they are
- C) which are
- D) those being

11

- A) NO CHANGE
- B) of
- C) from
- D) DELETE the underlined portion.

Questions 12-22 are based on the following passage.

### Transforming the American West Through Food and Hospitality

Just as travelers taking road trips today may need to take a break for food at a rest area along the highway, settlers traversing the American West by train in the mid-1800s often found **12** themselves in need of refreshment. However, food available on rail lines was generally of terrible quality. **13** Despite having worked for railroad companies, Fred Harvey, an English-born **14** entrepreneur. He decided to open his own restaurant business to serve rail customers. Beginning in the 1870s, he opened dozens of restaurants in rail stations and dining cars. These Harvey Houses, which constituted the first restaurant chain in the United States, **15** was unique for its high standards of service and quality. The menu was modeled after those of fine restaurants, so the food was leagues beyond the **16** sinister fare travelers were accustomed to receiving in transit.

12

- A) NO CHANGE
- B) himself or herself
- C) their selves
- D) oneself

13

Which choice provides the most logical introduction to the sentence?

- A) NO CHANGE
- B) He had lived in New York and New Orleans, so
- C) To capitalize on the demand for good food,
- D) DELETE the underlined portion.

14

- A) NO CHANGE
- B) entrepreneur:
- C) entrepreneur; he
- D) entrepreneur,

15

- A) NO CHANGE
- B) were unique for their
- C) was unique for their
- D) were unique for its

16

Which choice best maintains the tone established in the passage?

- A) NO CHANGE
- B) surly
- C) abysmal
- D) icky

His restaurants were immediately successful, but Harvey was not content to follow conventional business practices. **17** Although women did not traditionally work in restaurants in the nineteenth century, Harvey decided to try employing women as waitstaff. In 1883, he placed an advertisement seeking educated, well-mannered, articulate young women between the ages of 18 and 30. **18** Response to the advertisement was overwhelming, even tremendous, and Harvey soon replaced the male servers at his restaurants with women. Those who were hired as “Harvey Girls” joined an elite group of workers, who were expected to complete a 30-day training program and follow a strict code of rules for conduct and curfews. In the workplace, the women donned identical black-and-white uniforms and carried out their duties with precision. Not only were such regulations meant to ensure the efficiency of the business and the safety of the workers, **19** but also helped to raise people’s generally low opinion of the restaurant industry.

17

The writer is considering deleting the previous sentence. Should the writer make this change?

- A) Yes, because it introduces information that is irrelevant at this point in the passage.
- B) Yes, because it does not logically follow from the previous paragraph.
- C) No, because it provides a logical introduction to the paragraph.
- D) No, because it provides a specific example in support of arguments made elsewhere in the passage.

18

- A) NO CHANGE
- B) Response to the advertisement was overwhelming,
- C) Overwhelming, even tremendous, was the response to the advertisement,
- D) There was an overwhelming, even tremendous, response to the advertisement,

19

- A) NO CHANGE
- B) but also helping
- C) also helping
- D) but they also helped

In return for the servers' work, the position paid quite well for the time: \$17.50 a month, plus tips, meals, room and board, laundry service, and travel expenses. **20**

For as long as Harvey Houses served rail travelers through the mid-twentieth century, working there was a steady and lucrative position for women. Living independently and demonstrating an intense work

**21** ethic; the Harvey Girls became known as a transformative force in the American **22** West.

Advancing the roles of women in the restaurant industry and the American workforce as a whole, the Harvey Girls raised the standards for restaurants and blazed a trail in the fast-changing landscape of the western territories.

20

Which choice most logically follows the previous sentence?

- A) The growth of Harvey's business coincided with the expansion of the Santa Fe Railway, which served large sections of the American West.
- B) Harvey would end up opening dozens of restaurants and dining cars, plus 15 hotels, over his lucrative career.
- C) These benefits enabled the Harvey Girls to save money and build new and exciting lives for themselves in the so-called Wild West.
- D) The compensation was considered excellent at the time, though it may not seem like much money by today's standards.

21

- A) NO CHANGE
- B) ethic:
- C) ethic, and
- D) ethic,

22

The writer is considering revising the underlined portion of the sentence to read:

West, inspiring books, documentaries, and even a musical.

Should the writer add this information here?

- A) Yes, because it provides examples of the Harvey Girls' influence.
- B) Yes, because it serves as a transitional point in the paragraph.
- C) No, because it should be placed earlier in the passage.
- D) No, because it contradicts the main claim of the passage.

Questions 23-33 are based on the following passage and supplementary material.

### How Do You Like Those Apples?

Marketed as SmartFresh, the chemical 1-MCP (1-methylcyclopropene) has been used by fruit growers since 2002 in the United States and elsewhere to preserve the crispness and lengthen the storage life of apples and other fruit, which often must travel long distances before being eaten by consumers. **23** 1-MCP lengthens storage life by three to four times when applied to apples. This extended life allows producers to sell their apples in the off-season, months after the apples have been harvested. And at a cost of about one cent per pound of apples, 1-MCP is a highly cost-effective treatment. However, 1-MCP is not a panacea for fruit producers or sellers: there are problems and limitations associated with its use.

23

Which choice most effectively combines the underlined sentences?

- A) When applied to apples, 1-MCP lengthens storage life by three to four times, allowing producers to sell their apples in the off-season, months after the apples have been harvested.
- B) Producers are allowed to sell their apples months after they have been harvested—in the off-season—because 1-MCP, when applied to apples, lengthens their storage life by three to four times.
- C) 1-MCP lengthens storage life, when applied to apples, by three to four times, allowing producers to sell their apples months after the apples have been harvested in the off-season.
- D) Months after apples have been harvested, producers are allowed to sell their apples, in the off-season, because 1-MCP lengthens storage life when applied to apples by three to four times.

[1] 1-MCP works by limiting a fruit's production of ethylene, **24** it is a chemical that causes fruit to ripen and eventually rot. [2] While 1-MCP keeps apples **25** tight and crisp for months, it also limits **26** their scent production. [3] This may not be much of a problem with certain kinds of apples that are not naturally very fragrant, such as Granny Smith, but for apples that are prized for their fruity fragrance, such as McIntosh, this can be a problem with consumers, **27** that will reject apples lacking the expected aroma. [4] But some fruits do not respond as well to 1-MCP as others **28** did, and some even respond adversely. [5] Furthermore, some fruits, particularly those that naturally produce a large

24

- A) NO CHANGE
- B) being
- C) that is
- D) DELETE the underlined portion.

25

- A) NO CHANGE
- B) firm
- C) stiff
- D) taut

26

- A) NO CHANGE
- B) there
- C) its
- D) it's

27

- A) NO CHANGE
- B) they
- C) which
- D) who

28

- A) NO CHANGE
- B) do,
- C) have,
- D) will,

amount of ethylene, do not respond as well to 1-MCP treatment. [6] Take Bartlett **29** pears, for instance, unless they are treated with exactly the right amount of 1-MCP at exactly the right time, they will remain hard and green until they rot, and consumers who experience this will be unlikely to purchase them again. **30**

**29**

- A) NO CHANGE
- B) pears, for instance:
- C) pears for instance,
- D) pears. For instance,

**30**

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 5.

Finally, researchers have found that 1-MCP actually increases susceptibility to some pathologies in certain apple varieties. For example, Empire apples are prone to a condition that causes the flesh of the apple to turn brown. Traditionally, apple producers have dealt with this problem by leaving the apples in the open air for three weeks before storing them in a controlled atmosphere with tightly regulated temperature, humidity, and carbon dioxide levels. As the graph shows, the flesh of untreated Empire apples that are first stored in the open air undergoes **31** roughly five percent less browning than the flesh of untreated Empire apples that are immediately put into storage in a controlled environment. However, when Empire apples are treated with 1-MCP, **32** their flesh turns brown when the apples are first stored in the open air, though not under other conditions. Although

31

Which choice offers an accurate interpretation of the data in the graph?

- A) NO CHANGE
- B) slightly more browning than
- C) twice as much browning as
- D) substantially less browning than

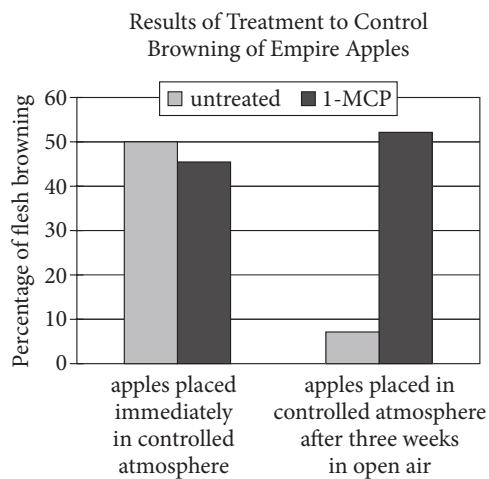
32

Which choice offers an accurate interpretation of the data in the graph?

- A) NO CHANGE
- B) roughly half of their flesh turns brown, regardless of whether the apples are first stored in the open air.
- C) their flesh browns when they are put directly into a controlled atmosphere but not when they are first stored in the open air.
- D) their flesh turns brown when they are first stored in the open air, though not as quickly as the apple flesh in an untreated group does.



researchers continue to search for the right combination of factors that will keep fruits fresh and attractive, **33** the problem may be that consumers are overly concerned with superficial qualities rather than the actual freshness of the fruit.



Adapted from Hannah J. James, Jacqueline F. Nock, and Chris B. Watkins, "The Failure of Postharvest Treatments to Control Firm Flesh Browning in Empire Apples." ©2010 by The New York State Horticultural Society.

33

The writer wants a conclusion that conveys how the shortcomings of 1-MCP presented in the passage affect the actions of people in the fruit industry. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) many of the improvements to fruit quality they have discovered so far have required trade-offs in other properties of the fruit.
- C) for now many fruit sellers must weigh the relative values of aroma, color, and freshness when deciding whether to use 1-MCP.
- D) it must be acknowledged that 1-MCP, despite some inadequacies, has enabled the fruit industry to ship and store fruit in ways that were impossible before.

Questions 34-44 are based on the following passage.

**More than One Way to Dress a Cat**

From Michelangelo's *David* to Vincent van Gogh's series of self-portraits to Grant Wood's iconic image of a farming couple in *American Gothic*, **34** Gothic. These works by human artists have favored representations of members of their own species to those of other species. Indeed, when we think about animals depicted in well-known works of art, the image of dogs playing poker—popularized in a series of paintings by American artist C. M. **35** Coolidge, may be the first and only one that comes to mind. Yet some of the earliest known works of art, including paintings and drawings tens of thousands of years old found on cave walls in Spain and France, **36** portrays animals. Nor has artistic homage to our fellow creatures entirely died out in the millennia since, **37** despite the many years that have passed between then and now.

34

- A) NO CHANGE
- B) *Gothic*. Works
- C) *Gothic*; these works
- D) *Gothic*, works

35

- A) NO CHANGE
- B) Coolidge—
- C) Coolidge;
- D) Coolidge

36

- A) NO CHANGE
- B) portraying
- C) portray
- D) has portrayed

37

The writer wants to link the first paragraph with the ideas that follow. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) with special attention being paid to domestic animals such as cats.
- C) even though most paintings in museums are of people, not animals.
- D) as the example of one museum in Russia shows.

[1] The State Hermitage Museum in St. Petersburg, one of Russia's greatest art museums, has long had a productive partnership with a much loved animal: the cat. [2] For centuries, cats have guarded this famous museum, ridding it of mice, rats, and other rodents that could damage the art, not to mention **38** scared off visitors. [3] Peter the Great introduced the first cat to the Hermitage in the early eighteenth century. [4] Later Catherine the Great declared the cats to be official guardians of the galleries. [5] Continuing the tradition, Peter's daughter Elizaveta introduced the best and strongest cats in Russia to the Hermitage. [6] Today, the museum holds a yearly festival honoring these faithful workers. **39**

**38**

- A) NO CHANGE
- B) scaring
- C) scare
- D) have scared

**39**

To make this paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 3.
- D) after sentence 6.

These cats are so cherished by the museum that officials recently **40** decreed original paintings to be made of six of them. In each, a cat is depicted upright in a humanlike pose and clothed in imperial-era Russian attire. The person chosen for this **41** task, digital artist, Eldar Zakirov painted the cats in the style traditionally used by portrait artists, in so doing **42** presenting the cats as noble individuals worthy of respect. One portrait, *The Hermitage Court Chamber Herald Cat*, includes an

40

- A) NO CHANGE
- B) commissioned
- C) forced
- D) licensed

41

- A) NO CHANGE
- B) task, digital artist, Eldar Zakirov,
- C) task digital artist Eldar Zakirov,
- D) task, digital artist Eldar Zakirov,

42

Which choice most effectively sets up the examples that follow?

- A) NO CHANGE
- B) managing to capture unique characteristics of each cat.
- C) commenting on the absurdity of dressing up cats in royal robes.
- D) indicating that the cats were very talented mouse catchers.

aristocratic tilt of feline ears as well as a stately sweep of tail emerging from the stiff scarlet and gold of royal court dress. The wise, thoughtful green eyes of the subject of *The Hermitage Court Outrunner Cat* mimic those of a trusted royal advisor. **43** Some may find it peculiar to observe cats portrayed in formal court poses, but these felines, by **44** mastering the art of killing mice and rats, are benefactors of the museum as important as any human.

43

At this point, the writer is considering adding the following sentence.

The museum occupies six historic buildings, including the Winter Palace, a former residence of Russian emperors.

Should the writer make this addition here?

- A) Yes, because it shows the link between Peter the Great and the cat paintings.
- B) Yes, because it helps explain why Russian art celebrates animals.
- C) No, because it fails to indicate why the Winter Palace became an art museum.
- D) No, because it provides background information that is irrelevant to the paragraph.

44

- A) NO CHANGE
- B) acting as the lead predator in the museum's ecosystem,
- C) hunting down and killing all the mice and rats one by one,
- D) protecting the museum's priceless artworks from destructive rodents,

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

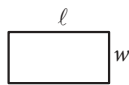
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

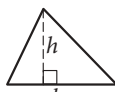


$$A = \pi r^2$$

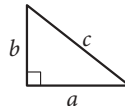
$$C = 2\pi r$$



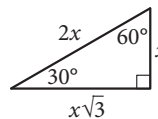
$$A = \ell w$$



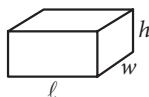
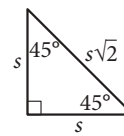
$$A = \frac{1}{2}bh$$



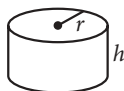
$$c^2 = a^2 + b^2$$



Special Right Triangles



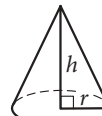
$$V = \ell wh$$



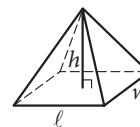
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

A painter will paint  $n$  walls with the same size and shape in a building using a specific brand of paint. The painter's fee can be calculated by the expression  $nK\ell h$ , where  $n$  is the number of walls,  $K$  is a constant with units of dollars per square foot,  $\ell$  is the length of each wall in feet, and  $h$  is the height of each wall in feet. If the customer asks the painter to use a more expensive brand of paint, which of the factors in the expression would change?

- A)  $h$
- B)  $\ell$
- C)  $K$
- D)  $n$

2

If  $3r = 18$ , what is the value of  $6r + 3$  ?

- A) 6
- B) 27
- C) 36
- D) 39

3

Which of the following is equal to  $a^{\frac{2}{3}}$ , for all values of  $a$  ?

- A)  $\sqrt{a^{\frac{1}{3}}}$
- B)  $\sqrt{a^3}$
- C)  $\sqrt[3]{a^{\frac{1}{2}}}$
- D)  $\sqrt[3]{a^2}$

4

The number of states that joined the United States between 1776 and 1849 is twice the number of states that joined between 1850 and 1900. If 30 states joined the United States between 1776 and 1849 and  $x$  states joined between 1850 and 1900, which of the following equations is true?

- A)  $30x = 2$
- B)  $2x = 30$
- C)  $\frac{x}{2} = 30$
- D)  $x + 30 = 2$



5

If  $\frac{5}{x} = \frac{15}{x+20}$ , what is the value of  $\frac{x}{5}$  ?

- A) 10
- B) 5
- C) 2
- D)  $\frac{1}{2}$

6

$$2x - 3y = -14$$

$$3x - 2y = -6$$

If  $(x, y)$  is a solution to the system of equations above, what is the value of  $x - y$  ?

- A) -20
- B) -8
- C) -4
- D) 8

7

$x$	$f(x)$
0	3
2	1
4	0
5	-2

The function  $f$  is defined by a polynomial. Some values of  $x$  and  $f(x)$  are shown in the table above. Which of the following must be a factor of  $f(x)$  ?

- A)  $x - 2$
- B)  $x - 3$
- C)  $x - 4$
- D)  $x - 5$

8

The line  $y = kx + 4$ , where  $k$  is a constant, is graphed in the  $xy$ -plane. If the line contains the point  $(c, d)$ , where  $c \neq 0$  and  $d \neq 0$ , what is the slope of the line in terms of  $c$  and  $d$  ?

- A)  $\frac{d-4}{c}$
- B)  $\frac{c-4}{d}$
- C)  $\frac{4-d}{c}$
- D)  $\frac{4-c}{d}$





9

$$kx - 3y = 4$$

$$4x - 5y = 7$$

In the system of equations above,  $k$  is a constant and  $x$  and  $y$  are variables. For what value of  $k$  will the system of equations have no solution?

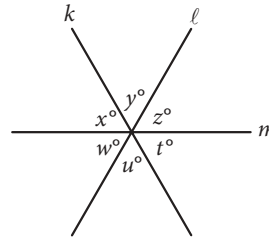
- A)  $\frac{12}{5}$   
 B)  $\frac{16}{7}$   
 C)  $-\frac{16}{7}$   
 D)  $-\frac{12}{5}$

10

In the  $xy$ -plane, the parabola with equation  $y = (x - 11)^2$  intersects the line with equation  $y = 25$  at two points,  $A$  and  $B$ . What is the length of  $\overline{AB}$ ?

- A) 10  
 B) 12  
 C) 14  
 D) 16

11



Note: Figure not drawn to scale.

In the figure above, lines  $k$ ,  $l$ , and  $m$  intersect at a point. If  $x + y = u + w$ , which of the following must be true?

- I.  $x = z$   
 II.  $y = w$   
 III.  $z = t$
- A) I and II only  
 B) I and III only  
 C) II and III only  
 D) I, II, and III

12

$$y = a(x - 2)(x + 4)$$

In the quadratic equation above,  $a$  is a nonzero constant. The graph of the equation in the  $xy$ -plane is a parabola with vertex  $(c, d)$ . Which of the following is equal to  $d$ ?

- A)  $-9a$   
 B)  $-8a$   
 C)  $-5a$   
 D)  $-2a$



13

The equation  $\frac{24x^2 + 25x - 47}{ax - 2} = -8x - 3 - \frac{53}{ax - 2}$  is true for all values of  $x \neq \frac{2}{a}$ , where  $a$  is a constant.

What is the value of  $a$  ?

- A) -16
- B) -3
- C) 3
- D) 16

14

What are the solutions to  $3x^2 + 12x + 6 = 0$  ?

- A)  $x = -2 \pm \sqrt{2}$
- B)  $x = -2 \pm \frac{\sqrt{30}}{3}$
- C)  $x = -6 \pm \sqrt{2}$
- D)  $x = -6 \pm 6\sqrt{2}$

15

$$C = \frac{5}{9}(F - 32)$$

The equation above shows how a temperature  $F$ , measured in degrees Fahrenheit, relates to a temperature  $C$ , measured in degrees Celsius. Based on the equation, which of the following must be true?

- I. A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of  $\frac{5}{9}$  degree Celsius.
- II. A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit.
- III. A temperature increase of  $\frac{5}{9}$  degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius.

- A) I only
- B) II only
- C) III only
- D) I and II only

**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \odot & \odot & \odot & \odot \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$				Answer: 2.5				
	7	/	1	2		2	.	5
	⊙	⊙	⊙	⊙		⊙	⊙	⊙
	0	0	0	0		0	0	0
①	①	⊙	①	①	①	①	①	①
②	②	②	⊙	②	②	⊙	②	②
③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⊙
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⊙	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2 / 3				.666				.667					
	2	/	3		.	6	6	6		.	6	6	7
	⊙	⊙	⊙		⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙
	0	0	0		0	0	0	0		0	0	0	0
①	①	⊙	①	①	①	①	①	①	①	①	①	①	①
②	⊙	②	②	②	②	②	②	②	②	②	②	②	②
③	③	③	⊙	③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⊙	⊙	⊙	⑥	⑥	⊙	⊙	⊙	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⊙
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

2 0 1				2 0 1			
	2	0	1		2	0	1
	⊙	⊙	⊙		⊙	⊙	⊙
	0	⊙	0		⊙	0	0
①	①	①	⊙	①	①	⊙	①
②	⊙	②	②	⊙	②	②	②
③	③	③	③	③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

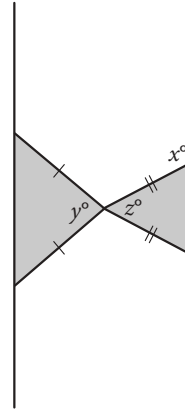
$$x^3(x^2 - 5) = -4x$$

If  $x > 0$ , what is one possible solution to the equation above?

17

If  $\frac{7}{9}x - \frac{4}{9}x = \frac{1}{4} + \frac{5}{12}$ , what is the value of  $x$ ?

18



Note: Figure not drawn to scale.

Two isosceles triangles are shown above. If  $180 - z = 2y$  and  $y = 75$ , what is the value of  $x$ ?



19

At a lunch stand, each hamburger has 50 more calories than each order of fries. If 2 hamburgers and 3 orders of fries have a total of 1700 calories, how many calories does a hamburger have?

20

In triangle  $ABC$ , the measure of  $\angle B$  is  $90^\circ$ ,  $BC = 16$ , and  $AC = 20$ . Triangle  $DEF$  is similar to triangle  $ABC$ , where vertices  $D$ ,  $E$ , and  $F$  correspond to vertices  $A$ ,  $B$ , and  $C$ , respectively, and each side of triangle  $DEF$  is  $\frac{1}{3}$  the length of the corresponding side of triangle  $ABC$ . What is the value of  $\sin F$  ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

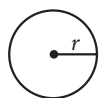
### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

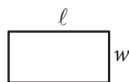
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

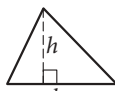


$$A = \pi r^2$$

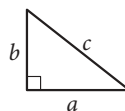
$$C = 2\pi r$$



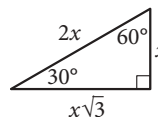
$$A = \ell w$$



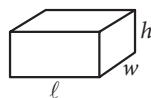
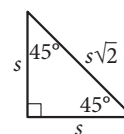
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



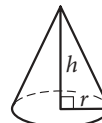
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

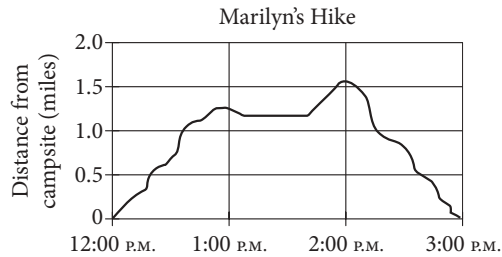
The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1



The graph above shows Marilyn's distance from her campsite during a 3-hour hike. She stopped for 30 minutes during her hike to have lunch. Based on the graph, which of the following is closest to the time she finished lunch and continued her hike?

- A) 12:40 P.M.
- B) 1:10 P.M.
- C) 1:40 P.M.
- D) 2:00 P.M.

2

Gender	Age		Total
	Under 40	40 or older	
Male	12	2	14
Female	8	3	11
Total	20	5	25

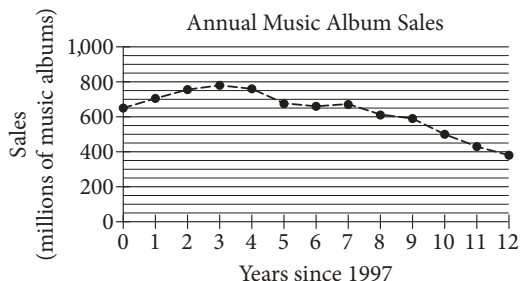
The table above shows the distribution of age and gender for 25 people who entered a contest. If the contest winner will be selected at random, what is the probability that the winner will be either a female under age 40 or a male age 40 or older?

- A)  $\frac{4}{25}$
- B)  $\frac{10}{25}$
- C)  $\frac{11}{25}$
- D)  $\frac{16}{25}$



3

The graph below shows the total number of music album sales, in millions, each year from 1997 through 2009.



Based on the graph, which of the following best describes the general trend in music album sales from 1997 through 2009?

- A) Sales generally increased each year since 1997.
- B) Sales generally decreased each year since 1997.
- C) Sales increased until 2000 and then generally decreased.
- D) Sales generally remained steady from 1997 through 2009.

4

$n$	1	2	3	4
$f(n)$	-2	1	4	7

The table above shows some values of the linear function  $f$ . Which of the following defines  $f$ ?

- A)  $f(n) = n - 3$
- B)  $f(n) = 2n - 4$
- C)  $f(n) = 3n - 5$
- D)  $f(n) = 4n - 6$

5

At Lincoln High School, approximately 7 percent of enrolled juniors and 5 percent of enrolled seniors were inducted into the National Honor Society last year. If there were 562 juniors and 602 seniors enrolled at Lincoln High School last year, which of the following is closest to the total number of juniors and seniors at Lincoln High School last year who were inducted into the National Honor Society?

- A) 140
- B) 69
- C) 39
- D) 30

6

$$3x^2 - 5x + 2$$

$$5x^2 - 2x - 6$$

Which of the following is the sum of the two polynomials shown above?

- A)  $8x^2 - 7x - 4$
- B)  $8x^2 + 7x - 4$
- C)  $8x^4 - 7x^2 - 4$
- D)  $8x^4 + 7x^2 - 4$





7

If  $\frac{3}{5}w = \frac{4}{3}$ , what is the value of  $w$ ?

- A)  $\frac{9}{20}$
- B)  $\frac{4}{5}$
- C)  $\frac{5}{4}$
- D)  $\frac{20}{9}$

8

The average number of students per classroom at Central High School from 2000 to 2010 can be modeled by the equation  $y = 0.56x + 27.2$ , where  $x$  represents the number of years since 2000, and  $y$  represents the average number of students per classroom. Which of the following best describes the meaning of the number 0.56 in the equation?

- A) The total number of students at the school in 2000
- B) The average number of students per classroom in 2000
- C) The estimated increase in the average number of students per classroom each year
- D) The estimated difference between the average number of students per classroom in 2010 and in 2000

9

Nate walks 25 meters in 13.7 seconds. If he walks at this same rate, which of the following is closest to the distance he will walk in 4 minutes?

- A) 150 meters
- B) 450 meters
- C) 700 meters
- D) 1,400 meters



Questions 10 and 11 refer to the following information.

Planet	Acceleration due to gravity $\left(\frac{\text{m}}{\text{sec}^2}\right)$
Mercury	3.6
Venus	8.9
Earth	9.8
Mars	3.8
Jupiter	26.0
Saturn	11.1
Uranus	10.7
Neptune	14.1

The chart above shows approximations of the acceleration due to gravity in meters per second squared  $\left(\frac{\text{m}}{\text{sec}^2}\right)$  for the eight planets in our solar system. The weight of an object on a given planet can be found by using the formula  $W = mg$ , where  $W$  is the weight of the object measured in newtons,  $m$  is the mass of the object measured in kilograms, and  $g$  is the acceleration due to gravity on the planet measured in  $\frac{\text{m}}{\text{sec}^2}$ .

10

What is the weight, in newtons, of an object on Mercury with a mass of 90 kilograms?

- A) 25
- B) 86
- C) 101
- D) 324

11

An object on Earth has a weight of 150 newtons. On which planet would the same object have an approximate weight of 170 newtons?

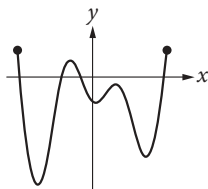
- A) Venus
- B) Saturn
- C) Uranus
- D) Neptune



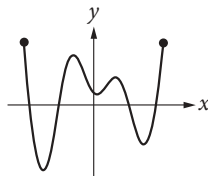
12

If the function  $f$  has five distinct zeros, which of the following could represent the complete graph of  $f$  in the  $xy$ -plane?

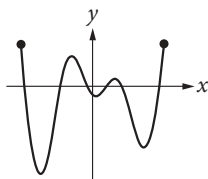
A)



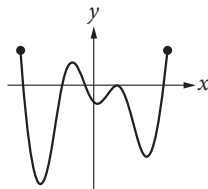
B)



C)



D)



13

$$h = -16t^2 + vt + k$$

The equation above gives the height  $h$ , in feet, of a ball  $t$  seconds after it is thrown straight up with an initial speed of  $v$  feet per second from a height of  $k$  feet. Which of the following gives  $v$  in terms of  $h$ ,  $t$ , and  $k$ ?

A)  $v = h + k - 16t$

B)  $v = \frac{h - k + 16}{t}$

C)  $v = \frac{h + k}{t} - 16t$

D)  $v = \frac{h - k}{t} + 16t$

14

The cost of using a telephone in a hotel meeting room is \$0.20 per minute. Which of the following equations represents the total cost  $c$ , in dollars, for  $h$  hours of phone use?

A)  $c = 0.20(60h)$

B)  $c = 0.20h + 60$

C)  $c = \frac{60h}{0.20}$

D)  $c = \frac{0.20h}{60}$

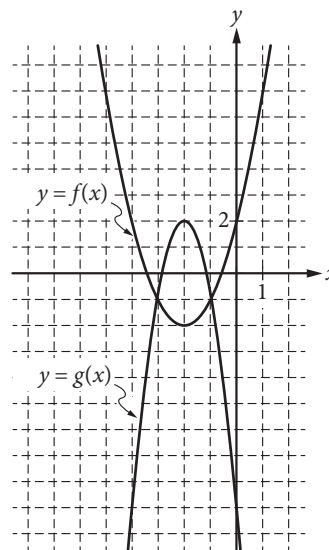


15

In order to determine if treatment X is successful in improving eyesight, a research study was conducted. From a large population of people with poor eyesight, 300 participants were selected at random. Half of the participants were randomly assigned to receive treatment X, and the other half did not receive treatment X. The resulting data showed that participants who received treatment X had significantly improved eyesight as compared to those who did not receive treatment X. Based on the design and results of the study, which of the following is an appropriate conclusion?

- A) Treatment X is likely to improve the eyesight of people who have poor eyesight.
- B) Treatment X improves eyesight better than all other available treatments.
- C) Treatment X will improve the eyesight of anyone who takes it.
- D) Treatment X will cause a substantial improvement in eyesight.

16



Graphs of the functions  $f$  and  $g$  are shown in the  $xy$ -plane above. For which of the following values of  $x$  does  $f(x) + g(x) = 0$  ?

- A)  $-3$
- B)  $-2$
- C)  $-1$
- D)  $0$



Questions 17 and 18 refer to the following information.

$$S(P) = \frac{1}{2}P + 40$$

$$D(P) = 220 - P$$

The quantity of a product supplied and the quantity of the product demanded in an economic market are functions of the price of the product. The functions above are the estimated supply and demand functions for a certain product. The function  $S(P)$  gives the quantity of the product supplied to the market when the price is  $P$  dollars, and the function  $D(P)$  gives the quantity of the product demanded by the market when the price is  $P$  dollars.

17

How will the quantity of the product supplied to the market change if the price of the product is increased by \$10?

- A) The quantity supplied will decrease by 5 units.
- B) The quantity supplied will increase by 5 units.
- C) The quantity supplied will increase by 10 units.
- D) The quantity supplied will increase by 50 units.

18

At what price will the quantity of the product supplied to the market equal the quantity of the product demanded by the market?

- A) \$90
- B) \$120
- C) \$133
- D) \$155

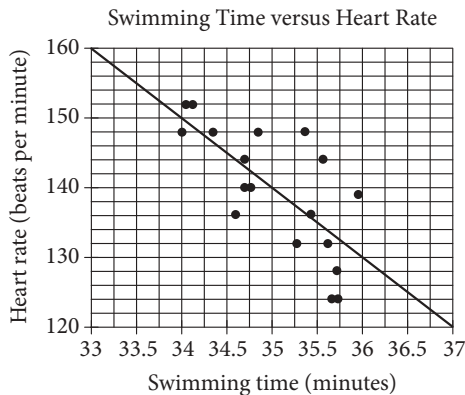
19

Graphene, which is used in the manufacture of integrated circuits, is so thin that a sheet weighing one ounce can cover up to 7 football fields. If a football field has an area of approximately  $1\frac{1}{3}$  acres, about how many acres could 48 ounces of graphene cover?

- A) 250
- B) 350
- C) 450
- D) 1,350



20



Michael swam 2,000 yards on each of eighteen days. The scatterplot above shows his swim time for and corresponding heart rate after each swim. The line of best fit for the data is also shown. For the swim that took 34 minutes, Michael's actual heart rate was about how many beats per minutes less than the rate predicted by the line of best fit?

- A) 1
- B) 2
- C) 3
- D) 4

21

Of the following four types of savings account plans, which option would yield exponential growth of the money in the account?

- A) Each successive year, 2% of the initial savings is added to the value of the account.
- B) Each successive year, 1.5% of the initial savings and \$100 is added to the value of the account.
- C) Each successive year, 1% of the current value is added to the value of the account.
- D) Each successive year, \$100 is added to the value of the account.

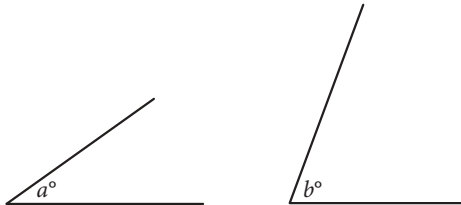
22

The sum of three numbers is 855. One of the numbers,  $x$ , is 50% more than the sum of the other two numbers. What is the value of  $x$  ?

- A) 570
- B) 513
- C) 214
- D) 155



23



Note: Figures not drawn to scale.

The angles shown above are acute and  $\sin(a^\circ) = \cos(b^\circ)$ . If  $a = 4k - 22$  and  $b = 6k - 13$ , what is the value of  $k$ ?

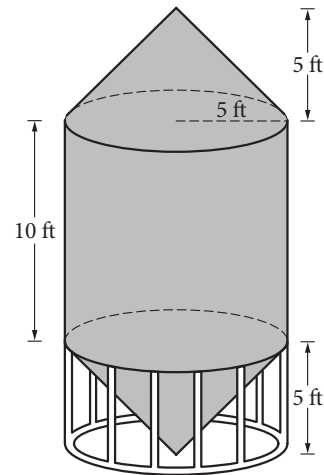
- A) 4.5
- B) 5.5
- C) 12.5
- D) 21.5

24

Mr. Kohl has a beaker containing  $n$  milliliters of solution to distribute to the students in his chemistry class. If he gives each student 3 milliliters of solution, he will have 5 milliliters left over. In order to give each student 4 milliliters of solution, he will need an additional 21 milliliters. How many students are in the class?

- A) 16
- B) 21
- C) 23
- D) 26

25



A grain silo is built from two right circular cones and a right circular cylinder with internal measurements represented by the figure above. Of the following, which is closest to the volume of the grain silo, in cubic feet?

- A) 261.8
- B) 785.4
- C) 916.3
- D) 1,047.2



26

In the  $xy$ -plane, the line determined by the points  $(2, k)$  and  $(k, 32)$  passes through the origin. Which of the following could be the value of  $k$  ?

- A) 0
- B) 4
- C) 8
- D) 16

27

A rectangle was altered by increasing its length by 10 percent and decreasing its width by  $p$  percent. If these alterations decreased the area of the rectangle by 12 percent, what is the value of  $p$  ?

- A) 12
- B) 15
- C) 20
- D) 22

28

In planning maintenance for a city's infrastructure, a civil engineer estimates that, starting from the present, the population of the city will decrease by 10 percent every 20 years. If the present population of the city is 50,000, which of the following expressions represents the engineer's estimate of the population of the city  $t$  years from now?

- A)  $50,000(0.1)^{20t}$
- B)  $50,000(0.1)^{\frac{t}{20}}$
- C)  $50,000(0.9)^{20t}$
- D)  $50,000(0.9)^{\frac{t}{20}}$





29

Gender	Handedness	
	Left	Right
Female		
Male		
Total	18	122

The incomplete table above summarizes the number of left-handed students and right-handed students by gender for the eighth-grade students at Keisel Middle School. There are 5 times as many right-handed female students as there are left-handed female students, and there are 9 times as many right-handed male students as there are left-handed male students. If there is a total of 18 left-handed students and 122 right-handed students in the school, which of the following is closest to the probability that a right-handed student selected at random is female? (Note: Assume that none of the eighth-grade students are both right-handed and left-handed.)

- A) 0.410
- B) 0.357
- C) 0.333
- D) 0.250

30

$$3x + b = 5x - 7$$

$$3y + c = 5y - 7$$

In the equations above,  $b$  and  $c$  are constants.

If  $b$  is  $c$  minus  $\frac{1}{2}$ , which of the following is true?

- A)  $x$  is  $y$  minus  $\frac{1}{4}$ .
- B)  $x$  is  $y$  minus  $\frac{1}{2}$ .
- C)  $x$  is  $y$  minus 1.
- D)  $x$  is  $y$  plus  $\frac{1}{2}$ .

**DIRECTIONS**

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer:  $\frac{7}{12}$

7	/	1	2
•	•	•	•
0	0	0	0
1	1	•	1
2	2	2	•
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
•	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5

	2	.	5
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	3
4	4	4	4
5	5	5	•
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
•	•	•
0	0	0
1	1	1
2	•	2
3	3	•
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

.	6	6	6
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	•
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

2	0	1
•	•	•
0	•	0
1	1	•
2	•	2
3	3	3

2	0	1	
•	•	•	•
0	•	0	0
1	1	•	1
2	•	2	2
3	3	3	3

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

Tickets for a school talent show cost \$2 for students and \$3 for adults. If Chris spends at least \$11 but no more than \$14 on  $x$  student tickets and 1 adult ticket, what is one possible value of  $x$  ?

32

Ages of the First 12 United States Presidents at the Beginning of Their Terms in Office

President	Age (years)	President	Age (years)
Washington	57	Jackson	62
Adams	62	Van Buren	55
Jefferson	58	Harrison	68
Madison	58	Tyler	51
Monroe	59	Polk	50
Adams	58	Taylor	65

The table above lists the ages of the first 12 United States presidents when they began their terms in office. According to the table, what was the mean age, in years, of these presidents at the beginning of their terms? (Round your answer to the nearest tenth.)

33

$$(-3x^2 + 5x - 2) - 2(x^2 - 2x - 1)$$

If the expression above is rewritten in the form  $ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are constants, what is the value of  $b$  ?

34

In a circle with center  $O$ , central angle  $AOB$  has a measure of  $\frac{5\pi}{4}$  radians. The area of the sector formed by central angle  $AOB$  is what fraction of the area of the circle?



35

An online store receives customer satisfaction ratings between 0 and 100, inclusive. In the first 10 ratings the store received, the average (arithmetic mean) of the ratings was 75. What is the least value the store can receive for the 11th rating and still be able to have an average of at least 85 for the first 20 ratings?

36

$$y \leq -15x + 3000$$

$$y \leq 5x$$

In the  $xy$ -plane, if a point with coordinates  $(a, b)$  lies in the solution set of the system of inequalities above, what is the maximum possible value of  $b$  ?



**Questions 37 and 38 refer to the following information.**

If shoppers enter a store at an average rate of  $r$  shoppers per minute and each stays in the store for an average time of  $T$  minutes, the average number of shoppers in the store,  $N$ , at any one time is given by the formula  $N = rT$ . This relationship is known as Little's law.

The owner of the Good Deals Store estimates that during business hours, an average of 3 shoppers per minute enter the store and that each of them stays an average of 15 minutes. The store owner uses Little's law to estimate that there are 45 shoppers in the store at any time.

37

Little's law can be applied to any part of the store, such as a particular department or the checkout lines. The store owner determines that, during business hours, approximately 84 shoppers per hour make a purchase and each of these shoppers spends an average of 5 minutes in the checkout line. At any time during business hours, about how many shoppers, on average, are waiting in the checkout line to make a purchase at the Good Deals Store?

38

The owner of the Good Deals Store opens a new store across town. For the new store, the owner estimates that, during business hours, an average of 90 shoppers per hour enter the store and each of them stays an average of 12 minutes. The average number of shoppers in the new store at any time is what percent less than the average number of shoppers in the original store at any time? (Note: Ignore the percent symbol when entering your answer. For example, if the answer is 42.1%, enter 42.1)

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

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## Answer Explanations

# SAT Practice Test #3

## Section 1: Reading Test

### QUESTION 1

**Choice B is the best answer.** In the passage, Lady Carlotta is approached by the “imposingly attired lady” Mrs. Quabarl while standing at a train station (lines 32-35). Mrs. Quabarl assumes Lady Carlotta is her new nanny, Miss Hope: “You must be Miss Hope, the governess I’ve come to meet” (lines 36-37). Lady Carlotta does not correct Mrs. Quabarl’s mistake and replies, “Very well, if I must I must” (line 39).

Choices A, C, and D are incorrect because the passage is not about a woman weighing a job choice, seeking revenge on an acquaintance, or disliking her new employer.

### QUESTION 2

**Choice C is the best answer.** In lines 1-3, the narrator states that Lady Carlotta “stepped out on to the platform of the small wayside station and took a turn or two up and down its uninteresting length” in order to “kill time.” In this context, Lady Carlotta was taking a “turn,” or a short walk, along the platform while waiting for the train to leave the station.

Choices A, B, and D are incorrect because in this context “turn” does not mean slight movement, change in rotation, or course correction. While Lady Carlotta may have had to rotate her body while moving across the station, “took a turn” implies that Lady Carlotta took a short walk along the platform’s length.

### QUESTION 3

**Choice A is the best answer.** In lines 10-14, the narrator states that some of Lady Carlotta’s acquaintances would often admonish, or criticize, Lady Carlotta for meddling in or openly expressing her opinion on other people’s affairs.

---

Choices B, C, and D are incorrect because the narrator does not suggest that other people viewed Lady Carlotta as tactful, ambitious, or unfriendly.

#### QUESTION 4

**Choice A is the best answer.** In lines 10-14, the narrator states that people often criticized Lady Carlotta and suggested that she not interfere in other people's affairs, which were "none of her business." The fact that people often were critical of Lady Carlotta's behavior provides evidence that Lady Carlotta was outspoken.

Choices B, C, and D do not provide the best evidence that Lady Carlotta was outspoken. Choices B, C, and D mention Lady Carlotta, but do not specify how others view her.

#### QUESTION 5

**Choice C is the best answer.** Lines 4-10 establish that Lady Carlotta intervened on the part of a struggling horse, the kind of behavior for which, lines 10-14 indicate, she received "plentiful admonition" from "certain of her acquaintances," who believed that she should mind her own business. Lines 14-22 indicate that Lady Carlotta had "only once . . . put the doctrine of non-interference into practice," and that was when "one of its most eloquent exponents" had been "besieged for nearly three hours in a small and extremely uncomfortable may-tree by an angry boar-pig" while Lady Carlotta blithely ignored the other woman's hypocritical pleas for interference. This incident provides insight into Lady Carlotta's character and also evokes humor through language choice (e.g., the droll understatement of "it is to be feared that [Lady Carlotta] lost the friendship of the ultimately rescued lady"; lines 22-23) and the sense that, narratively speaking, justice has been served.

Choice A is incorrect because nothing about the incident suggests deception on Lady Carlotta's part. Choice B is incorrect because there is nothing subtle about Lady Carlotta leaving another woman stuck in a tree for nearly three hours. Moreover, the passage does not suggest that this was an act of cruelty on Lady Carlotta's part; rather, the passage suggests that Lady Carlotta was justified in giving the woman stuck in a tree exactly what the woman had so often asked for: noninterference. Choice D is incorrect because the passage indicates that Lady Carlotta was acting consistently with her beliefs and only invoked the doctrine to teach a hypocritical person a lesson.

#### QUESTION 6

**Choice A is the best answer.** The narrator explains that Mrs. Quabarl told Lady Carlotta about the "nature of the charge" when she gave Lady Carlotta details about the Quabarl children (line 53-61). Since Lady Carlotta is pretending to be a governess, the term "charge" refers to her responsibilities, or job duties, when caring for the Quabarl children.

Choices B, C, and D are incorrect because in this context “charge” does not mean attack, fee, or expense.

### QUESTION 7

**Choice A is the best answer.** Lady Carlotta learns about Mrs. Quabarl’s children Claude, Wilfrid, and Irene (lines 53-58). The narrator then describes Mrs. Quabarl’s child Viola as “something or other else of a mould equally commonplace among children of that class and type in the twentieth century” (lines 58-61). This statement about Viola implies that all of the Quabarl children have skills typical, or “of a mould equally commonplace,” to other peers in their social class.

Choices B, C, and D are incorrect because the narrator does not indicate that all of the Quabarl children are unusually creative and intelligent, hostile to the idea of having a governess, or more educated than their peers.

### QUESTION 8

**Choice B is the best answer.** In lines 62-69, Mrs. Quabarl explains to Lady Carlotta that she wants her children to actively participate in their education, and that Lady Carlotta should not create lessons that require her children to simply memorize historical figures and dates. Mrs. Quabarl emphasizes an education centered on active engagement when she states that her children should “not only be TAUGHT . . . but INTERESTED in what they learn.”

Choices A, C, and D are incorrect because the narrator does not suggest that Mrs. Quabarl favors an education that emphasizes traditional values, artistic experimentation, or factual retention.

### QUESTION 9

**Choice B is the best answer.** In lines 77-82, the narrator describes Mrs. Quabarl as appearing “magnificent and autocratic,” or outwardly domineering, but easily “cowed and apologetic” when someone challenges, or defies, her authority.

Choices A, C, and D are incorrect because the narrator does not describe Mrs. Quabarl as selfish, bitter, or frequently imprudent.

### QUESTION 10

**Choice D is the best answer.** In lines 77-82, the narrator provides evidence that Mrs. Quabarl appears imposing, or autocratic, but is easily defied, or opposed: “She was one of those imperfectly self-assured individuals who are magnificent and autocratic as long as they are not seriously opposed. The least show of unexpected resistance goes a long way towards rendering them cowed and apologetic.”

---

Choices A, B, and C do not provide the best evidence that Mrs. Quabarl appears imposing but is easily defied. Choices A and B are incorrect because they present Mrs. Quabarl's opinions on railway companies and education, and choice C is incorrect because it focuses on Lady Carlotta, not Mrs. Quabarl.

### QUESTION 11

**Choice A is the best answer.** While the author predominantly supports the use of public transportation, in the third paragraph he recognizes some limitations to the public transportation system: it is a "depressing experience" (lines 25-26) and "underfunded, ill-maintained, and ill-planned" (line 31).

Choices B, C, and D are incorrect because the third paragraph does not expand upon an argument made in the first two paragraphs, provide an overview of a problem, or advocate ending the use of public transportation.

### QUESTION 12

**Choice C is the best answer.** The author notes that in North America "hopping in a car almost always gets you to your destination more quickly" (lines 32-34). This statement suggests that speed is one advantage to driving in North America.

Choices A, B, and D are incorrect because the author does not cite environmental impact, convenience, or cost as advantages of driving in North America.

### QUESTION 13

**Choice D is the best answer.** In lines 32-34, the author provides evidence that speed is one advantage to driving in North America, because driving "almost always gets you to your destination more quickly."

Choices A, B, and C do not provide the best evidence that speed is one advantage to driving in North America. Choices A and B are incorrect because they offer general information about using public transportation. Choice C is incorrect because although these lines mention North America, they focus on the disadvantages of public transportation.

### QUESTION 14

**Choice B is the best answer.** The author argues in the fourth paragraph that public transportation "can be faster, more comfortable, and cheaper than the private automobile" (lines 36-37) and provides examples of fast and convenient public transportation systems.

Choices A, C, and D are incorrect because they focus on points made in the fourth paragraph rather than the paragraph's central idea.



**QUESTION 15**

**Choice B is the best answer.** In lines 35-37, the author provides evidence that some public transportation systems are superior to driving, because public transportation “can be faster, more comfortable, and cheaper than the private automobile.”

Choices A, C, and D do not provide the best evidence that some public transportation systems are superior to driving, as they highlight points made in the fourth paragraph rather than the paragraph’s central idea.

**QUESTION 16**

**Choice C is the best answer.** In the last paragraph, the author explains the trend that people who became adults around the end of the twentieth century are more willing to use public transportation than people from older generations. The author notes, “If you credit the demographers, this transit trend has legs” (lines 58-59). In this context, “credit” means to believe the demographers’ claims about the trend.

Choices A, B, and D are incorrect because in this context, “credit” does not mean endow, attribute, or honor.

**QUESTION 17**

**Choice B is the best answer.** In lines 59-63, the author explains the trend of people who became adults around the end of the twentieth century “tend[ing] to favor cities over suburbs.” In this context, these adults “favor,” or prefer, cities over suburbs.

Choices A, C, and D are incorrect because in this context “favor” does not mean indulge, resemble, or serve.

**QUESTION 18**

**Choice B is the best answer.** In lines 63-67, the author explains that while riding on public transportation, people can use personal electronic devices, such as “iPads, MP3 players, Kindles, and smartphones.”

Choices A, C, and D are incorrect because they do not show that public transportation is compatible with the use of personal electronic devices.

**QUESTION 19**

**Choice A is the best answer.** Figure 1 shows that 10.7% of public transportation passengers are students and 6.7% of public transportation passengers are retirees. Thus, more students than retirees use public transportation.

Choices B and C are incorrect because figure 1 shows that more employed than unemployed people use public transportation and that more employed people than homemakers use public transportation.

---

Choice D is incorrect because figure 1 does not explain how frequently passengers use public transportation; it only identifies public transportation passengers by their primary occupation.

### QUESTION 20

**Choice A is the best answer.** Figure 1 shows that 72% of public transportation passengers are “employed outside the home,” and figure 2 indicates that 59.1% of public transportation trips are for “work.” It can be inferred from these figures that many public transportation passengers take public transportation to their place of employment.

Choices B, C, and D are incorrect because figure 1 and figure 2 do not indicate that public transportation passengers primarily use the system to run errands, use their own car on weekends, or are planning to purchase a car.

### QUESTION 21

**Choice D is the best answer.** The author explains that Ken Dial created an experiment to study the evolution of flight by observing how baby Chukars learn to fly. During the experiment, Dial noticed the unusual way Chukars use their “wings and legs cooperatively” to scale hay bales (lines 38-43), and he created “a series of ingenious experiments” (line 46) to study this observation. After his additional experiments, Dial determined that these baby birds angle “their wings differently from birds in flight” (lines 49-50).

Choices A, B, and C are incorrect because they do not accurately reflect the sequence of events in the passage.

### QUESTION 22

**Choice A is the best answer.** In lines 6-9, the author explains that Dial was “challenged,” or dared, by graduate students to develop “new data” on a long-standing scientific debate (the “ground-up-tree-down” theory).

Choices B, C, and D are incorrect because in this context “challenged” does not mean required, disputed with, or competed with.

### QUESTION 23

**Choice A is the best answer.** The author explains that Dial created his initial experiment to try and create “new data on the age-old ground-up-tree-down debate,” and that he looked for “clues” in “how baby game birds learned to fly” (lines 8-11). The note at the beginning of

the passage explains the “age-old ground-up-tree down debate” and offers two different theories on how birds evolved to fly. Finally, the last paragraph of the passage discusses WAIR in an evolutionary context.

Choices B, C, and D are incorrect because they do not identify Dial’s central assumption in setting up his research.

### QUESTION 24

**Choice B is the best answer.** In lines 6-11, the author provides evidence that Dial’s central assumption in setting up his research is that the acquisition of flight in young birds is linked to the acquisition of flight in their ancestors. The author notes that Dial created a project to “come up with new data on the age-old ground-up-tree-down debate.”

Choices A, C, and D do not provide the best evidence that Dial’s central assumption in setting up his research is that the acquisition of flight in young birds is linked to the acquisition of flight in their ancestors. Choices A, C, and D are incorrect because they focus on Dial’s experiment and his observations on ground birds.

### QUESTION 25

**Choice C is the best answer.** When a rancher observed Dial’s laboratory setup, he was “incredulous” that the Chukars were living on the ground, and he advised Dial to give the birds “something to climb on” (lines 16-23). This “key piece of advice” (line 14) led Dial to add hay bales to his laboratory. Dial later noticed that the Chukars were using their legs and wings to scale the hay bales, and this observation became the focal point of his research.

Choices A, B, and D are incorrect because the incident with the local rancher did not serve to reveal Dial’s motivation for creating the project, emphasize differences in laboratory and field research, or introduce a contributor to a scientific theory.

### QUESTION 26

**Choice C is the best answer.** The author explains that Dial’s “aha moment” came when he determined the Chukars used “their legs and wings cooperatively” to scale the hay bales (lines 40-42). Dial then created additional experiments to study how the birds dealt with gradually steeper inclines: “[he filmed] the birds as they raced up textured ramps tilted at increasing angles” (lines 46-48).

Choices A, B, and D are incorrect because Dial’s “aha moment” was not followed by Dial teaching the birds to fly, studying videos to find out why the birds no longer hopped, or consulting with other researchers.

---

### QUESTION 27

**Choice B is the best answer.** Dial observed that as the Chukars raced up steep ramps, they “began to flap” and “aimed their flapping down and backward, using the force . . . to keep their feet firmly pressed against the ramp” (lines 49-53). Dial determined that the position of their flapping wings facilitated the baby Chukars’ traction on the steep ramps.

Choices A, C, and D are incorrect because the passage does not indicate that the Chukars’ speed, alternation of wing and foot movement, or continual hopping motions facilitated their traction on steep ramps.

### QUESTION 28

**Choice B is the best answer.** In lines 61-63, the author explains that Dial named his scientific finding “WAIR, for wing-assisted incline running, and went on to document it in a wide range of species.” In this context, Dial “documented,” or recorded, the existence of WAIR in numerous bird species.

Choices A, C, and D are incorrect because in this context, “document” does not mean to portray, publish, or process.

### QUESTION 29

**Choice D is the best answer.** In lines 70-74, the author explains that gliding animals do not use a “flapping flight stroke,” or WAIR, wing-assisted incline running. Since Chukars, a ground bird, use WAIR to help scale steep inclines, it can be reasonably inferred that gliding animals do not use WAIR to aid in climbing slopes.

Choices A, B, and C are incorrect because the passage does not include information on gliding animals’ offspring, their method of locomotion, or their feeding habits.

### QUESTION 30

**Choice D is the best answer.** In lines 73-75, the author provides evidence that “the flapping flight stroke” is “something gliding animals don’t do.”

Choices A, B, and C do not provide the best evidence that gliding animals do not use a flapping stroke to aid in climbing slopes. These choices do not contain information about gliding animals.

### QUESTION 31

**Choice B is the best answer.** In lines 21-24, the authors of Passage 1 state society’s “common happiness” is dependent on women never becoming involved in politics. In this context, the authors of Passage 1 are suggesting that all members of society can have a “common,” or shared, happiness.

Choices A, C, and D are incorrect because in this context, “common” does not mean average, coarse, or similar.

### QUESTION 32

**Choice C is the best answer.** In lines 25-30, the authors of Passage 1 state that women should seek “gentle occupations and the cares of the home” so they can avoid performing difficult, or “strenuous,” and unpleasant, or “onerous,” tasks.

Choices A, B, and D are incorrect because the authors of Passage 1 do not suggest that running a household and raising children are rewarding for both sexes, yield less value for society, or require professional or political skills.

### QUESTION 33

**Choice C is the best answer.** In lines 25-30, the authors of Passage 1 provide evidence that women should run households and raise children because these roles do not require “strenuous habits and onerous duties.”

Choices A, B, and D do not provide the best evidence that running a household and raising children entail very few activities that are difficult or unpleasant; rather, these lines offer general information about the differences between the sexes.

### QUESTION 34

**Choice D is the best answer.** In lines 41-46, Wollstonecraft argues that if women do not receive an education “to become the companion of man,” or one that is comparable to men’s education, then society will not progress in “knowledge and virtue.”

Choices A, B, and C are incorrect because Wollstonecraft does not suggest that society can progress only if women have happiness and financial security, follow societal rules, or replace men as figures of power.

### QUESTION 35

**Choice C is the best answer.** Wollstonecraft argues that women should be granted an education comparable to men’s so that truth is “common to all” (lines 41-46). Wollstonecraft states that education will “strengthen [women’s] reason till she comprehend her duty” (lines 49-50). In this context, Wollstonecraft is arguing that education will improve women’s “reason,” or intellect, and allow women to consider their role in society.

Choices A, B, and D are incorrect because in this context “reason” does not mean motive, sanity, or explanation.

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### QUESTION 36

**Choice A is the best answer.** In lines 72-78, Wollstonecraft argues that the laws passed by society's leaders allow men to "contend for their freedom" but serve to "subjugate women." In this context, "subjugate" means to control. Wollstonecraft is arguing that society's leaders grant men freedoms that are denied to women.

Choices B, C, and D are incorrect because Wollstonecraft does not claim that society's leaders have granted freedoms that created a general reduction in individual virtue, caused arguments about happiness, or ensured equality for all people.

### QUESTION 37

**Choice D is the best answer.** In lines 72-75, Wollstonecraft provides evidence that society's leaders grant freedoms that privilege men. She argues that while society's leaders believe they "are acting in the manner best calculated to promote [women's] happiness," their decisions don't allow women to "contend for their freedom."

Choices A, B, and C do not provide the best evidence that society's leaders grant freedoms that privilege men over women.

### QUESTION 38

**Choice C is the best answer.** Wollstonecraft cites the statement made by the authors of Passage 1 that excluding women from political participation is "according to abstract principles . . . impossible to explain" (lines 61-65). Wollstonecraft then states that if the authors of Passage 1 can discuss "the abstract rights of man" they should be able to discuss the abstract rights of women (lines 66-69). In these lines, Wollstonecraft is developing her argument by highlighting a flaw in the reasoning presented by the authors of Passage 1.

Choices A, B, and D are incorrect because Wollstonecraft does not refer to the statement made in Passage 1 to call into question the authors' qualifications, dispute the assertion that women are excluded by their own government (sentence one of Passage 1), or validate the authors' conclusions on gender roles.

### QUESTION 39

**Choice A is the best answer.** The authors of Passage 1 argue that while restricting women's freedoms may be "impossible to explain" (line 7), this restriction is necessary for society's overall happiness (lines 13-17). Wollstonecraft, however, strongly challenges this argument, asking the authors of Passage 1, "Who made man the exclusive judge" of which freedoms are granted to women, and likening society's male leaders to tyrants as they deny women their "civil and political rights" and leave them "groping in the dark" (lines 78-88).

Choices B, C, and D are incorrect because they do not characterize the overall relationship between Passage 1 and Passage 2.

## QUESTION 40

**Choice D is the best answer.** The authors of Passage 1 admit that women are “excluded by the other half [men] from any participation in government” (lines 1-2), and Wollstonecraft states that society’s male leaders create laws that deny women “civil and political rights” (line 86).

Choices A, B, and C are incorrect because the authors of both passages would not agree that women had the same preferences as men, required a good education, or were as happy as men.

## QUESTION 41

**Choice A is the best answer.** Wollstonecraft argues in the final paragraph of Passage 2 that society’s male leaders are like “tyrants” that deny women “civil and political rights” (lines 81-88). The authors of Passage 1 would most likely argue that allowing women these rights would be “a reversal of [society’s] primary destinies” as society’s leaders should only seek women’s interests as they pertain to the “wishes of nature,” such as women’s role as mothers (lines 18-30). The authors of Passage 1 clarify that “nature” created two sexes for a particular reason, so while men can exercise civil and political rights, women are not naturally suited to these activities (lines 30-36).

Choices B and C are incorrect because they are not supported by information in Passage 1. Choice D is incorrect because the authors of Passage 1 do not mention “natural law,” only the “wishes of nature.”

## QUESTION 42

**Choice C is the best answer.** When discussing problems with bee colonies, the authors use phrases like “we suspect” (line 19) and “we postulate” (line 21) to show they are hypothesizing reasons for bee colonies’ susceptibility to mite infestations. The use of “can,” “may,” and “could” creates a tentative tone and provides further evidence that the authors believe, but are not certain, that their hypothesis is correct.

Choices A, B, and D are incorrect because the authors’ use of “can,” “may,” and “could” does not create an optimistic, dubious, or critical tone.

## QUESTION 43

**Choice C is the best answer.** In lines 24-28, the authors hypothesize that bee colonies will be susceptible to mite infestations if they do not occasionally feed on pyrethrum producing plants. In lines 42-46, they suggest creating a trial where a “small number of commercial honey bee colonies are offered a number of pyrethrum producing plants” to test their hypothesis.

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Choices A, B, and D are incorrect because the authors do not hypothesize that honeybees' exposure to both pyrethrums and mites will cause the honeybees to develop secondary infections, that beekeepers should increase their use of insecticides, or that humans are more susceptible to varroa mites.

#### QUESTION 44

**Choice D is the best answer.** In lines 24-28, the authors provide evidence that a bee colony may be more resistant to mite infections if the bees eat pyrethrums because this diet may help prevent bees from becoming "immunocompromised or nutritionally deficient." In lines 42-50, the authors suggest testing this hypothesis in a trial on honeybees.

Choices A, B, and C do not describe any of the authors' hypotheses.

#### QUESTION 45

**Choice D is the best answer.** The authors explain that when beekeepers use commercially produced insecticides to fight mite infections, they may "further weaken" bees that are "immunocompromised or nutritionally deficient" (lines 31-35).

Choices A, B, and C are incorrect because the authors do not suggest that beekeepers' use of commercially produced insecticides increases mite populations, kills bacteria, or destroys bees' primary food source.

#### QUESTION 46

**Choice C is the best answer.** In lines 31-35, the authors provide evidence that beekeepers' use of commercially produced insecticides may cause further harm to "immunocompromised or nutritionally deficient bees."

Choices A, B, and D are incorrect because they do not provide the best evidence that beekeepers' use of commercially produced insecticides may be harmful to bees; choices A, B, and D focus on mite infestations' impact on honeybees.

#### QUESTION 47

**Choice B is the best answer.** In lines 31-35, the authors argue that beekeepers' use of insecticides to control mite infestations may be harmful to some bees. The authors then state, "We further postulate that the proper dosage necessary to prevent mite infestation may be better left to the bees" (lines 35-37). In this context, the authors "postulate," or put forth the idea that the bees may naturally control mite infestations better than insecticides.

Choices A, C, and D are incorrect because in this context, "postulate" does not mean to make an unfounded assumption, question a belief or theory, or conclude based on firm evidence.



**QUESTION 48**

**Choice B is the best answer.** In the fourth paragraph the authors propose a trial to study if honeybees' consumption of pyrethrum producing plants helps the honeybees defend against mite infestations. In the experiment, the authors plan to offer honey bee colonies both pyrethrum producing plants and "a typical bee food source such as clover" to determine if these different diets affect the bees' susceptibility to mite infestations.

Choices A, C, and D are incorrect because the main purpose of the fourth paragraph is not to summarize the results of an experiment, provide a comparative nutritional analysis, or predict an outcome of an unfinished experiment.

**QUESTION 49**

**Choice A is the best answer.** In lines 43-45, the authors propose a scientific trial in which honeybees are "offered a number of pyrethrum producing plants, as well as a typical bee food source such as clover." Since the authors contrast the "pyrethrum producing plants" with clover, a "typical bee food source," it can be assumed that clover does not produce pyrethrums.

Choice B is incorrect because it is stated in the passage. Choices C and D are incorrect because they are not assumptions made by the authors.

**QUESTION 50**

**Choice B is the best answer.** The table shows that 77 percent of the honeybee colonies with colony collapse disorder were infected by all four pathogens.

Choices A, C, and D are incorrect because they do not identify the percent of honeybee colonies with colony collapse disorder that were infected by all four pathogens as based on data in the table.

**QUESTION 51**

**Choice D is the best answer.** The table shows that 81 percent of colonies without colony collapse disorder were affected by the pathogen *Nosema ceranae*.

Choices A, B, and C are incorrect because they do not identify the pathogen that infected the highest percentage of honeybee colonies without colony collapse disorder as based on data in the table.

**QUESTION 52**

**Choice D is the best answer.** The table discusses pathogen occurrence in honeybee colonies, but it includes no information as to whether these honeybees were infected with mites. Because the table does not

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suggest mites infested the honeybee colonies, no conclusions can be made as to whether mites increased the honeybees' "susceptibility to secondary infection with fungi, bacteria or viruses" (lines 4-5).

Choices A, B, and C are incorrect because the table provides no information about whether these honeybees were infected with mites.

## Section 2: Writing and Language Test

### QUESTION 1

**Choice A is the best answer** because by providing the comparative adjective "healthier" and the word "more" to make "productive" comparative, it creates a parallel structure within the list that begins with "happier."

Choices B, C, and D are incorrect because none creates a parallel structure within the list of qualities.

### QUESTION 2

**Choice B is the best answer.** The ways in which exposure to natural light affects employees is the main subject of the passage.

Choices A, C, and D are incorrect because none introduces the topic discussed in the remainder of the passage.

### QUESTION 3

**Choice C is the best answer.** It accurately notes that the proposed sentence would be placed directly between the first mention of circadian rhythms and the explanation of the term.

Choices A, B, and D are incorrect because each misinterprets the relationship between the proposed additional text and the ideas in the paragraph.

### QUESTION 4

**Choice C is the best answer.** It provides the correct possessive construction for "body," which must be a singular noun when discussed in general terms as in this sentence. Choice C also provides the correct plural construction for "clocks."

Choices A, B, and D are incorrect because each applies either a possessive or a plural construction in a place where it doesn't belong.

### QUESTION 5

**Choice A is the best answer.** The singular verb "is" agrees with the singular noun "absenteeism."

Choices B, C, and D are incorrect because each provides a verb that either fails to agree with the singular subject "absenteeism" or introduces redundancy.

**QUESTION 6**

**Choice B is the best answer.** It contains a direct reference to productivity, the topic introduced in the previous sentence.

Choices A, C, and D are incorrect because none directly addresses employee productivity, the primary subject of the previous sentence.

**QUESTION 7**

**Choice A is the best answer.** It opens with a reference to lowered worker productivity, creating a transition from the previous paragraph, and clearly positions the high energy costs of artificial light sources as an additional disadvantage.

Choices B, C, and D are incorrect because none of the choices offers an adequate transition from the previous paragraph: Each awkwardly inserts the issue of lower worker productivity into a statement about the high energy costs of artificial light sources.

**QUESTION 8**

**Choice D is the best answer.** The word “annual” is adequate to communicate that the savings occurred every year.

Choices A, B, and C are incorrect because each proposes an option that would result in a redundancy with “annual.”

**QUESTION 9**

**Choice C is the best answer.** It provides a transitional adverb that accurately communicates that this sentence describes an option that companies could choose (“light tubes”) instead of the option described in the previous sentence (“full-pane windows”).

Choices A, B, and D are incorrect because each proposes a transitional adverb that does not accurately reflect the relationship between this sentence and the one preceding it.

**QUESTION 10**

**Choice C is the best answer.** It provides the correct relative pronoun to correspond with the plural referent “light tubes” and the correct verb to introduce the definition that follows.

Choices A, B, and D are incorrect because each offers a pronoun inappropriate for opening a dependent clause defining “light tubes.”

**QUESTION 11**

**Choice B is the best answer.** The preposition “of” idiomatically follows the noun “means,” particularly as a way to connect it to another noun or verb.

Choices A, C, and D are incorrect because each results in nonstandard phrasing with “means.”

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## QUESTION 12

**Choice A is the best answer.** The plural reflexive pronoun “themselves” corresponds with the plural noun “settlers.”

Choices B, C, and D are incorrect because each provides either a nonstandard phrase or a singular pronoun that does not correspond with “settlers.”

## QUESTION 13

**Choice C is the best answer.** It creates a transition from the poor food quality mentioned in the previous sentence to the information about Harvey in the remainder of the sentence.

Choices A, B, and D are incorrect because none offers a transition from the previous sentence or a detail that corresponds precisely with the information in the remainder of the sentence.

## QUESTION 14

**Choice D is the best answer.** It correctly provides a comma to close the modifying clause “an English-born entrepreneur,” which opens with a comma.

Choices A, B, and C are incorrect because each proposes punctuation that creates an inappropriately strong separation between the subject “Fred Harvey” and the verb “decided.”

## QUESTION 15

**Choice B is the best answer.** It provides the plural verb and plural possessive pronoun that grammatically correspond to the plural referent “Harvey Houses.”

Choices A, C, and D are incorrect because each either fails to provide a verb that corresponds with the plural referent “Harvey Houses” or fails to provide the appropriate possessive pronoun.

## QUESTION 16

**Choice C is the best answer.** It accurately echoes an earlier characterization of the food as being of “terrible quality,” while maintaining the established tone of the passage.

Choices A, B, and D are incorrect either because the word is less formal than the established tone of the passage (“icky”) or because it illogically attributes agency to food (“sinister,” “surly”).

## QUESTION 17

**Choice C is the best answer.** It accurately interprets “not content to follow conventional business practices” as logically introducing the new practice of “employing women” described in the following sentences.

Choices A, B, and D are incorrect because none recognizes why the sentence is relevant to this particular location in the passage.

### QUESTION 18

**Choice B is the best answer.** It is concise and free of redundancies.

Choices A, C, and D are incorrect because each pairs “overwhelming” and “tremendous,” adjectives so close in meaning that together they present a redundancy.

### QUESTION 19

**Choice D is the best answer.** It contains the pronoun “they,” a necessary reference to “such regulations” in the previous clause.

Choices A, B, and C are incorrect because each lacks a necessary subject, such as a pronoun or noun.

### QUESTION 20

**Choice C is the best answer.** It refers directly to benefits for the restaurants’ female employees, the subject of the previous sentence.

Choices A, B, and D are incorrect because none logically builds upon the sentence that precedes it.

### QUESTION 21

**Choice D is the best answer.** It provides punctuation that indicates that the opening dependent clause modifies the subject “Harvey Girls.”

Choices A, B, and C are incorrect because each uses the punctuation for a dependent clause (“Living independently and demonstrating an intense work ethic”) as if it were an independent clause.

### QUESTION 22

**Choice A is the best answer.** It recognizes that the new information supports the previous sentence’s claim that “the Harvey Girls became known as a transformative force.”

Choices B, C, and D are incorrect because each misinterprets the relationship between the proposed text and the passage.

### QUESTION 23

**Choice A is the best answer.** It opens with a clause that identifies how 1-MCP affects apples, which focuses the sentence on 1-MCP as the subject and allows the ideas in the sentence to progress logically.

Choices B, C, and D are incorrect because each displays awkward or flawed modification and progression of ideas or creates redundancy.

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### QUESTION 24

**Choice D is the best answer.** Only the comma is necessary to separate “ethylene” from the appositive noun phrase that defines it.

Choices A, B, and C are incorrect because each creates a comma splice and/or adds unnecessary words.

### QUESTION 25

**Choice B is the best answer.** It offers an adjective that accurately describes fresh apples.

Choices A, C, and D are incorrect because each proposes an adjective that does not describe a plausible fruit texture.

### QUESTION 26

**Choice A is the best answer.** The plural possessive pronoun “their” corresponds with the plural referent “apples.”

Choices B, C, and D are incorrect because none provides a pronoun that is both possessive and plural.

### QUESTION 27

**Choice D is the best answer.** It provides the pronoun “who,” which accurately identifies the referent “consumers” as people and appropriately begins the relative clause.

Choices A, B, and C are incorrect because each contains a pronoun that either does not correspond with the human referent “consumers” or does not correctly begin the relative clause.

### QUESTION 28

**Choice B is the best answer.** It provides the present tense verb “do,” which corresponds to the present tense established earlier in the sentence.

Choices A, C, and D are incorrect because each contains a verb that deviates from the simple present tense established in the sentence.

### QUESTION 29

**Choice B is the best answer.** It provides a colon to appropriately introduce the clause that follows, an elaboration on the preceding claim that Bartlett pears are an example of fruit that “do not respond as well to 1-MCP treatment.”

Choices A, C, and D are incorrect because each either creates a comma splice or uses a transitional phrase (“For instance”) illogically.

**QUESTION 30**

**Choice B is the best answer.** Sentence 4 begins with “But,” indicating a contrast with a previous idea, and goes on to mention that 1-MCP can have negative effects. Sentence 1 continues the discussion of benefits of 1-MCP, and sentence 2 names the adverse effect of limiting scent production, so the most logical spot for sentence 4 is between these sentences.

Choices A, C, and D are incorrect because each proposes placing the sentence at a point where it would compromise the logical development of ideas in the paragraph.

**QUESTION 31**

**Choice D is the best answer.** It most accurately reflects the data in the graph, which shows a steep decrease in percentage of flesh browning when untreated apples are left in the open air for three weeks rather than placed immediately into a controlled atmosphere.

Choices A, B, and C are incorrect because each presents an inaccurate interpretation of the data in the graph.

**QUESTION 32**

**Choice B is the best answer.** It accurately interprets the data as indicating that “roughly half of their flesh turns brown” when apples are treated with 1-MCP: both bars representing 1-MCP treatment are near the 50% line.

Choices A, C, and D are incorrect because each proposes an inaccurate interpretation of the data.

**QUESTION 33**

**Choice C is the best answer.** It describes an action, weighing the relative values, that fruit sellers must take as a result of 1-MCP’s limitations.

Choices A, B, and D are incorrect because none specifically connects the shortcomings of 1-MCP with any action on the part of fruit sellers.

**QUESTION 34**

**Choice D is the best answer.** It clearly communicates that the preceding dependent clause modifies “works by human artists.”

Choices A, B, and C are incorrect because each fails to link the preceding dependent clause to an independent clause, resulting in an incomplete sentence.

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### QUESTION 35

**Choice B is the best answer.** It provides the necessary em dash to close the aside about artist C.M. Coolidge, which opens with an em dash.

Choices A, C, and D are incorrect because each provides closing punctuation for the aside that does not correspond with the opening punctuation.

### QUESTION 36

**Choice C is the best answer.** The plural verb “portray” corresponds with the plural noun “works of art.”

Choices A, B, and D are incorrect because none provides the plural verb in the present tense that the sentence requires.

### QUESTION 37

**Choice D is the best answer.** It names a “museum in Russia,” which is the subject of the next paragraph.

Choices A, B, and C are incorrect because each provides an overly general phrase that does not specifically link to the paragraph that follows.

### QUESTION 38

**Choice C is the best answer.** It creates parallelism with the verb “could damage” that appears earlier in the clause (“rodents that could damage . . . [and could] scare off visitors”).

Choices A, B, and D are incorrect because each presents a verb tense that is inconsistent with the sentence’s other present tense verb (“could damage”) that shares “mice, rats, and other rodents” as its subject.

### QUESTION 39

**Choice C is the best answer.** Sentence 5, which discusses Peter the Great’s daughter continuing his tradition, most logically follows the sentence about Peter the Great.

Choices A, B, and D are incorrect because each presents a placement that would compromise the logical development of the paragraph.

### QUESTION 40

**Choice B is the best answer.** “Commissioned” describes the act of hiring an artist to create a specific work.

Choices A, C, and D are incorrect because each provides a word that does not correspond logically with the context.



**QUESTION 41**

**Choice D is the best answer.** It provides punctuation that clearly places the noun phrase “digital artist Eldar Zakirov” as an appositive identifying the person mentioned in the previous phrase, “The person chosen for this task.”

Choices A, B, and C are incorrect because each fails to open and close the uninterrupted appositive noun phrase “digital artist Eldar Zakirov” with commas.

**QUESTION 42**

**Choice A is the best answer.** The phrase “noble individuals” corresponds with the subsequent examples of portraits where the cats are depicted as “aristocratic,” “stately,” and like a “trusted royal advisor.”

Choices B, C, and D are incorrect because each provides a statement that does not logically connect to the examples that follow.

**QUESTION 43**

**Choice D is the best answer.** It accurately states that the information in the proposed additional sentence is not related to formal portraits of cats, the main topic of the paragraph.

Choices A, B, and C are incorrect because each fails to recognize that the proposed sentence interrupts the logical development of the paragraph.

**QUESTION 44**

**Choice D is the best answer.** The tone corresponds with that established in the passage, and the phrasing appropriately focuses on the cats’ contribution to protecting artwork rather than on simply killing rodents.

Choices A, B, and C are incorrect because none makes explicit the link between the cats’ hunting activities and the service to the museum.

**Section 3: Math Test – No Calculator****QUESTION 1**

**Choice C is correct.** The painter’s fee is given by  $nK\ell h$ , where  $n$  is the number of walls,  $K$  is a constant with units of dollars per square foot,  $\ell$  is the length of each wall in feet, and  $h$  is the height of each wall in feet. Examining this equation shows that  $\ell$  and  $h$  will be used to determine the area of each wall. The variable  $n$  is the number of walls, so  $n$  times the area of each wall will give the amount of area that will need to be painted. The only remaining variable is  $K$ , which represents

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the cost per square foot and is determined by the painter's time and the price of paint. Therefore,  $K$  is the only factor that will change if the customer asks for a more expensive brand of paint.

Choice A is incorrect because a more expensive brand of paint would not cause the height of each wall to change. Choice B is incorrect because a more expensive brand of paint would not cause the length of each wall to change. Choice D is incorrect because a more expensive brand of paint would not cause the number of walls to change.

## QUESTION 2

**Choice D is correct.** Dividing each side of the equation  $3r = 18$  by 3 gives  $r = 6$ . Substituting 6 for  $r$  in the expression  $6r + 3$  gives  $6(6) + 3 = 39$ .

Alternatively, the expression  $6r + 3$  can be rewritten as  $2(3r) + 3$ . Substituting 18 for  $3r$  in the expression  $2(3r) + 3$  yields  $2(18) + 3$ , or  $36 + 3 = 39$ .

Choice A is incorrect because 6 is the value of  $r$ ; however, the question asks for the value of the expression  $6r + 3$ . Choices B and C are incorrect because if  $6r + 3$  were equal to either of these values, then it would not be possible for  $3r$  to be equal to 18, as stated in the question.

## QUESTION 3

**Choice D is correct.** By definition,  $a^{\frac{m}{n}} = \sqrt[n]{a^m}$  for any positive integers  $m$  and  $n$ . It follows, therefore, that  $a^{\frac{2}{3}} = \sqrt[3]{a^2}$ .

Choice A is incorrect. By definition,  $a^{\frac{1}{n}} = \sqrt[n]{a}$  for any positive integer  $n$ . Applying this definition as well as the power property of exponents to the expression  $\sqrt{a^{\frac{1}{3}}}$  yields  $\sqrt{a^{\frac{1}{3}}} = \left(a^{\frac{1}{3}}\right)^{\frac{1}{2}} = a^{\frac{1}{6}}$ . Because  $a^{\frac{1}{6}} \neq a^{\frac{2}{3}}$ ,  $\sqrt{a^{\frac{1}{3}}}$  is not the correct answer. Choice B is incorrect. By definition,  $a^{\frac{1}{n}} = \sqrt[n]{a}$  for any positive integer  $n$ . Applying this definition as well as the power property of exponents to the expression  $\sqrt{a^3}$  yields  $\sqrt{a^3} = \left(a^3\right)^{\frac{1}{2}} = a^{\frac{3}{2}}$ . Because  $a^{\frac{3}{2}} \neq a^{\frac{2}{3}}$ ,  $\sqrt{a^3}$  is not the correct answer. Choice C is incorrect.

By definition,  $a^{\frac{1}{n}} = \sqrt[n]{a}$  for any positive integer  $n$ . Applying this definition as well as the power property of exponents to the expression  $\sqrt[3]{a^{\frac{1}{2}}}$  yields  $\sqrt[3]{a^{\frac{1}{2}}} = \left(a^{\frac{1}{2}}\right)^{\frac{1}{3}} = a^{\frac{1}{6}}$ . Because  $a^{\frac{1}{6}} \neq a^{\frac{2}{3}}$ ,  $\sqrt[3]{a^{\frac{1}{2}}}$  is not the correct answer.

## QUESTION 4

**Choice B is correct.** To fit the scenario described, 30 must be twice as large as  $x$ . This can be written as  $2x = 30$ .

Choices A, C, and D are incorrect. These equations do not correctly relate the numbers and variables described in the stem. For example, the expression in choice C states that 30 is half as large as  $x$ , not twice as large as  $x$ .

**QUESTION 5**

**Choice C is correct.** Multiplying each side of  $\frac{5}{x} = \frac{15}{x+20}$  by  $x(x+20)$  gives  $5(x+20) = 15x$ . Using the distributive property to eliminate the parentheses yields  $5x + 100 = 15x$ , and then subtracting  $5x$  from each side of the equation  $5x + 100 = 15x$  gives  $100 = 10x$ . Finally, dividing both sides of the equation  $100 = 10x$  by  $10$  gives  $10 = x$ . Therefore, the value of  $\frac{x}{5}$  is  $\frac{10}{5} = 2$ .

Choice A is incorrect because it is the value of  $x$ , not  $\frac{x}{5}$ . Choices B and D are incorrect and may be the result of errors in arithmetic operations on the given equation.

**QUESTION 6**

**Choice C is correct.** Multiplying each side of the equation  $2x - 3y = -14$  by  $3$  gives  $6x - 9y = -42$ . Multiplying each side of the equation  $3x - 2y = -6$  by  $2$  gives  $6x - 4y = -12$ . Then, subtracting the sides of  $6x - 4y = -12$  from the corresponding sides of  $6x - 9y = -42$  gives  $-5y = -30$ . Dividing each side of the equation  $-5y = -30$  by  $-5$  gives  $y = 6$ . Finally, substituting  $6$  for  $y$  in  $2x - 3y = -14$  gives  $2x - 3(6) = -14$ , or  $x = 2$ . Therefore, the value of  $x - y$  is  $2 - 6 = -4$ .

Alternatively, adding the corresponding sides of  $2x - 3y = -14$  and  $3x - 2y = -6$  gives  $5x - 5y = -20$ , from which it follows that  $x - y = -4$ .

Choices A and B are incorrect and may be the result of an arithmetic error when solving the system of equations. Choice D is incorrect and may be the result of finding  $x + y$  instead of  $x - y$ .

**QUESTION 7**

**Choice C is correct.** If  $x - b$  is a factor of  $f(x)$ , then  $f(b)$  must equal  $0$ . Based on the table,  $f(4) = 0$ . Therefore,  $x - 4$  must be a factor of  $f(x)$ .

Choice A is incorrect because  $f(2) \neq 0$ . Choice B is incorrect because no information is given about the value of  $f(3)$ , so  $x - 3$  may or may not be a factor of  $f(x)$ . Choice D is incorrect because  $f(5) \neq 0$ .

**QUESTION 8**

**Choice A is correct.** The linear equation  $y = kx + 4$  is in slope-intercept form, and so the slope of the line is  $k$ . Since the line contains the point  $(c, d)$ , the coordinates of this point satisfy the equation  $y = kx + 4$ ; therefore,  $d = kc + 4$ . Solving this equation for the slope,  $k$ , gives  $k = \frac{d-4}{c}$ .

Choices B, C, and D are incorrect and may be the result of errors in substituting the coordinates of  $(c, d)$  in  $y = kx + 4$  or of errors in solving for  $k$  in the resulting equation.

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## QUESTION 9

**Choice A is correct.** If a system of two linear equations has no solution, then the lines represented by the equations in the coordinate plane are parallel. The equation  $kx - 3y = 4$  can be rewritten as  $y = \frac{k}{3}x - \frac{4}{3}$ , where  $\frac{k}{3}$  is the slope of the line, and the equation  $4x - 5y = 7$  can be rewritten as  $y = \frac{4}{5}x - \frac{7}{5}$ , where  $\frac{4}{5}$  is the slope of the line. If two lines are parallel, then the slopes of the line are equal. Therefore,  $\frac{4}{5} = \frac{k}{3}$ , or  $k = \frac{12}{5}$ . (Since the  $y$ -intercepts of the lines represented by the equations are  $-\frac{4}{3}$  and  $-\frac{7}{5}$ , the lines are parallel, not identical.)

Choices B, C, and D are incorrect and may be the result of a computational error when rewriting the equations or solving the equation representing the equality of the slopes for  $k$ .

## QUESTION 10

**Choice A is correct.** Substituting 25 for  $y$  in the equation  $y = (x - 11)^2$  gives  $25 = (x - 11)^2$ . It follows that  $x - 11 = 5$  or  $x - 11 = -5$ , so the  $x$ -coordinates of the two points of intersection are  $x = 16$  and  $x = 6$ , respectively. Since both points of intersection have a  $y$ -coordinate of 25, it follows that the two points are  $(16, 25)$  and  $(6, 25)$ . Since these points lie on the horizontal line  $y = 25$ , the distance between these points is the positive difference of the  $x$ -coordinates:  $16 - 6 = 10$ .

Alternatively, since a translation is a rigid motion, the distance between points  $A$  and  $B$  would be the same as the distance between the points of intersection of the line  $y = 25$  and the parabola  $y = x^2$ . Since those graphs intersect at  $(0, 5)$  and  $(0, -5)$ , the distance between the two points, and thus the distance between  $A$  and  $B$ , is 10.

Choices B, C, and D are incorrect and may be the result of an error in solving the quadratic equation that results when substituting 25 for  $y$  in the given quadratic equation.

## QUESTION 11

**Choice B is correct.** Since the angles marked  $y^\circ$  and  $u^\circ$  are vertical angles,  $y = u$ . Substituting  $y$  for  $u$  in the equation  $x + y = u + w$  gives  $x = w$ . Since the angles marked  $w^\circ$  and  $z^\circ$  are vertical angles,  $w = z$ . Therefore, by the transitive property,  $x = z$ , and so I must be true.

The equation in II need not be true. For example, if  $x = w = z = t = 70$  and  $y = u = 40$ , then all three pairs of vertical angles in the figure have equal measure and the given condition  $x + y = u + w$  holds. But it is not true in this case that  $y$  is equal to  $w$ . Therefore, II need not be true.

Since the top three angles in the figure form a straight angle, it follows that  $x + y + z = 180$ . Similarly,  $w + u + t = 180$ , and so  $x + y + z = w + u + t$ . Subtracting the sides of the given equation  $x + y = u + w$  from the corresponding sides of  $x + y + z = w + u + t$  gives  $z = t$ . Therefore, III must be true. Since only I and III must be true, the correct answer is choice B.

Choices A, C, and D are incorrect because each of these choices includes II, which need not be true.

### QUESTION 12

**Choice A is correct.** The parabola with equation  $y = a(x - 2)(x + 4)$  crosses the  $x$ -axis at the points  $(-4, 0)$  and  $(2, 0)$ . By symmetry, the  $x$ -coordinate of the vertex of the parabola is halfway between the  $x$ -coordinates of  $(-4, 0)$  and  $(2, 0)$ . Thus, the  $x$ -coordinate of the vertex is  $\frac{-4 + 2}{2} = -1$ . This is the value of  $c$ . To find the  $y$ -coordinate of the vertex, substitute  $-1$  for  $x$  in  $y = a(x - 2)(x + 4)$ :

$$y = a(x - 2)(x + 4) = a(-1 - 2)(-1 + 4) = a(-3)(3) = -9a$$

Therefore, the value of  $d$  is  $-9a$ .

Choice B is incorrect because the value of the constant term in the equation is not the  $y$ -coordinate of the vertex, unless there were no linear terms in the quadratic. Choice C is incorrect and may be the result of a sign error in finding the  $x$ -coordinate of the vertex. Choice D is incorrect because the negative of the coefficient of the linear term in the quadratic equation is not the  $y$ -coordinate of the vertex.

### QUESTION 13

**Choice B is correct.** Since  $24x^2 + 25x - 47$  divided by  $ax - 2$  is equal to  $-8x - 3$  with remainder  $-53$ , it is true that  $(-8x - 3)(ax - 2) - 53 = 24x^2 + 25x - 47$ . (This can be seen by multiplying each side of the given equation by  $ax - 2$ .) This can be rewritten as  $-8ax^2 + 16x - 3ax + 6 - 53 = 24x^2 + 25x - 47$ . Since the coefficients of the  $x^2$ -term have to be equal on both sides of the equation,  $-8a = 24$ , or  $a = -3$ .

Choices A, C, and D are incorrect and may be the result of either a conceptual misunderstanding or a computational error when trying to solve for the value of  $a$ .

### QUESTION 14

**Choice A is correct.** Dividing each side of the given equation by 3 gives the equivalent equation  $x^2 + 4x + 2 = 0$ . Then using the quadratic

formula,  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  with  $a = 1$ ,  $b = 4$ , and  $c = 2$ , gives the solutions  $x = -2 \pm \sqrt{2}$ .

Choices B, C, and D are incorrect and may be the result of errors when applying the quadratic formula.

### QUESTION 15

**Choice D is correct.** If  $C$  is graphed against  $F$ , the slope of the line is equal to  $\frac{5}{9}$  degrees Celsius/degrees Fahrenheit, which means that for an increase of 1 degree Fahrenheit, the increase is  $\frac{5}{9}$  of 1 degree Celsius. Thus, statement I is true. This is the equivalent to saying that an increase of 1 degree Celsius is equal to an increase of  $\frac{9}{5}$  degrees Fahrenheit.

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Since  $\frac{9}{5} = 1.8$ , statement II is true. On the other hand, statement III is not true, since a temperature increase of  $\frac{9}{5}$  degrees Fahrenheit, not  $\frac{5}{9}$  degree Fahrenheit, is equal to a temperature increase of 1 degree Celsius.

Choices A, B, and C are incorrect because each of these choices omits a true statement or includes a false statement.

### QUESTION 16

**The correct answer is either 1 or 2.** The given equation can be rewritten as  $x^5 - 5x^3 + 4x = 0$ . Since the polynomial expression on the left has no constant term, it has  $x$  as a factor:  $x(x^4 - 5x^2 + 4) = 0$ . The expression in parentheses is a quadratic equation in  $x^2$  that can be factored, giving  $x(x^2 - 1)(x^2 - 4) = 0$ . This further factors as  $x(x - 1)(x + 1)(x - 2)(x + 2) = 0$ . The solutions for  $x$  are  $x = 0$ ,  $x = 1$ ,  $x = -1$ ,  $x = 2$ , and  $x = -2$ . Since it is given that  $x > 0$ , the possible values of  $x$  are  $x = 1$  and  $x = 2$ . Either 1 or 2 may be gridded as the correct answer.

### QUESTION 17

**The correct answer is 2.** First, clear the fractions from the given equation by multiplying each side of the equation by 36 (the least common multiple of 4, 9, and 12). The equation becomes  $28x - 16x = 9 + 15$ . Combining like terms on each side of the equation yields  $12x = 24$ . Finally, dividing both sides of the equation by 12 yields  $x = 2$ .

Alternatively, since  $\frac{7}{9}x - \frac{4}{9}x = \frac{3}{9}x = \frac{1}{3}x$  and  $\frac{1}{4} + \frac{5}{12} = \frac{3}{12} + \frac{5}{12} = \frac{8}{12} = \frac{2}{3}$ , the given equation simplifies to  $\frac{1}{3}x = \frac{2}{3}$ . Multiplying each side of  $\frac{1}{3}x = \frac{2}{3}$  by 3 yields  $x = 2$ .

### QUESTION 18

**The correct answer is 105.** Since  $180 - z = 2y$  and  $y = 75$ , it follows that  $180 - z = 150$ , and so  $z = 30$ . Thus, each of the base angles of the isosceles triangle on the right has measure  $\frac{180^\circ - 30^\circ}{2} = 75^\circ$ . Therefore, the measure of the angle marked  $x^\circ$  is  $180^\circ - 75^\circ = 105^\circ$ , and so the value of  $x$  is 105.

### QUESTION 19

**The correct answer is 370.** A system of equations can be used where  $h$  represents the number of calories in a hamburger and  $f$  represents the number of calories in an order of fries. The equation  $2h + 3f = 1700$  represents the fact that 2 hamburgers and 3 orders of fries contain a total of 1700 calories, and the equation  $h = f + 50$  represents the fact

that one hamburger contains 50 more calories than an order of fries. Substituting  $f + 50$  for  $h$  in  $2h + 3f = 1700$  gives  $2(f + 50) + 3f = 1700$ . This equation can be solved as follows:

$$\begin{aligned} 2f + 100 + 3f &= 1700 \\ 5f + 100 &= 1700 \\ 5f &= 1600 \\ f &= 320 \end{aligned}$$

The number of calories in an order of fries is 320, so the number of calories in a hamburger is 50 more than 320, or 370.

## QUESTION 20

**The correct answer is  $\frac{3}{5}$  or .6.** Triangle  $ABC$  is a right triangle with its right angle at  $B$ . Thus,  $\overline{AC}$  is the hypotenuse of right triangle  $ABC$ , and  $\overline{AB}$  and  $\overline{BC}$  are the legs of right triangle  $ABC$ . By the Pythagorean theorem,  $AB = \sqrt{20^2 - 16^2} = \sqrt{400 - 256} = \sqrt{144} = 12$ . Since triangle  $DEF$  is similar to triangle  $ABC$ , with vertex  $F$  corresponding to vertex  $C$ , the measure of angle  $F$  equals the measure of angle  $C$ . Thus,  $\sin F = \sin C$ . From the side lengths of triangle  $ABC$ ,  $\sin C = \frac{\text{opposite side}}{\text{hypotenuse}} = \frac{AB}{AC} = \frac{12}{20} = \frac{3}{5}$ . Therefore,  $\sin F = \frac{3}{5}$ . Either  $\frac{3}{5}$  or its decimal equivalent, .6, may be gridded as the correct answer.

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice C is correct.** Marilyn's distance from her campsite remained the same during the time she ate lunch. This is represented by a horizontal segment in the graph. The only horizontal segment in the graph starts at a time of about 1:10 P.M. and ends at about 1:40 P.M. Therefore, Marilyn finished her lunch and continued her hike at about 1:40 P.M.

Choices A, B, and D are incorrect and may be the result of a misinterpretation of the graph. For example, choice B is the time Marilyn started her lunch, and choice D is the time Marilyn was at the maximum distance from her campsite.

### QUESTION 2

**Choice B is correct.** Of the 25 people who entered the contest, there are 8 females under age 40 and 2 males age 40 or older. Because there is no overlap in the categories, the probability that the contest winner will be either a female under age 40 or a male age 40 or older is

$$\frac{8}{25} + \frac{2}{25} = \frac{10}{25}.$$

Choice A is incorrect and may be the result of dividing 8 by 2, instead of adding 8 to 2, to find the probability. Choice C is incorrect; it is the probability that the contest winner will be either a female under

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age 40 or a female age 40 or older. Choice D is incorrect and may be the result of multiplying 8 and 2, instead of adding 8 and 2, to find the probability.

### QUESTION 3

**Choice C is correct.** Based on the graph, sales increased in the first 3 years since 1997, which is until year 2000, and then generally decreased thereafter.

Choices A, B, and D are incorrect; each of these choices contains inaccuracies in describing the general trend of music album sales from 1997 through 2009.

### QUESTION 4

**Choice C is correct.** The graph of  $y = f(n)$  in the coordinate plane is a line that passes through each of the points given in the table. From the table, one can see that an increase of 1 unit in  $n$  results in an increase of 3 units in  $f(n)$ ; for example,  $f(2) - f(1) = 1 - (-2) = 3$ . Therefore, the graph of  $y = f(n)$  in the coordinate plane is a line with slope 3. Only choice C is a line with slope 3. The  $y$ -intercept of the line is the value of  $f(0)$ . Since an increase of 1 unit in  $n$  results in an increase of 3 units in  $f(n)$ , it follows that  $f(1) - f(0) = 3$ . Since  $f(1) = -2$ , it follows that  $f(0) = f(1) - 3 = -5$ . Therefore, the  $y$ -intercept of the graph of  $f(n)$  is  $-5$ , and the equation in slope-intercept form that defined  $f$  is  $f(n) = 3n - 5$ .

Choices A, B, and D are incorrect because each equation has the incorrect slope of the line (the  $y$ -intercept in each equation is also incorrect).

### QUESTION 5

**Choice B is correct.** Since 7 percent of the 562 juniors is  $0.07(562)$  and 5 percent of the 602 seniors is  $0.05(602)$ , the expression  $0.07(562) + 0.05(602)$  can be evaluated to determine the total number of juniors and seniors inducted into the National Honor Society. Of the given choices, 69 is closest to the value of the expression.

Choice A is incorrect and may be the result of adding the number of juniors and seniors and the percentages given and then using the expression  $(0.07 + 0.05)(562 + 602)$ . Choices C and D are incorrect and may be the result of finding either only the number of juniors inducted or only the number of seniors inducted.

### QUESTION 6

**Choice A is correct.** The sum of the two polynomials is  $(3x^2 - 5x + 2) + (5x^2 - 2x - 6)$ . This can be rewritten by combining like terms:

$$(3x^2 - 5x + 2) + (5x^2 - 2x - 6) = (3x^2 + 5x^2) + (-5x - 2x) + (2 - 6) = 8x^2 - 7x - 4$$



Choice B is incorrect and may be the result of a sign error when combining the coefficients of the  $x$ -term. Choice C is incorrect and may be the result of adding the exponents, as well as the coefficients, of like terms. Choice D is incorrect and may be the result of a combination of the errors described in choice B and choice C.

### QUESTION 7

**Choice D is correct.** To solve the equation for  $w$ , multiply both sides of the equation by the reciprocal of  $\frac{3}{5}$ , which is  $\frac{5}{3}$ . This gives  $\left(\frac{5}{3}\right) \cdot \frac{3}{5} w = \frac{4}{3} \cdot \left(\frac{5}{3}\right)$ , which simplifies to  $w = \frac{20}{9}$ .

Choices A, B, and C are incorrect and may be the result of errors in arithmetic when simplifying the given equation.

### QUESTION 8

**Choice C is correct.** In the equation  $y = 0.56x + 27.2$ , the value of  $x$  increases by 1 for each year that passes. Each time  $x$  increases by 1,  $y$  increases by 0.56 since 0.56 is the slope of the graph of this equation. Since  $y$  represents the average number of students per classroom in the year represented by  $x$ , it follows that, according to the model, the estimated increase each year in the average number of students per classroom at Central High School is 0.56.

Choice A is incorrect because the total number of students in the school in 2000 is the product of the average number of students per classroom and the total number of classrooms, which would appropriately be approximated by the  $y$ -intercept (27.2) times the total number of classrooms, which is not given. Choice B is incorrect because the average number of students per classroom in 2000 is given by the  $y$ -intercept of the graph of the equation, but the question is asking for the meaning of the number 0.56, which is the slope. Choice D is incorrect because 0.56 represents the estimated yearly change in the average number of students per classroom. The estimated difference between the average number of students per classroom in 2010 and 2000 is 0.56 times the number of years that have passed between 2000 and 2010, that is,  $0.56 \times 10 = 5.6$ .

### QUESTION 9

**Choice B is correct.** Because Nate walks 25 meters in 13.7 seconds, and 4 minutes is equal to 240 seconds, the proportion

$\frac{25 \text{ meters}}{13.7 \text{ sec}} = \frac{x \text{ meters}}{240 \text{ sec}}$  can be used to find out how many meters,  $x$ ,

Nate walks in 4 minutes. The proportion can be simplified to

$\frac{25}{13.7} = \frac{x}{240}$ , because the units of meters per second cancel,

and then each side of the equation can be multiplied by 240,

giving  $\frac{(240)(25)}{13.7} = x \approx 438$ . Therefore, of the given options, 450 meters

is closest to the distance Nate will walk in 4 minutes.

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Choice A is incorrect and may be the result of setting up the proportion as  $\frac{13.7 \text{ sec}}{25 \text{ meters}} = \frac{x \text{ meters}}{240 \text{ sec}}$  and finding that  $x \approx 132$ , which is close to 150. Choices C and D are incorrect and may be the result of errors in calculation.

### QUESTION 10

**Choice D is correct.** On Mercury, the acceleration due to gravity is  $3.6 \text{ m/sec}^2$ . Substituting 3.6 for  $g$  and 90 for  $m$  in the formula  $W = mg$  gives  $W = 90(3.6) = 324$  newtons.

Choice A is incorrect and may be the result of dividing 90 by 3.6. Choice B is incorrect and may be the result of subtracting 3.6 from 90 and rounding to the nearest whole number. Choice C is incorrect because an object with a weight of 101 newtons on Mercury would have a mass of about 28 kilograms, not 90 kilograms.

### QUESTION 11

**Choice B is correct.** On Earth, the acceleration due to gravity is  $9.8 \text{ m/sec}^2$ . Thus, for an object with a weight of 150 newtons, the formula  $W = mg$  becomes  $150 = m(9.8)$ , which shows that the mass of an object with a weight of 150 newtons on Earth is about 15.3 kilograms. Substituting this mass into the formula  $W = mg$  and now using the weight of 170 newtons gives  $170 = 15.3g$ , which shows that the second planet's acceleration due to gravity is about  $11.1 \text{ m/sec}^2$ . According to the table, this value for the acceleration due to gravity holds on Saturn.

Choices A, C, and D are incorrect. Using the formula  $W = mg$  and the values for  $g$  in the table shows that an object with a weight of 170 newtons on these planets would not have the same mass as an object with a weight of 150 newtons on Earth.

### QUESTION 12

**Choice D is correct.** A zero of a function corresponds to an  $x$ -intercept of the graph of the function in the  $xy$ -plane. Therefore, the complete graph of the function  $f$ , which has five distinct zeros, must have five  $x$ -intercepts. Only the graph in choice D has five  $x$ -intercepts, and therefore, this is the only one of the given graphs that could be the complete graph of  $f$  in the  $xy$ -plane.

Choices A, B, and C are incorrect. The number of  $x$ -intercepts of each of these graphs is not equal to five; therefore, none of these graphs could be the complete graph of  $f$ , which has five distinct zeros.

### QUESTION 13

**Choice D is correct.** Starting with the original equation,  $h = -16t^2 + vt + k$ , in order to get  $v$  in terms of the other variables,  $-16t^2$  and  $k$  need to be subtracted from each side. This yields  $vt = h + 16t^2 - k$ , which when

divided by  $t$  will give  $v$  in terms of the other variables. However, the equation  $v = \frac{h + 16t^2 - k}{t}$  is not one of the options, so the right side needs to be further simplified. Another way to write the previous equation is  $v = \frac{h - k}{t} + \frac{16t^2}{t}$ , which can be simplified to  $v = \frac{h - k}{t} + 16t$ . Choices A, B, and C are incorrect and may be the result of arithmetic errors when rewriting the original equation to express  $v$  in terms of  $h$ ,  $t$ , and  $k$ .

### QUESTION 14

**Choice A is correct.** The hotel charges \$0.20 per minute to use the meeting-room phone. This per-minute rate can be converted to the hourly rate using the conversion 1 hour = 60 minutes, as shown below.

$$\frac{\$0.20}{\text{minute}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = \frac{\$(0.20 \times 60)}{\text{hour}}$$

Thus, the hotel charges  $\$(0.20 \times 60)$  per hour to use the meeting-room phone. Therefore, the cost  $c$ , in dollars, for  $h$  hours of use is  $c = (0.20 \times 60)h$ , which is equivalent to  $c = 0.20(60h)$ .

Choice B is incorrect because in this expression the per-minute rate is multiplied by  $h$ , the number of hours of phone use. Furthermore, the equation indicates that there is a flat fee of \$60 in addition to the per-minute or per-hour rate. This is not the case. Choice C is incorrect because the expression indicates that the hotel charges  $\$\left(\frac{60}{0.20}\right)$  per hour for use of the meeting-room phone, not  $\$0.20(60)$  per hour. Choice D is incorrect because the expression indicates that the hourly rate is  $\frac{1}{60}$  times the per-minute rate, not 60 times the per-minute rate.

### QUESTION 15

**Choice A is the correct answer.** Experimental research is a method used to study a small group of people and generalize the results to a larger population. However, in order to make a generalization involving cause and effect:

- The population must be well defined.
- The participants must be selected at random.
- The participants must be randomly assigned to treatment groups.

When these conditions are met, the results of the study can be generalized to the population with a conclusion about cause and effect. In this study, all conditions are met and the population from which the participants were selected are people with poor eyesight. Therefore, a general conclusion can be drawn about the effect of Treatment X on the population of people with poor eyesight.

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Choice B is incorrect. The study did not include all available treatments, so no conclusion can be made about the relative effectiveness of all available treatments. Choice C is incorrect. The participants were selected at random from a large population of people with poor eyesight. Therefore, the results can be generalized only to that population and not to anyone in general. Also, the conclusion is too strong: an experimental study might show that people are likely to be helped by a treatment, but it cannot show that anyone who takes the treatment will be helped. Choice D is incorrect. This conclusion is too strong. The study shows that Treatment X is likely to improve the eyesight of people with poor eyesight, but it cannot show that the treatment definitely will cause improvement in eyesight for every person. Furthermore, since the people undergoing the treatment in the study were selected from people with poor eyesight, the results can be generalized only to this population, not to all people.

### QUESTION 16

**Choice B is correct.** The graphs of  $y = f(x)$  and  $y = g(x)$  are given. In order for  $f(x) + g(x)$  to be 0, there must be one or more values of  $x$  for which the  $y$ -coordinates of the graphs are opposites. Looking at the graphs, one can see that this occurs at  $x = -2$ : the point  $(-2, -2)$  lies on the graph of  $f$ , and the point  $(-2, 2)$  lies on the graph of  $g$ . Thus, at  $x = -2$ , the value of  $f(x) + g(x)$  is  $-2 + 2 = 0$ .

Choices A, C, and D are incorrect because none of these  $x$ -values satisfies the given equation,  $f(x) + g(x) = 0$ .

### QUESTION 17

**Choice B is correct.** The quantity of the product supplied to the market is given by the function  $S(P) = \frac{1}{2}P + 40$ . If the price  $P$  of the product increases by \$10, the effect on the quantity of the product supplied can be determined by substituting  $P + 10$  for  $P$  in the function  $S(P) = \frac{1}{2}P + 40$ . This gives  $S(P + 10) = \frac{1}{2}(P + 10) + 40 = \frac{1}{2}P + 45$ , which shows that  $S(P + 10) = S(P) + 5$ . Therefore, the quantity supplied to the market will increase by 5 units when the price of the product is increased by \$10.

Alternatively, look at the coefficient of  $P$  in the linear function  $S$ . This is the slope of the graph of the function, where  $P$  is on the horizontal axis and  $S(P)$  is on the vertical axis. Since the slope is  $\frac{1}{2}$ , for every increase of 1 in  $P$ , there will be an increase of  $\frac{1}{2}$  in  $S(P)$ , and therefore, an increase of 10 in  $P$  will yield an increase of 5 in  $S(P)$ .

Choice A is incorrect. If the quantity supplied decreases as the price of the product increases, the function  $S(P)$  would be decreasing, but  $S(P) = \frac{1}{2}P + 40$  is an increasing function. Choice C is incorrect and may be the result of assuming the slope of the graph of  $S(P)$  is

equal to 1. Choice D is incorrect and may be the result of confusing the y-intercept of the graph of  $S(P)$  with the slope, and then adding 10 to the y-intercept.

### QUESTION 18

**Choice B is correct.** The quantity of the product supplied to the market will equal the quantity of the product demanded by the market if  $S(P)$  is equal to  $D(P)$ , that is, if  $\frac{1}{2}P + 40 = 220 - P$ . Solving this equation gives  $P = 120$ , and so \$120 is the price at which the quantity of the product supplied will equal the quantity of the product demanded.

Choices A, C, and D are incorrect. At these dollar amounts, the quantities given by  $S(P)$  and  $D(P)$  are not equal.

### QUESTION 19

**Choice C is correct.** It is given that 1 ounce of graphene covers 7 football fields. Therefore, 48 ounces can cover  $7 \times 48 = 336$  football fields. If each football field has an area of  $1\frac{1}{3}$  acres, then 336 football fields have a total area of  $336 \times 1\frac{1}{3} = 448$  acres. Therefore, of the choices given, 450 acres is closest to the number of acres 48 ounces of graphene could cover.

Choice A is incorrect and may be the result of dividing, instead of multiplying, the number of football fields by  $1\frac{1}{3}$ . Choice B is incorrect and may be the result of finding the number of football fields, not the number of acres, that can be covered by 48 ounces of graphene. Choice D is incorrect and may be the result of setting up the expression  $\frac{7 \times 48 \times 4}{3}$  and then finding only the numerator of the fraction.

### QUESTION 20

**Choice B is correct.** To answer this question, find the point in the graph that represents Michael's 34-minute swim and then compare the actual heart rate for that swim with the expected heart rate as defined by the line of best fit. To find the point that represents Michael's swim that took 34 minutes, look along the vertical line of the graph that is marked "34" on the horizontal axis. That vertical line intersects only one point in the scatterplot, at 148 beats per minute. On the other hand, the line of best fit intersects the vertical line representing 34 minutes at 150 beats per minute. Therefore, for the swim that took 34 minutes, Michael's actual heart rate was  $150 - 148 = 2$  beats per minute less than predicted by the line of best fit.

Choices A, C, and D are incorrect and may be the result of misreading the graph.

---

## QUESTION 21

**Choice C is correct.** Linear growth is characterized by an increase of a quantity at a constant rate. Exponential growth is characterized by an increase of a quantity at a relative rate; that is, an increase by the same factor over equal increments of time. In choice C, the value of the account increases by 1% each year; that is, the value is multiplied by the same factor, 1.01, each year. Therefore, the value described in choice C grows exponentially.

Choices A and B are incorrect because the rate depends only on the initial value, and thus the value increases by the same amount each year. Both options A and B describe linear growth. Choice D is incorrect; it is also a description of linear growth, as the increase is constant each year.

## QUESTION 22

**Choice B is correct.** One of the three numbers is  $x$ ; let the other two numbers be  $y$  and  $z$ . Since the sum of three numbers is 855, the equation  $x + y + z = 855$  is true. The statement that  $x$  is 50% more than the sum of the other two numbers can be represented as  $x = 1.5(y + z)$ , or  $x = \frac{3}{2}(y + z)$ . Multiplying both sides of the equation  $x = \frac{3}{2}(y + z)$  by  $\frac{2}{3}$  gives  $\frac{2}{3}x = y + z$ . Substituting  $\frac{2}{3}x$  in  $x + y + z = 855$  gives  $x + \frac{2}{3}x = 855$ , or  $\frac{5x}{3} = 855$ . Therefore,  $x$  equals  $\frac{3}{5} \times 855 = 513$ .

Choices A, C, and D are incorrect and may be the result of computational errors.

## QUESTION 23

**Choice C is correct.** Since the angles are acute and  $\sin(a^\circ) = \cos(b^\circ)$ , it follows from the complementary angle property of sines and cosines that  $a + b = 90$ . Substituting  $4k - 22$  for  $a$  and  $6k - 13$  for  $b$  gives  $(4k - 22) + (6k - 13) = 90$ , which simplifies to  $10k - 35 = 90$ . Therefore,  $10k = 125$ , and  $k = 12.5$ .

Choice A is incorrect and may be the result of mistakenly assuming that  $a = b$  and making a sign error. Choices B and D are incorrect because they result in values for  $a$  and  $b$  such that  $\sin(a^\circ) \neq \cos(b^\circ)$ .

## QUESTION 24

**Choice D is correct.** Let  $c$  be the number of students in Mr. Kohl's class. The conditions described in the question can be represented by the equations  $n = 3c + 5$  and  $n + 21 = 4c$ . Substituting  $3c + 5$  for  $n$  in the second equation gives  $3c + 5 + 21 = 4c$ , which can be solved to find  $c = 26$ .

Choices A, B, and C are incorrect because the values given for the number of students in the class cannot fulfill both conditions given in the question. For example, if there were 16 students in the class, then the first condition would imply that there are  $3(16) + 5 = 53$  milliliters

of solution in the beaker, but the second condition would imply that there are  $4(16) - 21 = 43$  milliliters of solution in the beaker. This contradiction shows that there cannot be 16 students in the class.

### QUESTION 25

**Choice D is correct.** The volume of the grain silo can be found by adding the volumes of all the solids of which it is composed. The silo is made up of a cylinder with height 10 feet (ft) and base radius 5 ft and two cones, each having height 5 ft and base radius 5 ft. The formulas  $V_{\text{cylinder}} = \pi r^2 h$  and  $V_{\text{cone}} = \frac{1}{3} \pi r^2 h$  can be used to determine the total volume of the silo. Since the two cones have identical dimensions, the total volume, in cubic feet, of the silo is given by  $V_{\text{silo}} = \pi(5)^2(10) + (2)\left(\frac{1}{3}\right)\pi(5)^2(5) = \left(\frac{4}{3}\right)(250)\pi$ , which is approximately equal to 1,047.2 cubic feet.

Choice A is incorrect because this is the volume of only the two cones. Choice B is incorrect because this is the volume of only the cylinder. Choice C is incorrect because this is the volume of only one of the cones plus the cylinder.

### QUESTION 26

**Choice C is correct.** The line passes through the origin,  $(2, k)$ , and  $(k, 32)$ . Any two of these points can be used to find the slope of the line. Since the line passes through  $(0, 0)$  and  $(2, k)$ , the slope of the line is equal to  $\frac{k-0}{2-0} = \frac{k}{2}$ . Similarly, since the line passes through  $(0, 0)$  and  $(k, 32)$ , the slope of the line is equal to  $\frac{32-0}{k-0} = \frac{32}{k}$ . Since each expression gives the slope of the same line, it must be true that  $\frac{k}{2} = \frac{32}{k}$ . Multiplying each side of  $\frac{k}{2} = \frac{32}{k}$  by  $2k$  gives  $k^2 = 64$ , from which it follows that  $k = 8$  or  $k = -8$ . Therefore, of the given choices, only 8 could be the value of  $k$ .

Choices A, B, and D are incorrect and may be the result of computational errors.

### QUESTION 27

**Choice C is correct.** Let  $\ell$  and  $w$  be the length and width, respectively, of the original rectangle. The area of the original rectangle is  $A = \ell w$ . The rectangle is altered by increasing its length by 10 percent and decreasing its width by  $p$  percent; thus, the length of the altered rectangle is  $1.1\ell$ , and the width of the altered rectangle is  $\left(1 - \frac{p}{100}\right)w$ . The alterations decrease the area by 12 percent, so the area of the altered rectangle is  $(1 - 0.12)A = 0.88A$ . The area of the altered rectangle is the product of its length and width, so  $0.88A = (1.1\ell)\left(1 - \frac{p}{100}\right)w$ . Since  $A = \ell w$ , this last equation can

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be rewritten as  $0.88A = (1.1)\left(1 - \frac{p}{100}\right)\ell w = (1.1)\left(1 - \frac{p}{100}\right)A$ , from

which it follows that  $0.88 = (1.1)\left(1 - \frac{p}{100}\right)$ , or  $0.8 = \left(1 - \frac{p}{100}\right)$ .

Therefore,  $\frac{p}{100} = 0.2$ , and so the value of  $p$  is 20.

Choice A is incorrect and may be the result of confusing the 12 percent decrease in area with the percent decrease in width. Choice B is incorrect because decreasing the width by 15 percent results in a 6.5 percent decrease in area, not a 12 percent decrease. Choice D is incorrect and may be the result of adding the percents given in the question (10 + 12).

### QUESTION 28

**Choice D is correct.** For the present population to decrease by 10 percent, it must be multiplied by the factor 0.9. Since the engineer estimates that the population will decrease by 10 percent every 20 years, the present population, 50,000, must be multiplied by  $(0.9)^n$ , where  $n$  is the number of 20-year periods that will have elapsed  $t$  years from now. After  $t$  years, the number of 20-year periods that have elapsed is  $\frac{t}{20}$ . Therefore,  $50,000(0.9)^{\frac{t}{20}}$  represents the engineer's estimate of the population of the city  $t$  years from now.

Choices A, B, and C are incorrect because each of these choices either confuses the percent decrease with the multiplicative factor that represents the percent decrease or mistakenly multiplies  $t$  by 20 to find the number of 20-year periods that will have elapsed in  $t$  years.

### QUESTION 29

**Choice A is correct.** Let  $x$  be the number of left-handed female students and let  $y$  be the number of left-handed male students. Then the number of right-handed female students will be  $5x$  and the number of right-handed male students will be  $9y$ . Since the total number of left-handed students is 18 and the total number of right-handed students is 122, the system of equations below must be satisfied.

$$\begin{cases} x + y = 18 \\ 5x + 9y = 122 \end{cases}$$

Solving this system gives  $x = 10$  and  $y = 8$ . Thus, 50 of the 122 right-handed students are female. Therefore, the probability that a right-handed student selected at random is female is  $\frac{50}{122}$ , which to the nearest thousandth is 0.410.

Choices B, C, and D are incorrect and may be the result of incorrectly calculating the missing values in the table.



**QUESTION 30**

**Choice A is correct.** Subtracting the sides of  $3y + c = 5y - 7$  from the corresponding sides of  $3x + b = 5x - 7$  gives  $(3x - 3y) + (b - c) = (5x - 5y + (-7 - (-7)))$ . Since  $b = c - \frac{1}{2}$ , or  $b - c = -\frac{1}{2}$ , it follows that  $(3x - 3y) + \left(-\frac{1}{2}\right) = (5x - 5y)$ . Solving this equation for  $x$  in terms of  $y$  gives  $x = y - \frac{1}{4}$ . Therefore,  $x$  is  $y$  minus  $\frac{1}{4}$ .

Choices B, C, and D are incorrect and may be the result of making a computational error when solving the equations for  $x$  in terms of  $y$ .

**QUESTION 31**

**The correct answer is either 4 or 5.** Because each student ticket costs \$2 and each adult ticket costs \$3, the total amount, in dollars, that Chris spends on  $x$  student tickets and 1 adult ticket is  $2(x) + 3(1)$ . Because Chris spends at least \$11 but no more than \$14 on the tickets, one can write the compound inequality  $2x + 3 \geq 11$  and  $2x + 3 \leq 14$ . Subtracting 3 from each side of both inequalities and then dividing each side of both inequalities by 2 yields  $x \geq 4$  and  $x \leq 5.5$ . Thus, the value of  $x$  must be an integer that is both greater than or equal to 4 and less than or equal to 5.5. Therefore,  $x = 4$  or  $x = 5$ . Either 4 or 5 may be gridded as the correct answer.

**QUESTION 32**

**The correct answer is 58.6.** The mean of a data set is determined by calculating the sum of the values and dividing by the number of values in the data set. The sum of the ages, in years, in the data set is 703, and the number of values in the data set is 12. Thus, the mean of the ages, in years, of the first 12 United States presidents at the beginning of their terms is  $\frac{703}{12}$ . The question asks for an answer rounded to the nearest tenth, so the decimal equivalent, rounded to the nearest tenth, is the correct answer. This rounded decimal equivalent is 58.6.

**QUESTION 33**

**The correct answer is 9.** To rewrite the difference  $(-3x^2 + 5x - 2) - 2(x^2 - 2x - 1)$  in the form  $ax^2 + bx + c$ , the expression can be simplified by using the distributive property and combining like terms as follows:

$$\begin{aligned} & -3x^2 + 5x - 2 - (2x^2 - 4x - 2) \\ & -3x^2 - 2x^2 + (5x - (-4x) + (-2 - (-2))) \\ & -5x^2 + 9x + 0 \end{aligned}$$

The coefficient of  $x$  is the value of  $b$ , which is 9.

Alternatively, since  $b$  is the coefficient of  $x$  in the difference  $(-3x^2 + 5x - 2) - 2(x^2 - 2x - 1)$ , one need only compute the  $x$ -term in the difference. The  $x$ -term is  $5x - 2(-2x) = 5x + 4x = 9x$ , so the value of  $b$  is 9.

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### QUESTION 34

**The correct answer is  $\frac{5}{8}$  or .625.** A complete rotation around a point is  $360^\circ$  or  $2\pi$  radians. Since the central angle  $AOB$  has measure  $\frac{5\pi}{4}$  radians, it represents  $\frac{\frac{5\pi}{4}}{2\pi} = \frac{5}{8}$  of a complete rotation around point  $O$ . Therefore, the sector formed by central angle  $AOB$  has area equal to  $\frac{5}{8}$  the area of the entire circle. Either the fraction  $5/8$  or its decimal equivalent, .625, may be gridded as the correct answer.

### QUESTION 35

**The correct answer is 50.** The mean of a data set is the sum of the values in the data set divided by the number of values in the data set. The mean of 75 is obtained by finding the sum of the first 10 ratings and dividing by 10. Thus, the sum of the first 10 ratings was 750. In order for the mean of the first 20 ratings to be at least 85, the sum of the first 20 ratings must be at least  $(85)(20) = 1700$ . Therefore, the sum of the next 10 ratings must be at least  $1700 - 750 = 950$ . The maximum rating is 100, so the maximum possible value of the sum of the 11th through 20th ratings is  $9 \times 100 = 900$ . Therefore, for the store to be able to have an average of at least 85 for the first 20 ratings, the least possible value for the 11th rating is  $950 - 900 = 50$ .

### QUESTION 36

**The correct answer is 750.** The inequalities  $y \leq -15x + 3000$  and  $y \leq 5x$  can be graphed in the  $xy$ -plane. They are represented by the lower half-planes with the boundary lines  $y = -15x + 3000$  and  $y = 5x$ , respectively. The solution set of the system of inequalities will be the intersection of these half-planes, including the boundary lines, and the solution  $(a, b)$  with the greatest possible value of  $b$  will be the point of intersection of the boundary lines. The intersection of boundary lines of these inequalities can be found by substituting  $5x$  for  $y$  in the equation for the first line:  $5x = -15x + 3000$ , which has solution  $x = 150$ . Thus, the  $x$ -coordinate of the point of intersection is 150. Therefore, the  $y$ -coordinate of the point of intersection of the boundary lines is  $5(150) = -15(150) + 3000 = 750$ . This is the maximum possible value of  $b$  for a point  $(a, b)$  that is in the solution set of the system of inequalities.

### QUESTION 37

**The correct answer is 7.** The average number of shoppers,  $N$ , in the checkout line at any time is  $N = rt$ , where  $r$  is the number of shoppers entering the checkout line per minute and  $T$  is the average number of minutes each shopper spends in the checkout line. Since 84 shoppers per hour make a purchase, 84 shoppers per hour enter the checkout line. This needs to be converted to the number of

shoppers per minute. Since there are 60 minutes in one hour, the rate is  $\frac{84 \text{ shoppers}}{60 \text{ minutes}} = 1.4$  shoppers per minute. Using the given formula with  $r = 1.4$  and  $t = 5$  yields  $N = rt = (1.4)(5) = 7$ . Therefore, the average number of shoppers,  $N$ , in the checkout line at any time during business hours is 7.

### QUESTION 38

**The correct answer is 60.** The estimated average number of shoppers in the original store at any time is 45. In the new store, the manager estimates that an average of 90 shoppers per hour enter the store, which is equivalent to 1.5 shoppers per minute. The manager also estimates that each shopper stays in the store for an average of 12 minutes. Thus, by Little's law, there are, on average,  $N = rt = (1.5)(12) = 18$  shoppers in the new store at any time. This is  $\frac{45 - 18}{45} \times 100 = 60$  percent less than the average number of shoppers in the original store at any time.



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# Practice Test #4

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from MacDonald Harris, *The Balloonist*. ©2011 by The Estate of Donald Heiney. During the summer of 1897, the narrator of this story, a fictional Swedish scientist, has set out for the North Pole in a hydrogen-powered balloon.

My emotions are complicated and not readily verifiable. I feel a vast yearning that is simultaneously a pleasure and a pain. I am certain of the consummation of this yearning, but I don't  
 5 know yet what form it will take, since I do not understand quite what it is that the yearning desires. For the first time there is borne in upon me the full truth of what I myself said to the doctor only an hour ago: that my motives in this undertaking are not  
 10 entirely clear. For years, for a lifetime, the machinery of my destiny has worked in secret to prepare for this moment; its clockwork has moved exactly toward this time and place and no other. Rising slowly from the earth that bore me and gave me sustenance, I am  
 15 carried helplessly toward an uninhabited and hostile, or at best indifferent, part of the earth, littered with the bones of explorers and the wrecks of ships, frozen supply caches, messages scrawled with chilled fingers and hidden in cairns that no eye will ever see.  
 20 Nobody has succeeded in this thing, and many have died. Yet in freely willing this enterprise, in choosing this moment and no other when the south wind will carry me exactly northward at a velocity of eight knots, I have converted the machinery of my

fate into the servant of my will. All this I understand, as I understand each detail of the technique by which this is carried out. What I don't understand is why I am so intent on going to this particular place. Who wants the North Pole! What good is it! Can you eat  
 30 it? Will it carry you from Gothenburg to Malmö like a railway? The Danish ministers have declared from their pulpits that participation in polar expeditions is beneficial to the soul's eternal well-being, or so I read in a newspaper. It isn't clear how this doctrine is to  
 35 be interpreted, except that the Pole is something difficult or impossible to attain which must nevertheless be sought for, because man is condemned to seek out and know everything whether or not the knowledge gives him pleasure. In  
 40 short, it is the same unthinking lust for knowledge that drove our First Parents out of the garden.

And suppose you were to find it in spite of all, this wonderful place that everybody is so anxious to stand on! *What* would you find? Exactly nothing.  
 45 A point precisely identical to all the others in a completely featureless wasteland stretching around it for hundreds of miles. It is an abstraction, a mathematical fiction. No one but a Swedish madman could take the slightest interest in it. Here I am. The  
 50 wind is still from the south, bearing us steadily northward at the speed of a trotting dog. Behind us, perhaps forever, lie the Cities of Men with their



teacups and their brass bedsteads. I am going forth of my own volition to join the ghosts of Bering and poor Franklin, of frozen De Long and his men. What I am on the brink of knowing, I now see, is not an ephemeral mathematical spot but myself. The doctor was right, even though I dislike him. Fundamentally I am a dangerous madman, and what I do is both a challenge to my egotism and a surrender to it.

1

Over the course of the passage, the narrator's attitude shifts from

- A) fear about the expedition to excitement about it.
- B) doubt about his abilities to confidence in them.
- C) uncertainty of his motives to recognition of them.
- D) disdain for the North Pole to appreciation of it.

2

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 10-12 ("For . . . moment")
- B) Lines 21-25 ("Yet . . . will")
- C) Lines 42-44 ("And . . . stand on")
- D) Lines 56-57 ("What . . . myself")

3

As used in lines 1-2, "not readily verifiable" most nearly means

- A) unable to be authenticated.
- B) likely to be contradicted.
- C) without empirical support.
- D) not completely understood.

4

The sentence in lines 10-13 ("For years . . . other") mainly serves to

- A) expose a side of the narrator that he prefers to keep hidden.
- B) demonstrate that the narrator thinks in a methodical and scientific manner.
- C) show that the narrator feels himself to be influenced by powerful and independent forces.
- D) emphasize the length of time during which the narrator has prepared for his expedition.

5

The narrator indicates that many previous explorers seeking the North Pole have

- A) perished in the attempt.
- B) made surprising discoveries.
- C) failed to determine its exact location.
- D) had different motivations than his own.

6

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 20-21 ("Nobody . . . died")
- B) Lines 25-27 ("All . . . out")
- C) Lines 31-34 ("The . . . newspaper")
- D) Lines 51-53 ("Behind . . . bedsteads")

7

Which choice best describes the narrator's view of his expedition to the North Pole?

- A) Immoral but inevitable
- B) Absurd but necessary
- C) Socially beneficial but misunderstood
- D) Scientifically important but hazardous

8

The question the narrator asks in lines 30-31 (“Will it . . . railway”) most nearly implies that

- A) balloons will never replace other modes of transportation.
- B) the North Pole is farther away than the cities usually reached by train.
- C) people often travel from one city to another without considering the implications.
- D) reaching the North Pole has no foreseeable benefit to humanity.

9

As used in line 49, “take the slightest interest in” most nearly means

- A) accept responsibility for.
- B) possess little regard for.
- C) pay no attention to.
- D) have curiosity about.

10

As used in line 50, “bearing” most nearly means

- A) carrying.
- B) affecting.
- C) yielding.
- D) enduring.

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from Alan Ehrenhalt, *The Great Inversion and the Future of the American City*. ©2013 by Vintage. Ehrenhalt is an urbanologist—a scholar of cities and their development. Demographic inversion is a phenomenon that describes the rearrangement of living patterns throughout a metropolitan area.

We are not witnessing the abandonment of the suburbs, or a movement of millions of people back to the city all at once. The 2010 census certainly did not  
 Line turn up evidence of a middle-class stampede to the  
 5 nation’s cities. The news was mixed: Some of the larger cities on the East Coast tended to gain population, albeit in small increments. Those in the Midwest, including Chicago, tended to lose substantial numbers. The cities that showed gains in  
 10 overall population during the entire decade tended to be in the South and Southwest. But when it comes to measuring demographic inversion, raw census numbers are an ineffective blunt instrument. A closer look at the results shows that the most powerful  
 15 demographic events of the past decade were the movement of African Americans out of central cities (180,000 of them in Chicago alone) and the settlement of immigrant groups in suburbs, often ones many miles distant from downtown.  
 20 Central-city areas that gained affluent residents in the first part of the decade maintained that population in the recession years from 2007 to 2009. They also, according to a 2011 study by Brookings, suffered considerably less from increased  
 25 unemployment than the suburbs did. Not many young professionals moved to new downtown condos in the recession years because few such residences were being built. But there is no reason to believe that the demographic trends prevailing prior  
 30 to the construction bust will not resume once that bust is over. It is important to remember that demographic inversion is not a proxy for population growth; it can occur in cities that are growing, those whose numbers are flat, and even in those  
 35 undergoing a modest decline in size.

America’s major cities face enormous fiscal problems, many of them the result of public pension obligations they incurred in the more prosperous years of the past two decades. Some, Chicago

40 prominent among them, simply are not producing  
enough revenue to support the level of public  
services to which most of the citizens have grown to  
feel entitled. How the cities are going to solve this  
problem, I do not know. What I do know is that if  
45 fiscal crisis were going to drive affluent professionals  
out of central cities, it would have done so by now.  
There is no evidence that it has.

The truth is that we are living at a moment in  
which the massive outward migration of the affluent  
50 that characterized the second half of the  
twentieth century is coming to an end. And we need  
to adjust our perceptions of cities, suburbs, and  
urban mobility as a result.

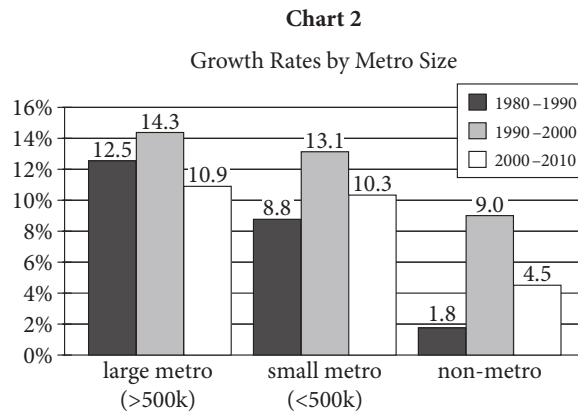
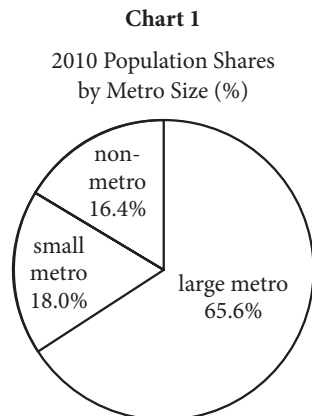
Much of our perspective on the process of  
55 metropolitan settlement dates, whether we realize it  
or not, from a paper written in 1925 by the  
University of Chicago sociologist Ernest W. Burgess.  
It was Burgess who defined four urban/suburban  
zones of settlement: a central business district; an  
60 area of manufacturing just beyond it; then a  
residential area inhabited by the industrial and  
immigrant working class; and finally an outer  
enclave of single-family dwellings.

Burgess was right about the urban America of  
65 1925; he was right about the urban America of 1974.  
Virtually every city in the country had a downtown,

where the commercial life of the metropolis was  
conducted; it had a factory district just beyond; it had  
districts of working-class residences just beyond that;  
70 and it had residential suburbs for the wealthy and the  
upper middle class at the far end of the continuum.  
As a family moved up the economic ladder, it also  
moved outward from crowded working-class  
districts to more spacious apartments and,  
75 eventually, to a suburban home. The suburbs of  
Burgess's time bore little resemblance to those at the  
end of the twentieth century, but the theory still  
essentially worked. People moved ahead in life by  
moving farther out.

80 But in the past decade, in quite a few places, this  
model has ceased to describe reality. There are still  
downtown commercial districts, but there are no  
factory districts lying next to them. There are  
scarcely any factories at all. These close-in parts of  
85 the city, whose few residents Burgess described as  
dwelling in "submerged regions of poverty,  
degradation and disease," are increasingly the  
preserve of the affluent who work in the commercial  
core. And just as crucially newcomers to America are  
90 not settling on the inside and accumulating the  
resources to move out; they are living in the suburbs  
from day one.

United States Population by Metropolitan Size/Status, 1980 – 2010



Adapted from William H. Frey, "Population Growth in Metro America since 1980: Putting the Volatile 2000s in Perspective." Published 2012 by Metropolitan Policy Program, Brookings Institution.

11

Which choice best summarizes the first paragraph of the passage (lines 1-35)?

- A) The 2010 census demonstrated a sizeable growth in the number of middle-class families moving into inner cities.
- B) The 2010 census is not a reliable instrument for measuring population trends in American cities.
- C) Population growth and demographic inversion are distinct phenomena, and demographic inversion is evident in many American cities.
- D) Population growth in American cities has been increasing since roughly 2000, while suburban populations have decreased.

12

According to the passage, members of which group moved away from central-city areas in large numbers in the early 2000s?

- A) The unemployed
- B) Immigrants
- C) Young professionals
- D) African Americans

13

In line 34, “flat” is closest in meaning to

- A) static.
- B) deflated.
- C) featureless.
- D) obscure.

14

According to the passage, which choice best describes the current financial situation in many major American cities?

- A) Expected tax increases due to demand for public works
- B) Economic hardship due to promises made in past years
- C) Greater overall prosperity due to an increased inner-city tax base
- D) Insufficient revenues due to a decrease in manufacturing

15

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 36-39 (“America’s . . . decades”)
- B) Lines 43-44 (“How . . . not know”)
- C) Lines 44-46 (“What . . . now”)
- D) Lines 48-51 (“The truth . . . end”)

16

The passage implies that American cities in 1974

- A) were witnessing the flight of minority populations to the suburbs.
- B) had begun to lose their manufacturing sectors.
- C) had a traditional four-zone structure.
- D) were already experiencing demographic inversion.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 54-57 (“Much . . . Ernest W. Burgess”)
- B) Lines 58-59 (“It was . . . settlement”)
- C) Lines 66-71 (“Virtually . . . continuum”)
- D) Lines 72-75 (“As . . . home”)

18

As used in line 68, “conducted” is closest in meaning to

- A) carried out.
- B) supervised.
- C) regulated.
- D) inhibited.

19

The author of the passage would most likely consider the information in chart 1 to be

- A) excellent evidence for the arguments made in the passage.
- B) possibly accurate but too crude to be truly informative.
- C) compelling but lacking in historical information.
- D) representative of a perspective with which the author disagrees.

20

According to chart 2, the years 2000–2010 were characterized by

- A) less growth in metropolitan areas of all sizes than had taken place in the 1990s.
- B) more growth in small metropolitan areas than in large metropolitan areas.
- C) a significant decline in the population of small metropolitan areas compared to the 1980s.
- D) roughly equal growth in large metropolitan areas and nonmetropolitan areas.

21

Chart 2 suggests which of the following about population change in the 1990s?

- A) Large numbers of people moved from suburban areas to urban areas in the 1990s.
- B) Growth rates fell in smaller metropolitan areas in the 1990s.
- C) Large numbers of people moved from metropolitan areas to nonmetropolitan areas in the 1990s.
- D) The US population as a whole grew more in the 1990s than in the 1980s.

**Questions 22-31 are based on the following passage.**

This passage is adapted from Emily Anthes, *Frankenstein's Cat*. ©2013 by Emily Anthes.

When scientists first learned how to edit the genomes of animals, they began to imagine all the ways they could use this new power. Creating brightly colored novelty pets was not a high priority.

Instead, most researchers envisioned far more consequential applications, hoping to create genetically engineered animals that saved human lives. One enterprise is now delivering on this dream. Welcome to the world of “pharming,” in which simple genetic tweaks turn animals into living pharmaceutical factories.

Many of the proteins that our cells crank out naturally make for good medicine. Our bodies’ own enzymes, hormones, clotting factors, and antibodies are commonly used to treat cancer, diabetes, autoimmune diseases, and more. The trouble is that it’s difficult and expensive to make these compounds on an industrial scale, and as a result, patients can face shortages of the medicines they need. Dairy animals, on the other hand, are expert protein producers, their udders swollen with milk. So the creation of the first transgenic animals—first mice, then other species—in the 1980s gave scientists an idea: What if they put the gene for a human antibody or enzyme into a cow, goat, or sheep? If they put the gene in just the right place, under the control of the right molecular switch, maybe they could engineer animals that produced healing human proteins in their milk. Then doctors could collect medicine by the bucketful.

Throughout the 1980s and ’90s, studies provided proof of principle, as scientists created transgenic mice, sheep, goats, pigs, cattle, and rabbits that did in fact make therapeutic compounds in their milk. At first, this work was merely gee-whiz, scientific geekery, lab-bound thought experiments come true. That all changed with ATryn, a drug produced by the Massachusetts firm GTC Biotherapeutics. ATryn is antithrombin, an anticoagulant that can be used to prevent life-threatening blood clots. The compound, made by our liver cells, plays a key role in keeping our bodies clot-free. It acts as a molecular bouncer, sidling up to clot-forming compounds and escorting them out of the bloodstream. But as many as 1 in

2,000 Americans are born with a genetic mutation that prevents them from making antithrombin. These patients are prone to clots, especially in their legs and lungs, and they are at elevated risk of suffering from fatal complications during surgery and childbirth. Supplemental antithrombin can reduce this risk, and GTC decided to try to manufacture the compound using genetically engineered goats.

To create its special herd of goats, GTC used microinjection, the same technique that produced GloFish and AquAdvantage salmon. The company’s scientists took the gene for human antithrombin and injected it directly into fertilized goat eggs. Then they implanted the eggs in the wombs of female goats. When the kids were born, some of them proved to be transgenic, the human gene nestled safely in their cells. The researchers paired the antithrombin gene with a promoter (which is a sequence of DNA that controls gene activity) that is normally active in the goat’s mammary glands during milk production. When the transgenic females lactated, the promoter turned the transgene on and the goats’ udders filled with milk containing antithrombin. All that was left to do was to collect the milk, and extract and purify the protein. *Et voilà*—human medicine! And, for GTC, liquid gold. ATryn hit the market in 2006, becoming the world’s first transgenic animal drug. Over the course of a year, the “milking parlors” on GTC’s 300-acre farm in Massachusetts can collect more than a kilogram of medicine from a single animal.

22

The primary purpose of the passage is to

- A) present the background of a medical breakthrough.
- B) evaluate the research that led to a scientific discovery.
- C) summarize the findings of a long-term research project.
- D) explain the development of a branch of scientific study.

23

The author's attitude toward pharming is best described as one of

- A) apprehension.
- B) ambivalence.
- C) appreciation.
- D) astonishment.

24

As used in line 20, "expert" most nearly means

- A) knowledgeable.
- B) professional.
- C) capable.
- D) trained.

25

What does the author suggest about the transgenic studies done in the 1980s and 1990s?

- A) They were limited by the expensive nature of animal research.
- B) They were not expected to yield products ready for human use.
- C) They were completed when an anticoagulant compound was identified.
- D) They focused only on the molecular properties of cows, goats, and sheep.

26

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 16-19 ("The trouble . . . need")
- B) Lines 25-29 ("If they . . . milk")
- C) Lines 35-36 ("At first . . . true")
- D) Lines 37-40 ("That all . . . clots")

27

According to the passage, which of the following is true of antithrombin?

- A) It reduces compounds that lead to blood clots.
- B) It stems from a genetic mutation that is rare in humans.
- C) It is a sequence of DNA known as a promoter.
- D) It occurs naturally in goats' mammary glands.

28

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 12-16 ("Many . . . more")
- B) Lines 42-44 ("It acts . . . bloodstream")
- C) Lines 44-46 ("But as . . . antithrombin")
- D) Lines 62-65 ("The researchers . . . production")

29

Which of the following does the author suggest about the "female goats" mentioned in line 59?

- A) They secreted antithrombin in their milk after giving birth.
- B) Some of their kids were not born with the antithrombin gene.
- C) They were the first animals to receive microinjections.
- D) Their cells already contained genes usually found in humans.

30

The most likely purpose of the parenthetical information in lines 63-64 is to

- A) illustrate an abstract concept.
- B) describe a new hypothesis.
- C) clarify a claim.
- D) define a term.

31

The phrase “liquid gold” (line 71) most directly suggests that

- A) GTC has invested a great deal of money in the microinjection technique.
- B) GTC’s milking parlors have significantly increased milk production.
- C) transgenic goats will soon be a valuable asset for dairy farmers.
- D) ATryn has proved to be a financially beneficial product for GTC.

**Questions 32-41 are based on the following passages.**

Passage 1 is adapted from Edmund Burke, *Reflections on the Revolution in France*. Originally published in 1790. Passage 2 is adapted from Thomas Paine, *Rights of Man*. Originally published in 1791.

**Passage 1**

To avoid . . . the evils of inconstancy and versatility, ten thousand times worse than those of obstinacy and the blindest prejudice, we have  
 Line consecrated the state, that no man should approach  
 5 to look into its defects or corruptions but with due caution; that he should never dream of beginning its reformation by its subversion; that he should approach to the faults of the state as to the wounds of a father, with pious awe and trembling solicitude. By  
 10 this wise prejudice we are taught to look with horror on those children of their country who are prompt rashly to hack that aged parent in pieces, and put him into the kettle of magicians, in hopes that by their poisonous weeds, and wild incantations, they may  
 15 regenerate the paternal constitution, and renovate their father’s life.

Society is indeed a contract. Subordinate contracts for objects of mere occasional interest may be dissolved at pleasure—but the state ought not to be  
 20 considered as nothing better than a partnership agreement in a trade of pepper and coffee, calico or tobacco, or some other such low concern, to be taken up for a little temporary interest, and to be dissolved by the fancy of the parties. It is to be looked on with  
 25 other reverence; because it is not a partnership in things subservient only to the gross animal existence of a temporary and perishable nature. It is a partnership in all science; a partnership in all art; a partnership in every virtue, and in all perfection.  
 30 As the ends of such a partnership cannot be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born. . . . The municipal corporations of  
 35 that universal kingdom are not morally at liberty at their pleasure, and on their speculations of a contingent improvement, wholly to separate and tear asunder the bands of their subordinate community, and to dissolve it into an unsocial, uncivil,  
 40 unconnected chaos of elementary principles.



**Passage 2**

Every age and generation must be as free to act for itself, *in all cases*, as the ages and generations which preceded it. The vanity and presumption of governing beyond the grave, is the most ridiculous  
 45 and insolent of all tyrannies.

Man has no property in man; neither has any generation a property in the generations which are to follow. The Parliament or the people of 1688, or of any other period, had no more right to dispose of the  
 50 people of the present day, or to bind or to control them in any shape whatever, than the parliament or the people of the present day have to dispose of, bind, or control those who are to live a hundred or a thousand years hence.

Every generation is, and must be, competent to all the purposes which its occasions require. It is the living, and not the dead, that are to be accommodated. When man ceases to be, his power and his wants cease with him; and having no longer  
 60 any participation in the concerns of this world, he has no longer any authority in directing who shall be its governors, or how its government shall be organized, or how administered. . . .

Those who have quitted the world, and those who are not yet arrived at it, are as remote from each other, as the utmost stretch of mortal imagination can conceive. What possible obligation, then, can exist between them; what rule or principle can be laid  
 65 down, that two nonentities, the one out of existence, and the other not in, and who never can meet in this world, that the one should control the other to the end of time? . . .

The circumstances of the world are continually changing, and the opinions of men change also; and as government is for the living, and not for the dead,  
 75 it is the living only that has any right in it. That which may be thought right and found convenient in one age, may be thought wrong and found inconvenient in another. In such cases, who is to  
 80 decide, the living, or the dead?

32

In Passage 1, Burke indicates that a contract between a person and society differs from other contracts mainly in its

- A) brevity and prominence.
- B) complexity and rigidity.
- C) precision and usefulness.
- D) seriousness and permanence.

33

As used in line 4, “state” most nearly refers to a

- A) style of living.
- B) position in life.
- C) temporary condition.
- D) political entity.

34

As used in line 22, “low” most nearly means

- A) petty.
- B) weak.
- C) inadequate.
- D) depleted.

35

It can most reasonably be inferred from Passage 2 that Paine views historical precedents as

- A) generally helpful to those who want to change society.
- B) surprisingly difficult for many people to comprehend.
- C) frequently responsible for human progress.
- D) largely irrelevant to current political decisions.

36

How would Paine most likely respond to Burke’s statement in lines 30-34, Passage 1 (“As the . . . born”)?

- A) He would assert that the notion of a partnership across generations is less plausible to people of his era than it was to people in the past.
- B) He would argue that there are no politically meaningful links between the dead, the living, and the unborn.
- C) He would question the possibility that significant changes to a political system could be accomplished within a single generation.
- D) He would point out that we cannot know what judgments the dead would make about contemporary issues.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 41-43 (“Every . . . it”)
- B) Lines 43-45 (“The vanity . . . tyrannies”)
- C) Lines 56-58 (“It is . . . accommodated”)
- D) Lines 67-72 (“What . . . time”)

38

Which choice best describes how Burke would most likely have reacted to Paine’s remarks in the final paragraph of Passage 2?

- A) With approval, because adapting to new events may enhance existing partnerships.
- B) With resignation, because changing circumstances are an inevitable aspect of life.
- C) With skepticism, because Paine does not substantiate his claim with examples of governments changed for the better.
- D) With disapproval, because changing conditions are insufficient justification for changing the form of government.

39

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-4 (“To avoid . . . state”)
- B) Lines 7-9 (“he should . . . solicitude”)
- C) Lines 27-29 (“It is . . . perfection”)
- D) Lines 34-38 (“The municipal . . . community”)

40

Which choice best states the relationship between the two passages?

- A) Passage 2 challenges the primary argument of Passage 1.
- B) Passage 2 advocates an alternative approach to a problem discussed in Passage 1.
- C) Passage 2 provides further evidence to support an idea introduced in Passage 1.
- D) Passage 2 exemplifies an attitude promoted in Passage 1.

41

The main purpose of both passages is to

- A) suggest a way to resolve a particular political struggle.
- B) discuss the relationship between people and their government.
- C) evaluate the consequences of rapid political change.
- D) describe the duties that governments have to their citizens.

**Questions 42-52 are based on the following passage and supplementary material.**

This passage is adapted from Carolyn Gramling, “Source of Mysterious Medieval Eruption Identified.” ©2013 by American Association for the Advancement of Science.

About 750 years ago, a powerful volcano erupted somewhere on Earth, kicking off a centuries-long cold snap known as the Little Ice Age. Identifying the volcano responsible has been tricky.

5 That a powerful volcano erupted somewhere in the world, sometime in the Middle Ages, is written in polar ice cores in the form of layers of sulfate deposits and tiny shards of volcanic glass. These cores suggest that the amount of sulfur the mystery  
10 volcano sent into the stratosphere put it firmly among the ranks of the strongest climate-perturbing eruptions of the current geological epoch, the Holocene, a period that stretches from 10,000 years ago to the present. A haze of stratospheric sulfur  
15 cools the climate by reflecting solar energy back into space.

In 2012, a team of scientists led by geochemist Gifford Miller strengthened the link between the mystery eruption and the onset of the Little Ice Age  
20 by using radiocarbon dating of dead plant material from beneath the ice caps on Baffin Island and Iceland, as well as ice and sediment core data, to determine that the cold summers and ice growth began abruptly between 1275 and 1300 C.E. (and  
25 became intensified between 1430 and 1455 C.E.). Such a sudden onset pointed to a huge volcanic eruption injecting sulfur into the stratosphere and starting the cooling. Subsequent, unusually large and frequent eruptions of other volcanoes, as well as  
30 sea-ice/ocean feedbacks persisting long after the aerosols have been removed from the atmosphere, may have prolonged the cooling through the 1700s.

Volcanologist Franck Lavigne and colleagues now think they’ve identified the volcano in question:  
35 Indonesia’s Samalas. One line of evidence, they note, is historical records. According to Babad Lombok, records of the island written on palm leaves in Old Javanese, Samalas erupted catastrophically before the end of the 13th century, devastating surrounding  
40 villages—including Lombok’s capital at the time, Pamatan—with ash and fast-moving sweeps of hot rock and gas called pyroclastic flows.

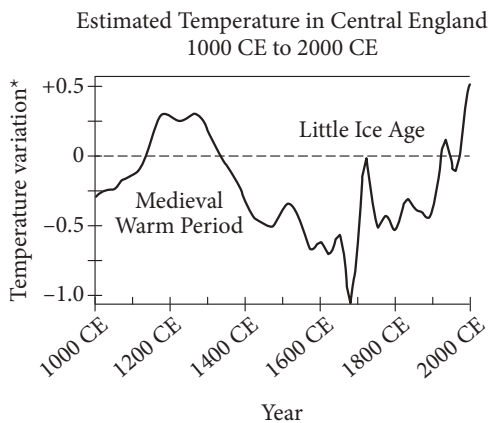
The researchers then began to reconstruct the formation of the large, 800-meter-deep caldera [a  
45 basin-shaped volcanic crater] that now sits atop the

volcano. They examined 130 outcrops on the flanks of the volcano, exposing sequences of pumice—ash hardened into rock—and other pyroclastic material. The volume of ash deposited, and the estimated  
50 height of the eruption plume (43 kilometers above sea level) put the eruption’s magnitude at a minimum of 7 on the volcanic explosivity index (which has a scale of 1 to 8)—making it one of the largest known in the Holocene.

55 The team also performed radiocarbon analyses on carbonized tree trunks and branches buried within the pyroclastic deposits to confirm the date of the eruption; it could not, they concluded, have happened before 1257 C.E., and certainly happened  
60 in the 13th century.

It’s not a total surprise that an Indonesian volcano might be the source of the eruption, Miller says. “An equatorial eruption is more consistent with the apparent climate impacts.” And, he adds, with sulfate  
65 appearing in both polar ice caps—Arctic and Antarctic—there is “a strong consensus” that this also supports an equatorial source.

Another possible candidate—both in terms of timing and geographical location—is Ecuador’s  
70 Quilotoa, estimated to have last erupted between 1147 and 1320 C.E. But when Lavigne’s team examined shards of volcanic glass from this volcano, they found that they didn’t match the chemical composition of the glass found in polar ice cores,  
75 whereas the Samalas glass is a much closer match. That, they suggest, further strengthens the case that Samalas was responsible for the medieval “year without summer” in 1258 C.E.



\*Variation from the 1961-1990 average temperature, in °C, represented at 0.

Adapted from John P. Rafferty, "Little Ice Age." Originally published in 2011. ©2014 by Encyclopedia Britannica, Inc.

42

The main purpose of the passage is to

- A) describe periods in Earth's recent geologic history.
- B) explain the methods scientists use in radiocarbon analysis.
- C) describe evidence linking the volcano Samalas to the Little Ice Age.
- D) explain how volcanic glass forms during volcanic eruptions.

43

Over the course of the passage, the focus shifts from

- A) a criticism of a scientific model to a new theory.
- B) a description of a recorded event to its likely cause.
- C) the use of ice core samples to a new method of measuring sulfates.
- D) the use of radiocarbon dating to an examination of volcanic glass.

44

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 17-25 ("In 2012 . . . 1455 C.E.")
- B) Lines 43-46 ("The researchers . . . atop the volcano")
- C) Lines 46-48 ("They examined . . . material")
- D) Lines 55-60 ("The team . . . 13th century")

45

The author uses the phrase "is written in" (line 6) most likely to

- A) demonstrate the concept of the hands-on nature of the work done by scientists.
- B) highlight the fact that scientists often write about their discoveries.
- C) underscore the sense of importance that scientists have regarding their work.
- D) reinforce the idea that the evidence is there and can be interpreted by scientists.

46

Where does the author indicate the medieval volcanic eruption most probably was located?

- A) Near the equator, in Indonesia
- B) In the Arctic region
- C) In the Antarctic region
- D) Near the equator, in Ecuador

47

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-3 ("About 750 . . . Ice Age")
- B) Lines 26-28 ("Such a . . . the cooling")
- C) Lines 49-54 ("The volume . . . the Holocene")
- D) Lines 61-64 ("It's not . . . climate impacts")

48

As used in line 68, the phrase “Another possible candidate” implies that

- A) powerful volcanic eruptions occur frequently.
- B) the effects of volcanic eruptions can last for centuries.
- C) scientists know of other volcanoes that erupted during the Middle Ages.
- D) other volcanoes have calderas that are very large.

49

Which choice best supports the claim that Quilotoa was not responsible for the Little Ice Age?

- A) Lines 3-4 (“Identifying . . . tricky”)
- B) Lines 26-28 (“Such a . . . cooling”)
- C) Lines 43-46 (“The researchers . . . atop the volcano”)
- D) Lines 71-75 (“But . . . closer match”)

50

According to the data in the figure, the greatest below-average temperature variation occurred around what year?

- A) 1200 CE
- B) 1375 CE
- C) 1675 CE
- D) 1750 CE

51

The passage and the figure are in agreement that the onset of the Little Ice Age began

- A) around 1150 CE.
- B) just before 1300 CE.
- C) just before 1500 CE.
- D) around 1650 CE.

52

What statement is best supported by the data presented in the figure?

- A) The greatest cooling during the Little Ice Age occurred hundreds of years after the temperature peaks of the Medieval Warm Period.
- B) The sharp decline in temperature supports the hypothesis of an equatorial volcanic eruption in the Middle Ages.
- C) Pyroclastic flows from volcanic eruptions continued for hundreds of years after the eruptions had ended.
- D) Radiocarbon analysis is the best tool scientists have to determine the temperature variations after volcanic eruptions.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Ghost Mural

In 1932 the well-known Mexican muralist David Alfaro Siqueiros was commissioned to paint a mural on the second-story exterior wall of a historic building in downtown Los Angeles. Siqueiros was asked to celebrate tropical America in his work, **1** he accordingly titled it “América Tropical.” He painted the mural’s first two sections, featuring images of a tropical rainforest and a Maya pyramid, during the day. **2** Also, to avoid

1

- A) NO CHANGE
- B) which he accordingly titled
- C) accordingly he titled it
- D) it was titled accordingly

2

- A) NO CHANGE
- B) However,
- C) Although,
- D) Moreover,

scrutiny, Siqueiros painted the final section of the mural, the **3** centerpiece at night.

**4** The reason for Siqueiros’s secrecy became clear when the mural was **5** confided. The centerpiece of the work was dominated by images of native people being oppressed and **6** including an eagle symbolizing the United States. Siqueiros’s political message did not please the wealthy citizens who had commissioned his work. They eventually ordered the mural to be literally whitewashed, or painted over with white paint.

However, by the 1970s, the white paint had begun to fade, and the bright colors of the mural were beginning to show through. At the same time, a social and civil rights movement for Mexican Americans was working to raise awareness of Mexican American cultural identity. Artists associated with **7** this began to rediscover and promote the work of the Mexican muralists, particularly Siqueiros. To them, “América Tropical” was an example of how art in public spaces could be used to celebrate Mexican American heritage while at the same time making a political statement. Inspired by Siqueiros and the other muralists, this new generation of artists strove to emulate the old mural masters.

3

- A) NO CHANGE
- B) centerpiece,
- C) centerpiece;
- D) centerpiece—

4

Which choice best connects the sentence with the previous paragraph?

- A) NO CHANGE
- B) All three sections of the mural were on display
- C) The community turned out in large numbers
- D) Siqueiros was informed of people’s reactions

5

- A) NO CHANGE
- B) promulgated.
- C) imparted.
- D) unveiled.

6

- A) NO CHANGE
- B) included
- C) includes
- D) had included

7

- A) NO CHANGE
- B) it
- C) them
- D) this movement

8 The result was an explosion of mural painting that spread throughout California and the southwestern United States in the 1970s. It was the Chicano mural movement. Hundreds of large, colorful new murals depicting elements of Mexican American life and history appeared during this period, some in designated cultural locations but many more in abandoned lots, on unused buildings, or 9 painted on infrastructure such as highways and bridges. Many of these murals can still be seen today, although some have not been well maintained.

8

Which choice most effectively combines the underlined sentences?

- A) The result was an explosion, the Chicano mural movement, of mural painting that spread throughout California and the southwestern United States in the 1970s.
- B) The result was the Chicano mural movement, an explosion of mural painting that spread throughout California and the southwestern United States in the 1970s.
- C) The explosion of mural painting that spread throughout California and the southwestern United States in the 1970s was the resulting Chicano mural movement.
- D) An explosion of mural painting resulted and it spread throughout California and the southwestern United States in the 1970s; it was the Chicano mural movement.

9

- A) NO CHANGE
- B) they were painted on
- C) on
- D) DELETE the underlined portion.



Fortunately, a new group of artists has discovered the murals, and efforts are underway to clean, restore, and repaint them. Once again, Siqueiros’s “América Tropical” is **10** leading the way. After a lengthy and complex restoration process, this powerful work is now a tourist attraction, complete with a visitor center and a rooftop viewing platform. **11** Advocates hope that Siqueiros’s mural will once more serve as an inspiration, this time inspiring viewers to save and restore an important cultural and artistic legacy.

10

Which choice most effectively sets up the information that follows?

- A) NO CHANGE
- B) being cleaned and restored.
- C) at risk of destruction.
- D) awaiting its moment of appreciation.

11

At this point, the writer is considering adding the following sentence.

When it was painted in 1932, Siqueiros’s mural was considered offensive, but now it is acclaimed.

Should the writer make this addition here?

- A) Yes, because it provides historical context for the changes discussed in the passage.
- B) Yes, because it provides a useful reminder of how people once viewed Siqueiros’s work.
- C) No, because it unnecessarily repeats information from earlier in the passage.
- D) No, because it makes a claim about Siqueiros’s work that is not supported by the passage.

Questions 12-22 are based on the following passage.

### The Hype of Healthier Organic Food

Some people buy organic food because they believe organically grown crops are more nutritious and safer for consumption than **12** the people who purchase their conventionally grown counterparts, which are usually produced with pesticides and synthetic fertilizers. In the name of health, **13** spending \$1.60 for every dollar they would have spent on food that is **14** grown in a manner that is considered conventional. Scientific evidence, **15** therefore, suggests that consumers do not reap significant benefits, in terms of either nutritional value or safety, from organic food.

12

- A) NO CHANGE
- B) the purchase of
- C) purchasing
- D) DELETE the underlined portion.

13

- A) NO CHANGE
- B) these consumers spend
- C) having spent
- D) to spend

14

- A) NO CHANGE
- B) grown with conventional methods, using pesticides and synthetic fertilizers.
- C) conventionally and therefore not organically grown.
- D) conventionally grown.

15

- A) NO CHANGE
- B) furthermore,
- C) however,
- D) subsequently,

Although advocates of organic food **16** preserve that organic produce is healthier than conventionally grown produce because it has more vitamins and minerals, this assertion is not supported by scientific research. **17** For instance, one review published in *The American Journal of Clinical Nutrition* provided analysis of the results of comparative studies conducted over a span of 50 years; researchers consistently found no evidence that organic crops are more nutritious than conventionally grown ones in terms of their vitamin and mineral content. **18** Similarly, Stanford University researchers who examined almost 250 studies comparing the nutritional content of different kinds of organic foods with that of their nonorganic counterparts found very little difference between the two.

16

- A) NO CHANGE
- B) carry on
- C) maintain
- D) sustain

17

- A) NO CHANGE
- B) However,
- C) In addition,
- D) Likewise,

18

At this point, the writer is considering adding the following sentence.

The United States Department of Agriculture (USDA) reports that organic agricultural products are now available in approximately 20,000 markets specializing in natural foods.

Should the writer make this addition here?

- A) Yes, because it adds a relevant research finding from a government agency.
- B) Yes, because it supports the passage's argument that organic food is less nutritious than conventionally grown food.
- C) No, because it is not relevant to the paragraph's discussion of scientific evidence.
- D) No, because it introduces a term that has not been defined in the passage.

Evidence also undermines the claim that organic food is safer to eat. While researchers have found lower levels of pesticide residue in organic produce than in nonorganic produce, the pesticide residue detected in conventional produce falls within acceptable safety limits. According to such organizations as the US Environmental Protection Agency, the minute amounts of residue falling within such limits **19** have no negative impact on human health. **20**

19

- A) NO CHANGE
- B) is having
- C) has had
- D) has

20

At this point, the writer wants to further reinforce the paragraph's claim about the safety of nonorganic food. Which choice most effectively accomplishes this goal?

- A) To be labeled organic, a product must meet certain standards determined and monitored by the US Department of Agriculture.
- B) Organic food, however, is regulated to eliminate artificial ingredients that include certain types of preservatives, sweeteners, colorings, and flavors.
- C) Moreover, consumers who are concerned about ingesting pesticide residue can eliminate much of it by simply washing or peeling produce before eating it.
- D) In fact, the Environmental Protection Agency estimates that about one-fifth of the pesticides used worldwide are applied to crops in the United States.

Based on scientific evidence, organic food offers neither significant nutritional nor safety benefits for consumers. Proponents of organic food, of course, are quick to add that **21** their are numerous other reasons to buy organic **22** food, such as, a desire to protect the environment from potentially damaging pesticides or a preference for the taste of organically grown foods. Research regarding these issues is less conclusive than the findings regarding nutritional content and pesticide residue safety limits. What is clear, though, is this: if a consumer's goal is to buy the healthiest and safest food to eat, the increased cost of organic food is a waste of money.

21

- A) NO CHANGE
- B) there are
- C) there is
- D) their is

22

- A) NO CHANGE
- B) food such as:
- C) food such as,
- D) food, such as

Questions 23-33 are based on the following passage and supplementary material.

### You Are Where You Say

Research on regional variations in English-language use has not only yielded answers to such **23** life-altering questions as how people in different parts of the United States refer to carbonated beverages (“soda”? “pop”? “coke”?) **24** it also illustrates how technology can change the very nature of research. While traditional, human-intensive data collection **25** has all but disappeared in language studies, the explosion of social media has opened new avenues for investigation.

[1] Perhaps the epitome of traditional methodology is the *Dictionary of American Regional English*, colloquially known as *DARE*. [2] Its fifth and final alphabetical volume—ending with “zydeco”—released in 2012, the dictionary represents decades of arduous work. [3] Over a six-year period from 1965 to 1970, university graduate students conducted interviews in more than a thousand communities across the nation. [4] Their goal was to determine what names people used for such everyday objects and concepts as a submarine sandwich

23

The writer wants to convey an attitude of genuine interest and to avoid the appearance of mockery. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) galvanizing
- C) intriguing
- D) weird

24

- A) NO CHANGE
- B) and also illustrates
- C) but also illustrates
- D) illustrating

25

Which choice most effectively sets up the contrast in the sentence and is consistent with the information in the rest of the passage?

- A) NO CHANGE
- B) still has an important place
- C) remains the only option
- D) yields questionable results

(a “hero” in New York City but a “dagwood” in many parts of Minnesota, Iowa, and Colorado) and a heavy rainstorm (variously a “gully washer,” “pour-down,” or “stump mover”). [5] The work that dictionary founder Frederic G. Cassidy had expected to be finished by 1976 was not, in fact, completed in his lifetime. [6] The wait did not dampen enthusiasm among **26** scholars. Scholars consider the work a signal achievement in linguistics. **27**

Not all research into regional English varieties **28** requires such time, effort, and resources, however. Today’s researchers have found that the veritable army of trained volunteers traveling the country conducting face-to-face interviews can sometimes be **29** replaced by another army the vast array of individuals volunteering details about their lives—and, inadvertently, their language—through social media. Brice Russ of Ohio State University, for example, has employed software to sort through postings on one social media **30** cite in search of particular words and phrases of interest as well as the location from which users are posting. From these data,

26

- A) NO CHANGE
- B) scholars, and these scholars
- C) scholars, but scholars
- D) scholars, who

27

To improve the cohesion and flow of this paragraph, the writer wants to add the following sentence.

Data gathering proved to be the quick part of the project.

The sentence would most logically be placed after

- A) sentence 2.
- B) sentence 3.
- C) sentence 4.
- D) sentence 5.

28

- A) NO CHANGE
- B) are requiring
- C) have required
- D) require

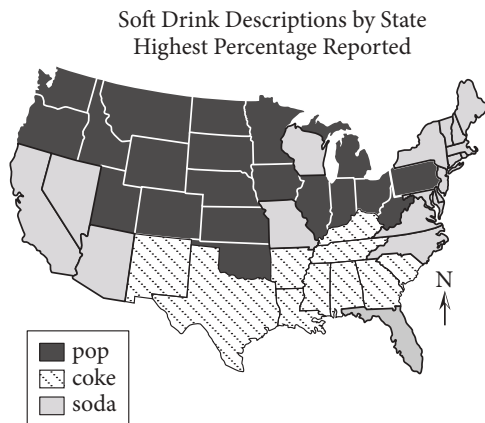
29

- A) NO CHANGE
- B) replaced—by another army,
- C) replaced by another army;
- D) replaced by another army:

30

- A) NO CHANGE
- B) site in search of
- C) sight in search for
- D) cite in search for

he was able, among other things, to confirm regional variations in people’s terms for soft drinks. As the map shows, “soda” is commonly heard in the middle and western portions of the United States; “pop” is frequently used in many southern states; and “coke” is predominant in the northeastern and southwest regions but used elsewhere as well. **31** As interesting as Russ’s findings are, though, **32** they’re true value lies in their reminder that the Internet is not merely a sophisticated tool for collecting data but is also **33** itself a rich source of data.



Adapted from Jennifer M. Smith, Department of Geography, The Pennsylvania State University, with data from [www.popvssoda.com](http://www.popvssoda.com)

31

The writer wants the information in the passage to correspond as closely as possible with the information in the map. Given that goal and assuming that the rest of the previous sentence would remain unchanged, in which sequence should the three terms for soft drinks be discussed?

- A) NO CHANGE
- B) “pop,” “soda,” “coke”
- C) “pop,” “coke,” “soda”
- D) “soda,” “coke,” “pop”

32

- A) NO CHANGE
- B) their true value lies in their
- C) there true value lies in they’re
- D) their true value lies in there

33

Which choice most effectively concludes the sentence and paragraph?

- A) NO CHANGE
- B) where we can learn what terms people use to refer to soft drinks.
- C) a useful way to stay connected to friends, family, and colleagues.
- D) helpful to researchers.



Questions 34-44 are based on the following passage.

### Creating Worlds: A Career in Game Design

If you love video games and have thought about how the games you play might be changed or improved, or if you've imagined creating a video game of your own, you might want to consider a career as a video game designer. There **34** were a number of steps you can take to determine whether game design is the right field for you and, if it is, to prepare yourself for such a career.

Before making the choice, you should have some sense of what a video game designer does. Every video game, whether for a console, computer, or mobile device, starts with a concept that originates in the mind of a designer. The designer envisions the game's fundamental **35** elements: the settings, characters, and plots that make each game unique, and is thus a primary creative force behind a video game.

Conceptualizing a game is only the beginning of a video game designer's **36** job, however, no matter how good a concept is, it will never be translated into a video game unless it is communicated effectively to all the other members of the video game development team. **37** A designer must generate extensive documentation and

**34**

- A) NO CHANGE
- B) has been
- C) are
- D) was

**35**

- A) NO CHANGE
- B) elements: the settings, characters, and plots that make each game unique—
- C) elements—the settings, characters, and plots that make each game unique—
- D) elements; the settings, characters, and plots that make each game unique;

**36**

- A) NO CHANGE
- B) job, however. No
- C) job—however, no
- D) job however no

**37**

At this point, the writer is considering adding the following sentence.

Successful communication is essential if a designer's idea is to become a reality.

Should the writer make this addition here?

- A) Yes, because it supports the conclusion drawn in the following sentence.
- B) Yes, because it illustrates a general principle discussed in the paragraph.
- C) No, because it distracts from the focus of the paragraph by introducing irrelevant material.
- D) No, because it merely reformulates the thought expressed in the preceding sentence.

**38** explain his or her ideas clearly in order to ensure that the programmers, artists, and others on the team all share the same vision. **39** Likewise, anyone considering a career as a video game designer must be **40** skilled writers and speakers. In addition, because video game development is a collaborative effort and because the development of any one game may take months or even years, a designer must be an effective team player as well as detail oriented.

[1] A basic understanding of computer programming is essential. [2] In fact, many designers **41** initially begin their pursuits as programmers. [3] Consider taking some general computer science courses as well as courses in artificial intelligence and graphics in order to increase your understanding of the technical challenges involved in developing a video game. [4] Courses in psychology and human behavior may help you develop **42** emphatic collaboration skills, while courses in the humanities, such as in literature and film, should give you the background necessary to develop effective narrative structures. [5] A

38

Which choice results in a sentence that best supports the point developed in this paragraph?

- A) NO CHANGE
- B) possess a vivid imagination
- C) assess his or her motivations carefully
- D) learn to accept constructive criticism

39

- A) NO CHANGE
- B) Nevertheless,
- C) Consequently,
- D) However,

40

- A) NO CHANGE
- B) a skilled writer and speaker.
- C) skilled both as writers and speakers.
- D) both skilled writers and speakers.

41

- A) NO CHANGE
- B) start to begin their work
- C) initiate their progression
- D) begin their careers

42

- A) NO CHANGE
- B) paramount
- C) eminent
- D) important

designer also needs careful educational preparation. [6] Finally, because a designer should understand the business aspects of the video game industry, such as budgeting and marketing, you may want to consider taking some business courses. [7] Although demanding and deadline driven, **43** video game design can be a lucrative and rewarding field for people who love gaming and have prepared themselves with the necessary skills and knowledge. **44**

**43**

- A) NO CHANGE
- B) the choice of video game design
- C) you should choose video game design because it
- D) choosing to design video games

**44**

To make this paragraph most logical, sentence 5 should be

- A) placed where it is now.
- B) placed before sentence 1.
- C) placed after sentence 3.
- D) DELETED from the paragraph.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

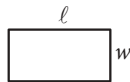
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

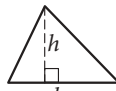


$$A = \pi r^2$$

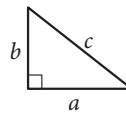
$$C = 2\pi r$$



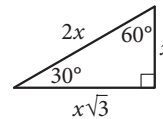
$$A = \ell w$$



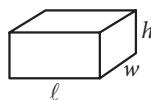
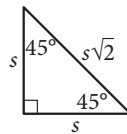
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



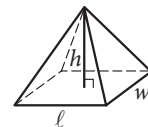
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

Which of the following expressions is equal to 0 for some value of  $x$  ?

- A)  $|x - 1| - 1$
- B)  $|x + 1| + 1$
- C)  $|1 - x| + 1$
- D)  $|x - 1| + 1$

2

$$f(x) = \frac{3}{2}x + b$$

In the function above,  $b$  is a constant. If  $f(6) = 7$ , what is the value of  $f(-2)$  ?

- A)  $-5$
- B)  $-2$
- C)  $1$
- D)  $7$

3

$$\frac{x}{y} = 6$$
$$4(y + 1) = x$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $y$  ?

- A) 2
- B) 4
- C) 12
- D) 24

4

If  $f(x) = -2x + 5$ , what is  $f(-3x)$  equal to?

- A)  $-6x - 5$
- B)  $6x + 5$
- C)  $6x - 5$
- D)  $6x^2 - 15x$



5

$$3(2x + 1)(4x + 1)$$

Which of the following is equivalent to the expression above?

- A)  $45x$
- B)  $24x^2 + 3$
- C)  $24x^2 + 18x + 3$
- D)  $18x^2 + 6$

6

If  $\frac{a-b}{b} = \frac{3}{7}$ , which of the following must also be true?

- A)  $\frac{a}{b} = -\frac{4}{7}$
- B)  $\frac{a}{b} = \frac{10}{7}$
- C)  $\frac{a+b}{b} = \frac{10}{7}$
- D)  $\frac{a-2b}{b} = -\frac{11}{7}$

7

While preparing to run a marathon, Amelia created a training schedule in which the distance of her longest run every week increased by a constant amount. If Amelia's training schedule requires that her longest run in week 4 is a distance of 8 miles and her longest run in week 16 is a distance of 26 miles, which of the following best describes how the distance Amelia runs changes between week 4 and week 16 of her training schedule?

- A) Amelia increases the distance of her longest run by 0.5 miles each week.
- B) Amelia increases the distance of her longest run by 2 miles each week.
- C) Amelia increases the distance of her longest run by 2 miles every 3 weeks.
- D) Amelia increases the distance of her longest run by 1.5 miles each week.



8

Which of the following equations represents a line that is parallel to the line with equation  $y = -3x + 4$  ?

- A)  $6x + 2y = 15$
- B)  $3x - y = 7$
- C)  $2x - 3y = 6$
- D)  $x + 3y = 1$

9

$$\sqrt{x-a} = x-4$$

If  $a = 2$ , what is the solution set of the equation above?

- A)  $\{3, 6\}$
- B)  $\{2\}$
- C)  $\{3\}$
- D)  $\{6\}$

10

If  $\frac{t+5}{t-5} = 10$ , what is the value of  $t$  ?

- A)  $\frac{45}{11}$
- B) 5
- C)  $\frac{11}{2}$
- D)  $\frac{55}{9}$

11

$$x = 2y + 5$$

$$y = (2x - 3)(x + 9)$$

How many ordered pairs  $(x, y)$  satisfy the system of equations shown above?

- A) 0
- B) 1
- C) 2
- D) Infinitely many

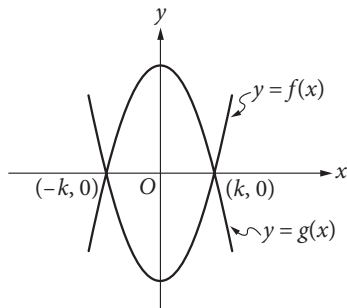


12

Ken and Paul each ordered a sandwich at a restaurant. The price of Ken's sandwich was  $x$  dollars, and the price of Paul's sandwich was \$1 more than the price of Ken's sandwich. If Ken and Paul split the cost of the sandwiches evenly and each paid a 20% tip, which of the following expressions represents the amount, in dollars, each of them paid? (Assume there is no sales tax.)

- A)  $0.2x + 0.2$
- B)  $0.5x + 0.1$
- C)  $1.2x + 0.6$
- D)  $2.4x + 1.2$

13



The functions  $f$  and  $g$ , defined by  $f(x) = 8x^2 - 2$  and  $g(x) = -8x^2 + 2$ , are graphed in the  $xy$ -plane above. The graphs of  $f$  and  $g$  intersect at the points  $(k, 0)$  and  $(-k, 0)$ . What is the value of  $k$ ?

- A)  $\frac{1}{4}$
- B)  $\frac{1}{2}$
- C) 1
- D) 2

14

$$\frac{8 - i}{3 - 2i}$$

If the expression above is rewritten in the form  $a + bi$ , where  $a$  and  $b$  are real numbers, what is the value of  $a$ ? (Note:  $i = \sqrt{-1}$ )

- A) 2
- B)  $\frac{8}{3}$
- C) 3
- D)  $\frac{11}{3}$

15

$$x^2 - \frac{k}{2}x = 2p$$

In the quadratic equation above,  $k$  and  $p$  are constants. What are the solutions for  $x$ ?

- A)  $x = \frac{k}{4} \pm \frac{\sqrt{k^2 + 2p}}{4}$
- B)  $x = \frac{k}{4} \pm \frac{\sqrt{k^2 + 32p}}{4}$
- C)  $x = \frac{k}{2} \pm \frac{\sqrt{k^2 + 2p}}{2}$
- D)  $x = \frac{k}{2} \pm \frac{\sqrt{k^2 + 32p}}{4}$



**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $7/2$ . (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \circ & \circ & \circ & \circ \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Answer:  $\frac{7}{12}$

7	/	1	2
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

← Fraction line

← Decimal point

Grid in result. →

Answer: 2.5

	2	.	5
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	6
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	7
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

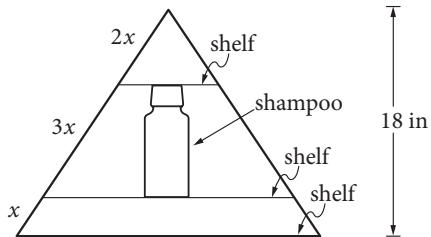
	2	0	1
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③

2	0	1	
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

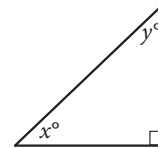


16



Jim has a triangular shelf system that attaches to his showerhead. The total height of the system is 18 inches, and there are three parallel shelves as shown above. What is the maximum height, in inches, of a shampoo bottle that can stand upright on the middle shelf?

17



In the triangle above, the sine of  $x^\circ$  is 0.6. What is the cosine of  $y^\circ$ ?

18

$$x^3 - 5x^2 + 2x - 10 = 0$$

For what real value of  $x$  is the equation above true?



19

$$-3x + 4y = 20$$

$$6x + 3y = 15$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $x$  ?

20

The mesosphere is the layer of Earth's atmosphere between 50 kilometers and 85 kilometers above Earth's surface. At a distance of 50 kilometers from Earth's surface, the temperature in the mesosphere is  $-5^\circ$  Celsius, and at a distance of 80 kilometers from Earth's surface, the temperature in the mesosphere is  $-80^\circ$  Celsius. For every additional 10 kilometers from Earth's surface, the temperature in the mesosphere decreases by  $k^\circ$  Celsius, where  $k$  is a constant. What is the value of  $k$  ?

**STOP**

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

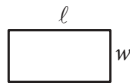
1. The use of a calculator **is permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

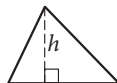


$$A = \pi r^2$$

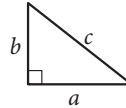
$$C = 2\pi r$$



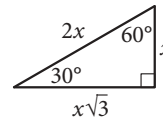
$$A = \ell w$$



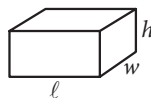
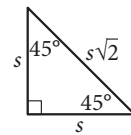
$$A = \frac{1}{2}bh$$



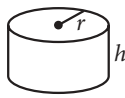
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

The monthly membership fee for an online television and movie service is \$9.80. The cost of viewing television shows online is included in the membership fee, but there is an additional fee of \$1.50 to rent each movie online. For one month, Jill's membership and movie rental fees were \$12.80. How many movies did Jill rent online that month?

- A) 1
- B) 2
- C) 3
- D) 4

2

One of the requirements for becoming a court reporter is the ability to type 225 words per minute. Donald can currently type 180 words per minute, and believes that with practice he can increase his typing speed by 5 words per minute each month. Which of the following represents the number of words per minute that Donald believes he will be able to type  $m$  months from now?

- A)  $5 + 180m$
- B)  $225 + 5m$
- C)  $180 + 5m$
- D)  $180 - 5m$

3

If a 3-pound pizza is sliced in half and each half is sliced into thirds, what is the weight, in ounces, of each of the slices? (1 pound = 16 ounces)

- A) 4
- B) 6
- C) 8
- D) 16

4

Nick surveyed a random sample of the freshman class of his high school to determine whether the Fall Festival should be held in October or November. Of the 90 students surveyed, 25.6% preferred October. Based on this information, about how many students in the entire 225-person class would be expected to prefer having the Fall Festival in October?

- A) 50
- B) 60
- C) 75
- D) 80



5

The density of an object is equal to the mass of the object divided by the volume of the object. What is the volume, in milliliters, of an object with a mass of 24 grams and a density of 3 grams per milliliter?

- A) 0.125
- B) 8
- C) 21
- D) 72

6

Last week Raul worked 11 more hours than Angelica. If they worked a combined total of 59 hours, how many hours did Angelica work last week?

- A) 24
- B) 35
- C) 40
- D) 48

7

Movies with Greatest Ticket Sales in 2012

MPAA rating	Type of movie				Total
	Action	Animated	Comedy	Drama	
PG	2	7	0	2	11
PG-13	10	0	4	8	22
R	6	0	5	6	17
Total	18	7	9	16	50

The table above represents the 50 movies that had the greatest ticket sales in 2012, categorized by movie type and Motion Picture Association of America (MPAA) rating. What proportion of the movies are comedies with a PG-13 rating?

- A)  $\frac{2}{25}$
- B)  $\frac{9}{50}$
- C)  $\frac{2}{11}$
- D)  $\frac{11}{25}$

8

Line  $\ell$  in the  $xy$ -plane contains points from each of Quadrants II, III, and IV, but no points from Quadrant I. Which of the following must be true?

- A) The slope of line  $\ell$  is undefined.
- B) The slope of line  $\ell$  is zero.
- C) The slope of line  $\ell$  is positive.
- D) The slope of line  $\ell$  is negative.



Number of Registered Voters  
in the United States in 2012, in Thousands

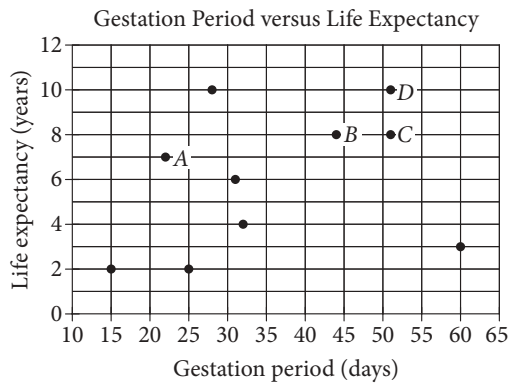
Region	Age, in years					Total
	18 to 24	25 to 44	45 to 64	65 to 74	75 and older	
Northeast	2,713	8,159	10,986	3,342	2,775	27,975
Midwest	3,453	11,237	13,865	4,221	3,350	36,126
South	5,210	18,072	21,346	7,272	4,969	56,869
West	3,390	10,428	11,598	3,785	2,986	32,187
Total	14,766	47,896	57,795	18,620	14,080	153,157

The table above shows the number of registered voters in 2012, in thousands, in four geographic regions and five age groups. Based on the table, if a registered voter who was 18 to 44 years old in 2012 is chosen at random, which of the following is closest to the probability that the registered voter was from the Midwest region?

- A) 0.10
- B) 0.25
- C) 0.40
- D) 0.75



Questions 10 and 11 refer to the following information.



A curator at a wildlife society created the scatterplot above to examine the relationship between the gestation period and life expectancy of 10 species of animals.

10

What is the life expectancy, in years, of the animal that has the longest gestation period?

- A) 3
- B) 4
- C) 8
- D) 10

11

Of the labeled points, which represents the animal for which the ratio of life expectancy to gestation period is greatest?

- A) A
- B) B
- C) C
- D) D

12

In the  $xy$ -plane, the graph of function  $f$  has  $x$ -intercepts at  $-3$ ,  $-1$ , and  $1$ . Which of the following could define  $f$ ?

- A)  $f(x) = (x - 3)(x - 1)(x + 1)$
- B)  $f(x) = (x - 3)(x - 1)^2$
- C)  $f(x) = (x - 1)(x + 1)(x + 3)$
- D)  $f(x) = (x + 1)^2(x + 3)$





13

The population of mosquitoes in a swamp is estimated over the course of twenty weeks, as shown in the table.

Time (weeks)	Population
0	100
5	1,000
10	10,000
15	100,000
20	1,000,000

Which of the following best describes the relationship between time and the estimated population of mosquitoes during the twenty weeks?

- A) Increasing linear
- B) Decreasing linear
- C) Exponential growth
- D) Exponential decay

14

$$1,000 \left( 1 + \frac{r}{1,200} \right)^{12}$$

The expression above gives the amount of money, in dollars, generated in a year by a \$1,000 deposit in a bank account that pays an annual interest rate of  $r\%$ , compounded monthly. Which of the following expressions shows how much additional money is generated at an interest rate of 5% than at an interest rate of 3%?

A)  $1,000 \left( 1 + \frac{5-3}{1,200} \right)^{12}$

B)  $1,000 \left( 1 + \frac{\frac{5}{3}}{1,200} \right)^{12}$

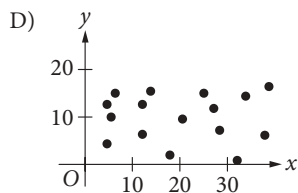
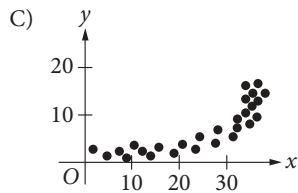
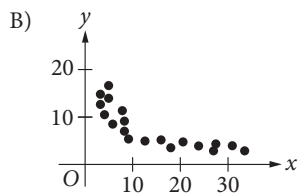
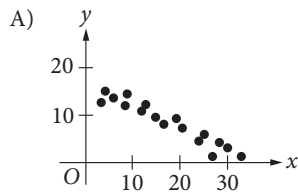
C)  $\frac{1,000 \left( 1 + \frac{5}{1,200} \right)^{12}}{1,000 \left( 1 + \frac{3}{1,200} \right)^{12}}$

D)  $1,000 \left( 1 + \frac{5}{1,200} \right)^{12} - 1,000 \left( 1 + \frac{3}{1,200} \right)^{12}$



15

Which of the following scatterplots shows a relationship that is appropriately modeled with the equation  $y = ax^b$ , where  $a$  is positive and  $b$  is negative?



Questions 16 and 17 refer to the following information.

Mr. Martinson is building a concrete patio in his backyard and deciding where to buy the materials and rent the tools needed for the project. The table below shows the materials' cost and daily rental costs for three different stores.

Store	Materials' Cost, $M$ (dollars)	Rental cost of wheelbarrow, $W$ (dollars per day)	Rental cost of concrete mixer, $K$ (dollars per day)
A	750	15	65
B	600	25	80
C	700	20	70

The total cost,  $y$ , for buying the materials and renting the tools in terms of the number of days,  $x$ , is given by  $y = M + (W + K)x$ .

16

For what number of days,  $x$ , will the total cost of buying the materials and renting the tools from Store B be less than or equal to the total cost of buying the materials and renting the tools from Store A?

- A)  $x \leq 6$
- B)  $x \geq 6$
- C)  $x \leq 7.3$
- D)  $x \geq 7.3$



17

If the relationship between the total cost,  $y$ , of buying the materials and renting the tools at Store C and the number of days,  $x$ , for which the tools are rented is graphed in the  $xy$ -plane, what does the slope of the line represent?

- A) The total cost of the project
  - B) The total cost of the materials
  - C) The total daily cost of the project
  - D) The total daily rental costs of the tools
- 

18

Jim has identical drinking glasses each in the shape of a right circular cylinder with internal diameter of 3 inches. He pours milk from a gallon jug into each glass until it is full. If the height of milk in each glass is about 6 inches, what is the largest number of full milk glasses that he can pour from one gallon of milk? (Note: There are 231 cubic inches in 1 gallon.)

- A) 2
- B) 4
- C) 5
- D) 6

19

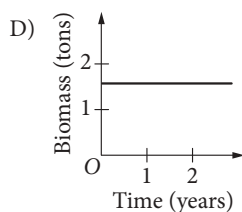
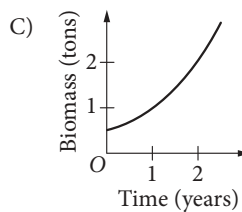
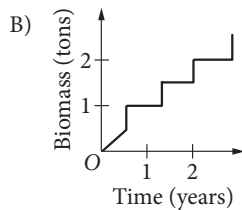
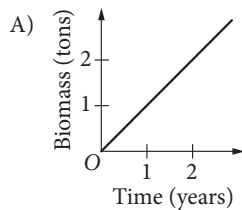
If  $3p - 2 \geq 1$ , what is the least possible value of  $3p + 2$  ?

- A) 5
- B) 3
- C) 2
- D) 1

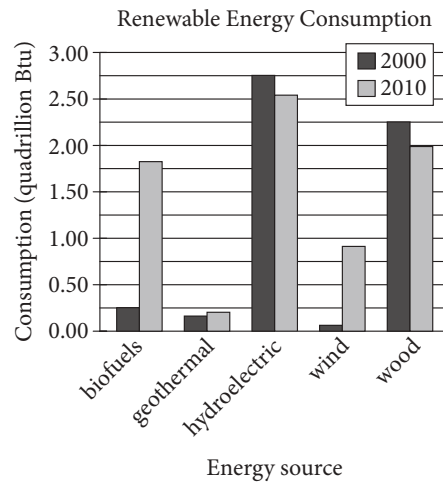


20

The mass of living organisms in a lake is defined to be the biomass of the lake. If the biomass in a lake doubles each year, which of the following graphs could model the biomass in the lake as a function of time? (Note: In each graph below,  $O$  represents  $(0, 0)$ .)



Questions 21 and 22 refer to the following information.



The bar graph above shows renewable energy consumption in quadrillions of British thermal units (Btu) in the United States, by energy source, for several energy sources in the years 2000 and 2010.

21

In a scatterplot of this data, where renewable energy consumption in the year 2000 is plotted along the  $x$ -axis and renewable energy consumption in the year 2010 is plotted along the  $y$ -axis for each of the given energy sources, how many data points would be above the line  $y = x$  ?

- A) 1
- B) 2
- C) 3
- D) 4



22

Of the following, which best approximates the percent decrease in consumption of wood power in the United States from 2000 to 2010 ?

- A) 6%
- B) 11%
- C) 21%
- D) 26%

23

The tables below give the distribution of high temperatures in degrees Fahrenheit ( $^{\circ}\text{F}$ ) for City A and City B over the same 21 days in March.

City A

Temperature ( $^{\circ}\text{F}$ )	Frequency
80	3
79	14
78	2
77	1
76	1

City B

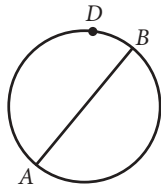
Temperature ( $^{\circ}\text{F}$ )	Frequency
80	6
79	3
78	2
77	4
76	6

Which of the following is true about the data shown for these 21 days?

- A) The standard deviation of temperatures in City A is larger.
- B) The standard deviation of temperatures in City B is larger.
- C) The standard deviation of temperatures in City A is the same as that of City B.
- D) The standard deviation of temperatures in these cities cannot be calculated with the data provided.



24



In the circle above, segment  $AB$  is a diameter. If the length of arc  $\widehat{ADB}$  is  $8\pi$ , what is the length of the radius of the circle?

- A) 2
- B) 4
- C) 8
- D) 16

25

$$f(x) = 2x^3 + 6x^2 + 4x$$

$$g(x) = x^2 + 3x + 2$$

The polynomials  $f(x)$  and  $g(x)$  are defined above. Which of the following polynomials is divisible by  $2x + 3$  ?

- A)  $h(x) = f(x) + g(x)$
- B)  $p(x) = f(x) + 3g(x)$
- C)  $r(x) = 2f(x) + 3g(x)$
- D)  $s(x) = 3f(x) + 2g(x)$

26

Let  $x$  and  $y$  be numbers such that  $-y < x < y$ . Which of the following must be true?

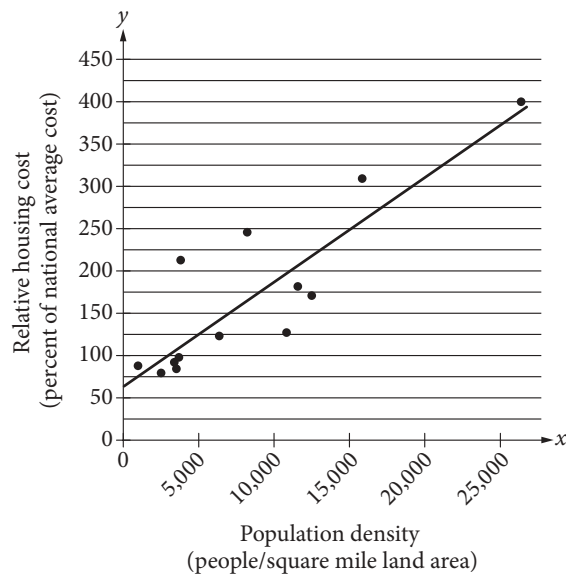
- I.  $|x| < y$
- II.  $x > 0$
- III.  $y > 0$

- A) I only
- B) I and II only
- C) I and III only
- D) I, II, and III



27

The relative housing cost for a US city is defined to be the ratio  $\frac{\text{average housing cost for the city}}{\text{national average housing cost}}$ , expressed as a percent.



The scatterplot above shows the relative housing cost and the population density for several large US cities in the year 2005. The line of best fit is also shown and has equation  $y = 0.0125x + 61$ . Which of the following best explains how the number 61 in the equation relates to the scatterplot?

- A) In 2005, the lowest housing cost in the United States was about \$61 per month.
- B) In 2005, the lowest housing cost in the United States was about 61% of the highest housing cost.
- C) In 2005, even in cities with low population densities, housing costs were never below 61% of the national average.
- D) In 2005, even in cities with low population densities, housing costs were likely at least 61% of the national average.



28

$$f(x) = (x + 6)(x - 4)$$

Which of the following is an equivalent form of the function  $f$  above in which the minimum value of  $f$  appears as a constant or coefficient?

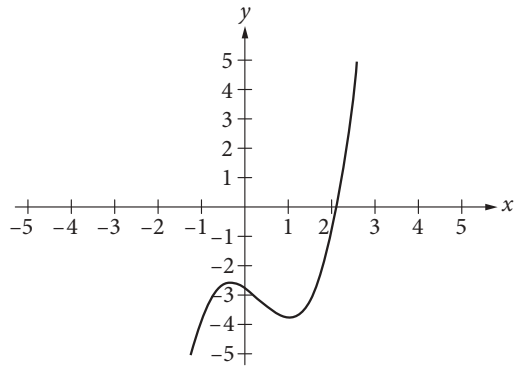
- A)  $f(x) = x^2 - 24$
- B)  $f(x) = x^2 + 2x - 24$
- C)  $f(x) = (x - 1)^2 - 21$
- D)  $f(x) = (x + 1)^2 - 25$

29

If  $x$  is the average (arithmetic mean) of  $m$  and 9,  $y$  is the average of  $2m$  and 15, and  $z$  is the average of  $3m$  and 18, what is the average of  $x$ ,  $y$ , and  $z$  in terms of  $m$ ?

- A)  $m + 6$
- B)  $m + 7$
- C)  $2m + 14$
- D)  $3m + 21$

30



The function  $f(x) = x^3 - x^2 - x - \frac{11}{4}$  is graphed in the  $xy$ -plane above. If  $k$  is a constant such that the equation  $f(x) = k$  has three real solutions, which of the following could be the value of  $k$ ?

- A) 2
- B) 0
- C) -2
- D) -3



**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & \bullet & \bullet & \bullet \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer → in boxes.

Answer:  $\frac{7}{12}$

7	/	1	2
•	•	•	•
0	0	0	0
1	1	•	1
2	2	2	•
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
•	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Answer: 2.5

	2	.	5
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	3
4	4	4	4
5	5	5	•
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

Grid in result.

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	•
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	•	•	•
7	7	7	•
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
•	•	•	•
0	0	•	0
1	1	1	•
2	•	2	2
3	3	3	3

2	0	1	
•	•	•	•
0	•	0	0
1	1	•	1
2	•	2	2
3	3	3	3

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

A partially filled pool contains 600 gallons of water. A hose is turned on, and water flows into the pool at the rate of 8 gallons per minute. How many gallons of water will be in the pool after 70 minutes?

32

The normal systolic blood pressure  $P$ , in millimeters of mercury, for an adult male  $x$  years old can be modeled by the equation  $P = \frac{x + 220}{2}$ . According to the model, for every increase of 1 year in age, by how many millimeters of mercury will the normal systolic blood pressure for an adult male increase?

33

The *pes*, a Roman measure of length, is approximately equal to 11.65 inches. It is also equivalent to 16 smaller Roman units called digits. Based on these relationships, 75 Roman digits is equivalent to how many feet, to the nearest hundredth? (12 inches = 1 foot)

34

In a study of bat migration habits, 240 male bats and 160 female bats have been tagged. If 100 more female bats are tagged, how many more male bats must be tagged so that  $\frac{3}{5}$  of the total number of bats in the study are male?

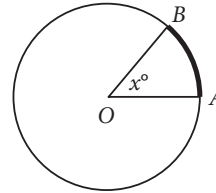


35

$$q = \frac{1}{2}nv^2$$

The dynamic pressure  $q$  generated by a fluid moving with velocity  $v$  can be found using the formula above, where  $n$  is the constant density of the fluid. An aeronautical engineer uses the formula to find the dynamic pressure of a fluid moving with velocity  $v$  and the same fluid moving with velocity  $1.5v$ . What is the ratio of the dynamic pressure of the faster fluid to the dynamic pressure of the slower fluid?

36



Note: Figure not drawn to scale.

In the figure above, the circle has center  $O$  and has radius 10. If the length of arc  $\widehat{AB}$  (shown in bold) is between 5 and 6, what is one possible integer value of  $x$  ?



---

**Questions 37 and 38 refer to the following information.**

The stock price of one share in a certain company is worth \$360 today. A stock analyst believes that the stock will lose 28 percent of its value each week for the next three weeks. The analyst uses the equation  $V = 360(r)^t$  to model the value,  $V$ , of the stock after  $t$  weeks.

37

What value should the analyst use for  $r$  ?

38

To the nearest dollar, what does the analyst believe the value of the stock will be at the end of three weeks? (Note: Disregard the \$ sign when gridding your answer.)

---

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**

**No Test Material On This Page**

**No Test Material On This Page**

**No Test Material On This Page**



**No Test Material On This Page**

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**No Test Material On This Page**

YOUR NAME (PRINT) ..... LAST FIRST MI

TEST CENTER ..... NUMBER NAME OF TEST CENTER ROOM NUMBER

# The SAT

## GENERAL DIRECTIONS

- You may work on only one section at a time.
- If you finish a section before time is called, check your work on that section. You may NOT turn to any other section.

## MARKING ANSWERS

- Be sure to mark your answer sheet properly.



- You must use a No. 2 pencil.
- Carefully mark only one answer for each question.
- Make sure you fill the entire circle darkly and completely.
- Do not make any stray marks on your answer sheet.
- If you erase, do so completely. Incomplete erasures may be scored as intended answers.
- Use only the answer spaces that correspond to the question numbers.

## USING YOUR TEST BOOK

- You may use the test book for scratch work, but you will not receive credit for anything that you write in your test book.
- After time has been called, you may not transfer answers from your test book to your answer sheet or fill in circles.
- You may not fold or remove pages or portions of a page from this book, or take the book or answer sheet from the testing room.

## SCORING

- For each correct answer, you receive one point.
- You do not lose points for wrong answers; therefore, you should try to answer every question even if you are not sure of the correct answer.

## IMPORTANT

The codes below are unique to your test book. Copy them on your answer sheet in boxes 8 and 9 and fill in the corresponding circles exactly as shown.

<b>9</b>	<b>TEST ID</b>				
	<small>(Copy from back of test book.)</small>				

<b>8</b>	<b>FORM CODE</b>					
	<small>(Copy and grid as on back of test book.)</small>					
A	A	A	A	0	0	0
B	B	B	B	1	1	1
C	C	C	C	2	2	2
D	D	D	D	3	3	3
E	E	E	E	4	4	4
F	F	F	F	5	5	5
G	G	G	G	6	6	6
H	H	H	H	7	7	7
I	I	I	I	8	8	8
J	J	J	J	9	9	9
K	K	K	K			
L	L	L	L			
M	M	M	M			
N	N	N	N			
O	O	O	O			
P	P	P	P			
Q	Q	Q	Q			
R	R	R	R			
S	S	S	S			
T	T	T	T			
U	U	U	U			
V	V	V	V			
W	W	W	W			
X	X	X	X			
Y	Y	Y	Y			
Z	Z	Z	Z			

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## Answer Explanations

# SAT Practice Test #4

## Section 1: Reading Test

### QUESTION 1

**Choice C is the best answer.** The narrator initially expresses uncertainty, or uneasiness, over his decision to set out for the North Pole: “my motives in this undertaking are not entirely clear” (lines 9-10). At the end of the passage, the narrator recognizes that because of this journey he is “on the brink of knowing . . . not an ethereal mathematical spot,” the North Pole, but himself (lines 56-57).

Choices A, B, and D are incorrect because the narrator does not suggest that he fears going on the expedition, doubts his own abilities, or feels disdain for the North Pole.

### QUESTION 2

**Choice D is the best answer.** Lines 56-57 provide evidence that the narrator eventually recognizes his motives for traveling to the North Pole: “What I am on the brink of knowing, I now see, is not an ephemeral mathematical spot but myself.” The narrator initially was unsure of why he was traveling to the North Pole, but realizes that he has embarked on a journey to find himself.

Choices A, B, and C are incorrect because they do not provide the best evidence that the narrator eventually recognizes his motives for traveling to the North Pole. Rather, choices A, B, and C all focus on the narrator’s preparations and expectations for the journey.

### QUESTION 3

**Choice D is the best answer.** In lines 1-6, the narrator says that he feels a “vast yearning” and that his emotions are “complicated.” He explains that he does “not understand quite what it is that the yearning desires.” In this context, his emotions are “not readily verifiable,” or not completely understood.

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Choices A, B, and C are incorrect because in this context, “not readily verifiable” does not mean unable to be authenticated, likely to be contradicted, or without empirical support.

#### QUESTION 4

**Choice C is the best answer.** In lines 10-13, the narrator explains that “the machinery of [his] destiny has worked in secret” to prepare him for this journey, as “its clockwork” has propelled him to “this time and place.” By using the phrases “the machinery” and “its clockwork,” the narrator is showing that powerful and independent forces are causing him to journey to the North Pole.

Choices A, B, and D are incorrect because they do not indicate the main purpose of lines 10-13. While lines 10-13 mention that these powerful and independent forces have been working “for years, for a lifetime” to convince the narrator to journey to the North Pole, they do not expose a hidden side of the narrator, demonstrate the narrator’s manner, or explain the amount of time the narrator has spent preparing for his expedition.

#### QUESTION 5

**Choice A is the best answer.** In lines 20-21, the narrator states that many people have perished while journeying to the North Pole: “Nobody has succeeded in this thing, and many have died.”

Choices B, C, and D are incorrect because the narrator does not indicate that previous explorers have made surprising discoveries, have failed to determine the exact location of the North Pole, or had different motivations than his own.

#### QUESTION 6

**Choice A is the best answer.** In lines 20-21, the narrator provides evidence that many previous explorers seeking the North Pole have perished in the attempt: “Nobody has succeeded in this thing, and many have died.”

Choices B, C, and D do not mention previous explorers; therefore, these lines do not provide the best evidence that explorers died while seeking the North Pole.

#### QUESTION 7

**Choice B is the best answer.** In lines 27-39, the narrator states that he is “intent” on traveling to the North Pole but acknowledges that the journey is absurd: “Who wants the North Pole! What good is it! Can you eat it? Will it carry you from Gothenburg to Malmö like a railway?” By asking these questions, the narrator recognizes that the North Pole has no practical value. Still, the narrator admits that finding the North Pole is necessary, as it “must nevertheless be sought for.”

Choices A, C, and D are incorrect because the narrator does not view his expedition to the North Pole as immoral, socially beneficial, or scientifically important.

## QUESTION 8

**Choice D is the best answer.** In lines 27-31, the narrator asks a series of rhetorical questions about the North Pole: “Who wants the North Pole! What good is it! Can you eat it? Will it carry you from Gothenburg to Malmö like a railway?” In this context, the narrator is suggesting that reaching the North Pole has no foreseeable benefit or value to humanity; unlike trains that bring travelers to specific destinations, the North Pole does not provide humans with a specific benefit or form of convenience.

Choices A, B, and C are incorrect because the question posed in lines 30-31 does not debate modes of travel, examine the proximity of cities that can be reached by trains, or question how often people travel.

## QUESTION 9

**Choice D is the best answer.** In lines 48-49, the narrator states that the North Pole “is an abstraction, a mathematical fiction” and that “no one but a Swedish madman could take the slightest interest in it.” In this context, the narrator is stating that people would not “take the slightest interest in,” or be curious about, the North Pole.

Choices A, B, and C are incorrect because in this context, “take the slightest interest in” does not mean to accept responsibility for, to possess little regard for, or to pay no attention to something.

## QUESTION 10

**Choice A is the best answer.** In lines 49-51, the narrator describes his balloon journey toward the North Pole: “The wind is still from the south, bearing us steadily northward at the speed of a trotting dog.” In this context, the wind is “bearing,” or carrying, the narrator in a direction to the North.

Choices B, C, and D are incorrect because in this context, “bearing” does not mean affecting, yielding, or enduring.

## QUESTION 11

**Choice C is the best answer.** The author states that “demographic inversion is not a proxy for population growth” (lines 32-33). In other words, demographic inversion is distinct from population growth. The author also notes that demographic inversion is evident in many American cities, as it “can occur in cities that are growing, those whose numbers are flat, and even in those undergoing a modest decline in size” (lines 33-35).

Choices A, B, and D are incorrect because they do not summarize the first paragraph.

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## QUESTION 12

**Choice D is the best answer.** The author notes that one of “the most powerful demographic events of the past decade [was] the movement of African Americans out of central cities” (lines 14-17).

Choices A, B, and C are incorrect because the author does not state that the unemployed, immigrants, or young professionals moved away from central-city areas in large numbers in the early 2000s.

## QUESTION 13

**Choice A is the best answer.** The author states that democratic inversion “can occur in cities that are growing, those whose numbers are flat, and even in those undergoing a modest decline in size” (lines 33-35). In this context, cities whose “numbers,” or population size, are “flat” have static, or unchanging, populations.

Choices B, C, and D are incorrect because in this context, “flat” does not mean deflated, featureless, or obscure.

## QUESTION 14

**Choice B is the best answer.** The author states that many major American cities are currently experiencing economic hardship, or “enormous fiscal problems,” because of “public pension obligations they incurred in the more prosperous years of the past two decades” (lines 36-39). The author then provides the example of Chicago, a city that can no longer afford to pay the “public services to which most of [its] citizens have grown to feel entitled” (lines 41-43). The author is arguing that many major American cities face economic hardship due to past promises (such as public services) they made to their constituents.

Choices A, C, and D are incorrect because the passage does not discuss expected tax increases, an inner-city tax base, or manufacturing production as they relate to the financial status of many major American cities.

## QUESTION 15

**Choice A is the best answer.** In lines 36-39, the author provides evidence that many major American cities are currently experiencing economic hardship due to promises made in past years: “America’s major cities face enormous fiscal problems, many of them the result of public pension obligations they incurred in the more prosperous years of the past two decades.” America’s major cities made past promises, such as “public pension obligations,” to their citizens, which caused their current financial situation.

Choices B, C, and D are incorrect because they do not provide evidence that many major American cities are currently experiencing economic hardship due to promises made in past years.



## QUESTION 16

**Choice C is the best answer.** The author explains how sociologist Ernest W. Burgess determined that urban areas have a traditional four-zone structure (lines 54-63). He then states that Burgess was “right about the urban America of 1974” (line 65) as it also followed the traditional four-zone structure: “Virtually every city in the country had a downtown, where the commercial life of the metropolis was conducted; it had a factory district just beyond; it had districts of working-class residences just beyond that; and it had residential suburbs for the wealthy and the upper middle class at the far end of the continuum” (lines 66-71).

Choices A, B, and D are incorrect because the passage does not imply that American cities in 1974 were witnessing the flight of minority populations to the suburbs, had begun to lose their manufacturing sectors, or were already experiencing demographic inversion.

## QUESTION 17

**Choice C is the best answer.** In lines 66-71, the author provides evidence that American cities in 1974 had a traditional four-zone structure: “Virtually every city in the country had a downtown, where the commercial life of the metropolis was conducted; it had a factory district just beyond; it had districts of working-class residences just beyond that; and it had residential suburbs for the wealthy and the upper middle class at the far end of the continuum.”

Choices A, B, and D are incorrect because they do not provide evidence that American urban cities in 1974 had a traditional four-zone structure. Choice A references a seminal paper on the layout of American cities, choice B identifies Burgess’s original theory, and choice D focuses on movement to the suburbs.

## QUESTION 18

**Choice A is the best answer.** In lines 66-68, the author notes that American cities in 1974 each had a “downtown, where the commercial life of the metropolis was conducted.” In this context, the author is stating that these cities “conducted,” or carried out, business, the “commercial life,” in downtown areas.

Choices B, C, and D are incorrect because in this context, “conducted” does not mean supervised, regulated, or inhibited.

## QUESTION 19

**Choice B is the best answer.** Chart 1 shows the percentage of the US population in 2010 that lived in non-metro, small metro, and large metro areas. While the author cites census numbers, he notes that “when it comes to measuring demographic inversion, raw census numbers are an ineffective blunt instrument” (lines 11-13). Census data refer to the number of people living in a specific area

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and the demographic information that's been collected on them. The author would most likely consider the information in chart 1 to be possibly accurate but an "ineffective blunt instrument" that's not truly informative.

Choices A and C are incorrect because the author would not consider census data to be excellent or compelling. Choice D is incorrect because while the author does not believe the census completely explains demographic inversion, he would be unlikely to disagree with the census data.

### QUESTION 20

**Choice A is the best answer.** Chart 2 shows that the growth of all metropolitan areas in the 1990s was higher than the growth in all metropolitan areas in the 2000s: large metro areas experienced a growth of 14.3% in the 1990s versus a growth of 10.9% in the 2000s, small metro areas experienced a growth of 13.1% in the 1990s versus a growth of 10.3% in the 2000s, and non-metro areas experienced a growth of 9.0% in the 1990s versus a growth of 4.5% in the 2000s.

Choices B, C, and D are incorrect because they do not accurately characterize the US growth rate by metro size from 2000-2010 as illustrated in chart 2.

### QUESTION 21

**Choice D is the best answer.** Chart 2 shows that in the 1990s the US population increased in large metro, small metro, and non-metro areas when compared to the population growth experienced in the 1980s. Large metro areas experienced a growth of 12.5% in the 1980s versus a growth of 14.3% in the 1990s, small metro areas experienced a growth of 8.8% in the 1980s versus a growth of 13.1% in the 1990s, and non-metro areas experienced a growth of 1.8% in the 1980s versus a growth of 9.0% in the 1990s. Given this information, the population grew more in all metro areas in the 1990s when compared to the growth of those areas in the 1980s.

Choices A, B, and C are incorrect because they do not draw an accurate conclusion about the US growth rate in the 1990s.

### QUESTION 22

**Choice A is the best answer.** Lines 9-11 introduce the focus of the passage: "Welcome to the world of 'pharming,' in which simple genetic tweaks turn animals into living pharmaceutical factories." The passage then discusses the chronological development of "pharming," and describes ATryn, a useful drug produced after decades of laboratory experiments.

Choices B and C are incorrect because the passage does not primarily evaluate research or summarize long-term research findings. Choice D is incorrect because "pharming" is not a branch of scientific study.

### QUESTION 23

**Choice C is the best answer.** The author is appreciative of pharming and describes it as turning “animals into living pharmaceutical factories” (lines 10-11). She expresses a positive view of pharming in line 70, when she describes its end result: “*Et voilà* — human medicine!”

Choices A, B, and D are incorrect because the author’s attitude about pharming is not accurately characterized as one of fear, disinterest, or surprise.

### QUESTION 24

**Choice C is the best answer.** In lines 19-21, the author explains that dairy animals are “expert,” or capable, “protein producers.”

Choices A, B, and D are incorrect because in this context “expert” does not mean knowledgeable, professional, or trained.

### QUESTION 25

**Choice B is the best answer.** In line 36, the author explains that the initial transgenic studies were “lab-bound thought experiments come true.” Those first studies, in other words, were considered to be of theoretical value only. They were not expected to yield products ready for human use.

Choices A and D are incorrect because the cost of animal research and the molecular properties of certain animals are not discussed in the passage. Choice C is incorrect because the passage does not suggest that all of the transgenic studies were focused on anticoagulants.

### QUESTION 26

**Choice C is the best answer.** In lines 35-36, the author provides evidence that the transgenic studies done in the 1980s and 1990s were not expected to yield products ready for human use. The author explains that the initial transgenic studies were “merely gee-whiz, scientific geekery, lab-bound thought experiments come true.”

Choices A, B, and D are incorrect because they do not provide evidence that the transgenic studies done in the 1980s and 1990s were not expected to yield products ready for human use. Choices A and B do not address the transgenic studies, and choice D focuses on ATryn, a drug that was intended for human use.

### QUESTION 27

**Choice A is the best answer.** Lines 42-44 explain that ATryn “acts as a molecular bouncer, sidling up to clot-forming compounds and escorting them out of the bloodstream.” Antithrombin can thus be seen as an agent that reduces the amount of dangerous clots in the bloodstream.

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Choices B, C, and D are incorrect because the passage does not suggest that antithrombin stems from a rare genetic mutation, is a sequence of DNA, or occurs naturally in goats' mammary glands.

### QUESTION 28

**Choice B is the best answer.** Lines 42-44 provide evidence that antithrombin reduces compounds that lead to blood clots, as it acts as a “molecular bouncer, sidling up to clot-forming compounds and escorting them out of the bloodstream.”

Choices A, C, and D do not provide evidence that antithrombin reduces compounds that lead to blood clots; these lines describe proteins, people unable to produce antithrombin, and the production of ATryn.

### QUESTION 29

**Choice B is the best answer.** In lines 60-62, the description of female goats' kids mentions that “some of them proved to be transgenic, the human gene nestled safely in their cells.” The statement “some of them” indicates that while a number of the newborn goats were transgenic, others were not.

Choices A, C, and D are incorrect because the passage does not suggest that the female goats used in the initial experiment secreted antithrombin in their milk after giving birth, were the first animals to receive the microinjections, or had cells that contained genes usually found in humans.

### QUESTION 30

**Choice D is the best answer.** In lines 63-64, the parenthetical is added after the phrase “a promoter,” which is “(. . . a sequence of DNA that controls gene activity).” The parenthetical's purpose is to define the term “promoter.”

Choices A, B, and C are incorrect because they do not correctly identify the purpose of the parenthetical information in lines 63-64.

### QUESTION 31

**Choice D is the best answer.** Gold is a valuable element that commands high prices, so calling something “liquid gold” implies that it has great value. Because the pharmaceutical company GTC was producing the drug in order to sell it, it can be inferred that describing ATryn as “liquid gold” means it proved to be a lucrative product for GTC.

Choices A, B, and C are incorrect because the phrase “liquid gold” does not refer to the microinjection technique, efficiency in dairy production, or transgenic goats being beneficial to dairy farmers.

### QUESTION 32

**Choice D is the best answer.** In lines 25-29, Burke describes the contract between a person and society as one that is “not a partnership in things subservient only to the gross animal existence of a temporary and perishable nature. It is a partnership in all science; a partnership in all art; a partnership in every virtue, and in all perfection.” Describing that contract as a partnership in all things indicates its seriousness, while describing it as not being a “temporary and perishable nature” implies its permanence.

Choice A is incorrect because line 27 states that the contract between a person and society is not “temporary or perishable,” meaning it is not brief. Choices B and C are incorrect because the passage does not compare the contracts in terms of complexity or precision.

### QUESTION 33

**Choice D is the best answer.** In lines 1-9, Burke explains that people have “consecrated the state” to “avoid . . . the evils of inconstancy and versatility,” and that people should examine “the faults of the state . . . with pious awe and trembling solitude.” Burke then explains that society is taught to “look with horror on those children of their country who want to hack that aged parent in pieces” (lines 10-12). Burke is arguing that children want to revise the state, or “this aged parent,” by amending its faults. In this context, “state” refers to a political entity, or government, that attempts to protect its citizens from “the evils of inconstancy and versatility.”

Choices A, B, and C are incorrect because in this context, “state” does not mean style of living, position in life, or temporary condition.

### QUESTION 34

**Choice A is the best answer.** In lines 17-29, Burke argues that “subordinate contracts,” are simply business agreements over traded goods, while the state is not merely “a partnership agreement in a trade . . . or some other such low concern . . . but a partnership in all science; a partnership in all art; a partnership in every virtue, and in all perfection.” In this context, Burke is stating that the state is not a contract consisting of “low” or petty concerns.

Choices B, C, and D are incorrect because in this context, “low” does not mean weak, inadequate, or depleted.

### QUESTION 35

**Choice D is the best answer.** In lines 41-43, Paine asserts that “Every age and generation must be as free to act for itself, *in all cases*, as the ages and generations which preceded it.” He later states that deceased citizens of a state should no longer have “any authority in directing who shall be its governors, or how its government shall be organized,

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or how administered” (lines 61-63). Paine doesn’t believe, in other words, that the decisions of previous generations should dictate the conditions of modern life and government.

Choices A, B, and C are incorrect because they do not accurately characterize the way Paine views historical precedents.

### QUESTION 36

**Choice B is the best answer.** In lines 30-34, Burke describes societal contracts as long-term agreements that preserve the interests of past generations and link the living and the dead into a “partnership.” Paine, however, states that past generations have no “control” over the decisions made by living (line 71) because the dead have “no longer any participation in the concerns of this world” (lines 59-60).

Choices A, C, and D are incorrect because they do not accurately characterize how Paine would respond to Burke’s claim that societal contracts link past and current generations.

### QUESTION 37

**Choice D is the best answer.** Lines 67-72 provide the best evidence that Paine would respond to Burke’s statement that society is a “partnership” between past and current generations (lines 30-34) with the explanation that the current generation cannot know what judgments the dead would make about contemporary issues. In these lines Paine explains: “What possible obligation, then, can exist between them; what rule or principle can be laid down, that two nonentities, the one out of existence, and the other not in, and who never can meet in this world, that the one should control the other to the end of time?”

Choices A, B, and C are incorrect because the lines cited do not provide the best evidence that Paine would respond to Burke’s statement that society is a “partnership” between past and current generations (lines 30-34) by arguing that the current generation cannot know what judgments the dead would make about contemporary issues.

### QUESTION 38

**Choice D is the best answer.** Paine concludes Passage 2 with the argument that because social issues change over time, the living should not try to adhere to decisions made by former generations (lines 73-80). Burke, however, states that living citizens exist within a “universal kingdom” (line 35) comprised of the living, the dead, and those who are not yet born. Burke argues that the living do not have the right to change their government based on “their speculations of a contingent improvement” (lines 36-37). Therefore, Burke would

disapprove of Paine's concluding argument, as he believes the living do not have sufficient justification for changing the existing governmental structure.

Choices A, B, and C are incorrect because they do not accurately describe how Burke would likely have responded to Paine's remarks in the final paragraph of Passage 2.

### QUESTION 39

**Choice D is the best answer.** Lines 34-38 provide the best evidence that Burke would disapprove of Paine's remarks in the final paragraph of Passage 2: "The municipal corporations of that universal kingdom are not morally at liberty at [the living's] pleasure, and on their speculations of a contingent improvement, wholly to separate and tear asunder the bands of their subordinate community." In these lines, Burke is arguing that the living do not have sufficient justification to change the existing governmental structure.

Choices A, B, and C do not provide the best evidence that Burke would disapprove of Paine's remarks in the final paragraph of Passage 2, as Burke believes the living do not have sufficient justification for changing the existing governmental structure.

### QUESTION 40

**Choice A is the best answer.** The primary argument of Passage 1 is that an inviolable contract exists between a people and its government, one that is to be "looked on with other reverence" (lines 24-25). Passage 1 suggests that this contract exists between past and future generations as well; in effect, current and future generations should be governed by decisions made in the past. Passage 2 challenges these points, as it argues that current and future generations are not obligated to preserve past generations' beliefs: "The Parliament or the people of 1688, or of any other period, had no more right to dispose of the people of the present day, or to bind or to control them in any shape whatever, than the parliament or the people of the present day have to dispose of, bind, or control those who are to live a hundred or a thousand years hence" (lines 48-54).

Choices B, C, and D are incorrect because Passage 2 does not offer an alternative approach to Passage 1, support an idea introduced in Passage 1, or exemplify an attitude promoted in Passage 1.

### QUESTION 41

**Choice B is the best answer.** Passage 1 argues that the government is sacred (lines 3-6) and that no person should interfere with it (lines 6-9). Passage 2 argues that people have the right to make changes to their government: "The circumstances of the world are continually

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changing, and the opinions of men change also; and as government is for the living, and not for the dead, it is the living only that has any right in it” (lines 73-76).

Choices A, C, and D are incorrect because they do not identify the main purpose of both passages.

#### QUESTION 42

**Choice C is the best answer.** The author explains that a “powerful volcano” erupted around 750 years ago and caused “a centuries-long cold snap known as the Little Ice Age” (lines 1-3). The author then states that a group of scientists believe the volcano Samalas was this “powerful volcano,” and she explains how the scientists’ research supports this claim (lines 17-78).

Choices A, B, and D are incorrect because they do not identify the main purpose of the passage.

#### QUESTION 43

**Choice B is the best answer.** The author begins the passage by explaining how the Little Ice Age was a “centuries-long cold snap” that was likely caused by a volcanic eruption (lines 1-3). The author then explains how scientists used radiocarbon analysis to determine when the Little Ice Age began and how a volcanic eruption triggered the cooling temperatures (lines 17-25).

Choices A, C, and D are incorrect because the passage does not criticize a scientific model, offer a new method of measuring sulfates, or shift from the use of radiocarbon dating to an examination of volcanic glass.

#### QUESTION 44

**Choice A is the best answer.** In lines 17-25, the passage shifts focus from describing a recorded event to providing evidence that the Little Ice Age was likely caused by a volcanic eruption. The passage states that scientists used “radiocarbon dating of dead plant material from beneath the ice caps on Baffin Island and Iceland, as well as ice and sediment core data” to determine when the Little Ice Age began and how it was connected to the “mystery” volcanic eruption.

Choices B, C, and D are incorrect because they do not provide the best evidence that the passage shifts focus from a description of a recorded event to its likely cause. Choices B, C, and D all focus on the scientists’ research but do not explain what caused the Little Ice Age.

#### QUESTION 45

**Choice D is the best answer.** According to lines 5-8, “That a powerful volcano erupted somewhere in the world, sometime in the Middle Ages, is written in polar ice cores in the form of layers of sulfate



deposits and tiny shards of volcanic glass.” The phrase “is written in” reinforces the idea that the polar ice caps contain evidence of the volcanic eruption, and that scientists can interpret this evidence by examining the “sulfate deposits and tiny shards of volcanic glass.”

Choices A, B, and C are incorrect because the author does not use the phrase “is written in” to demonstrate the concept of the hands-on nature of the scientists’ work, highlight the fact that scientists often write about their work, or underscore the sense of importance scientists have about their work.

### QUESTION 46

**Choice A is the best answer.** The scientists believe the volcano Samalas, located in Indonesia, was most likely the medieval volcanic eruption (lines 33-35). The eruption likely occurred near the equator because an equatorial location is “consistent with the apparent climate impacts” the scientists observed (lines 61-67).

Choices B, C, and D are incorrect because the scientists do not suggest that the medieval volcanic eruption was located in the Arctic region, the Antarctic region, or Ecuador.

### QUESTION 47

**Choice D is the best answer.** In lines 61-64, the author cites geochemist Gifford Miller’s findings that provide evidence that the medieval volcanic eruption most likely occurred in Indonesia near the equator: “It’s not a total surprise that an Indonesian volcano might be the source of the eruption, Miller says. ‘An equatorial eruption is more consistent with the apparent climate impacts.’”

Choices A, B, and C are incorrect because they do not provide evidence that the medieval volcanic eruption most likely occurred in Indonesia near the equator. Rather, choices A, B, and C focus on the medieval volcano’s power, impact, and magnitude.

### QUESTION 48

**Choice C is the best answer.** In lines 68-71, the author states, “Another possible candidate — both in terms of timing and geographical location — is Ecuador’s Quilotoa, estimated to have last erupted between 1147 and 1320 C.E.” The phrase “another possible candidate” implies that the scientists believe that in the Middle Ages a different volcanic eruption, such as an eruption from the volcano Quilotoa, could have been responsible for the onset of the Little Ice Age.

Choices A, B, and D are incorrect because the phrase “another possible candidate” does not imply the frequency or effects of volcanic eruptions, or that some volcanoes have large calderas.

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## QUESTION 49

**Choice D is the best answer.** In lines 71-75, the author explains how Lavigne's team proved that Quilotoa's eruption did not cause the Little Ice Age:

"But when Lavigne's team examined shards of volcanic glass from this volcano, they found that they didn't match the chemical composition of the glass found in polar ice cores, whereas the Samalas glass is a much closer match." These findings show that Samalas, not Quilotoa, was responsible for the onset of the Little Ice Age.

Choices A, B, and C are incorrect because they focus on the difficulty of identifying the volcano responsible for the Little Ice Age, the magnitude of the volcanic eruption, and the researchers' experiment.

## QUESTION 50

**Choice C is the best answer.** The data in the figure show the greatest below-average temperature variation occurred in 1675 CE, as the temperature reached a variation of  $-1.0^{\circ}$  Celsius.

Choice A is incorrect because the figure shows that the temperature in 1200 CE was above average ( $+0.25^{\circ}$  Celsius). Choices B and D are incorrect because the below-average temperature variation reported in 1675 CE (at  $-1.0^{\circ}$  Celsius) was greater than the below-average temperature variation reported for 1375 CE (around  $-0.25^{\circ}$  Celsius) and 1750 CE (around  $-0.5^{\circ}$  Celsius).

## QUESTION 51

**Choice B is the best answer.** The passage says that the Little Ice Age began "about 750 years ago" (line 1) and that "the cold summers and ice growth began abruptly between 1275 and 1300 C.E." (lines 23-24). The figure indicates that average temperatures in central England began to drop around 1275 CE, and this drop in temperatures continued "through the 1700s" (line 32).

Choices A, C, and D are incorrect because the passage and figure do not indicate that the Little Ice Age began around 1150 CE, just before 1500 CE, or around 1650 CE.

## QUESTION 52

**Choice A is the best answer.** The figure shows that the greatest cooling period of the Little Ice Age occurred between 1500 and 1700 CE; it also shows that the greatest warming period of the Medieval Warm Period occurred between 1150 and 1250 CE. Therefore, the Little Ice Age's greatest cooling occurred a couple of centuries, or "hundreds of years," after the temperature peaks of the Medieval Warm Period.

Choices B, C, and D are incorrect because the figure does not focus on equatorial volcanic eruptions, pyroclastic flows, or radiocarbon analysis.

## Section 2: Writing and Language Test

### QUESTION 1

**Choice B is the best answer** because the relative clause appropriately modifies the noun “work” in the preceding independent clause.

Choices A, C, and D are incorrect because each creates a comma splice.

### QUESTION 2

**Choice B is the best answer** because it creates the appropriate contrasting transition from the fact that the first two panels were painted during the day to the fact that the third panel was painted at night.

Choices A, C, and D are incorrect because each creates an inappropriate transition from the previous sentence. Choice A and choice D imply addition rather than contrast. Choice C results in an incomplete sentence.

### QUESTION 3

**Choice B is the best answer** because it creates an appropriate appositive to the subject “mural,” and is correctly set off by commas on both sides.

Choices A, C, and D are incorrect because each is incorrectly punctuated. Choice A lacks a comma after “centerpiece,” choice C unnecessarily introduces an independent clause, and choice D contains an em dash that has no parallel earlier in the sentence.

### QUESTION 4

**Choice A is the best answer** because it explicitly introduces the explanation for the behavior (painting at night) described in the previous paragraph.

Choices B, C, and D are incorrect because none alludes to the artist’s painting at night, which is described at the end of the previous paragraph and explained in this paragraph.

### QUESTION 5

**Choice D is the best answer** because it refers to an action that can be performed on a physical object such as a mural.

Choices A, B, and C are incorrect because each refers to an action that is performed on information rather than on a physical object.

### QUESTION 6

**Choice B is the best answer** because it creates a past tense construction consistent with the verb “was dominated.”

Choices A, C, and D are incorrect because none is consistent with the verb tense established earlier in the sentence.

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## QUESTION 7

**Choice D is the best answer** because it is the most precise choice, specifying the noun that the demonstrative pronoun “this” refers to.

Choices A, B, and C are incorrect because each provides a vague, nonspecific pronoun that does not concretely define a referent.

## QUESTION 8

**Choice B is the best answer** because it correctly places and punctuates the appositive phrase that describes the “Chicano mural movement.”

Choices A, C, and D are incorrect because each contains awkward syntax that obscures the relationship between the key noun phrases “an explosion of mural painting” and “the Chicano mural movement.”

## QUESTION 9

**Choice C is the best answer** because it creates parallel construction within the list of locations (“*in* abandoned lots, *on* unused buildings, or *on* infrastructure”).

Choices A, B, and D are incorrect because none follows the construction established within the list of locations.

## QUESTION 10

**Choice A is the best answer** because it alludes to the uniquely high level of investment, described in the next sentence, that the new group of artists is making in restoring and publicizing “América Tropical.”

Choices B, C, and D are incorrect because each fails to express the connection between the general restoration efforts mentioned in the previous sentence and the specific role of “América Tropical” in these efforts, which is described in the next sentence.

## QUESTION 11

**Choice C is the best answer** because details of the initial reaction to Siqueiros’s mural and its subsequent rediscovery are given previously in the passage and are not needed to set up the forward-looking sentence that follows.

Choices A, B, and D are incorrect because each provides an inaccurate interpretation of the sentence that the writer is considering adding.

## QUESTION 12

**Choice D is the best answer** because without the underlined portion, the sentence contains an appropriate parallel contrast between the phrases “organically grown crops” and “conventionally grown counterparts,” each of which describes crops.

Choices A, B, and C are incorrect because each creates an illogical comparison: crops to “people,” crops to “purchase,” and crops to “purchasing.”

**QUESTION 13**

**Choice B is the best answer** because it provides the subject “consumers,” creating a complete sentence and providing a referent for the pronoun “they” that appears later in the sentence.

Choices A, C, and D are incorrect because each lacks the subject that the sentence requires and none provide a referent for “they.”

**QUESTION 14**

**Choice D is the best answer** because it efficiently creates a contrast with “organically grown.”

Choices A, B, and C are incorrect because they are unnecessarily wordy and repeat information given in previous sentences.

**QUESTION 15**

**Choice C is the best answer** because it sets up the contrast between the added expense of organic food and the evidence that suggests a lack of benefits from eating organic food.

Choices A, B, and D are incorrect because each fails to acknowledge the contrast between the last sentence in the paragraph and the previous sentences.

**QUESTION 16**

**Choice C is the best answer** because “maintain” is commonly used to describe advocating a position in an argument.

Choices A, B, and D are incorrect because none is appropriate in the context of describing an opinion advocated by a group of people.

**QUESTION 17**

**Choice A is the best answer** because the transitional phrase “For instance” sets up an example supporting the point, made in the previous sentence, that organic food may not contain more vitamins and minerals than conventionally grown food.

Choices B, C, and D are incorrect because none indicates that the sentence is providing an example supporting the point made in the previous sentence.

**QUESTION 18**

**Choice C is the best answer** because it accurately identifies the reason that the writer should not add the proposed sentence: the paragraph is about evidence of nutritional content, not the availability of organic food.

Choices A, B, and D are incorrect because each provides an inaccurate interpretation of the proposed sentence’s relationship to the passage.

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### QUESTION 19

**Choice A is the best answer** because the plural verb “have” is consistent with the plural subject “amounts.”

Choices B, C, and D are incorrect because each is a singular verb, which is inconsistent with the plural subject “amounts.”

### QUESTION 20

**Choice C is the best answer** because the example it supplies, that pesticides can be minimized by washing or peeling produce, supports the claim that nonorganic food is safe.

Choices A, B, and D are incorrect because none supports the paragraph’s claim about the safety of nonorganic food.

### QUESTION 21

**Choice B is the best answer** because the plural noun phrase “numerous other reasons” must be preceded by a plural verb and a pronoun that does not indicate possession: “there are.”

Choices A, C, and D are incorrect because each contains the singular verb “is,” the possessive pronoun “their,” or both.

### QUESTION 22

**Choice D is the best answer** because a nonrestrictive clause must be preceded by a comma; in addition, “such as” is never followed by a comma. In this case, the list of reasons supporting the claim that there are benefits to buying organic food is nonrestrictive; the list tells the reader something about organic food but does not restrict or place limits on organic food.

Choices A, B, and C are incorrect because each places erroneous punctuation after the phrase “such as.” Choices B and C also lack the necessary comma preceding “such as.”

### QUESTION 23

**Choice C is the best answer** because “intriguing” conveys a realistic level of interest for the entertaining but ultimately inconsequential question of regional differences in words for carbonated beverages.

Choices A, B, and D are incorrect because each mocks the topic of regional words for carbonated beverages.

### QUESTION 24

**Choice C is the best answer** because “but also” is the appropriate transition to complete the correlative pair “not only . . . but also,” which begins earlier in the sentence.

Choices A, B, and D are incorrect because each fails to complete the phrase “not only . . . but also.”

**QUESTION 25**

**Choice B is the best answer** because it is consistent with the fact that there remains a “veritable army of trained volunteers traveling the country” and because it uses “still” to contrast this method with the “new avenues.”

Choices A, C, and D are incorrect because none is consistent with the information contained later in the passage.

**QUESTION 26**

**Choice D is the best answer** because it uses the relative pronoun “who” to avoid needless repetition of the word “scholars.”

Choices A, B, and C are incorrect because each unnecessarily repeats the word “scholars.”

**QUESTION 27**

**Choice C is the best answer** because the new sentence provides a logical transition from sentences 3 and 4, which describe the data collection, to sentence 5, which explains that completing the dictionary took far longer than expected.

Choices A, B, and D are incorrect because each fails to create a logical transition between the preceding and subsequent sentences.

**QUESTION 28**

**Choice A is the best answer** because the singular verb “requires” agrees with the singular subject “research.”

Choices B, C, and D are incorrect because they do not create subject-verb agreement.

**QUESTION 29**

**Choice D is the best answer** because a colon is the correct punctuation to introduce the elaborating phrase that follows the word “army.”

Choices A, B, and C are incorrect because none provides the appropriate punctuation.

**QUESTION 30**

**Choice B is the best answer** because it contains both the correct word to refer to an Internet location — “site” — and the correct preposition to complete the collocation “in search of.”

Choices A, C, and D are incorrect because each contains a word that does not refer to an Internet location, and choices C and D contain the wrong preposition.

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### QUESTION 31

**Choice C is the best answer** because it correctly associates each beverage term with the region described in the sentence according to the information contained in the map.

Choices A, B, and D are incorrect because each contradicts the information contained in the map.

### QUESTION 32

**Choice B is the best answer** because it contains the two plural possessive pronouns needed to refer to the subject “findings” — “their” and “their.”

Choices A, C, and D are incorrect because each contains a word frequently confused with “their.”

### QUESTION 33

**Choice A is the best answer** because it provides a summary and evaluation of gathering data from the Internet, which is the focus of the paragraph.

Choices B, C, and D are incorrect because each is either irrelevant to the main point of the paragraph or unnecessarily repeats information.

### QUESTION 34

**Choice C is the best answer** because it uses the present tense, which is consistent with the verbs that appear later in the sentence.

Choices A, B, and D are incorrect because they create awkward shifts in tense.

### QUESTION 35

**Choice C is the best answer** because the em dashes correctly bracket the examples of the types of elements.

Choices A, B, and D are incorrect because each uses either inconsistent or incorrect punctuation to set off the types of elements.

### QUESTION 36

**Choice B is the best answer** because a period is an appropriate way to separate the two independent clauses that meet at the underlined text.

Choices A, C, and D are incorrect because each either creates a comma splice or lacks necessary punctuation.

### QUESTION 37

**Choice D is the best answer** because the proposed sentence to be added is a paraphrase of the sentence before it, containing the same ideas.



Choices A, B, and C are incorrect because none fully acknowledges the relationship between the proposed sentence to be added and the other sentences in the paragraph.

### QUESTION 38

**Choice A is the best answer** because it highlights the importance of the game designer’s communication with others, which is the paragraph’s main point.

Choices B, C, and D are incorrect because none describes communication originating with the game designer, which is the main focus of the paragraph.

### QUESTION 39

**Choice C is the best answer** because the importance of communication is established in the previous sentences. The transition “consequently” best captures the fact that the designer must be skilled in this area.

Choices A, B, and D are incorrect because each contains a transition that either repeats information or creates an illogical relationship between this sentence and the previous sentences.

### QUESTION 40

**Choice B is the best answer** because it provides the singular nouns “writer” and “speaker” to agree with the singular pronoun “anyone.”

Choices A, C, and D are incorrect because none creates pronoun-referent agreement.

### QUESTION 41

**Choice D is the best answer** because it expresses in the clearest, simplest way the idea that many game designers start out as programmers.

Choices A, B, and C are incorrect because each is unnecessarily wordy and obscures meaning.

### QUESTION 42

**Choice D is the best answer** because it logically and appropriately modifies the phrase “collaboration skills.”

Choices A, B, and C are incorrect because none appropriately describes the value of collaboration skills.

### QUESTION 43

**Choice A is the best answer** because it provides a logical subject for the modifying phrase “demanding and deadline driven.”

Choices B, C, and D are incorrect because each creates a dangling modifier.

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## QUESTION 44

**Choice B is the best answer** because sentence 5 expresses the main point upon which the paragraph elaborates.

Choices A, C, and D are incorrect because none places sentence 5 in the appropriate position to set up the details contained in the paragraph.

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice A is correct.** The expression  $|x - 1| - 1$  will equal 0 if  $|x - 1| = 1$ . This is true for  $x = 2$  and for  $x = 0$ . For example, substituting  $x = 2$  into the expression  $|x - 1| - 1$  and simplifying the result yields  $|2 - 1| - 1 = |1| - 1 = 1 - 1 = 0$ . Therefore, there is a value of  $x$  for which  $|x - 1| - 1$  is equal to 0.

Choices B, C, and D are incorrect. By definition, the absolute value of any expression is a nonnegative number. For example, in answer choice B, substituting any value for  $x$  into the expression  $|x + 1|$  will yield a nonnegative number. Because the sum of a nonnegative number and a positive number is positive,  $|x + 1| + 1$  will be a positive number for any value of  $x$ . Therefore,  $|x + 1| + 1 \neq 0$  for any value of  $x$ . Similarly, the expressions given in answer choices C and D are not equivalent to zero for any value of  $x$ .

### QUESTION 2

**Choice A is correct.** Since  $f(x) = \frac{3}{2}x + b$  and  $f(6) = 7$ , substituting 6 for  $x$  in  $f(x) = \frac{3}{2}x + b$  gives  $f(6) = \frac{3}{2}(6) + b = 7$ . Then, solving the equation  $\frac{3}{2}(6) + b = 7$  for  $b$  gives  $\frac{18}{2} + b = 7$ , or  $9 + b = 7$ . Thus,  $b = 7 - 9 = -2$ . Substituting  $-2$  for the constant  $b$  gives  $f(x) = \frac{3}{2}x - 2$ ; therefore, one can evaluate  $f(-2)$  by substituting  $-2$  for  $x$ :  $\frac{3}{2}(-2) - 2 = -\frac{6}{2} - 2 = -3 - 2 = -5$ .

Choice B is incorrect as it is the value of  $b$ , not of  $f(-2)$ . Choice C is incorrect as it is the value of  $f(2)$ , not of  $f(-2)$ . Choice D is incorrect as it is the value of  $f(6)$ , not of  $f(-2)$ .

### QUESTION 3

**Choice A is correct.** The first equation can be rewritten as  $x = 6y$ . Substituting  $6y$  for  $x$  in the second equation gives  $4(y + 1) = 6y$ . The left-hand side can be rewritten as  $4y + 4$ , giving  $4y + 4 = 6y$ . Subtracting  $4y$  from both sides of the equation gives  $4 = 2y$ , or  $y = 2$ .

Choices B, C, and D are incorrect and may be the result of a computational or conceptual error when solving the system of equations.

**QUESTION 4**

**Choice B is correct.** If  $f(x) = -2x + 5$ , then one can evaluate  $f(-3x)$  by substituting  $-3x$  for every instance of  $x$ . This yields  $f(-3x) = -2(-3x + 5)$ , which simplifies to  $6x + 5$ .

Choices A, C, and D are incorrect and may be the result of miscalculations in the substitution or of misunderstandings of how to evaluate  $f(-3x)$ .

**QUESTION 5**

**Choice C is correct.** The expression  $3(2x + 1)(4x + 1)$  can be simplified by first distributing the 3 to yield  $(6x + 3)(4x + 1)$ , and then multiplying the binomials together to obtain  $24x^2 + 12x + 6x + 3$ . Combining like terms gives  $24x^2 + 18x + 3$ .

Choice A is incorrect and may be the result of performing the multiplication of  $3(2x + 1)(4x + 1)$  to result in  $24x^2 + 18x + 3$ , then incorrectly combining terms to result in  $45x$ . Choice B is incorrect and may be the result of correctly finding  $(6x + 3)(4x + 1)$ , but then multiplying only the first terms,  $(6x)(4x)$ , and the last terms,  $(3)(1)$ , but not the outer or inner terms,  $(6x)(1)$  and  $(3)(4x)$ . Choice D is incorrect and may be the result of incorrectly distributing the 3 to both  $(2x + 1)$  and  $(4x + 1)$  to obtain  $(6x + 3)(12x + 3)$ , and then adding  $3 + 3$  and  $6x + 12x$  and incorrectly adding the exponents of  $x$ .

**QUESTION 6**

**Choice B is correct.** The equation  $\frac{a-b}{b} = \frac{3}{7}$  can be rewritten as  $\frac{a}{b} - \frac{b}{b} = \frac{3}{7}$ , from which it follows that  $\frac{a}{b} - 1 = \frac{3}{7}$ , or  $\frac{a}{b} = \frac{3}{7} + 1 = \frac{10}{7}$ .

Choices A, C, and D are incorrect and may be the result of calculation errors in rewriting  $\frac{a-b}{b} = \frac{3}{7}$ . For example, choice A may be the result of a sign error in rewriting  $\frac{a-b}{b}$  as  $\frac{a}{b} + \frac{b}{b} = \frac{a}{b} + 1$ .

**QUESTION 7**

**Choice D is correct.** In Amelia's training schedule, her longest run in week 16 will be 26 miles and her longest run in week 4 will be 8 miles. Thus, Amelia increases the distance of her longest run by 18 miles over the course of 12 weeks. Since Amelia increases the distance of her longest run each week by a constant amount, her rate of increase is  $\frac{26-8}{16-4} = \frac{18}{12}$  miles per week, which is equal to 1.5 miles per week. So each week she increases the distance of her longest run by 1.5 miles.

Choices A, B, and C are incorrect because none of these training schedules would result in increasing Amelia's longest run from 8 miles in week 4 to 26 miles in week 16. For example, choice A is incorrect because if Amelia increases the distance of her longest run by 0.5 miles each week and has her longest run of 8 miles in week 4, her longest run in week 16 would be  $8 + 0.5 \cdot 12 = 14$  miles, not 26 miles.

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## QUESTION 8

**Choice A is correct.** For an equation of a line in the form  $y = mx + b$ , the constant  $m$  is the slope of the line. Thus, the line represented by  $y = -3x + 4$  has slope  $-3$ . Lines that are parallel have the same slope. To determine which of the given equations represents a line with the same slope as the line represented by  $y = -3x + 4$ , one can rewrite each equation in the form  $y = mx + b$ , that is, solve each equation for  $y$ . Choice A,  $6x + 2y = 15$ , can be rewritten as  $2y = -6x + 15$  by subtracting  $6x$  from each side of the equation. Then, dividing each side of  $2y = -6x + 15$  by  $2$  gives  $y = -\frac{6}{2}x + \frac{15}{2}$ , which simplifies to  $y = -3x + \frac{15}{2}$ . Therefore, this line has slope  $-3$  and is parallel to the line represented by  $y = -3x + 4$ . (The lines are parallel, not coincident, because they have different  $y$ -intercepts.)

Choices B, C, and D are incorrect and may be the result of common misunderstandings about which value in the equation of a line represents the slope of the line.

## QUESTION 9

**Choice D is correct.** The question states that  $\sqrt{x-a} = x - 4$  and that  $a = 2$ , so substituting  $2$  for  $a$  in the equation yields  $\sqrt{x-2} = x - 4$ . To solve for  $x$ , square each side of the equation, which gives  $(\sqrt{x-2})^2 = (x-4)^2$ , or  $x - 2 = (x - 4)^2$ . Then, expanding  $(x - 4)^2$  yields  $x - 2 = x^2 - 8x + 16$ , or  $0 = x^2 - 9x + 18$ . Factoring the right-hand side gives  $0 = (x - 3)(x - 6)$ , and so  $x = 3$  or  $x = 6$ . However, for  $x = 3$ , the original equation becomes  $\sqrt{3-2} = 3 - 4$ , which yields  $1 = -1$ , which is not true. Hence,  $x = 3$  is an extraneous solution that arose from squaring each side of the equation. For  $x = 6$ , the original equation becomes  $\sqrt{6-2} = 6 - 4$ , which yields  $\sqrt{4} = 2$ , or  $2 = 2$ . Since this is true, the solution set of  $\sqrt{x-2} = x - 4$  is  $\{6\}$ .

Choice A is incorrect because it includes the extraneous solution in the solution set. Choice B is incorrect and may be the result of a calculation or factoring error. Choice C is incorrect because it includes only the extraneous solution, and not the correct solution, in the solution set.

## QUESTION 10

**Choice D is correct.** Multiplying each side of  $\frac{t+5}{t-5} = 10$  by  $t - 5$  gives  $t + 5 = 10(t - 5)$ . Distributing the  $10$  to the binomial  $(t - 5)$  yields  $t + 5 = 10t - 50$ . Subtracting  $t$  from each side of this equation gives  $5 = 9t - 50$ , and then adding  $50$  to each side gives  $55 = 9t$ . Finally, dividing each side of the equation  $55 = 9t$  by  $9$  yields  $t = \frac{55}{9}$ .

Choices A, B, and C are incorrect and may be the result of calculation errors or incorrectly applying the distribution property.

### QUESTION 11

**Choice C is correct.** It is given that  $x = 2y + 5$  and  $y = (2x - 3)(x + 9)$ . To solve the system of equations, the quantity  $(2x - 3)(x + 9)$  can be substituted for  $y$  in the first equation to yield  $x = 2((2x - 3)(x + 9)) + 5$ , which simplifies to  $x = 4x^2 + 30x - 49$  and can be rewritten as  $4x^2 + 29x - 49 = 0$ . The discriminant of a quadratic equation in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are constants, is  $b^2 - 4ac$ . The discriminant for this quadratic equation is  $29^2 - 4(4)(-49)$ . This is a positive number which indicates that this quadratic equation has 2 distinct roots. The roots to the quadratic equation are the two  $x$ -coordinates of the ordered pairs which satisfy the system of equations. Since no other value of  $x$  satisfies  $4x^2 + 29x - 49 = 0$ , there are no other ordered pairs that satisfy the given system. Therefore, there are 2 ordered pairs  $(x, y)$  that satisfy the given system of equations.

Choices A and B are incorrect and may be the result of either a miscalculation or a conceptual error. Choice D is incorrect because a system of one quadratic equation and one linear equation cannot have infinitely many solutions.

### QUESTION 12

**Choice C is correct.** Since the price of Ken's sandwich was  $x$  dollars, and Paul's sandwich was \$1 more, the price of Paul's sandwich was  $x + 1$  dollars. Thus, the total cost of the sandwiches was  $2x + 1$  dollars. Since this cost was split evenly between two people, Ken and Paul each paid  $\frac{2x + 1}{2} = x + 0.5$  dollars plus a 20% tip. After adding the 20% tip, each of them paid  $(x + 0.5) + 0.2(x + 0.5) = 1.2(x + 0.5) = 1.2x + 0.6$  dollars.

Choices A, B, and D are incorrect. These expressions do not model the given context. They may be the result of errors in setting up the expression or of calculation errors.

### QUESTION 13

**Choice B is correct.** The points where the two graphs intersect can be found by setting the functions  $f(x)$  and  $g(x)$  equal to one another and then solving for  $x$ . This yields  $8x^2 - 2 = -8x^2 + 2$ . Adding  $8x^2$  and 2 to each side of the equation gives  $16x^2 = 4$ . Then dividing each side by 16 gives  $x^2 = \frac{1}{4}$ ; therefore,  $x$  must be either  $\frac{1}{2}$  or  $-\frac{1}{2}$ . From the graph, the value of  $k$  is the  $x$ -coordinate of the point of intersection on the positive  $x$ -axis. Therefore,  $k = \frac{1}{2}$ .

Alternatively, since  $(k, 0)$  lies on the graph of both  $f$  and  $g$ , it follows that  $f(k) = g(k) = 0$ . Thus, evaluating  $f(x) = 8x^2 - 2$  at  $x = k$  gives  $0 = 8k^2 - 2$ . Adding 2 to each side yields  $2 = 8k^2$  and then dividing each side by 8 gives  $\frac{1}{4} = k^2$ . Therefore, the value of  $k$  must be  $\frac{1}{2}$  or  $-\frac{1}{2}$ . From the graph,  $k$  is positive, so  $k = \frac{1}{2}$ .

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Choices A, C, and D are incorrect and may be the result of calculation errors in solving for  $x$  or  $k$ .

### QUESTION 14

**Choice A is correct.** To rewrite  $\frac{8-i}{3-2i}$  in the standard form  $a + bi$ , multiply the numerator and denominator of  $\frac{8-i}{3-2i}$  by the conjugate of the denominator,  $3 + 2i$ . This gives  $\left(\frac{8-i}{3-2i}\right)\left(\frac{3+2i}{3+2i}\right) = \frac{24 + 16i - 3i + (-i)(2i)}{3^2 - 6i + 6i - (2i)^2}$ . Since  $i^2 = -1$ , this can be rewritten as  $\frac{24 + 16i - 3i + 2}{9 - (-4)} = \frac{26 + 13i}{13}$ , which simplifies to  $2 + i$ . Therefore, when  $\frac{8-i}{3-2i}$  is rewritten in the standard form  $a + bi$ , the value of  $a$  is 2.

Choices B, C, and D are incorrect and may be the result of errors in symbolic manipulation. For example, choice B could be the result of mistakenly rewriting  $\frac{8-i}{3-2i}$  as  $\frac{8}{3} + \frac{1}{2}i$ .

### QUESTION 15

**Choice B is correct.** The given quadratic equation can be rewritten as  $2x^2 - kx - 4p = 0$ . Applying the quadratic formula,  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ , to this equation with  $a = 2$ ,  $b = -k$ , and  $c = -4p$  gives the solutions  $\frac{k}{4} \pm \frac{\sqrt{k^2 + 32p}}{4}$ .

Choices A, C, and D are incorrect and may be the result of errors in applying the quadratic formula.

### QUESTION 16

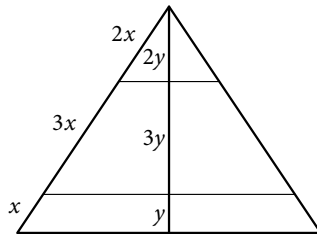
**The correct answer is 9.** Since the three shelves of the triangular shelf system are parallel, the three triangles in the figure are similar. Since the shelves divide the left side of the largest triangle in the ratio 2 to 3 to 1, the similarity ratios of the triangles are as follows.

- Smallest to middle: 2 to 5
- Smallest to largest: 2 to 6, or 1 to 3
- Middle to largest: 5 to 6

The height of the largest shampoo bottle that can stand upright on the middle shelf is equal to the height of the middle shelf. The height of the entire triangular shelf system is 18 inches. This is the height of the largest triangle. The height of the middle shelf is the height of the middle triangle minus the height of the smallest triangle. Since the similarity ratio of the middle triangle to the largest triangle is 5 to 6, the height of the middle triangle is  $\frac{5}{6}(18) = 15$  inches. Since the similarity ratio of the smallest triangle to the largest triangle is 1 to 3,

the height of the smallest triangle is  $\frac{1}{3}(18) = 6$  inches. Therefore the height of the largest shampoo bottle that can fit on the middle shelf is  $15 - 6 = 9$  inches.

Alternatively, in the diagram below, the altitude of the largest triangle has been drawn and is a line segment that intersects and is perpendicular to each of the parallel lines.



Using the proportional segment theorem, it follows that the lengths of the three segments formed by the altitude are in the ratio 2:3:1 (from top to bottom). If  $y$  is the length of the shortest segment, then the lengths of the three segments are  $2y$ ,  $3y$ , and  $y$ , with  $3y$  being the height of the middle shelf. Since  $2y + 3y + y = 18$ , it follows that  $3y = 9$ .

### QUESTION 17

**The correct answer is .6 or  $\frac{3}{5}$ .** The angles marked  $x^\circ$  and  $y^\circ$  are acute angles in a right triangle. Thus, they are complementary angles. By the complementary angle relationship between sine and cosine, it follows that  $\sin(x^\circ) = \cos(y^\circ)$ . Therefore, the cosine of  $y^\circ$  is .6. Either .6 or the equivalent fraction  $\frac{3}{5}$  may be gridded as the correct answer.

Alternatively, since the sine of  $x^\circ$  is .6, the ratio of the side opposite the  $x^\circ$  angle to the hypotenuse is .6. The side opposite the  $x^\circ$  angle is the side adjacent to the  $y^\circ$  angle. Thus, the ratio of the side adjacent to the  $y^\circ$  angle to the hypotenuse, which is equal to the cosine of  $y^\circ$ , is equal to .6.

### QUESTION 18

**The correct answer is 5.** The four-term polynomial expression can be factored completely, by grouping, as follows:

$$(x^3 - 5x^2) + (2x - 10) = 0$$

$$x^2(x - 5) + 2(x - 5) = 0$$

$$(x - 5)(x^2 + 2) = 0$$

By the zero product property, set each factor of the polynomial equal to 0 and solve each resulting equation for  $x$ . This gives  $x = 5$  or  $x = \pm i\sqrt{2}$ , respectively. Because the question asks for the real value of  $x$  that satisfies the equation, the correct answer is 5.

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### QUESTION 19

**The correct answer is 0.** Multiplying each side of  $-3x + 4y = 20$  by 2 gives  $-6x + 8y = 40$ . Adding each side of  $-6x + 8y = 40$  to the corresponding side of  $6x + 3y = 15$  gives  $11y = 55$ , or  $y = 5$ . Finally, substituting 5 for  $y$  in  $6x + 3y = 15$  gives  $6x + 3(5) = 15$ , or  $x = 0$ .

### QUESTION 20

**The correct answer is 25.** In the mesosphere, an increase of 10 kilometers in the distance above Earth results in a decrease in the temperature by  $k^\circ$  Celsius where  $k$  is a constant. Thus, the temperature in the mesosphere is linearly dependent on the distance above Earth. Using the values provided, one can calculate the unit rate of change

for the temperature in the mesosphere to be  $\frac{-80 - (-5)}{80 - 50} = \frac{-75}{30} = \frac{-25}{10}$ .

Therefore, within the mesosphere, if the distance above Earth increases by 1 kilometer, the temperature decreases by  $2.5^\circ$  Celsius. Therefore, if the distance above Earth increases by  $(1 \times 10) = 10$  kilometers, the temperature will decrease by  $(2.5 \times 10) = 25^\circ$  Celsius. Thus, the value of  $k$  is 25.

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice B is correct.** Let  $m$  be the number of movies Jill rented online during the month. Since the monthly membership fee is \$9.80 and there is an additional fee of \$1.50 to rent each movie online, the total of the membership fee and the movie rental fees, in dollars, can be written as  $9.80 + 1.50m$ . Since the total of these fees for the month was \$12.80, the equation  $9.80 + 1.50m = 12.80$  must be true. Subtracting 9.80 from each side and then dividing each side by 1.50 yields  $m = 2$ .

Choices A, C, and D are incorrect and may be the result of errors in setting up or solving the equation that represents the context.

### QUESTION 2

**Choice C is correct.** Donald believes he can increase his typing speed by 5 words per minute each month. Therefore, in  $m$  months, he believes he can increase his typing speed by  $5m$  words per minute. Because he is currently able to type at a speed of 180 words per minute, he believes that in  $m$  months, he will be able to increase his typing speed to  $180 + 5m$  words per minute.

Choice A is incorrect because the expression indicates that Donald currently types 5 words per minute and will increase his typing speed by 180 words per minute each month. Choice B is incorrect because the expression indicates that Donald currently types 225 words per



minute, not 180 words per minute. Choice D is incorrect because the expression indicates that Donald will decrease, not increase, his typing speed by 5 words per minute each month.

### QUESTION 3

**Choice C is correct.** Because there are 16 ounces in 1 pound, a 3-pound pizza weighs  $3 \times 16 = 48$  ounces. One half of the pizza weighs  $\frac{1}{2} \times 48 = 24$  ounces, and one-third of the half weighs  $\frac{1}{3} \times 24 = 8$  ounces.

Alternatively, since  $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ , cutting the pizza into halves and then into thirds results in a pizza that is cut into sixths. Therefore, each slice of the 48-ounce pizza weighs  $\frac{1}{6} \times 48 = 8$  ounces.

Choice A is incorrect and is the result of cutting each half into sixths rather than thirds. Choice B is incorrect and is the result of cutting each half into fourths rather than thirds. Choice D is incorrect and is the result of cutting the whole pizza into thirds.

### QUESTION 4

**Choice B is correct.** Because Nick surveyed a random sample of the freshman class, his sample was representative of the entire freshman class. Thus, the percent of students in the entire freshman class expected to prefer the Fall Festival in October is appropriately estimated by the percent of students who preferred it in the sample, 25.6%. Thus, of the 225 students in the freshman class, approximately  $225 \times 0.256 = 57.6$  or about 60 students would be expected to prefer having the Fall Festival in October.

Choices A, C, and D are incorrect. These choices may be the result of misapplying the concept of percent or of calculation errors.

### QUESTION 5

**Choice B is correct.** The density of an object is equal to the mass of the object divided by the volume of the object, which can be

expressed as density =  $\frac{\text{mass}}{\text{volume}}$ . Thus, if an object has a density

of 3 grams per milliliter and a mass of 24 grams, the equation

becomes 3 grams/milliliter =  $\frac{24 \text{ grams}}{\text{volume}}$ . This can be rewritten as

volume =  $\frac{24 \text{ grams}}{3 \text{ grams/milliliter}} = 8$  milliliters.

Choice A is incorrect and may be the result of confusing the density and the volume and setting up the density equation as  $24 = \frac{3}{\text{volume}}$ .

Choice C is incorrect and may be the result of a conceptual error that leads to subtracting 3 from 24. Choice D is incorrect and may be the result of confusing the mass and the volume and setting up the density equation as  $24 = \frac{\text{volume}}{3}$ .

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## QUESTION 6

**Choice A is correct.** Let  $a$  be the number of hours Angelica worked last week. Since Raul worked 11 more hours than Angelica, Raul worked  $a + 11$  hours last week. Since they worked a combined total of 59 hours, the equation  $a + (a + 11) = 59$  can represent this situation. This equation can be simplified to  $2a + 11 = 59$ , or  $2a = 48$ . Therefore,  $a = 24$ , and Angelica worked 24 hours last week.

Choice B is incorrect because it is the number of hours Raul worked last week. Choice C is incorrect. If Angelica worked 40 hours and Raul worked 11 hours more, Raul would have worked 51 hours, and the combined total number of hours they worked would be 91, not 59. Choice D is incorrect and may be the result of solving the equation  $a + 11 = 59$  rather than  $a + (a + 11) = 59$ .

## QUESTION 7

**Choice A is correct.** According to the table, of the 50 movies with the greatest ticket sales in 2012, 4 are comedy movies with a PG-13 rating. Therefore, the proportion of the 50 movies with the greatest ticket sales in 2012 that are comedy movies with a PG-13 rating is  $\frac{4}{50}$ , or equivalently,  $\frac{2}{25}$ .

Choice B is incorrect;  $\frac{9}{50}$  is the proportion of the 50 movies with the greatest ticket sales in 2012 that are comedy movies, regardless of rating. Choice C is incorrect;  $\frac{2}{11} = \frac{4}{22}$  is the proportion of movies with a PG-13 rating that are comedy movies. Choice D is incorrect;  $\frac{11}{25} = \frac{22}{50}$  is the proportion of the 50 movies with the greatest ticket sales in 2012 that have a rating of PG-13.

## QUESTION 8

**Choice D is correct.** The quadrants of the  $xy$ -plane are defined as follows: Quadrant I is above the  $x$ -axis and to the right of the  $y$ -axis; Quadrant II is above the  $x$ -axis and to the left of the  $y$ -axis; Quadrant III is below the  $x$ -axis and to the left of the  $y$ -axis; and Quadrant IV is below the  $x$ -axis and to the right of the  $y$ -axis. It is possible for line  $\ell$  to pass through Quadrants II, III, and IV, but not Quadrant I, only if line  $\ell$  has negative  $x$ - and  $y$ -intercepts. This implies that line  $\ell$  has a negative slope, since between the negative  $x$ -intercept and the negative  $y$ -intercept the value of  $x$  increases (from negative to zero) and the value of  $y$  decreases (from zero to negative); so the quotient of the change in  $y$  over the change in  $x$ , that is, the slope of line  $\ell$ , must be negative.

Choice A is incorrect because a line with an undefined slope is a vertical line, and if a vertical line passes through Quadrant IV, it must pass through Quadrant I as well. Choice B is incorrect because a line with a slope of zero is a horizontal line and, if a horizontal line passes

through Quadrant II, it must pass through Quadrant I as well. Choice C is incorrect because if a line with a positive slope passes through Quadrant IV, it must pass through Quadrant I as well.

### QUESTION 9

**Choice B is correct.** According to the table, in 2012 there was a total of  $14,766 + 47,896 = 62,662$  registered voters between 18 and 44 years old, and  $3,453 + 11,237 = 14,690$  of them were from the Midwest region. Therefore, the probability that a randomly chosen registered voter who was between 18 and 44 years old in 2012 was from the Midwest region is  $\frac{14,690}{62,662} \approx 0.234$ . Of the given choices, 0.25 is closest to this value.

Choice A is incorrect; this is the probability of selecting at random a registered voter from the Midwest who is 18 to 24 years old. Choice C is incorrect; this is the probability of selecting at random a registered voter from the Midwest who is 18 to 44 years old. Choice D is incorrect and may be the result of errors made when choosing the correct proportion or in calculating the probability.

### QUESTION 10

**Choice A is correct.** According to the graph, the animal with the longest gestation period (60 days) has a life expectancy of 3 years.

Choices B, C, and D are incorrect. All the animals that have a life expectancy of 4, 8, or 10 years have a gestation period that is shorter than 60 days, which is the longest gestation period.

### QUESTION 11

**Choice A is correct.** The ratio of life expectancy to gestation period for the animal represented by point A is approximately  $\frac{7 \text{ years}}{23 \text{ days}}$ , or about 0.3 years/day, which is greater than the ratio for the animals represented by the other labeled points (the ratios for points B, C, and D, in units of years of life expectancy per day of gestation, are approximately  $\frac{8}{44}$ ,  $\frac{8}{51}$ , and  $\frac{10}{51}$  respectively, each of which is less than 0.2 years/day).

Choices B, C, and D are incorrect and may be the result of errors in calculating the ratio or in reading the graph.

### QUESTION 12

**Choice C is correct.** All of the given choices are polynomials. If the graph of a polynomial function  $f$  in the  $xy$ -plane has an  $x$ -intercept at  $b$ , then  $(x - b)$  must be a factor of  $f(x)$ . Since  $-3$ ,  $-1$ , and  $1$  are each  $x$ -intercepts of the graph of  $f$ , it follows that  $(x + 3)$ ,  $(x + 1)$ , and  $(x - 1)$  must each be a factor of  $f(x)$ . Of the given equations, only the equation in choice C has these 3 factors. Therefore, only the equation in choice C could define the function  $f$ .

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Choices A, B, and D are incorrect because these equations do not contain all three factors necessary in order for the graph of the polynomial function  $f$  to have  $x$ -intercepts at  $-3$ ,  $-1$ , and  $1$ .

### QUESTION 13

**Choice C is correct.** The mosquito population starts at 100 in week 0 and then is multiplied by a factor of 10 every 5 weeks. Thus, if  $P(t)$  is the mosquito population after  $t$  weeks, then based on the table,  $P(t) = 100(10)^{\frac{t}{5}}$ , which indicates an exponential growth relationship.

Choice A is incorrect. Increasing linearly means that the estimated population grows by the same amount every 5 weeks. According to the table, from week 0 to week 5, the estimated population grows by 900 mosquitoes, and from week 5 to week 10, it grows by 9,900 mosquitoes. Therefore, the estimated population is not increasing linearly. Choices B and C are incorrect because according to the table, the estimated population is increasing, not decreasing.

### QUESTION 14

**Choice D is correct.** According to the given formula, the amount of money generated for a year at 5% interest, compounded monthly, is  $1,000\left(1 + \frac{5}{1,200}\right)^{12}$ , whereas the amount of money generated at 3% interest, compounded monthly, is  $1,000\left(1 + \frac{3}{1,200}\right)^{12}$ . Therefore, the difference between these two amounts,  $1,000\left(1 + \frac{5}{1,200}\right)^{12} - 1,000\left(1 + \frac{3}{1,200}\right)^{12}$ , shows how much additional money is generated at an interest rate of 5% than at an interest rate of 3%.

Choices A, B, and C are incorrect and may be the result of misinterpreting the given formula. For example, the expression in choice C gives how many times as much money, not how much additional money, is generated at an interest rate of 5% than at an interest rate of 3%.

### QUESTION 15

**Choice B is correct.** The graph of  $y = ax^b$ , where  $a$  is positive and  $b$  is negative, would show a trend that is decreasing, but with a rate of decrease that slows as  $x$  increases. Of the scatterplots shown, only the one in choice B would be appropriately modeled by such a function.

Choice A is incorrect, as this scatterplot is appropriately modeled by a linear function. Choice C is incorrect, as this scatterplot is appropriately modeled by an increasing function. Choice D is incorrect, as this scatterplot shows no clear relationship between  $x$  and  $y$ .

### QUESTION 16

**Choice A is correct.** The total cost  $y$ , in dollars, of buying the materials and renting the tools for  $x$  days from Store A and Store B is found by substituting the respective values for these stores from the table into the given equation,  $y = M + (W + K)x$ , as shown below.

$$\text{Store A: } y = 750 + (15 + 65)x = 750 + 80x$$

$$\text{Store B: } y = 600 + (25 + 80)x = 600 + 105x$$

Thus, the number of days,  $x$ , for which the total cost of buying the materials and renting the tools from Store B is less than or equal to the total cost of buying the materials and renting the tools from Store A can be found by solving the inequality  $600 + 105x \leq 750 + 80x$ . Subtracting  $80x$  and  $600$  from each side of  $600 + 105x \leq 750 + 80x$  and combining like terms yields  $25x \leq 150$ . Dividing each side of  $25x \leq 150$  by  $25$  yields  $x \leq 6$ .

Choice B is incorrect. The inequality  $x \geq 6$  is the number of days for which the total cost of buying the materials and renting the tools from Store B is greater than or equal to the total cost of buying the materials and renting the tools from Store A. Choices C and D are incorrect and may be the result of an error in setting up or simplifying the inequality.

### QUESTION 17

**Choice D is correct.** The total cost,  $y$ , of buying the materials and renting the tools in terms of the number of days,  $x$ , is given as  $y = M + (W + K)x$ . If this relationship is graphed in the  $xy$ -plane, the slope of the graph is equal to  $W + K$ , which is the daily rental cost of the wheelbarrow plus the daily rental cost of the concrete mixer, that is, the total daily rental costs of the tools.

Choice A is incorrect because the total cost of the project is  $y$ . Choice B is incorrect because the total cost of the materials is  $M$ , which is the  $y$ -intercept of the graph of  $y = M + (W + K)x$ . Choice C is incorrect because the total daily cost of the project is the total cost of the project divided by the total number of days the project took and, since materials cost more than 0 dollars, this is not the same as the total daily rental costs.

### QUESTION 18

**Choice C is correct.** The volume  $V$  of a right circular cylinder is given by the formula  $V = \pi r^2 h$ , where  $r$  is the base radius of the cylinder and  $h$  is the height of the cylinder. Since each glass has an internal diameter of 3 inches, each glass has a base radius of  $\frac{3}{2}$  inches. Since the height of the milk in each glass is 6 inches, the volume of milk in each glass is  $V = \pi \left(\frac{3}{2}\right)^2 (6) \approx 42.41$  cubic inches. The total number of glasses Jim can pour from 1 gallon is equal to  $\frac{\text{number of cubic inches in 1 gallon}}{\text{number of cubic inches in 1 glass}} = \frac{231}{42.41}$ , which is approximately 5.45 glasses. Since the question asks for the largest number of full glasses Jim can pour, the number of glasses needs to be rounded down to 5.

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Choices A, B, and D are incorrect and may be the result of conceptual errors or calculation errors. For example, choice D is incorrect because even though Jim can pour more than 5 full glasses, he will not have enough milk to pour a full 6th glass.

### QUESTION 19

**Choice A is correct.** Adding 4 to each side of the inequality  $3p - 2 \geq 1$  yields the inequality  $3p + 2 \geq 5$ . Therefore, the least possible value of  $3p + 2$  is 5.

Choice B is incorrect because it gives the least possible value of  $3p$ , not of  $3p + 2$ . Choice C is incorrect. If the least possible value of  $3p + 2$  were 2, then it would follow that  $3p + 2 \geq 2$ . Subtracting 4 from each side of this inequality would yield  $3p - 2 \geq -2$ . This contradicts the given inequality,  $3p - 2 \geq 1$ . Therefore, the least possible value of  $3p + 2$  cannot be 2. Choice D is incorrect because it gives the least possible value of  $p$ , not of  $3p + 2$ .

### QUESTION 20

**Choice C is correct.** Since the biomass of the lake doubles each year, the biomass starts at a positive value and then increases exponentially over time. Of the graphs shown, only the graph in choice C is of an increasing exponential function.

Choice A is incorrect because the biomass of the lake must start at a positive value, not zero. Furthermore, this graph shows linear growth, not exponential growth. Choice B is incorrect because the biomass of the lake must start at a positive value, not zero. Furthermore, this graph has vertical segments and is not a function. Choice D is incorrect because the biomass of the lake does not remain the same over time.

### QUESTION 21

**Choice C is correct.** For a data point to be above the line  $y = x$ , the value of  $y$  must be greater than the value of  $x$ . That is, the consumption in 2010 must be greater than the consumption in 2000. This occurs for 3 types of energy sources shown in the bar graph: biofuels, geothermal, and wind.

Choices A, B, and D are incorrect and may be the result of a conceptual error in presenting the data shown in a scatterplot. For example, choice B is incorrect because there are 2 data points in the scatterplot that lie below the line  $y = x$ .

### QUESTION 22

**Choice B is correct.** Reading the graph, the amount of wood power used in 2000 was 2.25 quadrillion BTUs and the amount used in 2010 was 2.00 quadrillion BTUs. To find the percent decrease, find the positive difference between the two amounts, divide by the earlier amount (from 2000),

and then multiply by 100:  $\frac{2.25 - 2.00}{2.25} \times 100 = \frac{0.25}{2.25} \times 100 \approx 11.1$  percent.

Of the choices given, 11% is closest to the percent decrease in the consumption of wood power from 2000 to 2010.

Choices A, C, and D are incorrect and may be the result of errors in reading the bar graph or in calculating the percent decrease.

### QUESTION 23

**Choice B is correct.** The standard deviation is a measure of how far the data set values are from the mean. In the data set for City A, the large majority of the data are in three of the five possible values, which are the three values closest to the mean. In the data set for City B, the data are more spread out, with many values at the minimum and maximum values. Therefore, by observation, the data for City B have a larger standard deviation.

Alternatively, one can calculate the mean and visually inspect the difference between the data values and the mean. For City A the mean is  $\frac{1,655}{21} \approx 78.8$ , and for City B the mean is  $\frac{1,637}{21} \approx 78.0$ . The data for City A are closely clustered near 79, which indicates a small standard deviation. The data for City B are spread out away from 78, which indicates a larger standard deviation.

Choices A, C, and D are incorrect and may be the result of misconceptions about the standard deviation.

### QUESTION 24

**Choice C is correct.** Since segment  $AB$  is a diameter of the circle, it follows that arc  $ADB$  is a semicircle. Thus, the circumference of the circle is twice the length of arc  $ADB$  which is  $2(8\pi) = 16\pi$ . Since the circumference of a circle is  $2\pi$  times the radius of the circle, the radius of this circle is  $16\pi$  divided by  $2\pi$ , which is equal to 8.

Choice A is incorrect. If the radius of the circle is 2, the circumference of the circle would be  $2(2\pi)$  and the length of arc  $ADB$  would be  $2\pi$ , not  $8\pi$ . Choice B is incorrect. If the radius of the circle is 4, the circumference of the circle would be  $2(4\pi)$  and the length of arc  $ADB$  would be  $4\pi$ , not  $8\pi$ . Choice D is incorrect; 16 is the length of the diameter of the circle, not of the radius.

### QUESTION 25

**Choice B is correct.** In  $f(x)$ , factoring out the greatest common factor,  $2x$ , yields  $f(x) = 2x(x^2 + 3x + 2)$ . It is given that  $g(x) = x^2 + 3x + 2$ , so using substitution,  $f(x)$  can be rewritten as  $f(x) = 2x \cdot g(x)$ . In the equation  $p(x) = f(x) + 3g(x)$ , substituting  $2x \cdot g(x)$  for  $f(x)$  yields  $p(x) = 2x \cdot g(x) + 3 \cdot g(x)$ . In  $p(x)$ , factoring out the greatest common factor,  $g(x)$ , yields  $p(x) = g(x)(2x + 3)$ . Because  $2x + 3$  is a factor of  $p(x)$ , it follows that  $p(x)$  is divisible by  $2x + 3$ .

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Choices A, C, and D are incorrect because  $2x + 3$  is not a factor of the polynomials  $h(x)$ ,  $r(x)$ , or  $s(x)$ . Using the substitution  $f(x) = 2x \cdot g(x)$ , and factoring further,  $h(x)$ ,  $r(x)$ , and  $s(x)$  can be rewritten as follows:

$$h(x) = (x + 1)(x + 2)(2x + 1)$$

$$r(x) = (x + 1)(x + 2)(4x + 3)$$

$$s(x) = 2(x + 1)(x + 2)(3x + 1)$$

Because  $2x + 3$  is not a factor of  $h(x)$ ,  $r(x)$ , or  $s(x)$ , it follows that  $h(x)$ ,  $r(x)$ , and  $s(x)$  are each not divisible by  $2x + 3$ .

### QUESTION 26

**Choice C is correct.** If  $-y < x < y$ , the value of  $x$  is either 0 or between  $-y$  and 0 or between 0 and  $y$ , so statement I,  $|x| < y$  is true. It is possible that the value of  $x$  is greater than zero, but  $x$  could be negative. For example, a counterexample to statement II,  $x > 0$ , is  $x = -2$  and  $y = 3$ , yielding  $-3 < -2 < 3$ , so the given condition is satisfied. Statement III must be true since  $-y < x < y$  implies that  $-y < y$ , so  $y$  must be greater than 0. Therefore, statements I and III are the only statements that must be true.

Choices A, B, and D are incorrect because each of these choices either omits a statement that must be true or includes a statement that could be false.

### QUESTION 27

**Choice D is correct.** To interpret what the number 61 in the equation of the line of best fit represents, one must first understand what the data in the scatterplot represent. Each of the points in the scatterplot represents a large US city, graphed according to its population density (along the horizontal axis) and its relative housing cost (along the vertical axis). The line of best fit for this data represents the expected relative housing cost for a certain population density, based on the data points in the graph. Thus, one might say, on average, a city of population density  $x$  is expected to have a relative housing cost of  $y\%$ , where  $y = 0.0125x + 61$ . The number 61 in the equation represents the  $y$ -intercept of the line of best fit, in that when the population density,  $x$ , is 0, there is an expected relative housing cost of 61%. This might not have meaning within the context of the problem, in that when the population density is 0, the population is 0, so there probably wouldn't be any housing costs. However, it could be interpreted that for cities with low population densities, housing costs were likely around or above 61% (since below 61% would be for cities with negative population densities, which is impossible).

Choice A is incorrect because it interprets the values of the vertical axis as dollars and not percentages. Choice B is incorrect because the lowest housing cost is about 61% of the national average, not 61% of the highest housing cost. Choice C is incorrect because one cannot absolutely assert that no city with a low population density had housing costs below 61% of the national average, as the model shows that it is unlikely, but not impossible.



## QUESTION 28

**Choice D is correct.** The minimum value of a quadratic function appears as a constant in the vertex form of its equation, which can be found from the standard form by completing the square. Rewriting  $f(x) = (x + 6)(x - 4)$  in standard form gives  $f(x) = x^2 + 2x - 24$ . Since the coefficient of the linear term is 2, the equation for  $f(x)$  can be rewritten in terms of  $(x + 1)^2$  as follows:

$$f(x) = x^2 + 2x - 24 = (x^2 + 2x + 1) - 1 - 24 = (x + 1)^2 - 25$$

The vertex form  $f(x) = (x + 1)^2 - 25$  shows that the minimum value of  $f$  is  $-25$  (and occurs at  $x = -1$ ).

Alternatively, since  $f(-6) = f(4) = 0$ , by symmetry the vertex must have an  $x$ -coordinate at the midpoint between  $-6$  and  $4$ , which is  $-1$ . Since  $f(-1) = (5)(-5) = -25$ , the vertex must be at  $(-1, -25)$ . Finally since the coefficient of  $x^2$  is 1, the vertex form must be  $f(x) = (x + 1)^2 - 25$ .

Choices A and C are incorrect because they are not equivalent to the given equation for  $f$ . Choice B is incorrect because the minimum value of  $f$ , which is  $-25$ , does not appear as a constant or a coefficient.

## QUESTION 29

**Choice B is correct.** Since the average of 2 numbers is the sum of the 2 numbers divided by 2, the equations  $x = \frac{m + 9}{2}$ ,  $y = \frac{2m + 15}{2}$  and  $z = \frac{3m + 18}{2}$  are true. The average of  $x$ ,  $y$ , and  $z$  is given by  $\frac{x + y + z}{3}$ . Because  $x$ ,  $y$ , and  $z$  are defined in terms of  $m$ , the expressions in terms of  $m$  can be substituted for each variable to give  $\frac{\frac{m + 9}{2} + \frac{2m + 15}{2} + \frac{3m + 18}{2}}{3}$ . This fraction can be simplified to  $\frac{6m + 42}{6}$ , or  $m + 7$ .

Choices A, C, and D are incorrect and may be the result of conceptual errors or calculation errors. For example, choice D is the sum of  $x$ ,  $y$ , and  $z$ , not the average.

## QUESTION 30

**Choice D is correct.** The equation  $f(x) = k$  gives the solutions to the system of equations  $y = f(x) = x^3 - x^2 - x - \frac{11}{4}$  and  $y = k$ . A real solution of a system of two equations corresponds to a point of intersection of the graphs of the two equations in the  $xy$ -plane. The graph of  $y = k$  is a horizontal line that contains the point  $(0, k)$ . Thus, the line with equation  $y = -3$  is a horizontal line that intersects the graph of the cubic equation three times, and it follows that the equation  $f(x) = x^3 - x^2 - x - \frac{11}{4} = -3$  has three real solutions.

Choices A, B, and C are incorrect because the graphs of  $y = 2$ ,  $y = 0$ , and  $y = -2$  are horizontal lines that do not intersect the graph of the cubic equation three times.

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### QUESTION 31

**The correct answer is 1160.** The pool contains 600 gallons of water before the hose is turned on, and water flows from the hose into the pool at a rate of 8 gallons per minute. Thus, the number of gallons of water in the pool  $m$  minutes after the hose is turned on is given by the expression  $600 + 8m$ . Therefore, after 70 minutes, there will be  $600 + 8(70) = 1160$  gallons of water in the pool.

### QUESTION 32

**The correct answer is  $\frac{1}{2}$  or .5.** The equation that models the normal systolic blood pressure  $P$ , in millimeters of mercury, for a male  $x$  years old,  $P = \frac{x + 220}{2}$ , can be rewritten as  $P = \frac{1}{2}x + 110$ . For each increase of 1 year in age, the value of  $x$  increases by 1; hence,  $P$  becomes  $\frac{1}{2}(x + 1) + 110 = \left(\frac{1}{2}x + 110\right) + \frac{1}{2}$ . That is,  $P$  increases by  $\frac{1}{2}$  millimeter of mercury. Either the fraction  $1/2$  or its decimal equivalent, .5, may be gridded as the correct answer.

### QUESTION 33

**The correct answer is 4.55.** Since there are 16 Roman digits in a Roman pes, 75 digits is equal to  $\frac{75}{16}$  pes. Since 1 pes is equal to 11.65 inches,  $\frac{75}{16}$  pes is equal to  $\frac{75}{16}(11.65)$  inches. Since 12 inches is equal to 1 foot,  $\frac{75}{16}(11.65)$  inches is equal to  $\frac{75}{16}(11.65)\left(\frac{1}{12}\right) = 4.55078125$  feet. Therefore, 75 digits is equal to  $\frac{75}{16}(11.65)\left(\frac{1}{12}\right) = 4.55078125$  feet. Rounded to the nearest hundredth of a foot, 75 Roman digits is equal to 4.55 feet.

### QUESTION 34

**The correct answer is 150.** In the study, 240 male and 160 plus another 100 female bats have been tagged, so that 500 bats have been tagged altogether. If  $x$  more male bats must be tagged for  $\frac{3}{5}$  of the total number of bats to be male, the proportion  $\frac{\text{male bats}}{\text{total bats}} = \frac{240 + x}{500 + x} = \frac{3}{5}$  must be true. Multiplying each side of  $\frac{240 + x}{500 + x} = \frac{3}{5}$  by  $5(500 + x)$  gives  $5(240 + x) = 3(500 + x)$ , which simplifies to  $1200 + 5x = 1500 + 3x$ . Subtracting 1200 from both sides and subtracting  $3x$  from both sides yields  $2x = 300$ , and dividing both sides by 2 gives  $x = 150$ . Therefore, 150 more male bats must be tagged; this will bring the total to 390 male bats out of 650 bats, which is equal to  $\frac{3}{5}$ .

**QUESTION 35**

**The correct answer is 2.25 or  $\frac{9}{4}$ .** Let  $q_s$  be the dynamic pressure of the slower fluid moving with velocity  $v_s$ , and let  $q_f$  be the dynamic pressure of the faster fluid moving with velocity  $v_f$ . Then  $v_f = 1.5v_s$ .

Given the equation  $q = \frac{1}{2}nv^2$ , substituting the dynamic pressure and velocity of the faster fluid gives  $q_f = \frac{1}{2}nv_f^2$ . Since  $v_f = 1.5v_s$ , the expression  $1.5v_s$  can be substituted for  $v_f$  in this equation, giving  $q_f = \frac{1}{2}n(1.5v_s)^2$ . This can be rewritten as  $q_f = (2.25)\frac{1}{2}nv_s^2 = (2.25)q_s$ .

Therefore, the ratio of the dynamic pressure of the faster fluid is  $\frac{q_f}{q_s} = \frac{2.25q_s}{q_s} = 2.25$ . Either 2.25 or the equivalent improper fraction  $\frac{9}{4}$  may be gridded as the correct answer.

Alternatively, since  $q$  is directly proportional to the square of  $v$ , scaling  $v$  by 1.5 should scale  $q$  by  $(1.5)^2 = 2.25$ .

**QUESTION 36**

**The correct answer is 29, 30, 31, 32, 33, or 34.** Since the radius of the circle is 10, its circumference is  $20\pi$ . The full circumference of a circle is  $360^\circ$ . Thus, an arc of length  $s$  on the circle corresponds to a central angle of  $x^\circ$ , where  $\frac{x}{360} = \frac{s}{20\pi}$ , or  $x = \frac{360}{20\pi}(s)$ . Since  $5 < s < 6$ , it follows that  $\frac{360}{20\pi}(5) < x < \frac{360}{20\pi}(6)$ , which becomes, to the nearest tenth,  $28.6 < x < 34.4$ . Therefore, the possible integer values of  $x$  are 29, 30, 31, 32, 33, and 34. Any one of these numbers may be gridded as the correct answer.

**QUESTION 37**

**The correct answer is .72.** According to the analyst's estimate, the value  $V$ , in dollars, of the stock will decrease by 28% each week for  $t$  weeks, where  $t = 1, 2,$  or  $3$ , with its value being given by the formula  $V = 360(r)^t$ . This equation is an example of exponential decay. A stock losing 28% of its value each week is the same as the stock's value decreasing to 72% of its value from the previous week, since  $V - (.28)V = (.72)V$ . Using this information, after 1 week the value, in dollars, of the stock will be  $V = 360(.72)$ ; after 2 weeks the value of the stock will be  $V = 360(.72)(.72) = 360(.72)^2$ ; and after 3 weeks the value of the stock will be  $V = 360(.72)(.72)(.72) = 360(.72)^3$ . For all of the values of  $t$  in question, namely  $t = 1, 2,$  and  $3$ , the equation  $V = 360(.72)^t$  is true. Therefore, the analyst should use .72 as the value of  $r$ .

---

### QUESTION 38

**The correct answer is 134.** The analyst's prediction is that the stock will lose 28 percent of its value for each of the next three weeks. Thus, the predicted value of the stock after 1 week is  $\$360 - (.28)\$360 = \$259.20$ ; after 2 weeks,  $\$259.20 - (.28)\$259.20 \approx \$186.62$ ; and after 3 weeks,  $\$186.62 - (.28)\$186.62 \approx \$134.37$ . Therefore, to the nearest dollar, the stock analyst believes the stock will be worth 134 dollars after three weeks.

# The SAT<sup>®</sup>

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# Practice Test #5

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from William Maxwell, *The Folded Leaf*. ©1959 by William Maxwell. Originally published in 1945.

The Alcazar Restaurant was on Sheridan Road near Devon Avenue. It was long and narrow, with tables for two along the walls and tables for four down the middle. The decoration was *art moderne*,  
 5 except for the series of murals depicting the four seasons, and the sick ferns in the front window. Lymie sat down at the second table from the cash register, and ordered his dinner. The history book, which he propped against the catsup and the glass  
 10 sugar bowl, had been used by others before him. Blank pages front and back were filled in with maps, drawings, dates, comic cartoons, and organs of the body; also with names and messages no longer clear and never absolutely legible. On nearly every other  
 15 page there was some marginal notation, either in ink or in very hard pencil. And unless someone had upset a glass of water, the marks on page 177 were from tears.

While Lymie read about the Peace of Paris, signed  
 20 on the thirtieth of May, 1814, between France and the Allied powers, his right hand managed again and again to bring food up to his mouth. Sometimes he chewed, sometimes he swallowed whole the food that he had no idea he was eating. The Congress of  
 25 Vienna met, with some allowance for delays, early in November of the same year, and all the powers engaged in the war on either side sent

plenipotentiaries. It was by far the most splendid and important assembly ever convoked to discuss and determine the affairs of Europe. The Emperor of Russia, the King of Prussia, the Kings of Bavaria, Denmark, and Wurttemberg, all were present in person at the court of the Emperor Francis I in the Austrian capital. When Lymie put down his fork and  
 30 began to count them off, one by one, on the fingers of his left hand, the waitress, whose name was Irma, thought he was through eating and tried to take his plate away. He stopped her. Prince Metternich (his right thumb) presided over the Congress, and  
 40 Prince Talleyrand (the index finger) represented France.

A party of four, two men and two women, came into the restaurant, all talking at once, and took possession of the center table nearest Lymie.  
 45 The women had shingled hair and short tight skirts which exposed the underside of their knees when they sat down. One of the women had the face of a young boy but disguised by one trick or another (rouge, lipstick, powder, wet bangs plastered against  
 50 the high forehead, and a pair of long pendent earrings) to look like a woman of thirty-five, which as a matter of fact she was. The men were older. They laughed more than there seemed any occasion for, while they were deciding between soup and shrimp  
 55 cocktail, and their laughter was too loud. But it was the women's voices, the terrible not quite sober pitch of the women's voices which caused Lymie to skim over two whole pages without knowing what was on them. Fortunately he realized this and went back.  
 60 Otherwise he might never have known about the



secret treaty concluded between England, France, and Austria, when the pretensions of Prussia and Russia, acting in concert, seemed to threaten a renewal of the attack. The results of the Congress were stated clearly at the bottom of page 67 and at the top of page 68, but before Lymie got halfway through them, a coat that he recognized as his father's was hung on the hook next to his chair. Lymie closed the book and said, "I didn't think you were coming."

Time is probably no more unkind to sporting characters than it is to other people, but physical decay unsustained by respectability is somehow more noticeable. Mr. Peters' hair was turning gray and his scalp showed through on top. He had lost weight also; he no longer filled out his clothes the way he used to. His color was poor, and the flower had disappeared from his buttonhole. In its place was an American Legion button.

Apparently he himself was not aware that there had been any change. He straightened his tie self-consciously and when Irma handed him a menu, he gestured with it so that the two women at the next table would notice the diamond ring on the fourth finger of his right hand. Both of these things, and also the fact that his hands showed signs of the manicurist, one can blame on the young man who had his picture taken with a derby hat on the back of his head, and also sitting with a girl in the curve of the moon. The young man had never for one second deserted Mr. Peters. He was always there, tugging at Mr. Peters' elbow, making him do things that were not becoming in a man of forty-five.

1

Over the course of the passage, the primary focus shifts from

- A) Lymie's inner thoughts to observations made by the other characters.
- B) an exchange between strangers to a satisfying personal relationship.
- C) the physical setting of the scene to the different characters' personality traits.
- D) Lymie's experience reading a book to descriptions of people in the restaurant.

2

The main purpose of the first paragraph is to

- A) introduce the passage's main character by showing his nightly habits.
- B) indicate the date the passage takes place by presenting period details.
- C) convey the passage's setting by describing a place and an object.
- D) foreshadow an event that is described in detail later in the passage.

3

It can reasonably be inferred that Irma, the waitress, thinks Lymie is "through eating" (line 37) because

- A) he has begun reading his book.
- B) his plate is empty.
- C) he is no longer holding his fork.
- D) he has asked her to clear the table.

4

Lymie's primary impression of the "party of four" (line 42) is that they

- A) are noisy and distracting.
- B) are a refreshing change from the other customers.
- C) resemble characters from his history book.
- D) represent glamour and youth.

5

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 45-47 ("The women . . . down")
- B) Lines 47-52 ("One . . . was")
- C) Lines 55-59 ("But . . . them")
- D) Line 69 ("Lymie . . . book")

6

The narrator indicates that Lymie finally closes the history book because

- A) his father has joined him at the table.
- B) the people at the other table are too disruptive.
- C) he has finished the chapter about the Congress.
- D) he is preparing to leave the restaurant.

7

The primary impression created by the narrator's description of Mr. Peters in lines 74-79 is that he is

- A) healthy and fit.
- B) angry and menacing.
- C) nervous and hesitant.
- D) aging and shriveled.

8

The main idea of the last paragraph is that Mr. Peters

- A) neglects to spend any time with his family members.
- B) behaves as if he is a younger version of himself.
- C) is very conscious of symbols of wealth and power.
- D) is preoccupied with the knowledge that he is growing old.

9

Which choice best supports the conclusion that Mr. Peters wants to attract attention?

- A) Lines 80-81 (“Apparently . . . change”)
- B) Lines 81-85 (“He straightened . . . hand”)
- C) Lines 90-91 (“The young . . . Mr. Peters”)
- D) Lines 91-93 (“He was . . . forty-five”)

10

As used in line 93, “becoming” most nearly means

- A) emerging.
- B) fitting.
- C) developing.
- D) happening.

**Questions 11-21 are based on the following passages.**

Passage 1 is adapted from Catharine Beecher, *Essay on Slavery and Abolitionism*. Originally published in 1837. Passage 2 is adapted from Angelina E. Grimké, *Letters to Catharine Beecher*. Originally published in 1838. Grimké encouraged Southern women to oppose slavery publicly. Passage 1 is Beecher’s response to Grimké’s views. Passage 2 is Grimké’s response to Beecher.

**Passage 1**

Heaven has appointed to one sex the superior, and to the other the subordinate station, and this without any reference to the character or conduct of  
 Line either. It is therefore as much for the dignity as it is  
 5 for the interest of females, in all respects to conform to the duties of this relation. . . . But while woman holds a subordinate relation in society to the other sex, it is not because it was designed that her duties or her influence should be any the less important, or  
 10 all-pervading. But it was designed that the mode of gaining influence and of exercising power should be altogether different and peculiar. . . .

A man may act on society by the collision of intellect, in public debate; he may urge his measures  
 15 by a sense of shame, by fear and by personal interest; he may coerce by the combination of public sentiment; he may drive by physical force, and he does not outstep the boundaries of his sphere. But all the power, and all the conquests that are lawful to  
 20 woman, are those only which appeal to the kindly, generous, peaceful and benevolent principles.

Woman is to win every thing by peace and love; by making herself so much respected, esteemed and loved, that to yield to her opinions and to gratify her  
 25 wishes, will be the free-will offering of the heart. But this is to be all accomplished in the domestic and social circle. There let every woman become so cultivated and refined in intellect, that her taste and judgment will be respected; so benevolent in feeling and action; that her motives will be revered;—so  
 30 unassuming and unambitious, that collision and competition will be banished;—so “gentle and easy to be entreated,” as that every heart will repose in her presence; then, the fathers, the husbands, and the  
 35 sons, will find an influence thrown around them, to which they will yield not only willingly but proudly. . . .

A woman may seek the aid of co-operation and combination among her own sex, to assist her in her  
 40 appropriate offices of piety, charity, maternal and

domestic duty; but whatever, in any measure, throws a woman into the attitude of a combatant, either for herself or others—whatever binds her in a party conflict—whatever obliges her in any way to exert  
 45 coercive influences, throws her out of her appropriate sphere. If these general principles are correct, they are entirely opposed to the plan of arraying females in any Abolition movement.

**Passage 2**

The investigation of the rights of the slave has led  
 50 me to a better understanding of my own. I have found the Anti-Slavery cause to be the high school of morals in our land—the school in which *human rights* are more fully investigated, and better understood and taught, than in any other. Here a  
 55 great fundamental principle is uplifted and illuminated, and from this central light, rays innumerable stream all around.

Human beings have *rights*, because they are *moral* beings: the rights of *all* men grow out of their moral  
 60 nature; and as all men have the same moral nature, they have essentially the same rights. These rights may be wrested from the slave, but they cannot be alienated: his title to himself is as perfect now, as is that of Lyman Beecher:<sup>1</sup> it is stamped on his moral  
 65 being, and is, like it, imperishable. Now if rights are founded in the nature of our moral being, then the *mere circumstance of sex* does not give to man higher rights and responsibilities, than to woman. To suppose that it does, would be to deny the  
 70 self-evident truth, that the “physical constitution is the mere instrument of the moral nature.” To suppose that it does, would be to break up utterly the relations, of the two natures, and to reverse their functions, exalting the animal nature into a monarch,  
 75 and humbling the moral into a slave; making the former a proprietor, and the latter its property.

When human beings are regarded as *moral* beings, *sex*, instead of being enthroned upon the summit, administering upon rights and  
 80 responsibilities, sinks into insignificance and nothingness. My doctrine then is, that whatever it is morally right for man to do, it is morally right for woman to do. Our duties originate, not from difference of sex, but from the diversity of our  
 85 relations in life, the various gifts and talents committed to our care, and the different eras in which we live.

<sup>1</sup> Lyman Beecher was a famous minister and the father of Catharine Beecher.

11

In Passage 1, Beecher makes which point about the status of women relative to that of men?

- A) Women depend on men for their safety and security, but men are largely independent of women.
- B) Women are inferior to men, but women play a role as significant as that played by men.
- C) Women have fewer rights than men do, but women also have fewer responsibilities.
- D) Women are superior to men, but tradition requires women to obey men.

12

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 6-10 (“But . . . all-pervading”)
- B) Lines 13-14 (“A man . . . debate”)
- C) Lines 16-18 (“he may coerce . . . sphere”)
- D) Lines 41-46 (“but whatever . . . sphere”)

13

In Passage 1, Beecher implies that women’s effect on public life is largely

- A) overlooked, because few men are interested in women’s thoughts about politics.
- B) indirect, because women exert their influence within the home and family life.
- C) unnecessary, because men are able to govern society themselves.
- D) symbolic, because women tend to be more idealistic about politics than men are.

14

As used in line 2, “station” most nearly means

- A) region.
- B) studio.
- C) district.
- D) rank.

15

As used in line 12, “peculiar” most nearly means

- A) eccentric.
- B) surprising.
- C) distinctive.
- D) infrequent.

16

What is Grimké’s central claim in Passage 2?

- A) The rights of individuals are not determined by race or gender.
- B) Men and women must learn to work together to improve society.
- C) Moral rights are the most important distinction between human beings and animals.
- D) Men and women should have equal opportunities to flourish.

17

In Passage 2, Grimké makes which point about human rights?

- A) They are viewed differently in various cultures around the world.
- B) They retain their moral authority regardless of whether they are recognized by law.
- C) They are sometimes at odds with moral responsibilities.
- D) They have become more advanced and refined throughout history.

18

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 58-61 (“Human . . . same rights”)
- B) Lines 61-65 (“These . . . imperishable”)
- C) Lines 71-76 (“To suppose . . . property”)
- D) Lines 77-81 (“When . . . nothingness”)

19

Which choice best states the relationship between the two passages?

- A) Passage 2 illustrates the practical difficulties of a proposal made in Passage 1.
- B) Passage 2 takes issue with the primary argument of Passage 1.
- C) Passage 2 provides a historical context for the perspective offered in Passage 1.
- D) Passage 2 elaborates upon several ideas implied in Passage 1.

20

Based on the passages, both authors would agree with which of the following claims?

- A) Women have moral duties and responsibilities.
- B) Men often work selflessly for political change.
- C) The ethical obligations of women are often undervalued.
- D) Political activism is as important for women as it is for men.

21

Beecher would most likely have reacted to lines 65-68 (“Now . . . woman”) of Passage 2 with

- A) sympathy, because she feels that human beings owe each other a debt to work together in the world.
- B) agreement, because she feels that human responsibilities are a natural product of human rights.
- C) dismay, because she feels that women actually have a more difficult role to play in society than men do.
- D) disagreement, because she feels that the natures of men and women are fundamentally different.

**Questions 22-31 are based on the following passage and supplementary material.**

This passage is adapted from Bryan Walsh, “Whole Food Blues: Why Organic Agriculture May Not Be So Sustainable.” ©2012 by Time Inc.

When it comes to energy, everyone loves efficiency. Cutting energy waste is one of those goals that both sides of the political divide can agree on, even if they sometimes diverge on how best to get there. Energy efficiency allows us to get more out of our given resources, which is good for the economy and (mostly) good for the environment as well. In an increasingly hot and crowded world, the only sustainable way to live is to get more out of less.

10 Every environmentalist would agree.

But change the conversation to food, and suddenly efficiency doesn’t look so good. Conventional industrial agriculture has become incredibly efficient on a simple land to food basis.

15 Thanks to fertilizers, mechanization and irrigation, each American farmer feeds over 155 people worldwide. Conventional farming gets more and more crop per square foot of cultivated land—over 170 bushels of corn per acre in Iowa, for example—which can mean less territory needs to be converted from wilderness to farmland.

20 And since a third of the planet is already used for agriculture—destroying forests and other wild habitats along the way—anything that could help us produce more food on less land would seem to be good for the environment.

Of course, that’s not how most environmentalists regard their arugula [a leafy green]. They have embraced organic food as better for the planet—and 30 healthier and tastier, too—than the stuff produced by agricultural corporations. Environmentalists disdain the enormous amounts of energy needed and waste created by conventional farming, while organic practices—forgoing artificial fertilizers and chemical pesticides—are considered far more sustainable. 35 Sales of organic food rose 7.7% in 2010, up to \$26.7 billion—and people are making those purchases for their consciences as much as their taste buds.

Yet a new meta-analysis in *Nature* does the math 40 and comes to a hard conclusion: organic farming yields 25% fewer crops on average than conventional agriculture. More land is therefore needed to produce fewer crops—and that means organic farming may not be as good for the planet as 45 we think.

In the *Nature* analysis, scientists from McGill University in Montreal and the University of Minnesota performed an analysis of 66 studies comparing conventional and organic methods across 50 34 different crop species, from fruits to grains to legumes. They found that organic farming delivered a lower yield for every crop type, though the disparity varied widely. For rain-watered legume crops like beans or perennial crops like fruit trees, organic 55 trailed conventional agriculture by just 5%. Yet for major cereal crops like corn or wheat, as well as most vegetables—all of which provide the bulk of the world’s calories—conventional agriculture outperformed organics by more than 25%.

60 The main difference is nitrogen, the chemical key to plant growth. Conventional agriculture makes use of 171 million metric tons of synthetic fertilizer each year, and all that nitrogen enables much faster plant growth than the slower release of nitrogen from the 65 compost or cover crops used in organic farming. When we talk about a Green Revolution, we really mean a nitrogen revolution—along with a lot of water.

But not all the nitrogen used in conventional 70 fertilizer ends up in crops—much of it ends up running off the soil and into the oceans, creating vast polluted dead zones. We’re already putting more nitrogen into the soil than the planet can stand over the long term. And conventional agriculture also 75 depends heavily on chemical pesticides, which can have unintended side effects.

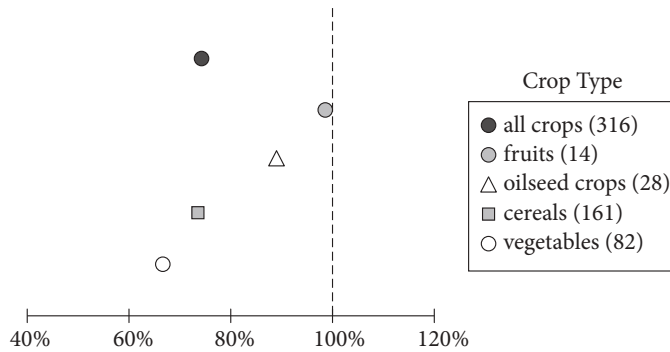
What that means is that while conventional agriculture is more efficient—sometimes much more efficient—than organic farming, there are trade-offs 80 with each. So an ideal global agriculture system, in the views of the study’s authors, may borrow the best from both systems, as Jonathan Foley of the University of Minnesota explained:

85 The bottom line? Today’s organic farming practices are probably best deployed in fruit and vegetable farms, where growing nutrition (not just bulk calories) is the primary goal. But for delivering sheer calories, especially in our staple crops of wheat, rice, maize, soybeans and so on, 90 conventional farms have the advantage right now.

Looking forward, I think we will need to deploy 95 different kinds of practices (especially new, mixed approaches that take the best of organic and conventional farming systems) where they are best suited—geographically, economically, socially, etc.

**Figure 1**

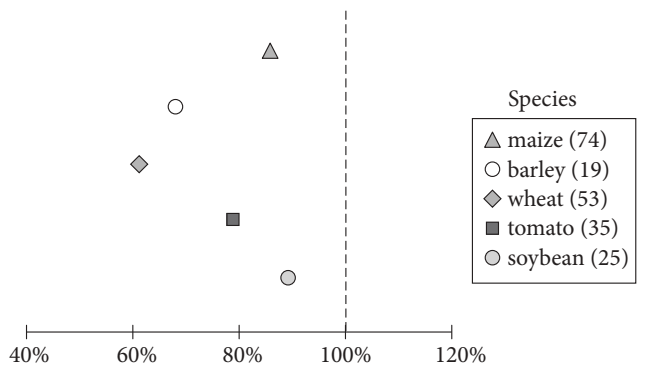
Organic Yield as a Percentage of Conventional Yield, by Crop Type



At 100%, the organic yield is the same as the conventional yield. The number of observations for each crop type is shown in parentheses.

**Figure 2**

Organic Yield as a Percentage of Conventional Yield, by Species



At 100%, the organic yield is the same as the conventional yield. The number of observations for each species is shown in parentheses.

Figures adapted from Verena Seufert, Navin Ramankutty, and Jonathan A. Foley, "Comparing the Yields of Organic and Conventional Agriculture." ©2012 by Nature Publishing Group.



22

As used in line 14, “simple” most nearly means

- A) straightforward.
- B) modest.
- C) unadorned.
- D) easy.

23

According to the passage, a significant attribute of conventional agriculture is its ability to

- A) produce a wide variety of fruits and vegetables.
- B) maximize the output of cultivated land.
- C) satisfy the dietary needs of the world’s population.
- D) lessen the necessity of nitrogen in plant growth.

24

Which choice best reflects the perspective of the “environmentalists” (line 27) on conventional agriculture?

- A) It produces inferior fruits and vegetables and is detrimental to the environment.
- B) It is energy efficient and reduces the need to convert wilderness to farmland.
- C) It is good for the environment only in the short run.
- D) It depletes critical resources but protects wildlife habitats.

25

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 27-28 (“Of course . . . green”)
- B) Lines 28-31 (“They . . . corporations”)
- C) Lines 31-35 (“Environmentalists . . . sustainable”)
- D) Lines 42-45 (“More . . . think”)

26

Which statement best expresses a relationship between organic farming and conventional farming that is presented in the passage?

- A) Both are equally sustainable, but they differ dramatically in the amount of land they require to produce equivalent yields.
- B) Both rely on artificial chemicals for pest control, but organic farmers use the chemicals sparingly in conjunction with natural remedies.
- C) Both use nitrogen to encourage plant growth, but the nitrogen used in conventional farming comes from synthetic sources.
- D) Both create a substantial amount of nitrogen runoff, but only the type of nitrogen found in fertilizers used in conventional farming can be dangerous.

27

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 13-14 (“Conventional . . . basis”)
- B) Lines 22-26 (“And since . . . environment”)
- C) Lines 51-53 (“They . . . widely”)
- D) Lines 61-65 (“Conventional . . . farming”)

28

According to Foley, an “ideal global agriculture system” (line 80)

- A) focuses primarily on yield percentages and global markets.
- B) considers multiple factors in the selection of farming techniques.
- C) weighs the economic interests of farmers against the needs of consumers.
- D) puts the nutritional value of produce first and foremost.

29

In line 88, “sheer” most nearly means

- A) transparent.
- B) abrupt.
- C) steep.
- D) pure.

30

Which statement is best supported by the information provided in figure 1?

- A) The organic yield as a percentage of conventional yield is greater for vegetables than for fruits.
- B) The organic yield as a percentage of conventional yield is similar for cereals and all crops.
- C) The reported number of observations for each crop type exceeds 82.
- D) The organic yield as a percentage of conventional yield is greater for vegetable crops than it is for oilseed crops.

31

Which of the following claims is supported by figure 2?

- A) Of the organically grown species represented, soybeans have the lowest yield.
- B) The organically grown maize and barley represented are comparable in their yields to conventionally grown maize and barley.
- C) Of the organically grown species represented, tomatoes have the highest yield.
- D) The organically grown species represented have lower yields than their conventionally grown counterparts do.

**Questions 32-41 are based on the following passage and supplementary material.**

This passage is adapted from John Bohannon, “Why You Shouldn’t Trust Internet Comments.” ©2013 by American Association for the Advancement of Science.

The “wisdom of crowds” has become a mantra of the Internet age. Need to choose a new vacuum cleaner? Check out the reviews on online merchant  
*Line* Amazon. But a new study suggests that such online  
 5 scores don’t always reveal the best choice. A massive controlled experiment of Web users finds that such ratings are highly susceptible to irrational “herd behavior”—and that the herd can be manipulated.

Sometimes the crowd really is wiser than you. The  
 10 classic examples are guessing the weight of a bull or the number of gumballs in a jar. Your guess is probably going to be far from the mark, whereas the average of many people’s choices is remarkably close to the true number.

15 But what happens when the goal is to judge something less tangible, such as the quality or worth of a product? According to one theory, the wisdom of the crowd still holds—measuring the aggregate of people’s opinions produces a stable, reliable  
 20 value. Skeptics, however, argue that people’s opinions are easily swayed by those of others. So nudging a crowd early on by presenting contrary opinions—for example, exposing them to some very good or very bad attitudes—will steer the crowd in a  
 25 different direction. To test which hypothesis is true, you would need to manipulate huge numbers of people, exposing them to false information and determining how it affects their opinions.

A team led by Sinan Aral, a network scientist at  
 30 the Massachusetts Institute of Technology in Cambridge, did exactly that. Aral has been secretly working with a popular website that aggregates news stories. The website allows users to make comments about news stories and vote each other’s comments  
 35 up or down. The vote tallies are visible as a number next to each comment, and the position of the comments is chronological. (Stories on the site get an average of about ten comments and about three votes per comment.) It’s a follow-up to his experiment  
 40 using people’s ratings of movies to measure how much individual people influence each other online (answer: a lot). This time, he wanted to know how much the crowd influences the individual, and whether it can be controlled from outside.

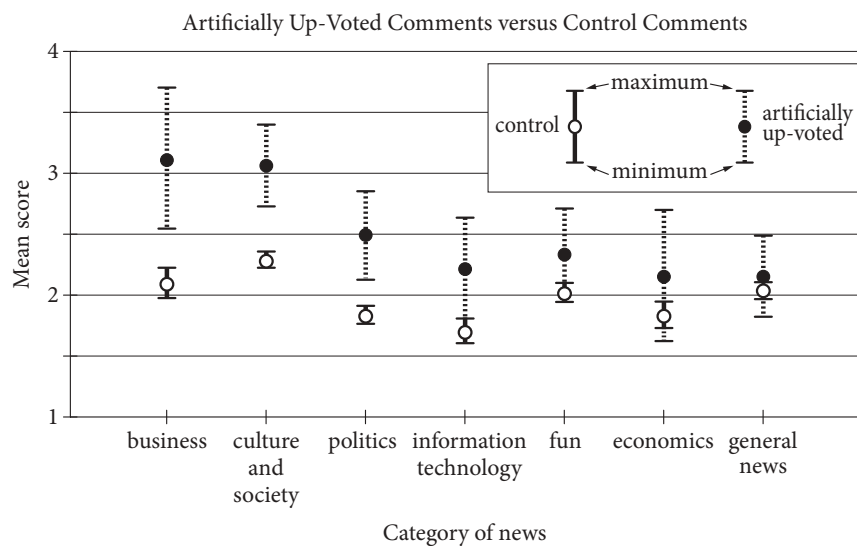
45 For five months, every comment submitted by a user randomly received an “up” vote (positive); a “down” vote (negative); or as a control, no vote at all. The team then observed how users rated those comments. The users generated more than  
 50 100,000 comments that were viewed more than 10 million times and rated more than 300,000 times by other users.

At least when it comes to comments on news sites, the crowd is more herdlike than wise.  
 55 Comments that received fake positive votes from the researchers were 32% more likely to receive more positive votes compared with a control, the team reports. And those comments were no more likely than the control to be down-voted by the next viewer  
 60 to see them. By the end of the study, positively manipulated comments got an overall boost of about 25%. However, the same did not hold true for negative manipulation. The ratings of comments that got a fake down vote were usually negated by an up  
 65 vote by the next user to see them.

“Our experiment does not reveal the psychology behind people’s decisions,” Aral says, “but an intuitive explanation is that people are more skeptical of negative social influence. They’re more  
 70 willing to go along with positive opinions from other people.”

Duncan Watts, a network scientist at Microsoft Research in New York City, agrees with that conclusion. “[But] one question is whether the  
 75 positive [herding] bias is specific to this site” or true in general, Watts says. He points out that the category of the news items in the experiment had a strong effect on how much people could be manipulated. “I would have thought that ‘business’ is  
 80 pretty similar to ‘economics,’ yet they find a much stronger effect (almost 50% stronger) for the former than the latter. What explains this difference? If we’re going to apply these findings in the real world, we’ll need to know the answers.”

85 Will companies be able to boost their products by manipulating online ratings on a massive scale?  
 “That is easier said than done,” Watts says. If people detect—or learn—that comments on a website are being manipulated, the herd may spook and leave  
 90 entirely.



Mean score: mean of scores for the comments in each category, with the score for each comment being determined by the number of positive votes from website users minus the number of negative votes

Adapted from Lev Muchnik, Sinan Aral, and Sean J. Taylor, "Social Influence Bias: A Randomized Experiment." ©2013 by American Association for the Advancement of Science.

32

Over the course of the passage, the main focus shifts from a discussion of an experiment and its results to

- A) an explanation of the practical applications of the results.
- B) a consideration of the questions prompted by the results.
- C) an analysis of the defects undermining the results.
- D) a conversation with a scientist who disputes the results.

33

The author of the passage suggests that crowds may be more effective at

- A) creating controversy than examining an issue in depth.
- B) reinforcing members' ideas than challenging those ideas.
- C) arriving at accurate quantitative answers than producing valid qualitative judgments.
- D) ranking others' opinions than developing genuinely original positions.

34

Which choice provides the best evidence for the answer to the previous question?

- A) Line 9 (“Sometimes . . . you”)
- B) Lines 11-14 (“Your . . . number”)
- C) Lines 17-20 (“According . . . value”)
- D) Lines 25-28 (“To test . . . opinions”)

35

Which choice best supports the view of the “skeptics” (line 20)?

- A) Lines 55-58 (“Comments . . . reports”)
- B) Lines 58-60 (“And . . . them”)
- C) Lines 63-65 (“The ratings . . . them”)
- D) Lines 76-79 (“He . . . manipulated”)

36

Which action would best address a question Watts raises about the study?

- A) Providing fewer fake positive comments
- B) Using multiple websites to collect ratings
- C) Requiring users to register on the website before voting
- D) Informing users that voting data are being analyzed

37

As used in line 85, “boost” most nearly means

- A) increase.
- B) accelerate.
- C) promote.
- D) protect.

38

As used in line 86, “scale” most nearly means

- A) level.
- B) wage.
- C) interval.
- D) scheme.

39

In the figure, which category of news has an artificially up-voted mean score of 2.5?

- A) Business
- B) Politics
- C) Fun
- D) General news

40

According to the figure, which category of news showed the smallest difference in mean score between artificially up-voted comments and control comments?

- A) Culture and society
- B) Information technology
- C) Fun
- D) General news

41

Data presented in the figure most directly support which idea from the passage?

- A) The mean score of artificially down-voted comments is similar to that of the control.
- B) The patterns observed in the experiment suggest that people are suspicious of negative social influence.
- C) The positive bias observed in users of the news site may not apply to human behavior in other contexts.
- D) The type of story being commented on has an impact on the degree to which people can be influenced.

**Questions 42-52 are based on the following passage.**

This passage is adapted from Joshua Foer, *Moonwalking with Einstein: The Art and Science of Remembering Everything*. ©2011 by Joshua Foer.

In 2000, a neuroscientist at University College London named Eleanor Maguire wanted to find out what effect, if any, all that driving around the labyrinthine streets of London might have on  
 5 cabbies' brains. When she brought sixteen taxi drivers into her lab and examined their brains in an MRI scanner, she found one surprising and important difference. The right posterior hippocampus, a part of the brain known to be  
 10 involved in spatial navigation, was 7 percent larger than normal in the cabbies—a small but very significant difference. Maguire concluded that all of that way-finding around London had physically altered the gross structure of their brains. The more  
 15 years a cabbie had been on the road, the more pronounced the effect.

The brain is a mutable organ, capable—within limits—of reorganizing itself and readapting to new kinds of sensory input, a phenomenon known as neuroplasticity. It had long been thought that the adult brain was incapable of spawning new neurons—that while learning caused synapses to rearrange themselves and new links between brain cells to form, the brain's basic anatomical structure  
 25 was more or less static. Maguire's study suggested the old inherited wisdom was simply not true.

After her groundbreaking study of London cabbies, Maguire decided to turn her attention to mental athletes. She teamed up with Elizabeth  
 30 Valentine and John Wilding, authors of the academic monograph *Superior Memory*, to study ten individuals who had finished near the top of the World Memory Championship. They wanted to find out if the memorizers' brains were—like the London cabbies'—structurally different from the rest of ours,  
 35 or if they were somehow just making better use of memory abilities that we all possess.

The researchers put both the mental athletes and a group of matched control subjects into MRI scanners  
 40 and asked them to memorize three-digit numbers, black-and-white photographs of people's faces, and magnified images of snowflakes, while their brains were being scanned. Maguire and her team thought it was possible that they might discover anatomical  
 45 differences in the brains of the memory champs,

evidence that their brains had somehow reorganized themselves in the process of doing all that intensive remembering. But when the researchers reviewed the imaging data, not a single significant structural  
 50 difference turned up. The brains of the mental athletes appeared to be indistinguishable from those of the control subjects. What's more, on every single test of general cognitive ability, the mental athletes' scores came back well within the normal range. The  
 55 memory champs weren't smarter, and they didn't have special brains.

But there was one telling difference between the brains of the mental athletes and the control subjects: When the researchers looked at which parts of the  
 60 brain were lighting up when the mental athletes were memorizing, they found that they were activating entirely different circuitry. According to the functional MRIs [fMRIs], regions of the brain that were less active in the control subjects seemed to be  
 65 working in overdrive for the mental athletes.

Surprisingly, when the mental athletes were learning new information, they were engaging several regions of the brain known to be involved in two specific tasks: visual memory and spatial  
 70 navigation, including the same right posterior hippocampal region that the London cabbies had enlarged with all their daily way-finding. At first glance, this wouldn't seem to make any sense. Why would mental athletes be conjuring images in  
 75 their mind's eye when they were trying to learn three-digit numbers? Why should they be navigating like London cabbies when they're supposed to be remembering the shapes of snowflakes?

Maguire and her team asked the mental athletes  
 80 to describe exactly what was going through their minds as they memorized. The mental athletes said they were consciously converting the information they were being asked to memorize into images, and distributing those images along familiar spatial  
 85 journeys. They weren't doing this automatically, or because it was an inborn talent they'd nurtured since childhood. Rather, the unexpected patterns of neural activity that Maguire's fMRIs turned up were the result of training and practice.



42

According to the passage, Maguire’s findings regarding taxi drivers are significant because they

- A) demonstrate the validity of a new method.
- B) provide evidence for a popular viewpoint.
- C) call into question an earlier consensus.
- D) challenge the authenticity of previous data.

43

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 8-12 (“The right . . . difference”)
- B) Lines 12-16 (“Maguire . . . effect”)
- C) Lines 17-20 (“The brain . . . neuroplasticity”)
- D) Lines 20-26 (“It had . . . true”)

44

As used in line 24, “basic” most nearly means

- A) initial.
- B) simple.
- C) necessary.
- D) fundamental.

45

Which question was Maguire’s study of mental athletes primarily intended to answer?

- A) Does the act of memorization make use of different brain structures than does the act of navigation?
- B) Do mental athletes inherit their unusual brain structures, or do the structures develop as a result of specific activities?
- C) Does heightened memorization ability reflect abnormal brain structure or an unusual use of normal brain structure?
- D) What is the relationship between general cognitive ability and the unusual brain structures of mental athletes?

46

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 27-29 (“After . . . athletes”)
- B) Lines 33-37 (“They . . . possess”)
- C) Lines 38-43 (“The researchers . . . scanned”)
- D) Lines 52-54 (“What’s . . . range”)

47

As used in line 39, “matched” most nearly means

- A) comparable.
- B) identical.
- C) distinguishable.
- D) competing.

48

The main purpose of the fifth paragraph (lines 57-65) is to

- A) relate Maguire’s study of mental athletes to her study of taxi drivers.
- B) speculate on the reason for Maguire’s unexpected results.
- C) identify an important finding of Maguire’s study of mental athletes.
- D) transition from a summary of Maguire’s findings to a description of her methods.

49

According to the passage, when compared to mental athletes, the individuals in the control group in Maguire’s second study

- A) showed less brain activity overall.
- B) demonstrated a wider range of cognitive ability.
- C) exhibited different patterns of brain activity.
- D) displayed noticeably smaller hippocampal regions.

50

The passage most strongly suggests that mental athletes are successful at memorization because they

- A) exploit parts of the brain not normally used in routine memorization.
- B) convert information they are trying to memorize into abstract symbols.
- C) organize information into numerical lists prior to memorization.
- D) exercise their brains regularly through puzzles and other mental challenges.

51

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 66-72 (“Surprisingly . . . way-finding”)
- B) Lines 72-73 (“At first . . . sense”)
- C) Lines 79-81 (“Maguire . . . memorized”)
- D) Lines 85-87 (“They . . . childhood”)

52

The questions in lines 74-78 primarily serve to

- A) raise doubts about the reliability of the conclusions reached by Maguire.
- B) emphasize and elaborate on an initially puzzling result of Maguire’s study of mental athletes.
- C) imply that Maguire’s findings undermine earlier studies of the same phenomenon.
- D) introduce and explain a connection between Maguire’s two studies and her earlier work.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Prehistoric Printing

Paleontologists are using modern technology to gain a greater understanding of the distant past. With the aid of computed tomography (CT) scanning and 3-D printing, researchers are able to create accurate models of prehistoric fossils. **1** These models have expanded

**1**

At this point, the writer is considering adding the following sentence.

Fossils provide paleontologists with a convenient way of estimating the age of the rock in which the fossils are found.

Should the writer make this addition here?

- A) Yes, because it supports the paragraph’s argument with an important detail.
- B) Yes, because it provides a logical transition from the preceding sentence.
- C) No, because it is not directly related to the main point of the paragraph.
- D) No, because it undermines the main claim of the paragraph.

researchers' knowledge of ancient species and **2** swear to advance the field of paleontology in the years to come.

CT scanners use X-rays to map the surface of a fossil in minute detail, recording as many as one million data points to create a digital blueprint. A 3-D printer then builds a polymer model based on this blueprint, much as a regular computer printer reproduces digital documents on paper. **3** Whereas the head of an ordinary computer printer moves back and forth while printing ink onto paper, the corresponding part of a 3-D printer moves in multiple dimensions while squirting out thin layers of melted polymer plastic. The plastic hardens quickly, **4** it allows the printer to build the layers of the final model. Compared with older ways of modeling fossils, scanning and printing in this way is extremely versatile.

2

- A) NO CHANGE
- B) subscribe
- C) vow
- D) promise

3

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it helps explain why X-rays are used in CT scanners.
- B) Kept, because it provides details to illustrate how a 3-D printer works.
- C) Deleted, because it contradicts the passage's information about digital blueprints.
- D) Deleted, because it creates confusion about how researchers gather data.

4

- A) NO CHANGE
- B) this
- C) which
- D) that

[1] One significant benefit of 3-D printing technology is its ability to create scale reproductions of fossils. [2] But now 3-D scale models can be rearranged with ease, which is a huge boon to scientists. [3] A team led by Drexel University professor Kenneth Lacovara is making models of dinosaur bones one-tenth the bones' original sizes [5] in order to learn how they fit together when the animals were alive. [4] In the past, such research was limited by the weight and bulk of the fossils as well as [6] its preciousness and fragility. [5] In many cases, scientists had to rearrange bones virtually, using artists' renderings. [7]

Because CT scanners can map objects that are impossible to excavate, CT scanning and 3-D printing can also be used to reproduce fossils that scientists cannot observe firsthand. [8] By contrast, researchers

5

- A) NO CHANGE
- B) in order for learning
- C) so that one is learning
- D) so to learn

6

- A) NO CHANGE
- B) it's
- C) their
- D) there

7

To make this paragraph most logical, sentence 2 should be placed

- A) where it is now.
- B) before sentence 1.
- C) after sentence 4.
- D) after sentence 5.

8

- A) NO CHANGE
- B) Nonetheless,
- C) Besides,
- D) For example,

from the National Museum of Brazil **9** has relied on this technique to study a fossilized skeleton that was discovered protruding from a rock at an old São Paulo railroad site. **10** The fossil was too delicate to be removed from the rock. Because of the fossil's delicate nature, the team dug up a block of stone around the fossil and brought it to their lab. With the aid of a CT scanner and a 3-D printer, they were able to produce a resin model of the fossil. Examining the model, the researchers determined that **11** one had found a new species, a 75-million-year-old crocodile. While not every discovery will be as dramatic as this one, paleontologists anticipate further expanding their knowledge of ancient life-forms as CT scanning and 3-D printing continue to make fossils more accessible.

9

- A) NO CHANGE
- B) relied
- C) will rely
- D) is relying

10

Which choice most effectively combines the underlined sentences?

- A) The fossil could not be removed from the rock on account of it being too delicate; moreover, the team dug up a block of stone around it and brought it to their lab.
- B) The team thought the fossil was too delicate to remove from the rock, and their next decision was to dig up a block of stone around the fossil and bring it to their lab.
- C) The fossil was too delicate to be removed from the rock, so the team dug up a block of stone around the fossil and brought it to their lab.
- D) In removing the fossil from the rock, the team found it was too delicate; then they dug up a block of stone around the fossil and brought it to their lab.

11

- A) NO CHANGE
- B) he or she
- C) they
- D) it

Questions 12-22 are based on the following passage.

**Thomas Nast, the Crusading Cartoonist**

“Stop them pictures!” Legend has it that the corrupt politician William “Boss” Tweed once used those words when ordering someone to offer a bribe to Thomas Nast, an artist who had become famous for cartoons that called for reforms to end corruption. **12** As a result, Tweed’s attempt to silence the artist failed, and Nast’s cartoons, published in magazines like *Harper’s Weekly*, actually played a key role in bringing Boss Tweed and his cronies to justice.

**13** There were powerful political organizations in the 1860s and the 1870s. The organizations were known as “political machines” and started taking control of city governments. These political machines were able to pack legislatures and courts with hand-picked supporters by purchasing **14** votes, a form of election fraud involving the exchange of money or favors for votes. Once a political machine had control of enough important positions, its members were able to use public funds to enrich themselves and their friends. Boss Tweed’s Tammany Hall group, which controlled New York

**15** City in the 1860s—stole more than \$30 million,

**12**

- A) NO CHANGE
- B) Therefore,
- C) Furthermore,
- D) DELETE the underlined portion.

**13**

Which choice most effectively combines the underlined sentences?

- A) Powerful political organizations in the 1860s and the 1870s started taking control of city governments, and they were known as “political machines.”
- B) Known as “political machines,” in the 1860s and the 1870s, political organizations that were powerful started taking control of city governments.
- C) City governments were taken control of in the 1860s and the 1870s, and powerful political organizations known as “political machines” did so.
- D) In the 1860s and the 1870s, powerful political organizations known as “political machines” started taking control of city governments.

**14**

- A) NO CHANGE
- B) votes, being
- C) votes, that is
- D) votes, which it is

**15**

- A) NO CHANGE
- B) City in the 1860s,
- C) City, in the 1860s,
- D) City in the 1860s



the equivalent of more than \$365 million today.

**16** Tweed had been elected to a single two-year term in Congress in 1852. Tammany Hall was so powerful and

**17** corrupt that, the *New York Times*, commented  
 “There is absolutely nothing . . . in the city which is beyond the reach of the insatiable gang.”

Given the extent of Tweed’s power, it is remarkable that a single cartoonist could have played such a significant role in bringing about his downfall. Nast’s cartoons depicted Tweed as a great big bloated thief. One of the artist’s most **18** famous images showed Tweed with a bag of money in place of his **19** head. Another featured Tweed leaning against a ballot box with the caption “As long as I count the votes, what are you going to do about it?” These cartoons were so effective in part because many of the citizens who supported Tweed were illiterate and thus could not read the newspaper accounts of his criminal activities. Nast’s cartoons, though, widely exposed the public to the injustice of Tweed’s political machine.

16

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it introduces the quote from the *New York Times* in the next sentence.
- B) Kept, because it adds a vital detail about Tweed that is necessary to understand his power.
- C) Deleted, because it blurs the focus of the paragraph by introducing loosely related information.
- D) Deleted, because it contains information that undermines the main claim of the passage.

17

- A) NO CHANGE
- B) corrupt, that the *New York Times* commented,
- C) corrupt that the *New York Times* commented,
- D) corrupt that the *New York Times*, commented

18

- A) NO CHANGE
- B) famous and well-known
- C) famous and commonly known
- D) famous, commonly known

19

Which choice adds the most relevant supporting information to the paragraph?

- A) head; like many other Nast cartoons, that one was published in *Harper’s Weekly*.
- B) head; Nast would later illustrate Tweed’s escape from prison.
- C) head, one depiction that omits Tweed’s signature hat.
- D) head, an image that perfectly captured Tweed’s greedy nature.

Nast's campaign to bring down Tweed and the Tammany Hall gang was ultimately successful. In the elections of 1871, the public voted against most of the Tammany Hall candidates, greatly weakening Tweed's power. Eventually, Tweed and his gang were **20** persecuted for a number of charges, including fraud and larceny, and many of them were sent to jail. In 1875 Tweed escaped from jail and fled to Spain and unwittingly **21** brought about one final **22** pinnacle for the power of political cartoons: A Spanish police officer recognized Tweed from one of Nast's cartoons. Consequently, Tweed was sent back to jail, and Nast was hailed as the man who toppled the great Tammany Hall machine.

20

- A) NO CHANGE
- B) persecuted on
- C) persecuted with
- D) prosecuted on

21

- A) NO CHANGE
- B) bringing
- C) brings
- D) has brought

22

- A) NO CHANGE
- B) triumph
- C) culmination
- D) apex

Questions 23-33 are based on the following passage and supplementary material.

### Rethinking Crowdfunding in the Arts

Crowdfunding is a popular way to raise money using the Internet. The process sounds simple: an artist, entrepreneur, or other innovator takes his or her ideas straight to the public via a crowdfunding website. The innovator creates a video about the project and offers, in exchange for donations, a series of “perks,” from acknowledgment on a social media site to a small piece of art. Many crowdfunding programs are all-or-nothing; in other words, the innovator must garner 100 percent funding for the project or the money is refunded to the donors. At **23** it’s best, the system can give creators direct access to millions of potential backers.

The home page of one leading crowdfunding site features a project to manufacture pinhole cameras on a 3-D printer. **24** The idea is obviously very attractive. An obscure method of photography may be made available to many with little expense. Within weeks, the project was 621 percent funded. In contrast, on the same page, a small Brooklyn performance venue is attempting to raise money for its current season. The venue features works of performance art showcased in a storefront window. Those who have seen the space consider it vital.

**25** However, that group may not be large enough; with just fourteen days to go in the fund-raising period, the campaign is only 46 percent funded.

23

- A) NO CHANGE
- B) its
- C) its’
- D) their

24

Which choice most effectively combines the underlined sentences?

- A) With the idea being obviously very attractive, an obscure method of photography may be made available to many at little expense.
- B) The idea is obviously very attractive: an obscure method of photography may be made available to many at little expense.
- C) An obscure method of photography may be made available to many at little expense, and the idea is obviously very attractive.
- D) An obscure method of photography, an idea that is obviously very attractive, may be made available to many at little expense.

25

- A) NO CHANGE
- B) Therefore,
- C) In effect,
- D) As a rule,

Artists such as these Brooklyn performers find that crowdfunding exacerbates problems that already exist.

**26** Work, that is easily understood and appreciated, is supported, while more complex work goes unnoticed.

**27** Time that could be used creating art is spent devising clever perks to draw the attention of potential contributors.

**28** In addition, audiences may contain many “free **29** riders,” they did not make contributions.

26

- A) NO CHANGE
- B) Work that is easily understood and appreciated is supported,
- C) Work that is easily understood, and appreciated is supported
- D) Work—that is easily understood and appreciated—is supported,

27

At this point, the writer is considering adding the following sentence.

Crowdfunding tends to attract contributors from a wide variety of professional fields.

Should the writer make this addition here?

- A) Yes, because it gives more information about the people who donate to crowdfunding campaigns.
- B) Yes, because it reinforces the writer’s point about the funding of artistic projects.
- C) No, because it fails to take into account project funding received from public institutions.
- D) No, because it blurs the focus of the paragraph by introducing a poorly integrated piece of information.

28

- A) NO CHANGE
- B) Conversely,
- C) However,
- D) Thus,

29

- A) NO CHANGE
- B) riders,” not making
- C) riders,” who did not make
- D) riders” to not make

Ironically, the success of crowdfunding may weaken overall funding for the arts if people begin to feel that paying for the art **30** loved by them is someone else's responsibility.

[1] One innovative playwright has woven the deficiencies of the system into her crowdfunding model. [2] Though the price for her tickets was higher than that of tickets for comparable shows, it was still affordable to most theatergoers—and reflected the real cost of the performance. [3] She presented the total cost for producing her play on a crowdfunding site. [4] Then she divided the total cost by the number of people she expected to attend the performance. [5] The result of the calculation was the minimum donor price, and only donors who paid at least the minimum ticket price were allowed to attend the performance. [6] By subverting the presumption that money used for her project is an altruistic donation, the playwright showed that **31** our work has monetary value to those who enjoy it. **32**

30

- A) NO CHANGE
- B) they love
- C) loved by him or her
- D) he or she loves

31

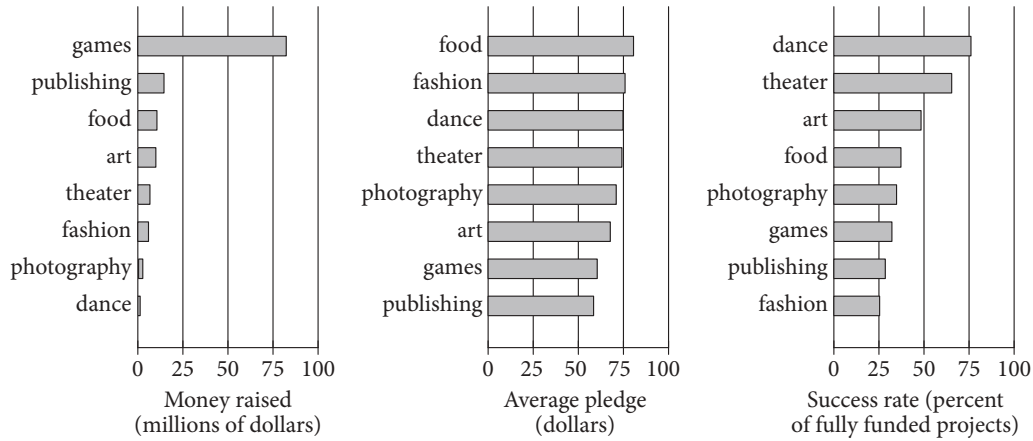
- A) NO CHANGE
- B) their
- C) her
- D) its

32

To make this paragraph most logical, sentence 2 should be placed

- A) where it is now.
- B) after sentence 3.
- C) after sentence 4.
- D) after sentence 5.

Crowdfunded Projects on Kickstarter in 2012



Adapted from "These Were the Most Successful Projects on Kickstarter Last Year." ©2013 by The Economist Newspaper Limited.

Question 33 asks about the graphic.

33

Which choice offers an accurate interpretation of the data in the graphs?

- A) The project category with the lowest amount of money raised was also the most successfully funded project category.
- B) The project category with the highest average pledge amount was also the most successfully funded project category.
- C) The project category with the lowest average pledge amount was also the project category that raised the most money.
- D) The project category with the highest average pledge amount was also the project category with the most money raised.

Questions 34-44 are based on the following passage.

**Investigative Journalism: An Evolving American Tradition**

[1] The recent precipitous decline of print journalism as a viable profession has exacerbated long-held concerns about the state of investigative reporting in the United States. [2] Facing lower print circulation and diminished advertising revenue, many major newspapers have reduced or eliminated investigative resources. [3] Newspapers, the traditional nurturing ground for investigative journalism, have been hit especially hard by the widespread availability of free news online. [4] To survive, investigative journalism must continue to adapt to the digital age. **34**

It is not difficult to understand why a cash-strapped, understaffed publication might feel pressure to cut teams of investigative **35** reporter's—their work is expensive and time-consuming. **36** Taking on the public interest, investigative journalism involves original, often long-form reporting on such topics as **37** illegal activities, street crime, corporate wrongdoing, and political corruption. An investigative story involves one or more experienced journalists dedicating their full energy and the resources of the publisher to a piece for a prolonged period of time. Expensive legal battles may ensue. The results of this work, though costly, have

**34**

For the sake of the logic and cohesion of the paragraph, sentence 3 should be

- A) placed where it is now.
- B) placed before sentence 1.
- C) placed after sentence 1.
- D) DELETED from the paragraph.

**35**

- A) NO CHANGE
- B) reporters:
- C) reporters,
- D) reporter's;

**36**

- A) NO CHANGE
- B) Undertaken in
- C) Overtaking
- D) Taking off from

**37**

- A) NO CHANGE
- B) business scandals,
- C) abuse of government power,
- D) DELETE the underlined portion.

helped keep those in power accountable. The exposure by *Washington Post* reporters Bob Woodward and Carl Bernstein of government misconduct in the Watergate scandal resulted in the resignation of President Richard Nixon in 1974. More recently, Seymour Hersh, reporting for the *New Yorker* in 2004, helped publicize the mistreatment of Iraqi prisoners by US personnel at Abu Ghraib during the Iraq War. **38** In these and other cases, exposure from reporters has served as an important **39** blockade to or scolding of malfeasance.

38

At this point, the writer is considering adding the following sentence.

In 1954, Edward R. Murrow and Fred Friendly produced episodes of the CBS television show *See It Now* that contributed to the end of US senator Joseph McCarthy’s anticommunist “witch hunts.”

Should the writer make this addition here?

- A) Yes, because it helps clarify that the passage’s main focus is on investigations of political corruption.
- B) Yes, because it offers an important counterpoint to the other cases previously described in the paragraph.
- C) No, because it gives an example that is both chronologically and substantively out of place in the paragraph.
- D) No, because it provides an example that is inconsistent with the passage’s definition of investigative journalism.

39

- A) NO CHANGE
- B) interference to or condemnation of
- C) drag on or reproof of
- D) deterrent or rebuke to



While worrisome, the decline of traditional print media **40** could not entail the end of investigative journalism. **41** Although many newsrooms have reduced their staff, some still employ investigative reporters. Nonprofit **42** enterprises such as the Organized Crime and Corruption Reporting Project have begun to fill the void created by staff losses at newspapers and magazines. Enterprising freelance reporters, newly funded by nonprofits, make extensive use of social media,

40

Which choice most effectively suggests that the “end of investigative journalism” is a real possibility but one that can be prevented?

- A) NO CHANGE
- B) need
- C) will
- D) must

41

Which choice most effectively sets up the examples in the following sentences?

- A) NO CHANGE
- B) Investigative journalism also declined between the 1930s and 1950s, only to be revived in the 1960s.
- C) According to the Pew Research Center, more people get their national and international news from the Internet than from newspapers.
- D) Indeed, recent years have witnessed innovative adjustments to changing times.

42

- A) NO CHANGE
- B) enterprises: such as
- C) enterprises such as:
- D) enterprises, such as

including blogs and Twitter, to foster a public conversation about key issues. The Help Me Investigate project, **43** for example, solicited readers to submit tips and information related to ongoing stories to its website. Far from marking the end of investigative journalism, **44** cooperation among journalists and ordinary citizens has been facilitated by the advent of the digital age through an increase in the number of potential investigators.

43

- A) NO CHANGE
- B) therefore,
- C) however,
- D) in any case,

44

- A) NO CHANGE
- B) the number of potential investigators has increased since the advent of the digital age owing to the facilitation of cooperation among journalists and ordinary citizens.
- C) the advent of the digital age has increased the number of potential investigators by facilitating cooperation among journalists and ordinary citizens.
- D) by facilitating cooperation among journalists and ordinary citizens the advent of the digital age has increased the number of potential investigators.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

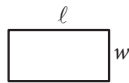
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

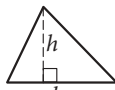


$$A = \pi r^2$$

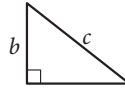
$$C = 2\pi r$$



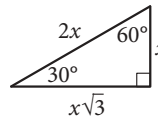
$$A = \ell w$$



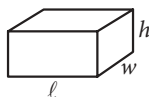
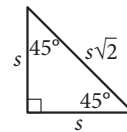
$$A = \frac{1}{2}bh$$



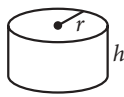
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



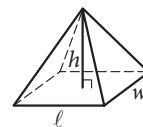
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

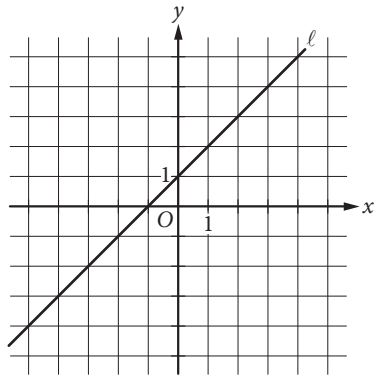
The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



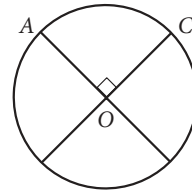
1



Which of the following is an equation of line  $\ell$  in the  $xy$ -plane above?

- A)  $x = 1$
- B)  $y = 1$
- C)  $y = x$
- D)  $y = x + 1$

2



The circle above with center  $O$  has a circumference of 36. What is the length of minor arc  $\widehat{AC}$  ?

- A) 9
- B) 12
- C) 18
- D) 36

3

What are the solutions of the quadratic equation  $4x^2 - 8x - 12 = 0$  ?

- A)  $x = -1$  and  $x = -3$
- B)  $x = -1$  and  $x = 3$
- C)  $x = 1$  and  $x = -3$
- D)  $x = 1$  and  $x = 3$



4

Which of the following is an example of a function whose graph in the  $xy$ -plane has no  $x$ -intercepts?

- A) A linear function whose rate of change is not zero
- B) A quadratic function with real zeros
- C) A quadratic function with no real zeros
- D) A cubic polynomial with at least one real zero

5

$$\sqrt{k+2} - x = 0$$

In the equation above,  $k$  is a constant. If  $x = 9$ , what is the value of  $k$ ?

- A) 1
- B) 7
- C) 16
- D) 79

6

Which of the following is equivalent to the sum of the expressions  $a^2 - 1$  and  $a + 1$ ?

- A)  $a^2 + a$
- B)  $a^3 - 1$
- C)  $2a^2$
- D)  $a^3$

7

Jackie has two summer jobs. She works as a tutor, which pays \$12 per hour, and she works as a lifeguard, which pays \$9.50 per hour. She can work no more than 20 hours per week, but she wants to earn at least \$220 per week. Which of the following systems of inequalities represents this situation in terms of  $x$  and  $y$ , where  $x$  is the number of hours she tutors and  $y$  is the number of hours she works as a lifeguard?

- A)  $12x + 9.5y \leq 220$   
 $x + y \geq 20$
- B)  $12x + 9.5y \leq 220$   
 $x + y \leq 20$
- C)  $12x + 9.5y \geq 220$   
 $x + y \leq 20$
- D)  $12x + 9.5y \geq 220$   
 $x + y \geq 20$



8

In air, the speed of sound  $S$ , in meters per second, is a linear function of the air temperature  $T$ , in degrees Celsius, and is given by  $S(T) = 0.6T + 331.4$ . Which of the following statements is the best interpretation of the number 331.4 in this context?

- A) The speed of sound, in meters per second, at  $0^\circ\text{C}$
- B) The speed of sound, in meters per second, at  $0.6^\circ\text{C}$
- C) The increase in the speed of sound, in meters per second, that corresponds to an increase of  $1^\circ\text{C}$
- D) The increase in the speed of sound, in meters per second, that corresponds to an increase of  $0.6^\circ\text{C}$

9

$$y = x^2$$
$$2y + 6 = 2(x + 3)$$

If  $(x, y)$  is a solution of the system of equations above and  $x > 0$ , what is the value of  $xy$  ?

- A) 1
- B) 2
- C) 3
- D) 9

10

If  $a^2 + b^2 = z$  and  $ab = y$ , which of the following is equivalent to  $4z + 8y$  ?

- A)  $(a + 2b)^2$
- B)  $(2a + 2b)^2$
- C)  $(4a + 4b)^2$
- D)  $(4a + 8b)^2$



11

The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

- A) 11
- B) 22
- C) 44
- D) 66

12

Which of the following is equivalent to  $9^{\frac{3}{4}}$ ?

- A)  $\sqrt[3]{9}$
- B)  $\sqrt[4]{9}$
- C)  $\sqrt{3}$
- D)  $3\sqrt{3}$

13

At a restaurant,  $n$  cups of tea are made by adding  $t$  tea bags to hot water. If  $t = n + 2$ , how many additional tea bags are needed to make each additional cup of tea?

- A) None
- B) One
- C) Two
- D) Three

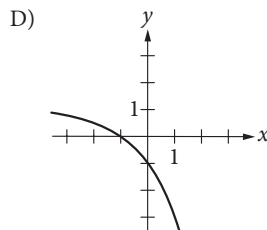
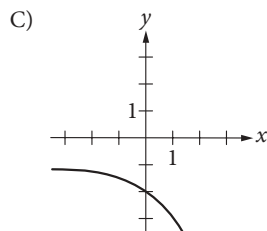
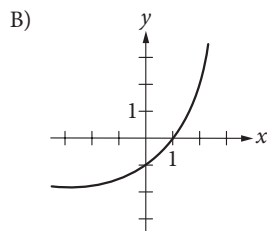
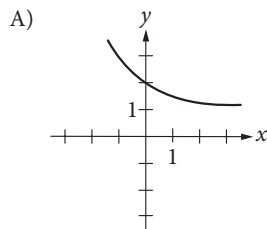




14

$$f(x) = 2^x + 1$$

The function  $f$  is defined by the equation above. Which of the following is the graph of  $y = -f(x)$  in the  $xy$ -plane?



15

Alan drives an average of 100 miles each week. His car can travel an average of 25 miles per gallon of gasoline. Alan would like to reduce his weekly expenditure on gasoline by \$5. Assuming gasoline costs \$4 per gallon, which equation can Alan use to determine how many fewer average miles,  $m$ , he should drive each week?

A)  $\frac{25}{4}m = 95$

B)  $\frac{25}{4}m = 5$

C)  $\frac{4}{25}m = 95$

D)  $\frac{4}{25}m = 5$

**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $7/2$ . (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \circ & \circ & \circ & \circ \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result. →

Answer: $\frac{7}{12}$				Answer: 2.5			
	7	/	12		2	.	5
	○	○	○		○	○	○
	○	○	○		○	○	○
1	○	○	○	1	○	○	○
2	○	○	○	2	○	○	○
3	○	○	○	3	○	○	○
4	○	○	○	4	○	○	○
5	○	○	○	5	○	○	○
6	○	○	○	6	○	○	○
7	○	○	○	7	○	○	○
8	○	○	○	8	○	○	○
9	○	○	○	9	○	○	○

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3		.	6	6	6		.	6	6	7
	○	○	○		○	○	○	○		○	○	○	○
	○	○	○		○	○	○	○		○	○	○	○
1	○	○	○	1	○	○	○	○	1	○	○	○	○
2	○	○	○	2	○	○	○	○	2	○	○	○	○
3	○	○	○	3	○	○	○	○	3	○	○	○	○
4	○	○	○	4	○	○	○	○	4	○	○	○	○
5	○	○	○	5	○	○	○	○	5	○	○	○	○
6	○	○	○	6	○	○	○	○	6	○	○	○	○
7	○	○	○	7	○	○	○	○	7	○	○	○	○
8	○	○	○	8	○	○	○	○	8	○	○	○	○
9	○	○	○	9	○	○	○	○	9	○	○	○	○

Answer: 201 – either position is correct

	2	0	1		2	0	1
	○	○	○		○	○	○
	○	○	○		○	○	○
1	○	○	○	1	○	○	○
2	○	○	○	2	○	○	○
3	○	○	○	3	○	○	○

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

Maria plans to rent a boat. The boat rental costs \$60 per hour, and she will also have to pay for a water safety course that costs \$10. Maria wants to spend no more than \$280 for the rental and the course. If the boat rental is available only for a whole number of hours, what is the maximum number of hours for which Maria can rent the boat?

17

$$2(p + 1) + 8(p - 1) = 5p$$

What value of  $p$  is the solution of the equation above?

18

$$\begin{aligned}\frac{1}{2}(2x + y) &= \frac{21}{2} \\ y &= 2x\end{aligned}$$

The system of equations above has solution  $(x, y)$ .

What is the value of  $x$  ?



19

$$\frac{2x+6}{(x+2)^2} - \frac{2}{x+2}$$

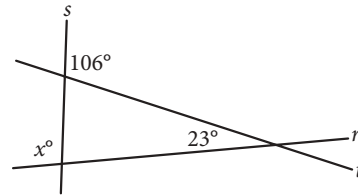
The expression above is equivalent to  $\frac{a}{(x+2)^2}$ ,

where  $a$  is a positive constant and  $x \neq -2$ .

What is the value of  $a$  ?

20

Intersecting lines  $r$ ,  $s$ , and  $t$  are shown below.



What is the value of  $x$  ?

# STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

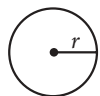
### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

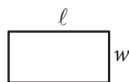
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

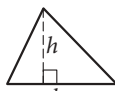


$$A = \pi r^2$$

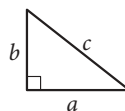
$$C = 2\pi r$$



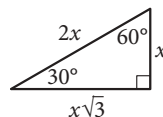
$$A = \ell w$$



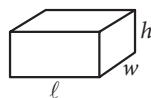
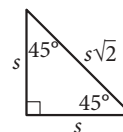
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



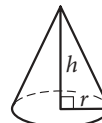
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

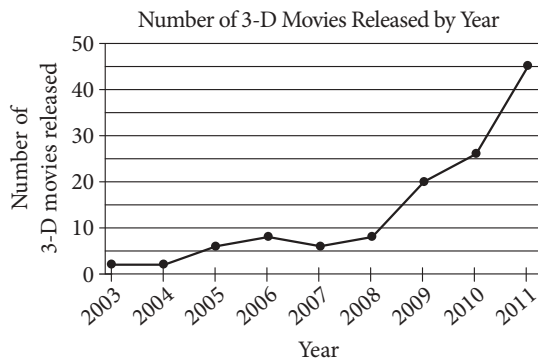
The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1



According to the line graph above, between which two consecutive years was there the greatest change in the number of 3-D movies released?

- A) 2003–2004
- B) 2008–2009
- C) 2009–2010
- D) 2010–2011

2

$x$	$f(x)$
1	5
3	13
5	21

Some values of the linear function  $f$  are shown in the table above. Which of the following defines  $f$ ?

- A)  $f(x) = 2x + 3$
- B)  $f(x) = 3x + 2$
- C)  $f(x) = 4x + 1$
- D)  $f(x) = 5x$

3

To make a bakery's signature chocolate muffins, a baker needs 2.5 ounces of chocolate for each muffin. How many pounds of chocolate are needed to make 48 signature chocolate muffins?  
(1 pound = 16 ounces)

- A) 7.5
- B) 10
- C) 50.5
- D) 120



4

If  $3(c + d) = 5$ , what is the value of  $c + d$  ?

- A)  $\frac{3}{5}$
- B)  $\frac{5}{3}$
- C) 3
- D) 5

5

The weight of an object on Venus is approximately  $\frac{9}{10}$  of its weight on Earth. The weight of an object on Jupiter is approximately  $\frac{23}{10}$  of its weight on Earth. If an object weighs 100 pounds on Earth, approximately how many more pounds does it weigh on Jupiter than it weighs on Venus?

- A) 90
- B) 111
- C) 140
- D) 230

6

An online bookstore sells novels and magazines. Each novel sells for \$4, and each magazine sells for \$1. If Sadie purchased a total of 11 novels and magazines that have a combined selling price of \$20, how many novels did she purchase?

- A) 2
- B) 3
- C) 4
- D) 5





7

The Downtown Business Association (DBA) in a certain city plans to increase its membership by a total of  $n$  businesses per year. There were  $b$  businesses in the DBA at the beginning of this year. Which function best models the total number of businesses,  $y$ , the DBA plans to have as members  $x$  years from now?

- A)  $y = nx + b$
- B)  $y = nx - b$
- C)  $y = b(n)^x$
- D)  $y = n(b)^x$

8

Which of the following is an equivalent form of  $(1.5x - 2.4)^2 - (5.2x^2 - 6.4)$  ?

- A)  $-2.2x^2 + 1.6$
- B)  $-2.2x^2 + 11.2$
- C)  $-2.95x^2 - 7.2x + 12.16$
- D)  $-2.95x^2 - 7.2x + 0.64$

9

In the 1908 Olympic Games, the Olympic marathon was lengthened from 40 kilometers to approximately 42 kilometers. Of the following, which is closest to the increase in the distance of the Olympic marathon, in miles? (1 mile is approximately 1.6 kilometers.)

- A) 1.00
- B) 1.25
- C) 1.50
- D) 1.75



10

The density  $d$  of an object is found by dividing the mass  $m$  of the object by its volume  $V$ . Which of the following equations gives the mass  $m$  in terms of  $d$  and  $V$ ?

- A)  $m = dV$
- B)  $m = \frac{d}{V}$
- C)  $m = \frac{V}{d}$
- D)  $m = V + d$

11

$$-2x + 3y = 6$$

In the  $xy$ -plane, the graph of which of the following equations is perpendicular to the graph of the equation above?

- A)  $3x + 2y = 6$
- B)  $3x + 4y = 6$
- C)  $2x + 4y = 6$
- D)  $2x + 6y = 3$

12

$$\begin{aligned} \frac{1}{2}y &= 4 \\ x - \frac{1}{2}y &= 2 \end{aligned}$$

The system of equations above has solution  $(x, y)$ . What is the value of  $x$ ?

- A) 3
- B)  $\frac{7}{2}$
- C) 4
- D) 6

13

$$\begin{aligned} y &\leq 3x + 1 \\ x - y &> 1 \end{aligned}$$

Which of the following ordered pairs  $(x, y)$  satisfies the system of inequalities above?

- A)  $(-2, -1)$
- B)  $(-1, 3)$
- C)  $(1, 5)$
- D)  $(2, -1)$



14

Type of surgeon	Major professional activity		Total
	Teaching	Research	
General	258	156	414
Orthopedic	119	74	193
Total	377	230	607

In a survey, 607 general surgeons and orthopedic surgeons indicated their major professional activity. The results are summarized in the table above. If one of the surgeons is selected at random, which of the following is closest to the probability that the selected surgeon is an orthopedic surgeon whose indicated professional activity is research?

- A) 0.122
- B) 0.196
- C) 0.318
- D) 0.379



15

A polling agency recently surveyed 1,000 adults who were selected at random from a large city and asked each of the adults, “Are you satisfied with the quality of air in the city?” Of those surveyed, 78 percent responded that they were satisfied with the quality of air in the city. Based on the results of the survey, which of the following statements must be true?

- I. Of all adults in the city, 78 percent are satisfied with the quality of air in the city.
  - II. If another 1,000 adults selected at random from the city were surveyed, 78 percent of them would report they are satisfied with the quality of air in the city.
  - III. If 1,000 adults selected at random from a different city were surveyed, 78 percent of them would report they are satisfied with the quality of air in the city.
- A) None
  - B) II only
  - C) I and II only
  - D) I and III only

Questions 16-18 refer to the following information.

Species of tree	Growth factor
Red maple	4.5
River birch	3.5
Cottonwood	2.0
Black walnut	4.5
White birch	5.0
American elm	4.0
Pin oak	3.0
Shagbark hickory	7.5

One method of calculating the approximate age, in years, of a tree of a particular species is to multiply the diameter of the tree, in inches, by a constant called the growth factor for that species. The table above gives the growth factors for eight species of trees.

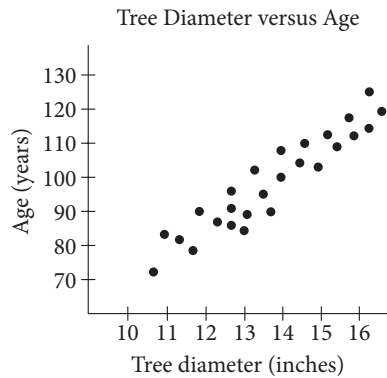
16

According to the information in the table, what is the approximate age of an American elm tree with a diameter of 12 inches?

- A) 24 years
- B) 36 years
- C) 40 years
- D) 48 years



17



The scatterplot above gives the tree diameter plotted against age for 26 trees of a single species. The growth factor of this species is closest to that of which of the following species of tree?

- A) Red maple
- B) Cottonwood
- C) White birch
- D) Shagbark hickory

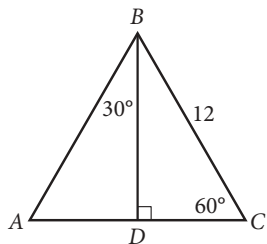
18

If a white birch tree and a pin oak tree each now have a diameter of 1 foot, which of the following will be closest to the difference, in inches, of their diameters 10 years from now? (1 foot = 12 inches)

- A) 1.0
- B) 1.2
- C) 1.3
- D) 1.4



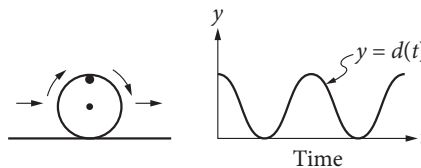
19



In  $\triangle ABC$  above, what is the length of  $\overline{AD}$  ?

- A) 4
- B) 6
- C)  $6\sqrt{2}$
- D)  $6\sqrt{3}$

20



The figure on the left above shows a wheel with a mark on its rim. The wheel is rolling on the ground at a constant rate along a level straight path from a starting point to an ending point. The graph of  $y = d(t)$  on the right could represent which of the following as a function of time from when the wheel began to roll?

- A) The speed at which the wheel is rolling
- B) The distance of the wheel from its starting point
- C) The distance of the mark on the rim from the center of the wheel
- D) The distance of the mark on the rim from the ground



21

$$\frac{a-b}{a} = c$$

In the equation above, if  $a$  is negative and  $b$  is positive, which of the following must be true?

- A)  $c > 1$
- B)  $c = 1$
- C)  $c = -1$
- D)  $c < -1$

22

In State X, Mr. Camp's eighth-grade class consisting of 26 students was surveyed and 34.6 percent of the students reported that they had at least two siblings. The average eighth-grade class size in the state is 26. If the students in Mr. Camp's class are representative of students in the state's eighth-grade classes and there are 1,800 eighth-grade classes in the state, which of the following best estimates the number of eighth-grade students in the state who have fewer than two siblings?

- A) 16,200
- B) 23,400
- C) 30,600
- D) 46,800



Questions 23 and 24 refer to the following information.

Townsend Realty Group Investments		
Property address	Purchase price (dollars)	Monthly rental price (dollars)
Clearwater Lane	128,000	950
Driftwood Drive	176,000	1,310
Edgemont Street	70,000	515
Glenview Street	140,000	1,040
Hamilton Circle	450,000	3,365

The Townsend Realty Group invested in the five different properties listed in the table above. The table shows the amount, in dollars, the company paid for each property and the corresponding monthly rental price, in dollars, the company charges for the property at each of the five locations.

23

The relationship between the monthly rental price  $r$ , in dollars, and the property's purchase price  $p$ , in thousands of dollars, can be represented by a linear function. Which of the following functions represents the relationship?

- A)  $r(p) = 2.5p - 870$
- B)  $r(p) = 5p + 165$
- C)  $r(p) = 6.5p + 440$
- D)  $r(p) = 7.5p - 10$

24

Townsend Realty purchased the Glenview Street property and received a 40% discount off the original price along with an additional 20% off the discounted price for purchasing the property in cash. Which of the following best approximates the original price, in dollars, of the Glenview Street property?

- A) \$350,000
- B) \$291,700
- C) \$233,300
- D) \$175,000





25

A psychologist set up an experiment to study the tendency of a person to select the first item when presented with a series of items. In the experiment, 300 people were presented with a set of five pictures arranged in random order. Each person was asked to choose the most appealing picture. Of the first 150 participants, 36 chose the first picture in the set. Among the remaining 150 participants,  $p$  people chose the first picture in the set. If more than 20% of all participants chose the first picture in the set, which of the following inequalities best describes the possible values of  $p$ ?

- A)  $p > 0.20(300 - 36)$ , where  $p \leq 150$
- B)  $p > 0.20(300 + 36)$ , where  $p \leq 150$
- C)  $p - 36 > 0.20(300)$ , where  $p \leq 150$
- D)  $p + 36 > 0.20(300)$ , where  $p \leq 150$

26

The surface area of a cube is  $6\left(\frac{a}{4}\right)^2$ , where  $a$  is a positive constant. Which of the following gives the perimeter of one face of the cube?

- A)  $\frac{a}{4}$
- B)  $a$
- C)  $4a$
- D)  $6a$

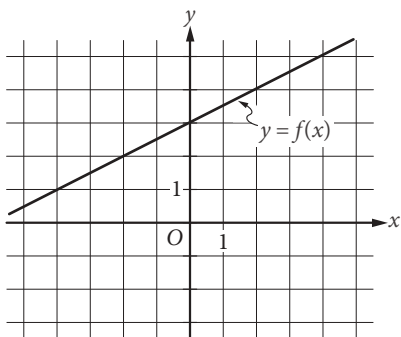
27

The mean score of 8 players in a basketball game was 14.5 points. If the highest individual score is removed, the mean score of the remaining 7 players becomes 12 points. What was the highest score?

- A) 20
- B) 24
- C) 32
- D) 36



28



The graph of the linear function  $f$  is shown in the  $xy$ -plane above. The slope of the graph of the linear function  $g$  is 4 times the slope of the graph of  $f$ . If the graph of  $g$  passes through the point  $(0, -4)$ , what is the value of  $g(9)$  ?

- A) 5
- B) 9
- C) 14
- D) 18

29

$$x^2 + 20x + y^2 + 16y = -20$$

The equation above defines a circle in the  $xy$ -plane. What are the coordinates of the center of the circle?

- A)  $(-20, -16)$
- B)  $(-10, -8)$
- C)  $(10, 8)$
- D)  $(20, 16)$

30

$$y = x^2 - a$$

In the equation above,  $a$  is a positive constant and the graph of the equation in the  $xy$ -plane is a parabola. Which of the following is an equivalent form of the equation?

- A)  $y = (x + a)(x - a)$
- B)  $y = (x + \sqrt{a})(x - \sqrt{a})$
- C)  $y = \left(x + \frac{a}{2}\right)\left(x - \frac{a}{2}\right)$
- D)  $y = (x + a)^2$

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \odot & \odot & \odot & \odot \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$				Answer: 2.5				
	7	/	1	2		2	.	5
	⊙	⊙	⊙	⊙		⊙	⊙	⊙
	0	0	0	0		0	0	0
①	①	⊙	①	①	①	①	①	①
②	②	②	⊙	②	②	⊙	②	②
③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⊙
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⊙	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2 / 3				.666				.667					
	2	/	3		.	6	6	6		.	6	6	7
	⊙	⊙	⊙		⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙
	0	0	0		0	0	0	0		0	0	0	0
①	①	⊙	①	①	①	①	①	①	①	①	①	①	①
②	⊙	②	②	②	②	②	②	②	②	②	②	②	②
③	③	③	⊙	③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⊙	⊙	⊙	⑥	⑥	⊙	⊙	⊙	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⊙
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

2 0 1				2 0 1			
	2	0	1		2	0	1
	⊙	⊙	⊙		⊙	⊙	⊙
	0	⊙	0		⊙	0	0
①	①	①	⊙	①	①	⊙	①
②	⊙	②	②	⊙	②	②	②
③	③	③	③	③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

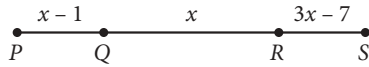
Horsepower and watts are units of measure of power. They are directly proportional such that 5 horsepower is equal to 3730 watts. How much power, in watts, is equal to 2 horsepower?

32

The painting *The Starry Night* by Vincent van Gogh is rectangular in shape with height 29 inches and width 36.25 inches. If a reproduction was made where each dimension is  $\frac{1}{3}$  the corresponding original dimension, what is the height of the reproduction, in inches?



33



Note: Figure not drawn to scale.

On  $\overline{PS}$  above,  $PQ = RS$ . What is the length of  $\overline{PS}$  ?

34

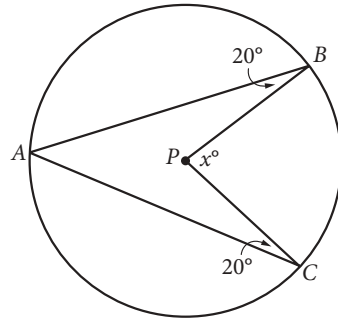
In the  $xy$ -plane, the point  $(2, 5)$  lies on the graph of the function  $f$ . If  $f(x) = k - x^2$ , where  $k$  is a constant, what is the value of  $k$  ?



35

A landscaper is designing a rectangular garden. The length of the garden is to be 5 feet longer than the width. If the area of the garden will be 104 square feet, what will be the length, in feet, of the garden?

36



Point  $P$  is the center of the circle in the figure above. What is the value of  $x$  ?



Questions 37 and 38 refer to the following information.

Ms. Simon's Workday Morning Drive

Segment of drive	Distance (miles)	Average driving speed with no traffic delay (mph)
From home to freeway entrance	0.6	25
From freeway entrance to freeway exit	15.4	50
From freeway exit to workplace	1.4	35

Ms. Simon drives her car from her home to her workplace every workday morning. The table above shows the distance, in miles, and her average driving speed, in miles per hour (mph), when there is no traffic delay, for each segment of her drive.

37

One morning, Ms. Simon drove directly from her home to her workplace in 24 minutes. What was her average speed, in miles per hour, during her drive that morning?

38

If Ms. Simon starts her drive at 6:30 a.m., she can drive at her average driving speed with no traffic delay for each segment of the drive. If she starts her drive at 7:00 a.m., the travel time from the freeway entrance to the freeway exit increases by 33% due to slower traffic, but the travel time for each of the other two segments of her drive does not change. Based on the table, how many more minutes does Ms. Simon take to arrive at her workplace if she starts her drive at 7:00 a.m. than if she starts her drive at 6:30 a.m.? (Round your answer to the nearest minute.)

## STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

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# **Answer Explanations**

## **SAT® Practice Test #5**

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## Answer Explanations

# SAT Practice Test #5

## Section 1: Reading Test

### QUESTION 1

**Choice D is the best answer.** The passage begins with the main character, Lymie, sitting in a restaurant and reading a history book. The first paragraph describes the book in front of him (“Blank pages front and back were filled in with maps, drawings, dates, comic cartoons, and organs of the body,” lines 11-13). The second paragraph reveals what Lymie is reading about (the Peace of Paris and the Congress of Vienna) and suggests his intense concentration on the book (“sometimes he swallowed whole the food that he had no idea he was eating,” lines 23-24). In the third paragraph, the focus of the passage shifts to a description and discussion of others in the restaurant, namely “A party of four, two men and two women . . .” (lines 42-43).

Choice A is incorrect because the passage does not provide observations made by other characters, only offering Lymie’s and the narrator’s observations. Choice B is incorrect because the beginning of the passage focuses on Lymie as he reads by himself and the end of the passage focuses on the arrival of Lymie’s father, with whom Lymie’s relationship seems somewhat strained. Choice C is incorrect because the setting is described in the beginning of the first paragraph but is never the main focus of the passage.

### QUESTION 2

**Choice C is the best answer.** The main purpose of the first paragraph is to establish the passage’s setting by describing a place and an object. The place is the Alcazar Restaurant, which is described as being “long and narrow” and decorated with “*art moderne*,” murals, and plants (lines 2-6), and the object is the history book Lymie is reading.

Choice A is incorrect because rather than establishing what Lymie does every night, the first paragraph describes what Lymie is doing on *one* night. Choice B is incorrect because nothing in the first paragraph indicates when the passage takes place, as the details provided (such as the restaurant and the book) are not specific to one era. Choice D is incorrect because nothing in the first paragraph clearly foreshadows a later event.

### QUESTION 3

**Choice C is the best answer.** The passage states that “when Lymie put down his fork and began to count . . . the waitress, whose name was Irma, thought he was through eating and tried to take his plate away” (lines 34-38). It is reasonable to assume that Irma thinks Lymie is finished eating because he is no longer holding his fork.

Choice A is incorrect because Lymie has already been reading his book while eating for some time before Irma thinks he is finished eating. Choice B is incorrect because the passage doesn’t state that Lymie’s plate is empty, and the fact that Lymie stops Irma from taking his plate suggests that it is not empty. Choice D is incorrect because the passage gives no indication that Lymie asks Irma to clear the table.

#### QUESTION 4

**Choice A is the best answer.** The passage makes it clear that Lymie finds the party of four who enter the restaurant to be loud and bothersome, as their entrance means he is no longer able to concentrate on his book: “They laughed more than there seemed any occasion for . . . and their laughter was too loud. But it was the women’s voices . . . which caused Lymie to skim over two whole pages without knowing what was on them” (lines 52-59).

Choices B, C, and D are incorrect because lines 55-59 make clear that Lymie is annoyed by the party of four, not that he finds their presence refreshing (choice B), thinks they resemble the people he is reading about (choice C), or thinks they represent glamour and youth (choice D).

#### QUESTION 5

**Choice C is the best answer.** The previous question asks about Lymie’s impression of the party of four who enter the restaurant, with the correct answer being that he finds them noisy and distracting. This is supported in lines 55-59: “But it was the women’s voices, the terrible not quite sober pitch of the women’s voices, which caused Lymie to skim over two whole pages without knowing what was on them.”

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about Lymie’s impression of the party of four who enter the restaurant. Rather than showing that Lymie finds the group of strangers noisy and distracting, the lines simply describe how two of the four people look (choices A and B) and indicate what Lymie does when his father joins him in the restaurant (choice D).

#### QUESTION 6

**Choice A is the best answer.** In the passage, Lymie closes his book only after “a coat that he recognized as his father’s was hung on the hook next to his chair” (lines 67-68). It is Lymie’s father’s arrival that causes him to close the book.

Choices B, C, and D are incorrect because lines 67-70 of the passage clearly establish that Lymie closes his book because his father has arrived, not that he does so because the party of four is too loud (choice B), because he has finished reading a section of the book (choice C), or because he is getting ready to leave (choice D).

### QUESTION 7

**Choice D is the best answer.** In lines 74-79, the narrator describes Mr. Peters as “gray” and balding, noting that he has “lost weight” and his color is “poor.” This description suggests Mr. Peters is aging and losing strength and vigor.

Choices A, B, and C are incorrect because the description of Mr. Peters in lines 74-79 suggests he is a person who is wan and losing vitality, not someone who is healthy and in good shape (choice A), angry and intimidating (choice B), or emotionally anxious (choice C).

### QUESTION 8

**Choice B is the best answer.** In the last paragraph of the passage, Mr. Peters is described as being unaware “that there had been any change” in his appearance since he was younger (lines 80-81). Later in the paragraph, the passage states that “the young man” Mr. Peters once was “had never for one second deserted” him (lines 90-91). The main idea of the last paragraph is that Mr. Peters still thinks of himself as young, or at least acts as if he is a younger version of himself.

Choice A is incorrect because Mr. Peters is spending time with Lymie, his son, and there is no indication that he generally does not spend time with his family. Choice C is incorrect because although there are brief mentions of a diamond ring and manicured fingers, the paragraph focuses on Mr. Peters’s overall appearance, not on his awareness of status symbols. Choice D is incorrect because the last paragraph clearly states that Mr. Peters is “not aware that there had been any change” and thinks of himself as young.

### QUESTION 9

**Choice B is the best answer.** In lines 81-85, Mr. Peters is described as having “straightened his tie self-consciously” and gestured with a menu “so that the two women at the next table would notice the diamond ring on the fourth finger of his right hand.” Mr. Peters’s actions are those of someone who wants to attract attention and be noticed.

Choices A, C, and D are incorrect because the lines cited do not support the idea Mr. Peters wants to attract attention to himself. Choices A and C address Mr. Peters’s view of himself. Choice D indicates that Mr. Peters’s view of himself affects his behavior but does not reveal that he acts in a way meant to draw attention.

### QUESTION 10



**Choice B is the best answer.** The last sentence of the passage states that Mr. Peters’s mischaracterization of himself makes him act in ways that are not “becoming” for a man of his age. In this context, “becoming” suggests behavior that is appropriate or fitting.

Choices A, C, and D are incorrect because in the context of describing one’s behavior, “becoming” means appropriate or fitting, not becoming known (choice A), becoming more advanced (choice C), or simply occurring (choice D).

### QUESTION 11

**Choice B is the best answer.** In Passage 1, Beecher makes the point that even if women in her society are perceived as being inferior to men, they are still able to effect considerable influence on that society: “But while woman holds a subordinate relation in society to the other sex, it is not because it was designed that her duties or her influence should be any the less important, or all-pervading” (lines 6-10).

Choice A is incorrect because Beecher describes the dynamic between men and women in terms of the way they can change society, not in terms of security and physical safety. Choice C is incorrect because even though Beecher implies that women have fewer rights in society than men do, she doesn’t say that women have fewer responsibilities. Choice D is incorrect because Beecher does not assert that women are superior to men.

### QUESTION 12

**Choice A is the best answer.** The previous question asks what point Beecher makes regarding the relationship between men and women in her society, with the answer being that women are considered inferior but can still have influence. This is supported in lines 6-10: “But while woman holds a subordinate relation in society to the other sex, it is not because it was designed that her duties or her influence should be any the less important, or all-pervading.”

Choices B, C, and D are incorrect because the lines cited do not support the answer to the previous question about the point Beecher makes regarding the relationship between men and women in her society. Instead, they describe ways men can affect society (choices B and C) and explain how certain actions undertaken by a woman can be viewed negatively (choice D).

### QUESTION 13

**Choice B is the best answer.** In the third paragraph (lines 22-37), Beecher suggests that women can be “so much respected, esteemed and loved” by those around them that men will accede to their wishes: “then, the fathers, the husbands, and the sons, will find an influence thrown around them, to which they will yield not only willingly but proudly . . .” These lines show that Beecher believes women can influence society by influencing the men around them; in other words, women have an indirect influence on public life.

Choices A, C, and D are incorrect because lines 34-37 make it clear that Beecher believes women do have an effect on society, even if it is an indirect effect. Beecher does not indicate that women's effect on public life is ignored because most men are not interested (choice A), unnecessary because men do not need help governing society (choice C), or merely symbolic because women tend to be idealistic (choice D).

#### QUESTION 14

**Choice D is the best answer.** Regarding the dynamic of men and women in society, Beecher says that one sex is given "the subordinate station" while the other is given the "superior" station (lines 1-2). In the context of how one gender exists in comparison to the other, the word "station" suggests a standing or rank.

Choices A, B, and C are incorrect because in the context of the relative standing of men and women in Beecher's society, the word "station" suggests a standing or rank, not a physical location or area (choices A, B, and C).

#### QUESTION 15

**Choice C is the best answer.** When describing how men and women can influence society, Beecher says the ways they can do so "should be altogether different and peculiar" (lines 11-12). In the context of the "altogether different" ways men and women can influence society, the word "peculiar" implies being unique or distinctive.

Choices A, B, and D are incorrect because in the context of the "altogether different" ways men and women can influence society, the word "peculiar" suggests something unique or distinctive, not something unusual and odd (choice A), unexpected (choice B), or rare (choice D).

#### QUESTION 16

**Choice A is the best answer.** In Passage 2, Grimké makes the main point that people have rights because they are human, not because of their gender or race. This is clear in lines 58-60, when Grimké states that "human beings have *rights*, because they are *moral* beings: the rights of *all* men grow out of their moral nature" and lines 65-68, when Grimké writes, "Now if rights are founded in the nature of our moral being, then the *mere circumstance of sex* does not give to man higher rights and responsibilities, than to woman."

Choices B, C, and D are incorrect because Grimké primarily emphasizes that all men and women inherently have the same rights ("rights are founded in the nature of our moral being," lines 65-66). Her central claim is not that men and women need to work together to change society (choice B), that moral rights are the distinguishing characteristic separating humans from animals (choice C), or that there should be equal opportunities for men and women to advance and succeed.

#### QUESTION 17

**Choice B is the best answer.** In Passage 2, Grimké makes the point that human rights are not fleeting or changeable but things that remain, regardless of the circumstances, because they are tied to humans' moral nature. She emphasizes that human rights exist even if societal laws attempt to contradict or override them, citing slavery as an example: "These rights may be wrested from the slave, but they cannot be alienated: his title to himself is as perfect now, as is that of Lyman Beecher: it is stamped on his moral being, and is, like it, imperishable" (lines 61-65).

Choices A and D are incorrect because in Passage 2, Grimké makes the point that human rights are inherent and unchanging, not that they are viewed differently in different societies (choice A) or that they have changed and developed over time (choice D). Choice C is incorrect because Grimké doesn't describe a clash between human rights and moral responsibilities; instead, she says that humans have rights "because they are *moral beings*" (lines 58-59).

### QUESTION 18

**Choice B is the best answer.** The previous question asks what point Grimké makes about human rights in Passage 2, with the answer being that they exist and have moral authority whether or not they are established by societal law. This is supported in lines 61-65: "These rights may be wrested from the slave, but they cannot be alienated: his title to himself is as perfect now, as is that of Lyman Beecher: it is stamped on his moral being, and is, like it, imperishable."

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about the point Grimké makes about human rights in Passage 2. Instead, they explain the source of all people's human rights (choice A), indicate what would happen if rights were determined by gender (choice C), and discuss why gender is irrelevant to rights (choice D).

### QUESTION 19

**Choice B is the best answer.** In Passage 1, Beecher asserts that men and women naturally have different positions in society: "Heaven has appointed to one sex the superior, and to the other the subordinate station" (lines 1-2). She goes on to argue that a woman should act within her subordinate role to influence men but should not "exert coercive influences" that would put her "out of her appropriate sphere" (lines 44-46). In Passage 2, Grimké takes issue with the idea that men and women have different rights and roles. She asserts that as moral beings all people have the same inherent rights and states that "the *mere circumstance of sex* does not give to man higher rights and responsibilities, than to woman" (lines 66-68).

Choice A is incorrect because Passage 2 does not discuss the practical difficulties of something that is proposed in Passage 1 but rather argues against the main point of Passage 1. Choice C is incorrect because Passage 2 does not provide historical context for the view expressed in Passage 1; the passages were published at around the same time and both discuss contemporary society. Choice D is incorrect because Passage 2 does not elaborate on implications found in Passage 1 as much as it disputes the ideas explicitly expressed in Passage 1.

## QUESTION 20

**Choice A is the best answer.** While Beecher and Grimké clearly disagree regarding a woman’s role in society, the passages suggest that both authors share the belief that women do have moral duties and responsibilities in society. In Passage 1, Beecher writes that “while woman holds a subordinate relation in society to the other sex, it is not because it was designed that her duties or her influence should be any the less important, or all-pervading” (lines 6-10). She suggests that women do have an obligation to use their influence to bring about beneficial changes in society. In Passage 2, Grimké asserts that all people “are *moral beings*” (lines 58-59) and that both men and women have “rights and responsibilities” (line 68). She concludes that “whatever it is morally right for man to do, it is morally right for woman to do” (lines 81-83).

Choice B is incorrect because neither author suggests that when men work to bring about political changes, they often do so out of consideration for others rather than considerations for themselves. Choice C is incorrect because neither passage discusses the value given to women’s ethical obligations, although both authors suggest that women do have ethical and moral obligations. Choice D is incorrect because in Passage 1 Beecher argues that women should avoid direct political activism, cautioning against actions that would put them outside their “appropriate sphere” (line 46).

## QUESTION 21

**Choice D is the best answer.** In lines 65-68 of Passage 2, Grimké writes, “Now if rights are founded in the nature of our moral being, then the *mere circumstance of sex* does not give to man higher rights and responsibilities, than to woman.” In other words, gender does not make men’s rights and duties superior to women’s. Beecher, on the other hand, begins Passage 1 by stating that “heaven has appointed to one sex the superior, and to the other the subordinate station,” suggesting that men and women have fundamentally different natures. Therefore, Beecher most likely would have disagreed with Grimké’s assertion.

Choices A and B are incorrect because Beecher fundamentally disagrees with Grimké regarding the basic nature and societal roles of men and women, making it very unlikely that she would have viewed Grimké’s statement in lines 65-68 with either sympathy or agreement. Choice C is incorrect because Beecher wouldn’t necessarily have been dismayed by Grimké’s belief as much as she would have simply disagreed with it, and she does not indicate that the role of women in society is more difficult to play than is that of men.

## QUESTION 22

**Choice A is the best answer.** In line 14, the passage states that industrial agriculture has become “incredibly efficient on a simple land to food basis.” In this context, “simple” suggests something basic or straightforward.

Choices B, C, and D are incorrect because in the context of a land to food dynamic, the word “simple” suggests something basic or straightforward, not something humble (choice B), something without any decoration or ornamentation (choice C), or something that requires little effort (choice D).

### QUESTION 23

**Choice B is the best answer.** The passage clearly states that conventional agriculture is very efficient, especially when compared to organic farming: “organic farming yields 25% fewer crops on average than conventional agriculture” (lines 40-42) and in a study “organic farming delivered a lower yield for every crop type” (lines 51-52). It can therefore be understood from the passage that conventional agriculture does a good job maximizing the output of the land that is farmed.

Choice A is incorrect because the passage states how efficient conventional agriculture is in regard to the amount of food it can produce but does not indicate that it produces a significantly wide variety of fruits and vegetables. Choice C is incorrect because even if the passage does say that each American farmer can produce crops to feed “over 155 people worldwide” (lines 16-17), it never claims that conventional agriculture can satisfactorily feed everyone in the world. Choice D is incorrect because the passage states that conventional agriculture uses a great deal of nitrogen, not that it changes the need for nitrogen in plant growth one way or the other.

### QUESTION 24

**Choice A is the best answer.** The passage makes it clear that “most environmentalists” (line 27) believe conventional agriculture produces food that is not as healthy as food produced through organic farming and that it is more harmful to the environment than organic farming is: many environmentalists “have embraced organic food as better for the planet—and healthier and tastier, too—than the stuff produced by agricultural corporations” (lines 28-31).

Choices B, C, and D are incorrect because they are not supported by the passage. The passage never states that many environmentalists believe that conventional farming reduces the need to convert wilderness to farmland (choice B), is in any way good for the environment (choice C), or protects wildlife habitats (choice D).

### QUESTION 25

**Choice B is the best answer.** The previous question asks how environmentalists perceive conventional agriculture, with the answer being that they believe it produces a product that is less healthy and more environmentally destructive than that produced by organic farming. This is supported in lines 28-31: “They have embraced organic food as better for the planet—and healthier and tastier, too—than the stuff produced by agricultural corporations.”

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about how environmentalists perceive the efforts of conventional agriculture. Although the lines in choice A do touch on environmentalists’ views, they indicate only that most environmentalists

don't view conventional agriculture's ability to "produce more food on less land" (line 25) as beneficial to the environment. Choice C is incorrect because these lines address environmentalists' view of the environmental effects of conventional and organic farming but not the taste or nutritional value of the food produced. Choice D is incorrect because these lines focus on a drawback to organic farming.

### QUESTION 26

**Choice C is the best answer.** The passage makes it clear that while both conventional and organic farming need nitrogen for plant growth, conventional farming uses synthetic fertilizers and organic does not: "Conventional agriculture makes use of 171 million metric tons of synthetic fertilizer each year, and all that nitrogen enables much faster plant growth than the slower release of nitrogen from the compost or cover crops used in organic farming" (lines 61-65).

Choice A is incorrect because the passage does not state that conventional and organic farming are equally sustainable and does state that organic farming needs "more land" to produce "fewer crops" (lines 42-43) but does not indicate that it always requires dramatically more land. Choice B is incorrect because the passage does not state that organic farming uses artificial chemicals. Choice D is incorrect because the passage mentions nitrogen runoff only as a product of conventional farming, not organic farming, and does not indicate that only the nitrogen in conventional fertilizers is dangerous.

### QUESTION 27

**Choice D is the best answer.** The previous question asks about the relationship between conventional agriculture and organic farming, with the answer being that unlike organic farms, conventional farms use synthetic fertilizers. This is supported in lines 61-65: "Conventional agriculture makes use of 171 million metric tons of synthetic fertilizer each year, and all that nitrogen enables much faster plant growth than the slower release of nitrogen from the compost or cover crops used in organic farming."

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question about the relationship between conventional and organic farming, instead describing the efficiency only of conventional agriculture (choice A), discussing one perceived positive aspect of conventional agriculture (choice B), and highlighting a drawback of organic farming (choice C).

### QUESTION 28

**Choice B is the best answer.** The passage states that the authors of the study comparing conventional and organic farming have come to the conclusion that an "ideal global agriculture system" would "borrow the best from both systems" (lines 80-82). The quote from Jonathan Foley in lines 84-97 indicates that this ideal system would take into consideration many different factors, including the nutrition and calories offered by specific types of foods as well as different geographic, economic, and social needs.

Choices A and D are incorrect because the passage makes it clear that the "ideal global agriculture system" would give consideration to multiple factors, not that it would focus mainly on productivity

(choice A) or nutritional value (choice D). Choice C is incorrect because Foley states that the ideal system would take economics into consideration but does not indicate that farmers' economic interests would be weighed against consumers' needs.

### QUESTION 29

**Choice D is the best answer.** The passage states that conventional agriculture can be superior to organic farming in terms of producing "sheer calories" (line 88). In this context, "sheer" most nearly means pure; the passage is referring to the pure number of calories delivered by foods.

Choices A, B, and C are incorrect because in the context of discussing the calories foods can provide, "sheer" suggests the pure number of calories. Also, it does not make sense to say that calories can be seen through (choice A), are somehow sudden or happen unexpectedly (choice B), or are at a very sharp angle (choice C).

### QUESTION 30

**Choice B is the best answer.** Figure 1 shows that the organic yield as a percentage of conventional yield is similar for cereals and all crops, with both yielding roughly 75%.

Choice A is incorrect because figure 1 shows that the organic yield as a percentage of conventional yield is higher for fruits (just under 100%) than for vegetables (just under 70%). Choice C is incorrect because figure 1 shows there were only 28 observations for oilseed crops. Choice D is incorrect because figure 1 shows that the organic yield as a percentage of conventional yield is higher for oilseed crops (approximately 90%) than for vegetables (just under 70%).

### QUESTION 31

**Choice D is the best answer.** Every organically grown species represented in figure 2 produces a smaller yield than do their conventional counterparts. All of the organically grown species are within a range of approximately 60–90% of the conventional yield.

Choice A is incorrect because figure 2 shows that soybeans have the highest yield (approximately 90%), not the lowest. Choice B is incorrect because figure 2 shows that organically grown barley and maize are produced at a lower yield than the conventionally grown species (just below 70% and just below 90%, respectively), not a comparable one. Choice C is incorrect because figure 2 shows that soybeans, not tomatoes, have the highest yield of the organically grown species.

### QUESTION 32

**Choice B is the best answer.** The majority of the passage focuses on the experiment concerning "how much the crowd influences the individual, and whether it can be controlled from outside" (lines 42-44). After explaining the experiment and the results it produced, the passage moves on to consider questions raised by the results, such as whether the findings are site specific or "true in general" (lines

75-76), why different findings are observed, and whether companies can “boost their products by manipulating online ratings on a massive scale” (lines 85-86).

Choice A is incorrect because the passage does not conclude by explaining the practical ways the experiment’s findings have been applied but rather by considering questions the findings raise. Choices C and D are incorrect because the passage does not indicate that there were any flaws in the experiment’s findings and does not include statements from anyone who disputes the findings.

### QUESTION 33

**Choice C is the best answer.** The author of the passage suggests that a group of people can be “wiser” and more effective than a single person at assessing a quantitative answer, or a measurement, versus producing a valid qualitative judgment, or a judgment of the quality of something. This is most clear in lines 11-14, which state that when guessing a bull’s weight or how many gumballs are in a jar, “your guess is probably going to be far from the mark, whereas the average of many people’s choices is remarkably close to the true number.”

Choices A, B, and D are incorrect because lines 11-14 indicate that the author believes that crowds may be more effective than individuals when arriving at quantitative answers rather than qualitative results. Nothing in the passage suggests that the author believes that crowds are better at starting disagreements than studying an issue in depth (choice A), supporting ideas rather than challenging them (choice B), or ranking opinions rather than coming up with new ideas (choice D).

### QUESTION 34

**Choice B is the best answer.** The previous question asks what the author of the passage suggests about the wisdom of crowds, with the answer being that crowds can be more effective at producing quantitative answers than qualitative results. This is supported in lines 11-14: when it comes to guessing a bull’s weight or how many gumballs are in a jar, “your guess is probably going to be far from the mark, whereas the average of many people’s choices is remarkably close to the true number.”

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about the author’s belief about when the wisdom of a crowd is effective. Instead, they simply state that crowds are sometimes wiser than individuals, without explaining when (choice A), put forth a theory held by someone other than the author (choice C), and explain how hypotheses about the wisdom of crowds could be tested (choice D).

### QUESTION 35

**Choice A is the best answer.** In the passage, the author explains that those who are skeptical of the theory that “measuring the aggregate of people’s opinions produces a stable, reliable value” (lines 18-20) believe that “people’s opinions are easily swayed by those of others” (lines 20-21). This idea is best supported in lines 55-58, which describe a finding from a study of opinions in crowds: “Comments that received fake positive votes from the researchers were 32% more likely to receive more positive votes



compared with a control, the team reports.” In other words, people were more likely to give a positive vote when they thought other people had given positive votes.

Choices B, C, and D are incorrect because the lines cited do not provide support for the skeptics’ idea that people’s opinions are easily influenced by the thoughts of others. Instead, they cite findings concerning people giving ratings *different* from those already given (choices B and C) and share an observation that the degree to which others can be influenced depends in part on the context of the situation (choice D).

### QUESTION 36

**Choice B is the best answer.** One question Watts asks in regard to the experiment is whether the results would hold true on a larger scale. The passage quotes him in lines 74-76: “[But] one question is whether the positive [herding] bias is specific to this site’ or true in general.” Doing the experiment again but collecting ratings on multiple websites would address Watts’s question, as it would show whether or not the same results occur on other sites.

Choices A, C, and D are incorrect. Providing fewer fake positive comments during the experiment (choice A), requiring users to be registered on the website (choice C), or telling users that their answers will be studied (choice D) are actions that likely would affect the results of the experiment involving users voting on comments about stories on one news website, but they would not address Watts’s questions about whether the study would produce the same results on *other* websites or why different categories of news items had different effects on the news website.

### QUESTION 37

**Choice C is the best answer.** In lines 85-86 the author asks, “Will companies be able to boost their products by manipulating online ratings on a massive scale?” In the context of selling products by manipulating user reviews, “boost” most nearly means promote.

Choices A, B, and D are incorrect because in the context of selling products by manipulating user reviews, the word “boost” refers to promoting the products, not making them larger or bigger (choice A), faster (choice B), or safe (choice D).

### QUESTION 38

**Choice A is the best answer.** In lines 85-86 the author asks, “Will companies be able to boost their products by manipulating online ratings on a massive scale?” In the context of selling products by manipulating user reviews on a massive scale, the word “scale” most nearly means level or size.

Choices B, C, and D are incorrect because in the context of selling products by manipulating user reviews, a massive “scale” refers to a great level or size, not to a payment (choice B), an interval or space between things (choice C), or a plan (choice D).

### QUESTION 39

**Choice B is the best answer.** The figure shows that while the mean score of the control comments in the politics category is below 2.0, the artificially up-voted mean score for that category is exactly 2.5.

Choice A is incorrect because the artificially up-voted mean score of comments in the business category is higher than 3.0. Choice C is incorrect because the artificially up-voted mean score of comments in the fun category is less than 2.5. Choice D is incorrect because the artificially up-voted mean score of the comments in the general news category is just over 2.0.

### QUESTION 40

**Choice D is the best answer.** The figure shows that the mean score for both control comments and artificially up-voted comments in the general news category is just above 2.0.

Choice A is incorrect because the mean score for the control comments in the culture and society category is a little below 2.5 while the mean score for the artificially up-voted comments is over 3.0. Choice B is incorrect because the mean score for the control comments in the information technology category is a little above 1.5 while the mean score for the artificially up-voted comments is above 2.0. Choice C is incorrect because the mean score for the control comments in the fun category is exactly 2.0 while the mean score for the artificially up-voted comments is nearly 2.5.

### QUESTION 41

**Choice D is the best answer.** In the passage Watts notes that “the category of the news items . . . had a strong effect on how much people could be manipulated” (lines 76-79). That idea is directly supported by the data in the figure, which show that the difference in mean score between the control comments and the artificially up-voted comments varies by subject (for example, in the general news category there is virtually no difference between the mean scores of the two types of comments, while for the business category there is almost a 1.0-point difference between the mean scores).

Choices A and B are incorrect because the passage provides no data for artificially down-voted comments or negative social influence. Choice C is incorrect because the figure applies only to one context (mean score of control comments versus mean score of artificially up-voted comments on the news site); there is no way to tell what patterns would be observed in other contexts.

### QUESTION 42

**Choice C is the best answer.** According to the passage, Maguire found that taxi drivers’ hippocampi are “7 percent larger than normal,” which is evidence that “way-finding around London had physically altered the gross structure of their brains” (lines 10-14). In lines 20-26, the passage indicates that this finding challenges an earlier consensus: “It had long been thought that the adult brain was incapable of spawning new neurons—that . . . the brain’s basic anatomical structure was more or less static. Maguire’s study suggested the old inherited wisdom was simply not true.”

Choice A is incorrect because the passage does not indicate that Maguire used a new method in her study or that her findings demonstrate the validity of a method. Choice B is incorrect because lines 20-26 show that Maguire’s findings disprove a popular viewpoint, not that they support one. Choice D is incorrect because although Maguire’s findings call into question a previous idea, there is no indication that they challenge the authenticity of any previous data.

### QUESTION 43

**Choice D is the best answer.** The previous question asks about the significance of Maguire’s findings, with the answer being that her findings call into question a previous belief. This is supported in lines 20-26: “It had long been thought that the adult brain was incapable of spawning new neurons—that . . . the brain’s basic anatomical structure was more or less static. Maguire’s study suggested the old inherited wisdom was simply not true.”

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question about the significance of Maguire’s findings. Choices A and B are incorrect because these lines present Maguire’s observation and her conclusion but do not indicate that her findings call into question a previous belief. Choice C is incorrect because these lines simply explain one capability of the human brain.

### QUESTION 44

**Choice D is the best answer.** In line 24, the passage discusses the “brain’s basic anatomical structure.” In this context, the word “basic” most nearly means fundamental.

Choices A, B, and C are incorrect because in the context of discussing the brain’s structure, the word “basic” most nearly means fundamental, not first (choice A), uncomplicated (choice B), or required (choice C).

### QUESTION 45

**Choice C is the best answer.** The purpose of Maguire’s study of the mental athletes was to try to determine what it is that makes them so good at memorization, and in particular if they have structurally different brains than people without such extraordinary memorization skills or if they have normal brain structures but use them in unusual ways. This is supported in lines 33-37, which state that Maguire and her team “wanted to find out if the memorizers’ brains were—like the London cabbies’—structurally different from the rest of ours, or if they were somehow just making better use of memory abilities that we all possess.”

Choice A is incorrect because the study was an attempt to compare the brains of mental athletes to the brains of the general population, not to compare the use of different brain structures in memorization and navigation. Choices B and D are incorrect because the passage makes it clear that it was not known

if mental athletes have unusual brain structures; finding out if they do was actually one of the goals of the study.

#### QUESTION 46

**Choice B is the best answer.** The previous question asks what Maguire’s study of mental athletes attempted to answer, with the answer being the question of whether it is brain structure or an unusual use of the brain that gives certain people extraordinary memorization skills. This is supported in lines 33-37: “They wanted to find out if the memorizers’ brains were—like the London cabbies’—structurally different from the rest of ours, or if they were somehow just making better use of memory abilities that we all possess.”

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about what Maguire’s study of mental athletes was investigating. Instead they simply identify the subject of the study (choice A), explain what the study involved (choice C), and state a finding concerning the cognitive ability of the mental athletes (choice D).

#### QUESTION 47

**Choice A is the best answer.** In lines 38-39, the passage describes part of Maguire’s study by stating that “the researchers put both the mental athletes and a group of matched control subjects into MRI scanners.” In the context of a study that has two groups of subjects, the word “matched” suggests subjects that are similar or comparable.

Choices B, C, and D are incorrect because in the context of a study with two groups of subjects, the word “matched” suggests subjects that are similar or comparable, not ones that are exactly the same (choice B), ones that are recognizably different (choice C), or ones that are rivals (choice D).

#### QUESTION 48

**Choice C is the best answer.** The main purpose of the fifth paragraph (lines 57-65) is to relate what Maguire discovered about the mental athletes, namely that their brain structures are not different from those of the control group but that the mental athletes use their brains differently: “there was one telling difference . . . regions of the brain that were less active in the control subjects seemed to be working in overdrive for the mental athletes.”

Choice A is incorrect because the fifth paragraph does not mention the taxi drivers or the study involving them. Choice B is incorrect because the fifth paragraph describes some of the unexpected results of Maguire’s study but does not address the possible reasons for those results. Choice D is incorrect because the fifth paragraph describes only Maguire’s findings, not her methods.

#### QUESTION 49

**Choice C is the best answer.** The passage indicates that Maguire’s second study revealed that people in the control group don’t have different brain structures than the mental athletes but that they use their brains differently. In particular, the two groups use different pathways in the brain: “regions of the brain that were less active in the control subjects seemed to be working in overdrive for the mental athletes” (lines 63-65).

Choices A and D are incorrect because the passage states that there was only “one telling difference between the brains of the mental athletes and the control subjects” (lines 57-58); there is no indication that the control group showed less total brain activity or had smaller hippocampal regions. Choice B is incorrect because the passage mentions only the general cognitive ability of the mental athletes, noting that their scores were “within the normal range” (line 54).

### QUESTION 50

**Choice A is the best answer.** After establishing in lines 50-51 that the brains of the control group and the mental athletes seemed to be “indistinguishable,” the passage suggests that the reason mental athletes are so good at memorization is that they use parts of their brains that most other people don’t use when memorizing: “Surprisingly, when the mental athletes were learning new information, they were engaging several regions of the brain known to be involved in two specific tasks: visual memory and spatial navigation, including the same right posterior hippocampal region that the London cabbies had enlarged with all their daily way-finding” (lines 66-72).

Choices B and C are incorrect because the passage explains that the mental athletes were converting information into images, not abstract symbols or numerical lists. Choice D is incorrect because it is not supported by the passage, as the author discusses the mental athletes’ actions while memorizing but not any brain exercises the mental athletes regularly do.

### QUESTION 51

**Choice A is the best answer.** The previous question asks what the passage suggests about the mental athletes’ success with memorization, with the answer being that they use parts of the brain that most other people don’t use when memorizing. This is supported in lines 66-72: “Surprisingly, when the mental athletes were learning new information, they were engaging several regions of the brain known to be involved in two specific tasks: visual memory and spatial navigation, including the same right posterior hippocampal region that the London cabbies had enlarged with all their daily way-finding.”

Choices B, C, and D are incorrect because the lines cited do not support the answer to the previous question about what the passage suggests about the mental athletes’ success with memorization. Instead, they acknowledge that Maguire’s findings seem odd (choice B), describe how Maguire first responded to the results (choice C), and explain things that *don’t* account for the mental athletes’ ability (choice D).

### QUESTION 52

**Choice B is the best answer.** According to the passage, Maguire’s study revealed that the mental athletes were using the same parts of the brain for memorization as were the London cabbies from the first study, a result that was initially puzzling. The questions in lines 74-78 highlight and expand on that result, making it clear that it is surprising to find that the mental athletes use images to remember numbers or use a part of the brain associated with navigation when trying to remember shapes. Although it became clear *how* the mental athletes were memorizing things, it was not clear why they were doing it that way.

Choice A is incorrect because the questions in lines 74-78 seem to reflect additional questions Maguire and others had based on their result and do not suggest that Maguire’s conclusions may not be reliable. Choice C is incorrect because the passage makes no mention of any earlier studies of the phenomenon of using images to remember numbers or to use a part of the brain associated with navigation when trying to remember shapes. Choice D is incorrect because the questions in lines 74-78 specifically address Maguire’s two studies but not her earlier work.

## Section 2: Writing Test

### QUESTION 1

**Choice C is the best answer** because the sentence is not directly related to the main point of the paragraph and should not be added. The main idea of the paragraph is that new high-tech fossil models help expand scientists’ knowledge of ancient species. There is no indication in the paragraph that these scientists are concerned about the age of the rocks in which fossils are found.

Choices A and B are incorrect because the sentence should not be added. It neither adds support to an argument nor provides a transition from one sentence to another. Choice D is incorrect because the sentence does not undermine any claim made in the paragraph.

### QUESTION 2

**Choice D is the best answer** because “promise” suggests the hope of good things to come. The models offer the possibility of advancing the field of paleontology in the future.

Choices A, B, and C are incorrect because they do not make sense in the context of the passage.

### QUESTION 3

**Choice B is the best answer** because the sentence should be kept: it provides a brief but useful explanation of how a 3-D printer works.

Choice A is incorrect. The sentence should be kept because it provides important information about 3-D printers, not because it explains why X-rays are used in CT scanners. Choices C and D are incorrect because the sentence is neither contradictory nor confusing and should not be deleted.

#### QUESTION 4

**Choice C is the best answer** because the relative pronoun “which” appropriately follows the independent clause “The plastic hardens quickly.” It introduces the relative clause explaining what the fact that the plastic hardens quickly allows the printer to do.

Choices A, B, and D are incorrect because each results in a comma splice (the joining of two independent clauses with only a comma).

#### QUESTION 5

**Choice A is the best answer** because no change is needed. The prepositional phrase “in order” and the infinitive “to learn” are appropriately used in conjunction to create an idiomatic phrase.

Choices B and D are incorrect because the phrases “in order for learning” and “so to learn” are not idiomatic. Choice C is incorrect because the pronoun “one” is inconsistent with the noun “team,” which identifies a specific team.

#### QUESTION 6

**Choice C is the best answer** because the personal plural pronoun “their” agrees in number with its antecedent, the plural noun “fossils.”

Choice A is incorrect because the pronoun “its” is singular and doesn’t agree with the plural antecedent “fossils.” Choices B and D are incorrect because a personal pronoun is needed in the sentence. Neither “it’s” (the contraction of “it is”) nor “there” is a personal pronoun.

#### QUESTION 7

**Choice D is the best answer** because sentence 2 should be placed after sentence 5 to make the paragraph most logical. Sentence 2 begins “But now,” signaling a contrast with the past. Sentences 4 and 5 tell what scientists did in the past, so it makes sense for sentence 2 to follow sentence 5.

Choices A, B, and C are incorrect because they result in a paragraph that does not proceed logically. Keeping sentence 2, which begins “But now,” where it is now (choice A) or placing it at the beginning of the paragraph (choice B) signals a contrast with the past that doesn’t make sense in context. Placing sentence 2 after sentence 4 (choice C) appropriately signals a contrast with the past but creates problems for sentence 5, which needs to be placed directly after sentence 4 to continue the discussion of past research limitations.

### QUESTION 8

**Choice D is the best answer** because the phrase “for example” indicates that an example will follow. In this paragraph, the sentence that follows the phrase provides a relevant example of the use of technology to “reproduce fossils that scientists cannot observe firsthand.”

Choices A, B, and C are incorrect because they set up expectations that are not carried out in the paragraph. “By contrast” in choice A and “nonetheless” in choice B suggest that contrary information will follow. “Besides” in choice C suggests that additional information will follow. None of these choices indicates what should be indicated: that an example will follow.

### QUESTION 9

**Choice B is the best answer** because the simple past tense verb “relied” is consistent with the other past tense verbs in the National Museum of Brazil example, such as “dug” and “determined.”

Choices A and D are incorrect because they provide singular verbs that don’t agree in number with the plural subject “researchers.” Choice C is incorrect because the future tense helping verb “will” is inconsistent with the other past tense verbs in the National Museum of Brazil example.

### QUESTION 10

**Choice C is the best answer** because it clearly and concisely combines the sentences in a way that shows the cause-effect relationship between the condition of the fossil and the decision by the research team.

Choices A, B, and D are incorrect because they do not effectively combine the sentences. In each of these choices, the sentence mischaracterizes the relationship between the condition of the fossil and the decision by the research team.

### QUESTION 11



**Choice C is the best answer** because the plural pronoun “they” correctly refers to its plural antecedent “researchers.”

Choices A, B, and D are incorrect because “one,” “he or she,” and “it” are singular pronouns. A plural pronoun is needed to agree in number with the plural antecedent “researchers.”

### QUESTION 12

**Choice D is the best answer** because no transitional phrase is needed between the two sentences. The first sentence indicates that Tweed wanted to silence Nast, and the second sentence simply states what happened next: that his attempt to do so failed.

Choices A, B, and C are incorrect because no transitional phrase or conjunctive adverb such as “therefore” or “furthermore” is needed between the sentences. The information in the second sentence neither results from information in the first nor is in addition to it. Rather, it tells what happened next: the first sentence indicates that Tweed wanted to silence Nast, and the second states that his attempt to do so failed.

### QUESTION 13

**Choice D is the best answer** because it is the only choice that clearly and concisely conveys the key information that “in the 1860s and the 1870s, . . . organizations known as ‘political machines’ started taking control of city governments.”

Choices A, B, and C are incorrect because they all contain unnecessary words or invert the logical order of words in ways that lead to vagueness and redundancy. In choice A, it is unclear if the pronoun “they” refers to “organizations” or “governments.” In choices B and C, word order is inverted, creating a lack of concision (“political organizations that were powerful” is used instead of “powerful political organizations”; “governments were taken control of” and “organizations . . . did so” are used instead of “organizations . . . started taking control of governments”).

### QUESTION 14

**Choice A is the best answer** because no words are needed between the noun phrase “purchasing votes” and the explanatory appositive phrase that follows it (“a form of . . .”).

Choices B, C, and D are incorrect because the participle “being” and the pronouns “that” and “which” are not needed to introduce the appositive phrase “a form of . . .,” which explains the concept of “purchasing votes.”

### QUESTION 15

**Choice B is the best answer** because the comma after “1860s” is used correctly with the comma after “group” to set off the inessential (nonrestrictive) clause “which controlled New York City in the 1860s.”

Choice A is incorrect because a dash cannot be used in conjunction with a comma to set off a nonessential clause. Either two commas or two dashes may be used, but not one of each.

Choice C is incorrect because a comma is not needed after “City.” Choice D is incorrect because a comma is necessary to separate the nonessential clause from the rest of the sentence.

#### **QUESTION 16**

**Choice C is the best answer** because the sentence should be deleted. Although the information is true, it is not essential to the paragraph, which is focused on political machines in general and the Tammany Hall group in particular, not on Tweed himself.

Choices A and B are incorrect because the sentence should not be kept. Choice D is incorrect because, while the sentence should be deleted, it does not undermine or challenge the main claim of the passage.

#### **QUESTION 17**

**Choice C is the best answer** because no comma is needed before “commented,” and the comma after “commented” correctly separates the first part of the sentence from the quotation it introduces.

Choices A, B, and D are incorrect because each includes one or more unnecessary commas.

#### **QUESTION 18**

**Choice A is the best answer** because the adjective “famous,” which means widely known, clearly and concisely describes “images.”

Choices B, C, and D are incorrect because “well-known” and “commonly known” are repetitive when used with the adjective “famous,” which means widely known.

#### **QUESTION 19**

**Choice D is the best answer** because it adds the most relevant supporting information. The paragraph is focused on the cartoons’ depictions of Tweed as a thief, so making an explicit connection between one cartoon and “Tweed’s greedy nature” is extremely relevant to the paragraph.

Choices A, B, and C are incorrect because they all contain irrelevant information. Information about Nast's other cartoons, Tweed's prison escape, and Tweed's hat is not important to add to the paragraph, which is focused on the cartoons' depictions of Tweed as a thief.

### QUESTION 20

**Choice D is the best answer** because the word "prosecuted" correctly indicates that Tweed was charged and tried for his crimes. The preposition "on" is idiomatic when used with the verb "prosecuted."

Choices A, B, and C are incorrect because the word "persecuted" means that someone is harassed or oppressed, not that he or she is charged with a crime. "Persecuted" doesn't fit into the context of this sentence, which is about the legal troubles of Tweed and his gang.

### QUESTION 21

**Choice A is the best answer** because the past tense verb "brought" is consistent with the other past tense verbs in the sentence, such as "escaped" and "fled."

Choices B, C, and D are incorrect because the participle "bringing," the present tense verb "brings," and the present perfect tense verb "has brought" are not consistent with the other verbs in the sentence.

### QUESTION 22

**Choice B is the best answer** because "triumph" indicates victory. It could be considered a victory for political cartoons that Tweed was recaptured because he was recognized from a Nast cartoon.

Choices A, C, and D are incorrect because "pinnacle," "culmination," and "apex" all suggest the highest point or end of something. None of these words indicates the appropriate relationship between the recapture of Tweed and the impact of Nast's cartoons.

### QUESTION 23

**Choice B is the best answer** because the singular possessive pronoun "its" is used correctly to refer to the singular noun "system."

Choice A is incorrect because the contraction "it's" cannot be used to show possession. Choice C is incorrect because "its" is already possessive; an apostrophe is unnecessary. Choice D is incorrect because "their" is a plural possessive pronoun that does not agree in number with the singular noun "system."

## QUESTION 24

**Choice B is the best answer** because it clearly and concisely combines the sentences to show the relationship between the claim (“the idea is obviously very attractive”) and the supporting information about the cameras’ cost.

Choices A, C, and D are incorrect because they mischaracterize the relationship between the claim (“the idea is obviously very attractive”) and the supporting information about the cameras’ cost. The claim about the idea’s attractiveness is not *in addition to* the information about the cost; rather, the information about the cameras’ cost supports the claim that the idea is very attractive.

## QUESTION 25

**Choice A is the best answer** because “however” is used correctly to indicate contrast. Some people consider the art space vital, but that group of people may be too small to generate necessary funding for the project.

Choices B, C, and D are incorrect because neither “therefore,” “in effect,” nor “as a rule” indicates the appropriate relationship between the two sentences being connected. The two sentences form a contrast: some people consider the art space vital, but that group of people may be too small to generate necessary funding for the project.

## QUESTION 26

**Choice B is the best answer** because no commas are needed to set off the restrictive clause (“that is easily understood and appreciated”) that follows the subject.

Choices A and D are incorrect because the clause that describes “work” is essential and should not be set off with punctuation. Setting off a clause with two commas or dashes indicates that it is nonessential to the sentence (nonrestrictive). Choice C is incorrect because no comma is needed between the two verbs.

## QUESTION 27

**Choice D is the best answer** because the sentence should not be added. The general information it contains is not relevant to this paragraph’s discussion of crowdfunding for the arts.

Choices A and B are incorrect because the sentence should not be added. Information about crowdfunding in general is not relevant to the discussion of the arts in this paragraph. Additionally, the sentence doesn’t support the writer’s point about funding of artistic projects.

Choice C is incorrect because, while the sentence should not be added, “funding received from public institutions” is not an idea that is developed in the passage.

### QUESTION 28

**Choice A is the best answer** because “in addition” appropriately introduces an additional problem with crowdfunding in the arts.

Choices B, C, and D are incorrect because “conversely,” “however,” and “thus” do not indicate the appropriate relationship between what is said earlier in the paragraph about problems with crowdfunding in the arts and the additional problem that follows.

### QUESTION 29

**Choice C is the best answer** because the pronoun “who” appropriately introduces a dependent clause defining “free riders.”

Choice A is incorrect because it results in a comma splice (two independent clauses cannot be joined by only a comma). Choice B is incorrect because it is not clear which people don’t contribute: “audiences” or “free riders.” Choice D is incorrect because the infinitive phrase “to not make” doesn’t make sense in the sentence.

### QUESTION 30

**Choice B is the best answer** because the plural pronoun “they” agrees in number with the plural noun “people” and results in a clear, straightforward clause: “if people begin to feel that paying for the art they love is someone else’s responsibility.”

Choice A is incorrect because the passive voice is unnecessary and adds some confusion about which antecedent the pronoun “them” is referring to: “arts” or “people.” Choices C and D are incorrect because the pronouns “him” and “her” and “he” and “she” are singular and do not agree in number with the plural antecedent “people.”

### QUESTION 31

**Choice C is the best answer** because the singular pronoun “her” is consistent with the pronoun “her” that is used earlier in the sentence to refer to the playwright.

Choices A and B are incorrect because they are plural pronouns that are not consistent with the singular pronoun “her” used earlier in the sentence to refer to the singular noun “playwright.” Choice D is incorrect because the singular pronoun “its” is not consistent with “her” and is not used to refer to a person.

### QUESTION 32

**Choice D is the best answer** because sentence 2, which mentions the high price of the playwright’s tickets, logically follows sentence 5, which addresses how the price of tickets was determined.

Choices A, B, and C are incorrect because sentence 2 does not logically follow sentences 1, 3, or 4. Sentences 3, 4, and 5 present a logical sequence of activities that establish the ticket price: first the playwright presents the total cost of her production, then she projects the attendance, and then she sets a per-person cost and prices tickets accordingly. Sentence 2, which addresses the ticket price, must come after the completion of this sequence; it can’t come before the sequence (choice A) or interrupt the sequence (choices B and C).

### QUESTION 33

**Choice A is the best answer** because it accurately interprets data in the graph. The category “dance” had the lowest amount of money raised but also had the highest percentage of projects fully funded.

Choices B, C, and D are incorrect because they do not accurately interpret the information provided in the graph.

### QUESTION 34

**Choice C is the best answer** because sentence 3 needs to be placed before sentence 2 for the paragraph to be cohesive. Sentence 3 presents a cause (“newspapers . . . have been hit especially hard by the widespread availability of free news online”) and sentence 2 presents an effect of that cause (“newspapers have reduced or eliminated investigative resources”).

Choice A is incorrect because sentence 3 needs to precede sentence 2, not follow it: sentence 3 presents a cause (“newspapers . . . have been hit especially hard”), and sentence 2 presents an effect (“newspapers have reduced or eliminated investigative resources”). Choice B is incorrect because sentence 1 needs to precede sentence 3, not follow it: sentence 1 offers a general assessment of “print journalism as a viable profession,” and sentence 3 offers information about one form of print journalism (newspapers). Choice D is incorrect because sentence 3 is needed to provide an explanation for the “lower print circulation and diminished advertising revenue” noted in sentence 2.

### QUESTION 35

**Choice B is the best answer** because the plural noun “reporters” is used correctly as the object of the preposition “of” and because the colon appropriately joins two independent clauses, indicating that the second clause (“their work is expensive and time-consuming”) follows logically from the first (“It is not difficult . . . reporters”).

Choices A and D are incorrect because the singular possessive “reporter’s” does not provide an object for the preposition “of.” Choice C is incorrect because the comma after “reporters” creates a comma splice (the comma is used without a conjunction to join two independent clauses).

### QUESTION 36

**Choice B is the best answer** because the phrase “undertaken in” appropriately identifies why and for whom investigative journalism is conducted (“in the public interest”—that is, to serve the interests of all of the people instead of only a few).

Choice A is incorrect because “taking on the public interest” implies that investigative journalism is the adversary of the public interest (that is, it “takes on,” or confronts, the interests of ordinary people). Choice C is incorrect because it implies that investigative journalism overpowers or takes control of the public interest. Choice D is incorrect because it is unclear what “taking off from the public interest” might mean in this context.

### QUESTION 37

**Choice D is the best answer** because the general term “illegal activities” creates redundancy with the specific examples provided in the sentence and should be deleted. “Street crime,” “corporate wrongdoing,” and “political corruption” are all specific examples of “illegal activities,” so it is unnecessary to mention “illegal activities” as a separate item in the list.

Choice A is incorrect because the general term “illegal activities” creates redundancy with the specific examples of illegal activities provided in the sentence. Choices B and C are incorrect because they repeat ideas that are already in the sentence: “corporate wrongdoing” is a type of “business scandal,” and “political corruption” is a type of “abuse of government power.”

### QUESTION 38

**Choice C is the best answer** because the sentence is out of place in the paragraph: the year 1954 breaks the chronology of the other examples (1974, 2004), and the example is about television news instead of print journalism.

Choices A and B are incorrect because the sentence is out of place in the paragraph and should not be added. Choice D is incorrect because, while the passage should not be added, the reason

is not the one specified. The example of journalists reporting a story that exposes a person in power is consistent with the passage’s definition of investigative journalism.

### QUESTION 39

**Choice D is the best answer** because “deterrent” and “rebuke to” appropriately indicate the effect that exposure by reporters has had on “malfeasance” (misconduct).

Choices A, B, and C are incorrect because they do not appropriately indicate the effect that exposure by reporters has had on “malfeasance” (misconduct). It is unclear how journalism would act as a “blockade” to misconduct, and it is not idiomatic to say that these reports have acted as an important “interference to” or “drag on” misconduct.

### QUESTION 40

**Choice B is the best answer** because the verb phrase “need not entail”—an inverted form of “does not need to entail”—appropriately conveys the writer’s point that the decline in traditional print media does not *necessarily* mean “the end of investigative journalism.” In other words, this possibility is real but can be prevented.

Choices A and C are incorrect because “could not” and “will not” indicate certainty—in other words, that there is no possibility of an end to investigative journalism. Choice D is incorrect because “must not” suggests a call to action by the writer (“this *must* be prevented”) that is inconsistent with the approach taken in the paragraph.

### QUESTION 41

**Choice D is the best answer** because the noun phrase “innovative adjustments” sets up the examples that follow. The examples of the Organized Crime and Corruption Reporting Project, blogs and Twitter, and Help Me Investigate all refer to innovative projects and media that enable investigative journalism to thrive outside of traditional newspapers and magazines.

Choices A, B, and C are incorrect because they do not set up the specific examples of innovative projects and media that are helping fill the void left by the decline of investigative journalism in traditional newspapers and magazines.

### QUESTION 42

**Choice A is the best answer** because no punctuation is needed to separate the subject of the sentence, “enterprises,” from the adjective phrase beginning “such as.”



Choices B and C are incorrect because placing a colon before or after “such as” would create an error in sentence structure: a colon must be preceded by an independent clause. Choice D is incorrect because no comma is necessary here.

### QUESTION 43

**Choice A is the best answer** because the transitional phrase “for example” appropriately indicates that the Help Me Investigate project discussed in the sentence is an example of the use of social media mentioned in the previous sentence.

Choices B, C, and D are incorrect because neither “therefore,” “however,” nor “in any case” indicates the true relationship between this and the previous sentence. The Help Me Investigate project discussed in the current sentence is an example of the use of social media mentioned in the previous sentence.

### QUESTION 44

**Choice C is the best answer** because the full subject of the independent clause, “the advent of the digital age,” directly follows the dependent clause that introduces it.

Choices A, B, and D are incorrect because the subjects of their independent clauses do not directly follow the introductory dependent clause. “Far from marking the end of investigative journalism” refers to the “advent of the digital age,” not to “cooperation among journalists” (choice A) or “the number of potential investigators” (choice B). In choice D, an interrupting phrase (“by facilitating cooperation among journalists and ordinary citizens”) separates the subject from the dependent clause that modifies it.

## Section 3: Math Test - No Calculator

### QUESTION 1

**Choice D is correct.** From the graph, the  $y$ -intercept of line  $\ell$  is  $(0, 1)$ . The line also passes through the point  $(1, 2)$ . Therefore the slope of the line is  $\frac{2-1}{1-0} = \frac{1}{1} = 1$ , and in slope-intercept form, the equation for line  $\ell$  is  $y = x + 1$ .

Choice A is incorrect. It is the equation of the vertical line that passes through the point  $(1, 0)$ . Choice B is incorrect. It is the equation of the horizontal line that passes through the point  $(0, 1)$ . Choice C is incorrect. The line defined by this equation has  $y$ -intercept  $(0, 0)$ , whereas line  $\ell$  has  $y$ -intercept  $(0, 1)$ .

## QUESTION 2

**Choice A is correct.** A circle has 360 degrees of arc. In the circle shown,  $O$  is the center of the circle and angle  $AOC$  is a central angle of the circle. From the figure, the two diameters that meet to form angle  $AOC$  are perpendicular, so the measure of angle  $AOC$  is  $90^\circ$ . This central angle intercepts minor arc  $AC$ , meaning minor arc  $AC$  has  $90^\circ$  of arc. Since the circumference (length) of the entire circle is 36, the length of minor arc  $AC$  is  $\frac{90}{360} \times 36 = 9$ .

Choices B, C, and D are incorrect. The perpendicular diameters divide the circumference of the circle into four equal arcs; therefore, minor arc  $AC$  is  $\frac{1}{4}$  of the circumference. However, the lengths in choices B and C are, respectively,  $\frac{1}{3}$  and  $\frac{1}{2}$  the circumference of the circle, and the length in choice D is the length of the entire circumference. None of these lengths is  $\frac{1}{4}$  the circumference.

## QUESTION 3

**Choice B is correct.** Dividing both sides of the quadratic equation  $4x^2 - 8x - 12 = 0$  by 4 yields  $x^2 - 2x - 3 = 0$ . The equation  $x^2 - 2x - 3 = 0$  can be factored as  $(x + 1)(x - 3) = 0$ . This equation is true when  $x + 1 = 0$  or  $x - 3 = 0$ . Solving for  $x$  gives the solutions to the original quadratic equation:  $x = -1$  and  $x = 3$ .

Choices A and C are incorrect because  $-3$  is not a solution of  $4x^2 - 8x - 12 = 0$ :  $4(-3)^2 - 8(-3) - 12 = 36 + 24 - 12 \neq 0$ . Choice D is incorrect because  $1$  is not a solution of  $4x^2 - 8x - 12 = 0$ :  $4(1)^2 - 8(1) - 12 = 4 - 8 - 12 \neq 0$ .

## QUESTION 4

**Choice C is correct.** If  $f$  is a function of  $x$ , then the graph of  $f$  in the  $xy$ -plane consists of all points  $(x, f(x))$ . An  $x$ -intercept is where the graph intersects the  $x$ -axis; since all points on the  $x$ -axis have  $y$ -coordinate 0, the graph of  $f$  will cross the  $x$ -axis at values of  $x$  such that  $f(x) = 0$ . Therefore, the graph of a function  $f$  will have no  $x$ -intercepts if and only if  $f$  has no real zeros. Likewise, the graph of a quadratic function with no real zeros will have no  $x$ -intercepts.

Choice A is incorrect. The graph of a linear function in the  $xy$ -plane whose rate of change is not zero is a line with a nonzero slope. The  $x$ -axis is a horizontal line and thus has slope 0, so the graph of the linear function whose rate of change is not zero is a line that is not parallel to the  $x$ -axis. Thus, the graph must intersect the  $x$ -axis at some point, and this point is an  $x$ -intercept.

of the graph. Choices B and D are incorrect because the graph of any function with a real zero must have an x-intercept.

### QUESTION 5

**Choice D is correct.** If  $x = 9$  in the equation  $\sqrt{k+2} - x = 0$ , this equation becomes  $\sqrt{k+2} - 9 = 0$ , which can be rewritten as  $\sqrt{k+2} = 9$ . Squaring each side of  $\sqrt{k+2} = 9$  gives  $k + 2 = 81$ , or  $k = 79$ . Substituting  $k = 79$  into the equation  $\sqrt{k+2} - 9 = 0$  confirms this is the correct value for  $k$ .

Choices A, B, and C are incorrect because substituting any of these values for  $k$  in the equation  $\sqrt{k+2} - 9 = 0$  gives a false statement. For example, if  $k = 7$ , the equation becomes  $\sqrt{7+2} - 9 = \sqrt{9} - 9 = 3 - 9 = 0$ , which is false.

### QUESTION 6

**Choice A is correct.** The sum of  $(a^2 - 1)$  and  $(a + 1)$  can be rewritten as  $(a^2 - 1) + (a + 1)$ , or  $a^2 - 1 + a + 1$ , which is equal to  $a^2 + a + 0$ . Therefore, the sum of the two expressions is equal to  $a^2 + a$ .

Choices B and D are incorrect. Since neither of the two expressions has a term with  $a^3$ , the sum of the two expressions cannot have the term  $a^3$  when simplified. Choice C is incorrect. This choice may result from mistakenly adding the terms  $a^2$  and  $a$  to get  $2a^2$ .

### QUESTION 7

**Choice C is correct.** If Jackie works  $x$  hours as a tutor, which pays \$12 per hour, she earns  $12x$  dollars. If Jackie works  $y$  hours as a lifeguard, which pays \$9.50 per hour, she earns  $9.5y$  dollars. Thus the total, in dollars, Jackie earns in a week that she works  $x$  hours as a tutor and  $y$  hours as a lifeguard is  $12x + 9.5y$ . Therefore, the condition that Jackie wants to earn at least \$220 is represented by the inequality  $12x + 9.5y \geq 220$ . The condition that Jackie can work no more than 20 hours per week is represented by the inequality  $x + y \leq 20$ . These two inequalities form the system shown in choice C.

Choice A is incorrect. This system represents the conditions that Jackie earns no more than \$220 and works at least 20 hours. Choice B is incorrect. The first inequality in this system represents the condition that Jackie earns no more than \$220. Choice D is incorrect. The second inequality in this system represents the condition that Jackie works at least 20 hours.

### QUESTION 8

**Choice A is correct.** The constant term 331.4 in  $S(T) = 0.6T + 331.4$  is the value of  $S$  when  $T = 0$ . The value  $T = 0$  corresponds to a temperature of  $0^\circ\text{C}$ . Since  $S(T)$  represents the speed of sound, 331.4 is the speed of sound, in meters per second, when the temperature is  $0^\circ\text{C}$ .

Choice B is incorrect. When  $T = 0.6^\circ\text{C}$ ,  $S(T) = 0.6(0.6) + 331.4 = 331.76$ , not 331.4, meters per second. Choice C is incorrect. Based on the given formula, the speed of sound increases by 0.6 meters per second for every increase of temperature by  $1^\circ\text{C}$ , as shown by the equation  $0.6(T + 1) + 331.4 = (0.6T + 331.4) + 0.6$ . Choice D is incorrect. An increase in the speed of sound, in meters per second, that corresponds to an increase of  $0.6^\circ\text{C}$  is  $0.6(0.6) = 0.36$ .

### QUESTION 9

**Choice A is correct.** Substituting  $x^2$  for  $y$  in the second equation gives  $2(x^2) + 6 = 2(x + 3)$ . This equation can be solved as follows:

$$2x^2 + 6 = 2x + 6 \text{ (Apply the distributive property.)}$$

$$2x^2 + 6 - 2x - 6 = 0 \text{ (Subtract } 2x \text{ and } 6 \text{ from both sides of the equation.)}$$

$$2x^2 - 2x = 0 \text{ (Combine like terms.)}$$

$$2x(x - 1) = 0 \text{ (Factor both terms on the left side of the equation by } 2x\text{.)}$$

Thus,  $x = 0$  and  $x = 1$  are the solutions to the system. Since  $x > 0$ , only  $x = 1$  needs to be considered. The value of  $y$  when  $x = 1$  is  $y = x^2 = 1^2 = 1$ . Therefore, the value of  $xy$  is  $(1)(1) = 1$ .

Choices B, C, and D are incorrect and likely result from a computational or conceptual error when solving this system of equations.

### QUESTION 10

**Choice B is correct.** Substituting  $a^2 + b^2$  for  $z$  and  $ab$  for  $y$  into the expression  $4z + 8y$  gives  $4(a^2 + b^2) + 8ab$ . Multiplying  $a^2 + b^2$  by 4 gives  $4a^2 + 4b^2 + 8ab$ , or equivalently  $4(a^2 + 2ab + b^2)$ . Since  $(a^2 + 2ab + b^2) = (a + b)^2$ , it follows that  $4z + 8y$  is equivalent to  $(2a + 2b)^2$ .

Choices A, C, and D are incorrect and likely result from errors made when substituting or factoring.

### QUESTION 11

**Choice C is correct.** The volume of right circular cylinder A is given by the expression  $\pi r^2 h$ , where  $r$  is the radius of its circular base and  $h$  is its height. The volume of a cylinder with twice

the radius and half the height of cylinder A is given by  $\pi(2r)^2(\frac{1}{2})h$ , which is equivalent to  $4\pi r^2(\frac{1}{2})h = 2\pi r^2h$ . Therefore, the volume is twice the volume of cylinder A, or  $2 \times 22 = 44$ .

Choice A is incorrect and likely results from not multiplying the radius of cylinder A by 2. Choice B is incorrect and likely results from not squaring the 2 in  $2r$  when applying the volume formula. Choice D is incorrect and likely results from a conceptual error.

### QUESTION 12

**Choice D is correct.** Since 9 can be rewritten as  $3^2$ ,  $9^{\frac{3}{4}}$  is equivalent to  $3^{2(\frac{3}{4})}$ . Applying the properties of exponents, this can be written as  $3^{\frac{3}{2}}$ , which can further be rewritten as  $3^{\frac{2}{2}}(3^{\frac{1}{2}})$ , an expression that is equivalent to  $3\sqrt{3}$ .

Choice A is incorrect; it is equivalent to  $9^{\frac{1}{3}}$ . Choice B is incorrect; it is equivalent to  $9^{\frac{1}{4}}$ . Choice C is incorrect; it is equivalent to  $3^{\frac{1}{2}}$ .

### QUESTION 13

**Choice B is correct.** When  $n$  is increased by 1,  $t$  increases by the coefficient of  $n$ , which is 1.

Choices A, C, and D are incorrect and likely result from a conceptual error when interpreting the equation.

### QUESTION 14

**Choice C is correct.** The graph of  $y = -f(x)$  is the graph of the equation  $y = -(2^x + 1)$ , or  $y = -2^x - 1$ . This should be the graph of a decreasing exponential function. The  $y$ -intercept of the graph can be found by substituting the value  $x = 0$  into the equation, as follows:  $y = -2^0 - 1 = -1 - 1 = -2$ . Therefore, the graph should pass through the point  $(0, -2)$ . Choice C is the only function that passes through this point.

Choices A and B are incorrect because the graphed functions are increasing instead of decreasing. Choice D is incorrect because the function passes through the point  $(0, -1)$  instead of  $(0, -2)$ .

### QUESTION 15

**Choice D is correct.** Since gasoline costs \$4 per gallon, and since Alan's car travels an average of 25 miles per gallon, the expression  $\frac{4}{25}$  gives the cost, in dollars per mile, to drive the car.

Multiplying  $\frac{4}{25}$  by  $m$  gives the cost for Alan to drive  $m$  miles in his car. Alan wants to reduce his weekly spending by \$5, so setting  $\frac{4}{25}m$  equal to 5 gives the number of miles,  $m$ , by which he must reduce his driving.

Choices A, B, and C are incorrect. Choices A and B transpose the numerator and the denominator in the fraction. The fraction  $\frac{25}{4}$  would result in the unit miles per dollar, but the question requires a unit of dollars per mile. Choices A and C set the expression equal to 95 instead of 5, a mistake that may result from a misconception that Alan wants to reduce his driving by 5 miles each week; instead, the question says he wants to reduce his weekly expenditure by \$5.

#### QUESTION 16

**The correct answer is 4.** The equation  $60h + 10 \leq 280$ , where  $h$  is the number of hours the boat has been rented, can be written to represent the situation. Subtracting 10 from both sides and then dividing by 60 yields  $h \leq 4.5$ . Since the boat can be rented only for whole numbers of hours, the maximum number of hours for which Maria can rent the boat is 4.

#### QUESTION 17

**The correct answer is  $\frac{6}{5}$ , or 1.2.** To solve the equation  $2(p + 1) + 8(p - 1) = 5p$ , first distribute the terms outside the parentheses to the terms inside the parentheses:  $2p + 2 + 8p - 8 = 5p$ . Next, combine like terms on the left side of the equal sign:  $10p - 6 = 5p$ . Subtracting  $10p$  from both sides yields  $-6 = -5p$ . Finally, dividing both sides by  $-5$  gives  $p = \frac{6}{5} = 1.2$ . Either  $\frac{6}{5}$  or 1.2 can be gridded as the correct answer.

#### QUESTION 18

**The correct answer is  $\frac{21}{4}$ , or 5.25.** Use substitution to create a one-variable equation that can be solved for  $x$ . The second equation gives that  $y = 2x$ . Substituting  $2x$  for  $y$  in the first equation gives  $\frac{1}{2}(2x + 2x) = \frac{21}{2}$ . Dividing both sides of this equation by  $\frac{1}{2}$  yields  $(2x + 2x) = 21$ . Combining

like terms results in  $4x = 21$ . Finally, dividing both sides by 4 gives  $x = \frac{21}{4} = 5.25$ . Either 21/4 or 5.25 can be gridded as the correct answer.

### QUESTION 19

**The correct answer is 2.** The given expression can be rewritten as  $\frac{2x+6}{(x+2)^2} - \frac{2x+4}{(x+2)^2}$ , which is equivalent to  $\frac{2x+6-2x-4}{(x+2)^2}$ , or  $\frac{2}{(x+2)^2}$ . This is in the form  $\frac{a}{(x+2)^2}$ ; therefore,  $a = 2$ .

### QUESTION 20

**The correct answer is 97.** The intersecting lines form a triangle, and the angle with measure of  $x^\circ$  is an exterior angle of this triangle. The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles of the triangle. One of these angles has measure of  $23^\circ$  and the other, which is supplementary to the angle with measure  $106^\circ$ , has measure of  $180^\circ - 106^\circ = 74^\circ$ . Therefore, the value of  $x$  is  $23 + 74 = 97$ .

## Section 4: Math Test - Calculator

### QUESTION 1

**Choice D is correct.** The change in the number of 3-D movies released between any two consecutive years can be found by first estimating the number of 3-D movies released for each of the two years and then finding the positive difference between these two estimates. Between 2003 and 2004, this change is approximately  $2 - 2 = 0$  movies; between 2008 and 2009, this change is approximately  $20 - 8 = 12$  movies; between 2009 and 2010, this change is approximately  $26 - 20 = 6$  movies; and between 2010 and 2011, this change is approximately  $46 - 26 = 20$  movies. Therefore, of the pairs of consecutive years in the choices, the greatest increase in the number of 3-D movies released occurred during the time period between 2010 and 2011.

Choices A, B, and C are incorrect. Between 2010 and 2011, approximately 20 more 3-D movies were released. The change in the number of 3-D movies released between any of the other pairs of consecutive years is significantly smaller than 20.

### QUESTION 2

**Choice C is correct.** Because  $f$  is a linear function of  $x$ , the equation  $f(x) = mx + b$ , where  $m$  and  $b$  are constants, can be used to define the relationship between  $x$  and  $f(x)$ . In this equation,  $m$  represents the increase in the value of  $f(x)$  for every increase in the value of  $x$  by 1. From the table, it can be determined that the value of  $f(x)$  increases by 8 for every increase in the value of  $x$  by 2. In other words, for the function  $f$  the value of  $m$  is  $\frac{8}{2}$ , or 4. The value of  $b$  can be found by substituting the values of  $x$  and  $f(x)$  from any row of the table and the value of  $m$  into the equation  $f(x) = mx + b$  and solving for  $b$ . For example, using  $x = 1$ ,  $f(x) = 5$ , and  $m = 4$  yields  $5 = 4(1) + b$ . Solving for  $b$  yields  $b = 1$ . Therefore, the equation defining the function  $f$  can be written in the form  $f(x) = 4x + 1$ .

Choices A, B, and D are incorrect. Any equation defining the linear function  $f$  must give values of  $f(x)$  for corresponding values of  $x$ , as shown in each row of the table. According to the table, if  $x = 3$ ,  $f(x) = 13$ . However, substituting  $x = 3$  into the equation given in choice A gives  $f(3) = 2(3) + 3$ , or  $f(3) = 9$ , not 13. Similarly, substituting  $x = 3$  into the equation given in choice B gives  $f(3) = 3(3) + 2$ , or  $f(3) = 11$ , not 13. Lastly, substituting  $x = 3$  into the equation given in choice D gives  $f(3) = 5(3)$ , or  $f(3) = 15$ , not 13. Therefore, the equations in choices A, B, and D cannot define  $f$ .

### QUESTION 3

**Choice A is correct.** If 2.5 ounces of chocolate are needed for each muffin, then the number of ounces of chocolate needed to make 48 muffins is  $48 \times 2.5 = 120$  ounces. Since 1 pound = 16 ounces, the number of pounds that is equivalent to 120 ounces is  $\frac{120}{16} = 7.5$  pounds. Therefore, 7.5 pounds of chocolate are needed to make the 48 muffins.

Choice B is incorrect. If 10 pounds of chocolate were needed to make 48 muffins, then the total number of ounces of chocolate needed would be  $10 \times 16 = 160$  ounces. The number of ounces of chocolate per muffin would then be  $\frac{160}{48} = 3.33$  ounces per muffin, not 2.5 ounces per muffin. Choices C and D are also incorrect. Following the same procedures as used to test choice B gives 16.8 ounces per muffin for choice C and 40 ounces per muffin for choice D, not 2.5 ounces per muffin. Therefore, 50.5 and 120 pounds cannot be the number of pounds needed to make 48 signature chocolate muffins.

### QUESTION 4

**Choice B is correct.** The value of  $c + d$  can be found by dividing both sides of the given equation by 3. This yields  $c + d = \frac{5}{3}$ .



Choice A is incorrect. If the value of  $c + d$  is  $\frac{3}{5}$ , then  $3 \times \frac{3}{5} = 5$ ; however,  $\frac{9}{5}$  is not equal to 5.

Choice C is incorrect. If the value of  $c + d$  is 3, then  $3 \times 3 = 9$ ; however, 9 is not equal to 5.

Choice D is incorrect. If the value of  $c + d$  is 5, then  $3 \times 5 = 15$ ; however, 15 is not equal to 5.

### QUESTION 5

**Choice C is correct.** The weight of an object on Venus is approximately  $\frac{9}{10}$  of its weight on Earth. If an object weighs 100 pounds on Earth, then the object's weight on Venus is given by  $\frac{9}{10}(100) = 90$  pounds. The same object's weight on Jupiter is approximately  $\frac{23}{10}$  of its weight on Earth; therefore, the object weighs  $\frac{23}{10}(100) = 230$  pounds on Jupiter. The difference between the object's weight on Jupiter and the object's weight on Venus is  $230 - 90 = 140$  pounds. Therefore, an object that weighs 100 pounds on Earth weighs 140 more pounds on Jupiter than it weighs on Venus.

Choice A is incorrect because it is the weight, in pounds, of the object on Venus. Choice B is incorrect because it is the weight, in pounds, of an object on Earth if it weighs 100 pounds on Venus. Choice D is incorrect because it is the weight, in pounds, of the object on Jupiter.

### QUESTION 6

**Choice B is correct.** Let  $n$  be the number of novels and  $m$  be the number of magazines that Sadie purchased. If Sadie purchased a total of 11 novels and magazines, then  $n + m = 11$ . It is given that the combined price of 11 novels and magazines is \$20. Since each novel sells for \$4 and each magazine sells for \$1, it follows that  $4n + m = 20$ . So the system of equations below must hold.

$$\begin{aligned}4n + m &= 20 \\n + m &= 11\end{aligned}$$

Subtracting side by side the second equation from the first equation yields  $3n = 9$ , so  $n = 3$ . Therefore, Sadie purchased 3 novels.

Choice A is incorrect. If 2 novels were purchased, then a total of \$8 was spent on novels. That leaves \$12 to be spent on magazines, which means that 12 magazines would have been purchased. However, Sadie purchased a total of 11 novels and magazines. Choices C and D are incorrect. If 4 novels were purchased, then a total of \$16 was spent on novels. That leaves \$4 to be spent on magazines, which means that 4 magazines would have been purchased. By the

same logic, if Sadie purchased 5 novels, she would have no money at all (\$0) to buy magazines. However, Sadie purchased a total of 11 novels and magazines.

### QUESTION 7

**Choice A is correct.** The DBA plans to increase its membership by  $n$  businesses each year, so  $x$  years from now, the association plans to have increased its membership by  $nx$  businesses. Since there are already  $b$  businesses at the beginning of this year, the total number of businesses,  $y$ , the DBA plans to have as members  $x$  years from now is modeled by  $y = nx + b$ .

Choice B is incorrect. The equation given in choice B correctly represents the increase in membership  $x$  years from now as  $nx$ . However, the number of businesses at the beginning of the year,  $b$ , has been subtracted from this amount of increase, not added to it. Choices C and D are incorrect because they use exponential models to represent the increase in membership. Since the membership increases by  $n$  businesses each year, this situation is correctly modeled by a linear relationship.

### QUESTION 8

**Choice C is correct.** The first expression  $(1.5x - 2.4)^2$  can be rewritten as  $(1.5x - 2.4)(1.5x - 2.4)$ . Applying the distributive property to this product yields  $(2.25x^2 - 3.6x - 3.6x + 5.76) - (5.2x^2 - 6.4)$ . This difference can be rewritten as  $(2.25x^2 - 3.6x - 3.6x + 5.76) + (-1)(5.2x^2 - 6.4)$ . Distributing the factor of  $-1$  through the second expression yields  $2.25x^2 - 3.6x - 3.6x + 5.76 - 5.2x^2 + 6.4$ . Regrouping like terms, the expression becomes  $(2.25x^2 - 5.2x^2) + (-3.6x - 3.6x) + (5.76 + 6.4)$ . Combining like terms yields  $-2.95x^2 - 7.2x + 12.16$ .

Choices A, B, and D are incorrect and likely result from errors made when applying the distributive property or combining the resulting like terms.

### QUESTION 9

**Choice B is correct.** In 1908, the marathon was lengthened by  $42 - 40 = 2$  kilometers. Since 1 mile is approximately 1.6 kilometers, the increase of 2 kilometers can be converted to miles by multiplying as shown:  $2 \text{ kilometers} \times \frac{1 \text{ mile}}{1.6 \text{ kilometers}} = 1.25 \text{ miles}$ .

Choices A, C, and D are incorrect and may result from errors made when applying the conversion rate or other computational errors.

### QUESTION 10

**Choice A is correct.** The density  $d$  of an object can be found by dividing the mass  $m$  of the object by its volume  $V$ . Symbolically this is expressed by the equation  $d = \frac{m}{V}$ . Solving this equation for  $m$  yields  $m = dV$ .

Choices B, C, and D are incorrect and are likely the result of errors made when translating the definition of density into an algebraic equation and errors made when solving this equation for  $m$ . If the equations given in choices B, C, and D are each solved for density  $d$ , none of the resulting equations are equivalent to  $d = \frac{m}{V}$ .

### QUESTION 11

**Choice A is correct.** The equation  $-2x + 3y = 6$  can be rewritten in the slope-intercept form as follows:  $y = \frac{2}{3}x + 2$ . So the slope of the graph of the given equation is  $\frac{2}{3}$ . In the  $xy$ -plane, when two nonvertical lines are perpendicular, the product of their slopes is  $-1$ . So, if  $m$  is the slope of a line perpendicular to the line with equation  $y = \frac{2}{3}x + 2$ , then  $m \times \frac{2}{3} = -1$ , which yields  $m = -\frac{3}{2}$ . Of the given choices, only the equation in choice A can be rewritten in the form  $y = -\frac{3}{2}x + b$ , for some constant  $b$ . Therefore, the graph of the equation in choice A is perpendicular to the graph of the given equation.

Choices B, C, and D are incorrect because the graphs of the equations in these choices have slopes, respectively, of  $-\frac{3}{4}$ ,  $-\frac{1}{2}$ , and  $-\frac{1}{3}$ , not  $-\frac{3}{2}$ .

### QUESTION 12

**Choice D is correct.** Adding the two equations side by side eliminates  $y$  and yields  $x = 6$ , as shown.

$$\begin{array}{r} \frac{1}{2}y = 4 \\ x - \frac{1}{2}y = 2 \\ \hline x + 0 = 6 \end{array}$$

If  $(x, y)$  is a solution to the system, then  $(x, y)$  satisfies both equations in the system and any equation derived from them. Therefore,  $x = 6$ .

Choices A, B, and C are incorrect and may be the result of errors when solving the system.

### QUESTION 13

**Choice D is correct.** Any point  $(x, y)$  that is a solution to the given system of inequalities must satisfy both inequalities in the system. Since the second inequality in the system can be rewritten as  $y < x - 1$ , the system is equivalent to the following system.

$$\begin{aligned}y &\leq 3x + 1 \\y &< x - 1\end{aligned}$$

Since  $3x + 1 > x - 1$  for  $x > -1$  and  $3x + 1 \leq x - 1$  for  $x \leq -1$ , it follows that  $y < x - 1$  for  $x > -1$  and  $y \leq 3x + 1$  for  $x \leq -1$ . Of the given choices, only  $(2, -1)$  satisfies these conditions because  $-1 < 2 - 1 = 1$ .

Alternate approach: Substituting  $(2, -1)$  into the first inequality gives  $-1 \leq 3(2) + 1$ , or  $-1 \leq 7$ , which is a true statement. Substituting  $(2, -1)$  into the second inequality gives  $2 - (-1) > 1$ , or  $3 > 1$ , which is a true statement. Therefore, since  $(2, -1)$  satisfies both inequalities, it is a solution to the system.

Choice A is incorrect because substituting  $-2$  for  $x$  and  $-1$  for  $y$  in the first inequality gives  $-1 \leq 3(-2) + 1$ , or  $-1 \leq -5$ , which is false. Choice B is incorrect because substituting  $-1$  for  $x$  and  $3$  for  $y$  in the first inequality gives  $3 \leq 3(-1) + 1$ , or  $3 \leq -2$ , which is false. Choice C is incorrect because substituting  $1$  for  $x$  and  $5$  for  $y$  in the first inequality gives  $5 \leq 3(1) + 1$ , or  $5 \leq 4$ , which is false.

### QUESTION 14

**Choice A is correct.** According to the table, 74 orthopedic surgeons indicated that research is their major professional activity. Since a total of 607 surgeons completed the survey, it follows that the probability that the randomly selected surgeon is an orthopedic surgeon whose indicated major professional activity is research is 74 out of 607, or  $74/607$ , which is  $\approx 0.122$ .

Choices B, C, and D are incorrect and may be the result of finding the probability that the randomly selected surgeon is an orthopedic surgeon whose major professional activity is teaching (choice B), an orthopedic surgeon whose major professional activity is either teaching or research (choice C), or a general surgeon or orthopedic surgeon whose major professional activity is research (choice D).

### QUESTION 15

**Choice A is correct.** Statement I need not be true. The fact that 78% of the 1,000 adults who were surveyed responded that they were satisfied with the air quality in the city does not mean that the exact same percentage of all adults in the city will be satisfied with the air quality in the city. Statement II need not be true because random samples, even when they are of the same size, are not necessarily identical with regard to percentages of people in them who have a certain opinion. Statement III need not be true for the same reason that statement II need not be true: results from different samples can vary. The variation may be even bigger for this sample since it would be selected from a different city. Therefore, none of the statements must be true.

Choices B, C, and D are incorrect because none of the statements must be true.

### QUESTION 16

**Choice D is correct.** According to the given information, multiplying a tree species' growth factor by the tree's diameter is a method to approximate the age of the tree. Multiplying the growth factor, 4.0, of the American elm given in the table by the given diameter of 12 inches yields an approximate age of 48 years.

Choices A, B, and C are incorrect because they do not result from multiplying the given diameter of an American elm tree with that tree species' growth factor..

### QUESTION 17

**Choice D is correct.** The growth factor of a tree species is approximated by the slope of a line of best fit that models the relationship between diameter and age. A line of best fit can be visually estimated by identifying a line that goes in the same direction of the data and where roughly half the given data points fall above and half the given data points fall below the line. Two points that fall on the line can be used to estimate the slope and  $y$ -intercept of the equation of a line of best fit. Estimating a line of best fit for the given scatterplot could give the points (11, 80) and (15, 110). Using these two points, the slope of the equation of the line of best fit can be calculated as  $\frac{110-80}{15-11}$ , or 7.5. The slope of the equation is interpreted as the growth factor for a species of tree. According to the table, the species of tree with a growth factor of 7.5 is shagbark hickory.

Choices A, B, and C are incorrect and likely result from errors made when estimating a line of best fit for the given scatterplot and its slope.

### QUESTION 18

**Choice C is correct.** According to the given information, multiplying a tree species' growth factor by the tree's diameter is a method to approximate the age of the tree. A white birch with a diameter of 12 inches (or 1 foot) has a given growth factor of 5 and is approximately 60 years old. A pin oak with a diameter of 12 inches (or 1 foot) has a given growth factor of 3 and is approximately 36 years old. The diameters of the two trees 10 years from now can be found by dividing each tree's age in 10 years, 70 years, and 46 years, by its respective growth factor. This yields 14 inches and  $15\frac{1}{3}$  inches. The difference between  $15\frac{1}{3}$  and 14 is  $1\frac{1}{3}$ , or approximately 1.3 inches.

Choices A, B, and D are incorrect and a result of incorrectly calculating the diameters of the two trees in 10 years.

### QUESTION 19

**Choice B is correct.** Triangles  $ADB$  and  $CDB$  are congruent to each other because they are both  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles and share the side  $\overline{BD}$ . In triangle  $ADB$ , side  $\overline{AD}$  is opposite to the angle  $30^\circ$ ; therefore, the length of  $\overline{AD}$  is half the length of hypotenuse  $\overline{AB}$ . Since the triangles are congruent,  $AB = BC = 12$ . So the length of  $\overline{AD}$  is  $\frac{12}{2} = 6$ .

Choice A is incorrect. If the length of  $\overline{AD}$  were 4, then the length of  $\overline{AB}$  would be 8. However, this is incorrect because  $\overline{AB}$  is congruent to  $\overline{BC}$ , which has a length of 12. Choices C and D are also incorrect. Following the same procedures as used to test choice A gives  $\overline{AB}$  a length of  $12\sqrt{2}$  for choice C and  $12\sqrt{3}$  for choice D. However, these results cannot be true because  $\overline{AB}$  is congruent to  $\overline{BC}$ , which has a length of 12.

### QUESTION 20

**Choice D is correct.** The graph on the right shows the change in distance from the ground of the mark on the rim over time. The  $y$ -intercept of the graph corresponds to the mark's position at the start of the motion ( $t = 0$ ); at this moment, the mark is at its highest point from the ground. As the wheel rolls, the mark approaches the ground, its distance from the ground decreasing until it reaches 0—the point where it touches the ground. After that, the mark moves up and away from the ground, its distance from the ground increasing until it reaches its maximum height from the ground. This is the moment when the wheel has completed a full rotation. The remaining part of the graph shows the distance of the mark from the ground during the second rotation of the wheel. Therefore, of the given choices, only choice D is in agreement with the given information.

Choice A is incorrect because the speed at which the wheel is rolling does not change over time, meaning the graph representing the speed would be a horizontal line. Choice B is incorrect because the distance of the wheel from its starting point to its ending point increases continuously; the graph shows a quantity that changes periodically over time, alternately decreasing and increasing. Choice C is incorrect because the distance of the mark from the center of the wheel is constant and equals the radius of the wheel. The graph representing this distance would be a horizontal line, not the curved line of the graph shown.

### QUESTION 21

**Choice A is correct.** The equation can be rewritten as  $1 - \frac{b}{a} = c$ , or equivalently  $1 - c = \frac{b}{a}$ . Since  $a < 0$  and  $b > 0$ , it follows that  $\frac{b}{a} < 0$ , and so  $1 - c < 0$ , or equivalently  $c > 1$ .

Choice B is incorrect. If  $c = 1$ , then  $a - b = a$ , or  $b = 0$ . But it is given that  $b > 0$ , so  $c = 1$  cannot be true. Choice C is incorrect. If  $c = -1$ , then  $a - b = -a$ , or  $2a = b$ . But this equation contradicts the premise that  $a < 0$  and  $b > 0$ , so  $c = -1$  cannot be true. Choice D is incorrect. For example, if  $c = -2$ , then  $a - b = -2a$ , or  $3a = b$ . But this contradicts the fact that  $a$  and  $b$  have opposite signs, so  $c < -1$  cannot be true.

### QUESTION 22

**Choice C is correct.** It is given that 34.6% of 26 students in Mr. Camp's class reported that they had at least two siblings. Since 34.6% of 26 is 8.996, there must have been 9 students in the class who reported having at least two siblings and 17 students who reported that they had fewer than two siblings. It is also given that the average eighth-grade class size in the state is 26 and that Mr. Camp's class is representative of all eighth-grade classes in the state. This means that in each eighth-grade class in the state there are about 17 students who have fewer than two siblings. Therefore, the best estimate of the number of eighth-grade students in the state who have fewer than two siblings is  $17 \times$  (number of eighth-grade classes in the state), or  $17 \times 1,800 = 30,600$ .

Choice A is incorrect because 16,200 is the best estimate for the number of eighth-grade students in the state who have at least, not fewer than, two siblings. Choice B is incorrect because 23,400 is half of the estimated total number of eighth-grade students in the state; however, since the students in Mr. Camp's class are representative of students in the eighth-grade classes in the state and more than half of the students in Mr. Camp's class have fewer than two siblings, more than half of the students in each eighth-grade class in the state have fewer than two siblings, too. Choice D is incorrect because 46,800 is the estimated total number of eighth-grade students in the state.

### QUESTION 23

**Choice D is correct.** The linear function that represents the relationship will be in the form  $r(p) = ap + b$ , where  $a$  and  $b$  are constants and  $r(p)$  is the monthly rental price, in dollars, of a property that was purchased with  $p$  thousands of dollars. According to the table,  $(70, 515)$  and  $(450, 3,365)$  are ordered pairs that should satisfy the function, which leads to the system of equations below.

$$\begin{cases} 70a + b = 515 \\ 450a + b = 3,365 \end{cases}$$

Subtracting side by side the first equation from the second eliminates  $b$  and gives  $380a = 2,850$ ; solving for  $a$  gives  $a = \frac{2,850}{380} = 7.5$ . Substituting 7.5 for  $a$  in the first equation of the system gives  $525 + b = 515$ ; solving for  $b$  gives  $b = -10$ . Therefore, the linear function that represents the relationship is  $r(p) = 7.5p - 10$ .

Choices A, B, and C are incorrect because the coefficient of  $p$ , or the rate at which the rental price, in dollars, increases for every thousand-dollar increase of the purchase price is different from what is suggested by these choices. For example, the Glenview Street property was purchased for \$140,000, but the rental price that each of the functions in these choices provides is significantly off from the rental price given in the table, \$1,040.

### QUESTION 24

**Choice B is correct.** Let  $x$  be the original price, in dollars, of the Glenview Street property. After the 40% discount, the price of the property became  $0.6x$  dollars, and after the additional 20% off the discounted price, the price of the property became  $0.8(0.6x)$ . Thus, in terms of the original price of the property,  $x$ , the purchase price of the property is  $0.48x$ . It follows that  $0.48x = 140,000$ . Solving this equation for  $x$  gives  $x = 291,666.\bar{6}$ . Therefore, of the given choices, \$291,700 best approximates the original price of the Glenview Street property.

Choice A is incorrect because it is the result of dividing the purchase price of the property by 0.4, as though the purchase price were 40% of the original price. Choice C is incorrect because it is the closest to dividing the purchase price of the property by 0.6, as though the purchase price were 60% of the original price. Choice D is incorrect because it is the result of dividing the purchase price of the property by 0.8, as though the purchase price were 80% of the original price.

### QUESTION 25



**Choice D is correct.** Of the first 150 participants, 36 chose the first picture in the set, and of the 150 remaining participants,  $p$  chose the first picture in the set. Hence, the proportion of the participants who chose the first picture in the set is  $\frac{36+p}{300}$ . Since more than 20% of all the participants chose the first picture, it follows that  $\frac{36+p}{300} > 0.20$ . This inequality can be rewritten as  $p + 36 > 0.20(300)$ . Since  $p$  is a number of people among the remaining 150 participants,  $p \leq 150$ .

Choices A, B, and C are incorrect and may be the result of some incorrect interpretations of the given information or of computational errors.

### QUESTION 26

**Choice B is correct.** A cube has 6 faces of equal area, so if the total surface area of a cube is  $6\left(\frac{a}{4}\right)^2$ , then the area of one face is  $\left(\frac{a}{4}\right)^2$ . Likewise, the area of one face of a cube is the square of one of its sides; therefore, if the area of one face is  $\left(\frac{a}{4}\right)^2$ , then the length of one side of the cube is  $\frac{a}{4}$ . Since the perimeter of one face of a cube is four times the length of one side, the perimeter is  $4\left(\frac{a}{4}\right) = a$ .

Choice A is incorrect because if the perimeter of one face of the cube is  $\frac{a}{4}$ , then the total

surface area of the cube is  $6\left(\frac{\frac{a}{4}}{4}\right)^2 = 6\left(\frac{a}{16}\right)^2$ , which is not  $6\left(\frac{a}{4}\right)^2$ . Choice C is incorrect because if

the perimeter of one face of the cube is  $4a$ , then the total surface area of the cube is

$6\left(\frac{4a}{4}\right)^2 = 6a^2$ , which is not  $6\left(\frac{a}{4}\right)^2$ . Choice D is incorrect because if the perimeter of one face of

the cube is  $6a$ , then the total surface area of the cube is  $6\left(\frac{6a}{4}\right)^2 = 6\left(\frac{3a}{2}\right)^2$ , which is not  $6\left(\frac{a}{4}\right)^2$ .

### QUESTION 27

**Choice C is correct.** If the mean score of 8 players is 14.5, then the total of all 8 scores is  $14.5 \times 8 = 116$ . If the mean of 7 scores is 12, then the total of all 7 scores is  $12 \times 7 = 84$ . Since the set of 7 scores was made by removing the highest score of the set of 8 scores, then the difference between the total of all 8 scores and the total of all 7 scores is equal to the removed score:  $116 - 84 = 32$ .

Choice A is incorrect because if 20 is removed from the group of 8 scores, then the mean score of the remaining 7 players is  $\frac{(14.5 \cdot 8) - 20}{7} \approx 13.71$ , not 12. Choice B is incorrect because if 24 is removed from the group of 8 scores, then the mean score of the remaining 7 players is  $\frac{(14.5 \cdot 8) - 24}{7} \approx 13.14$ , not 12. Choice D is incorrect because if 36 is removed from the group of 8 scores, then the mean score of the remaining 7 players is  $\frac{(14.5 \cdot 8) - 36}{7} \approx 11.43$ , not 12.

### QUESTION 28

**Choice C is correct.** The slope of a line is  $\frac{\text{rise}}{\text{run}}$  and can be calculated using the coordinates of any two points on the line. For example, the graph of  $f$  passes through the points (0, 3) and (2, 4), so the slope of the graph of  $f$  is  $\frac{4-3}{2-0} = \frac{1}{2}$ . The slope of the graph of function  $g$  is 4 times the slope of the graph of  $f$ , so the slope of the graph of  $g$  is  $4\left(\frac{1}{2}\right) = 2$ . Since the point (0, -4) is the  $y$ -intercept of  $g$ ,  $g$  is defined as  $g(x) = 2x - 4$ . It follows that  $g(9) = 2(9) - 4 = 14$ .

Choice A is incorrect because if  $g(9) = 5$ , then the slope of the graph of function  $g$  is  $\frac{-4-5}{0-9} = 1$ , which is not 4 times the slope of the graph of  $f$ . Choices B and D are also incorrect. The same procedures used to test choice A yields  $\frac{-4-9}{0-9} = \frac{13}{9}$  and  $\frac{-4-18}{0-9} = \frac{22}{9}$  for the slope of the graph of  $g$  for choices B and D, respectively. Neither of these slopes is 4 times the slope of the graph of  $f$ .

### QUESTION 29

**Choice B is correct.** The standard equation of a circle in the  $xy$ -plane is of the form  $(x - h)^2 + (y - k)^2 = r^2$ , where  $(h, k)$  are the coordinates of the center of the circle and  $r$  is the radius. To convert the given equation to the standard form, complete the squares. The first two terms need a 100 to complete the square, and the second two terms need a 64. Adding 100 and 64 to both sides of the given equation yields  $(x^2 + 20x + 100) + (y^2 + 16y + 64) = -20 + 100 + 64$ , which

is equivalent to  $(x + 10)^2 + (y + 8)^2 = 144$ . Therefore, the coordinates of the center of the circle are  $(-10, -8)$ .

Choice A is incorrect and is likely the result of not properly dividing when attempting to complete the square. Choice C is incorrect and is likely the result of making a sign error when evaluating the coordinates of the center. Choice D is incorrect and is likely the result of not properly dividing when attempting to complete the square and making a sign error when evaluating the coordinates of the center.

### QUESTION 30

**Choice B is correct.** The given equation can be thought of as the difference of two squares, where one square is  $x^2$  and the other square is  $(\sqrt{a})^2$ . Using the difference of squares formula, the equation can be rewritten as  $y = (x + \sqrt{a})(x - \sqrt{a})$ .

Choices A, C, and D are incorrect because they are not equivalent to the given equation. Choice A is incorrect because it is equivalent to  $y = x^2 - a^2$ . Choice C is incorrect because it is equivalent to  $y = x^2 - \frac{a^2}{4}$ . Choice D is incorrect because it is equivalent to  $y = x^2 + 2ax + a^2$ .

### QUESTION 31

**The correct answer is 1492.** Let  $x$  be the number of watts that is equal to 2 horsepower. Since 5 horsepower is equal to 3730 watts, it follows that  $\frac{2}{5} = \frac{x}{3730}$ . Solving this proportion for  $x$  yields  $5x = 7460$ , or  $x = \frac{7460}{5} = 1492$ .

### QUESTION 32

**The correct answer is  $\frac{29}{3}$ .** It is given that the height of the original painting is 29 inches and the reproduction's height is  $\frac{1}{3}$  the original height. One-third of 29 is  $\frac{29}{3}$ , or  $9.\bar{6}$ . Either the fraction  $\frac{29}{3}$  or the decimals 9.66 or 9.67 can be gridded as the correct answer.

### QUESTION 33

**The correct answer is 7.** It is given that  $PQ = RS$ , and the diagram shows that  $PQ = x - 1$  and  $RS = 3x - 7$ . Therefore, the equation  $x - 1 = 3x - 7$  must be true. Solving this equation for  $x$  leads to

$2x = 6$ , so  $x = 3$ . The length of segment  $PS$  is the sum of the lengths of  $PQ$ ,  $QR$ , and  $RS$ , which is  $(x - 1) + x + (3x - 7)$ , or equivalently  $5x - 8$ . Substituting 3 for  $x$  in this expression gives  $5(3) - 8 = 7$ .

#### QUESTION 34

**The correct answer is 9.** Since the point  $(2, 5)$  lies on the graph of  $y = f(x)$  in the  $xy$ -plane, the ordered pair  $(2, 5)$  must satisfy the equation  $y = f(x)$ . That is,  $5 = f(2)$ , or  $5 = k - 2^2$ . This equation simplifies to  $5 = k - 4$ . Therefore, the value of the constant  $k$  is 9.

#### QUESTION 35

**The correct answer is 13.** Let  $w$  represent the width of the rectangular garden, in feet. Since the length of the garden will be 5 feet longer than the width of the garden, the length of the garden will be  $w + 5$  feet. Thus the area of the garden will be  $w(w + 5)$ . It is also given that the area of the garden will be 104 square feet. Therefore,  $w(w + 5) = 104$ , which is equivalent to  $w^2 + 5w - 104 = 0$ . The quadratic formula can be used or the equation above can be factored to result in  $(w + 13)(w - 8) = 0$ . Therefore,  $w = 8$  and  $w = -13$ . Because width cannot be negative, the width of the garden must be 8 feet. This means the length of the garden must be  $8 + 5 = 13$  feet.

#### QUESTION 36

**The correct answer is 80.** The measure of an angle inscribed in a circle is half the measure of the central angle that intercepts the same arc. That is,  $m\angle A = \frac{x^\circ}{2}$ . Also, the sum of the interior angles of quadrilateral  $ABCP$  is  $360^\circ$ , and the measure of the obtuse angle  $P$  is  $360^\circ - x^\circ$ . Hence,  $\frac{x^\circ}{2} + 20^\circ + (360^\circ - x^\circ) + 20^\circ = 360^\circ$ . Simplifying this equation gives  $\frac{x^\circ}{2} = 40^\circ$ , and so  $x = 80$ .

Alternate approach: If points  $A$  and  $P$  are joined, then the triangles that will be formed,  $APB$  and  $APC$ , are isosceles because  $PA = PB = PC$ . It follows that the base angles on both triangles each have measure of  $20^\circ$ . Angle  $A$  consists of two base angles, and therefore,  $m\angle A = 40^\circ$ . Since the measure of an angle inscribed in a circle is half the measure of the central angle that intercepts the same arc, it follows that the value of  $x$  is  $80^\circ$ .

#### QUESTION 37

**The correct answer is 43.5, 43, or 44.** The distance from Ms. Simon's home to her workplace is  $0.6 + 15.4 + 1.4 = 17.4$  miles. Ms. Simon took 24 minutes to drive this distance. Since there are 60 minutes in one hour, her average speed, in miles per hour, for this trip is  $\frac{17.4}{24} \times 60 = 43.5$  miles per hour. Based on the directions,  $87/2$  or 43.5 can be gridded as the correct answer. We

are accepting 43 and 44 as additional correct answers because the precision of the measurements provided does not support an answer with three significant digits.

### QUESTION 38

**The correct answer is 6.** Ms. Simon travels 15.4 miles on the freeway, and her average speed for this portion of the trip is 50 miles per hour when there is no traffic delay. Therefore, when there is no traffic delay, Ms. Simon spends  $\frac{15.4 \text{ miles}}{50 \text{ mph}} = 0.308$  hours on the freeway. Since there are 60 minutes in one hour, she spends  $(0.308)(60) = 18.48$  minutes on the freeway when there is no delay. Leaving at 7:00 a.m. results in a trip that is 33% longer, and 33% of 18.48 minutes is 6.16; the travel time for each of the other two segments does not change. Therefore, rounded to the nearest minute, it takes Ms. Simon 6 more minutes to drive to her workplace when she leaves at 7:00 a.m.

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# Practice Test #6

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**Test begins on the next page.**



# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from Daniyal Mueenuddin, "Nawabdin Electrician." ©2009 by Daniyal Mueenuddin.

Another man might have thrown up his hands—but not Nawabdin. His twelve daughters acted as a spur to his genius, and he looked with satisfaction in the mirror each morning at the face of  
 5 a warrior going out to do battle. Nawab of course knew that he must proliferate his sources of revenue—the salary he received from K. K. Harouni for tending the tube wells would not even begin to suffice. He set up a little one-room flour mill, run off  
 10 a condemned electric motor—condemned by him. He tried his hand at fish-farming in a little pond at the edge of his master’s fields. He bought broken radios, fixed them, and resold them. He did not demur even when asked to fix watches, though that  
 15 enterprise did spectacularly badly, and in fact earned him more kicks than kudos, for no watch he took apart ever kept time again.

K. K. Harouni rarely went to his farms, but lived mostly in Lahore. Whenever the old man visited,  
 20 Nawab would place himself night and day at the door leading from the servants’ sitting area into the walled grove of ancient banyan trees where the old farmhouse stood. Grizzled, his peculiar aviator

glasses bent and smudged, Nawab tended the  
 25 household machinery, the air conditioners, water heaters, refrigerators, and water pumps, like an engineer tending the boilers on a foundering steamer in an Atlantic gale. By his superhuman efforts he almost managed to maintain K. K. Harouni in the  
 30 same mechanical cocoon, cooled and bathed and lighted and fed, that the landowner enjoyed in Lahore.

Harouni of course became familiar with this ubiquitous man, who not only accompanied him on  
 35 his tours of inspection, but morning and night could be found standing on the master bed rewiring the light fixture or in the bathroom poking at the water heater. Finally, one evening at teatime, gauging the psychological moment, Nawab asked if he might say  
 40 a word. The landowner, who was cheerfully filing his nails in front of a crackling rosewood fire, told him to go ahead.

“Sir, as you know, your lands stretch from here to the Indus, and on these lands are fully seventeen tube  
 45 wells, and to tend these seventeen tube wells there is but one man, me, your servant. In your service I have earned these gray hairs”—here he bowed his head to show the gray—“and now I cannot fulfill my duties as I should. Enough, sir, enough. I beg you, forgive  
 50 me my weakness. Better a darkened house and proud hunger within than disgrace in the light of day. Release me, I ask you, I beg you.”

The old man, well accustomed to these sorts of speeches, though not usually this florid, filed away at  
 55 his nails and waited for the breeze to stop.

“What’s the matter, Nawabdin?”

“Matter, sir? O what could be the matter in your service. I’ve eaten your salt for all my years. But sir, on the bicycle now, with my old legs, and with the  
60 many injuries I’ve received when heavy machinery fell on me—I cannot any longer bicycle about like a bridegroom from farm to farm, as I could when I first had the good fortune to enter your employment. I beg you, sir, let me go.”

65 “And what’s the solution?” asked Harouni, seeing that they had come to the crux. He didn’t particularly care one way or the other, except that it touched on his comfort—a matter of great interest to him.

“Well, sir, if I had a motorcycle, then I could  
70 somehow limp along, at least until I train up some younger man.”

The crops that year had been good, Harouni felt expansive in front of the fire, and so, much to the disgust of the farm managers, Nawab received a  
75 brand-new motorcycle, a Honda 70. He even managed to extract an allowance for gasoline.

The motorcycle increased his status, gave him weight, so that people began calling him “Uncle,” and asking his opinion on world affairs, about which he  
80 knew absolutely nothing. He could now range further, doing a much wider business. Best of all, now he could spend every night with his wife, who had begged to live not on the farm but near her family in Firoza, where also they could educate at  
85 least the two eldest daughters. A long straight road ran from the canal headworks near Firoza all the way to the Indus, through the heart of the K. K. Harouni lands. Nawab would fly down this road on his new machine, with bags and cloths hanging from every  
90 knob and brace, so that the bike, when he hit a bump, seemed to be flapping numerous small vestigial wings; and with his grinning face, as he rolled up to whichever tube well needed servicing, with his ears almost blown off, he shone with the speed of his  
95 arrival.

1

The main purpose of the first paragraph is to

- A) characterize Nawab as a loving father.
- B) outline the schedule of a typical day in Nawab’s life.
- C) describe Nawab’s various moneymaking ventures.
- D) contrast Nawab’s and Harouni’s lifestyles.

2

As used in line 16, “kicks” most nearly means

- A) thrills.
- B) complaints.
- C) jolts.
- D) interests.

3

The author uses the image of an engineer at sea (lines 23-28) most likely to

- A) suggest that Nawab often dreams of having a more exciting profession.
- B) highlight the fact that Nawab’s primary job is to tend to Harouni’s tube wells.
- C) reinforce the idea that Nawab has had many different occupations in his life.
- D) emphasize how demanding Nawab’s work for Harouni is.

4

Which choice best supports the claim that Nawab performs his duties for Harouni well?

- A) Lines 28-32 (“By his . . . Lahore”)
- B) Lines 40-42 (“The landowner . . . ahead”)
- C) Lines 46-49 (“In your . . . should”)
- D) Line 58 (“I’ve . . . years”)

5

In the context of the conversation between Nawab and Harouni, Nawab’s comments in lines 43-52 (“Sir . . . beg you”) mainly serve to

- A) flatter Harouni by mentioning how vast his lands are.
- B) boast to Harouni about how competent and reliable Nawab is.
- C) emphasize Nawab’s diligence and loyalty to Harouni.
- D) notify Harouni that Nawab intends to quit his job tending the tube wells.

6

Nawab uses the word “bridegroom” (line 62) mainly to emphasize that he’s no longer

- A) in love.
- B) naive.
- C) busy.
- D) young.

7

It can reasonably be inferred from the passage that Harouni provides Nawab with a motorcycle mainly because

- A) Harouni appreciates that Nawab has to work hard to support his family.
- B) Harouni sees benefit to himself from giving Nawab a motorcycle.
- C) Nawab’s speech is the most eloquent that Harouni has ever heard.
- D) Nawab threatens to quit if Harouni doesn’t agree to give him a motorcycle.

8

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 65-66 (“And . . . crux”)
- B) Lines 66-68 (“He didn’t . . . him”)
- C) Lines 75-76 (“He even . . . gasoline”)
- D) Lines 80-81 (“He could . . . business”)

9

The passage states that the farm managers react to Nawab receiving a motorcycle with

- A) disgust.
- B) happiness.
- C) envy.
- D) indifference.

10

According to the passage, what does Nawab consider to be the best result of getting the motorcycle?

- A) People start calling him “Uncle.”
- B) He’s able to expand his business.
- C) He’s able to educate his daughters.
- D) He can spend more time with his wife.

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from Stephen Coleman, Scott Anthony, and David E. Morrison, “Public Trust in the News.” ©2009 by Stephen Coleman.

The news is a form of public knowledge. Unlike personal or private knowledge (such as the health of one’s friends and family; the conduct of a private hobby; a secret liaison), public knowledge  
 Line 5 increases in value as it is shared by more people. The date of an election and the claims of rival candidates; the causes and consequences of an environmental disaster; a debate about how to frame a particular law; the latest reports from a war zone—these are all  
 10 examples of public knowledge that people are generally expected to know in order to be considered informed citizens. Thus, in contrast to personal or private knowledge, which is generally left to individuals to pursue or ignore, public knowledge is  
 15 promoted even to those who might not think it matters to them. In short, the circulation of public knowledge, including the news, is generally regarded as a public good which cannot be solely demand-driven.

20 The production, circulation, and reception of public knowledge is a complex process. It is generally accepted that public knowledge should be authoritative, but there is not always common agreement about what the public needs to  
 25 know, who is best placed to relate and explain it, and how authoritative reputations should be determined and evaluated. Historically, newspapers such as *The Times* and broadcasters such as the BBC were widely regarded as the trusted shapers of authoritative  
 30 agendas and conventional wisdom. They embodied the *Oxford English Dictionary’s* definition of authority as the “power over, or title to influence, the opinions of others.” As part of the general process of the transformation of authority whereby there has  
 35 been a reluctance to uncritically accept traditional sources of public knowledge, the demand has been for all authority to make explicit the frames of value which determine their decisions. Centres of news production, as our focus groups show, have not been  
 40 exempt from this process. Not surprisingly perhaps some news journalists feel uneasy about this renegotiation of their authority:

Editors are increasingly casting a glance at the “most read” lists on their own and other websites  
 45 to work out which stories matter to readers and viewers. And now the audience—which used to know its place—is being asked to act as a kind of journalistic ombudsman, ruling on our credibility (broadcast journalist, 2008).

50 The result of democratising access to TV news could be political disengagement by the majority and a dumbing down through a popularity contest of stories (online news editor, 2007).

Despite the rhetorical bluster of these statements,  
 55 they amount to more than straightforward professional defensiveness. In their reference to an audience “which used to know its place” and conflation between democratisation and “dumbing down,” they are seeking to argue for a particular mode of public knowledge: one which is shaped by  
 60 experts, immune from populist pressures; and disseminated to attentive, but mainly passive recipients. It is a view of citizenship that closes down opportunities for popular involvement in the making  
 65 of public knowledge by reinforcing the professional claims of experts. The journalists quoted above are right to feel uneasy, for there is, at almost every institutional level in contemporary society, scepticism towards the epistemological authority of  
 70 expert elites. There is a growing feeling, as expressed by several of our focus group participants, that the news media should be “informative rather than authoritative”; the job of journalists should be to  
 “give the news as raw as it is, without putting their  
 75 slant on it”; and people should be given “sufficient information” from which “we would be able to form opinions of our own.”

At stake here are two distinct conceptions of authority. The journalists we have quoted are  
 80 resistant to the democratisation of news: the supremacy of the clickstream (according to which editors raise or lower the profile of stories according to the number of readers clicking on them online); the parity of popular culture with “serious”  
 85 news; the demands of some audience members for raw news rather than constructed narratives.

Percentage of Respondents Seeing News Stories  
as Inaccurate or Favoring One Side

	1985	1992	2003	2007	2011
<i>News organizations...</i>					
• Get the facts straight	55	49	36	39	25
• Often have inaccurate stories	34	44	56	53	66
• Don't know	11	7	8	8	9
• Are pretty independent	37	35	23	23	15
• Are often influenced by powerful people and organizations	53	58	70	69	80
• Don't know	10	7	7	8	5
<i>On political and social issues, news organizations...</i>					
• Deal fairly with all sides	34	31	26	26	16
• Tend to favor one side	53	63	66	66	77
• Don't know	13	6	8	8	7

Adapted from "Pew Research Center for the People & the Press Report on Views of the News Media, 1985–2011." ©2011 by Pew Research Center.

11

The main purpose of the passage is to

- A) analyze the technological developments that have affected the production, circulation, and reception of news stories.
- B) discuss changes in the perception of the news media as a source of public knowledge.
- C) show how journalists' frames of value influence the production of news stories.
- D) challenge the conventional view that news is a form of public knowledge.

12

According to the passage, which expectation do traditional authorities now face?

- A) They should be uninfluenced by commercial considerations.
- B) They should be committed to bringing about positive social change.
- C) They should be respectful of the difference between public and private knowledge.
- D) They should be transparent about their beliefs and assumptions.

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 2-5 (“Unlike . . . people”)
- B) Lines 20-21 (“The production . . . process”)
- C) Lines 33-38 (“As part . . . decisions”)
- D) Lines 43-46 (“Editors . . . viewers”)

14

As used in line 24, “common” most nearly means

- A) numerous.
- B) familiar.
- C) widespread.
- D) ordinary.

15

The authors most likely include the extended quotations in lines 43-53 to

- A) present contradictory examples.
- B) cite representative opinions.
- C) criticize typical viewpoints.
- D) suggest viable alternatives.

16

The authors indicate that the public is coming to believe that journalists' reports should avoid

- A) personal judgments about the events reported.
- B) more information than is absolutely necessary.
- C) quotations from authorities on the subject matter.
- D) details that the subjects of news reports wish to keep private.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 12-16 (“Thus . . . them”)
- B) Lines 30-33 (“They . . . others”)
- C) Lines 40-42 (“Not surprisingly . . . authority”)
- D) Lines 70-77 (“There . . . own”)

18

As used in line 74, “raw” most nearly means

- A) unfiltered.
- B) exposed.
- C) harsh.
- D) inexperienced.

19

Based on the table, in which year were people the most trusting of the news media?

- A) 1985
- B) 1992
- C) 2003
- D) 2011

20

Which statement is best supported by information presented in the table?

- A) Between 1985 and 2011, the proportion of inaccurate news stories rose dramatically.
- B) Between 1992 and 2003, the proportion of people who believed that news organizations were biased almost doubled.
- C) Between 2003 and 2007, people’s views of the accuracy, independence, and fairness of news organizations changed very little.
- D) Between 2007 and 2011, people’s perception that news organizations are accurate increased, but people’s perception that news organizations are fair diminished.

21

The 2011 data in the table best serve as evidence of

- A) “political disengagement by the majority” (line 51).
- B) “the professional claims of experts” (lines 65-66).
- C) “scepticism towards the epistemological authority of expert elites” (lines 69-70).
- D) “the supremacy of the clickstream” (line 81).



**Questions 22-32 are based on the following passage.**

This passage is adapted from Elsa Youngsteadt, “Decoding a Flower’s Message.” ©2012 by Sigma Xi, The Scientific Research Society.

Texas gourd vines unfurl their large, flared blossoms in the dim hours before sunrise. Until they close at noon, their yellow petals and mild, squashy  
 Line aroma attract bees that gather nectar and shuttle  
 5 pollen from flower to flower. But “when you advertise [to pollinators], you advertise in an open communication network,” says chemical ecologist Ian Baldwin of the Max Planck Institute for Chemical Ecology in Germany. “You attract not just  
 10 the good guys, but you also attract the bad guys.” For a Texas gourd plant, striped cucumber beetles are among the very bad guys. They chew up pollen and petals, defecate in the flowers and transmit the dreaded bacterial wilt disease, an infection that can  
 15 reduce an entire plant to a heap of collapsed tissue in mere days.

In one recent study, Nina Theis and Lynn Adler took on the specific problem of the Texas gourd—how to attract enough pollinators but not  
 20 too many beetles. The Texas gourd vine’s main pollinators are honey bees and specialized squash bees, which respond to its floral scent. The aroma includes 10 compounds, but the most abundant—and the only one that lures squash bees  
 25 into traps—is 1,4-dimethoxybenzene.

Intuition suggests that more of that aroma should be even more appealing to bees. “We have this assumption that a really fragrant flower is going to attract a lot of pollinators,” says Theis, a chemical  
 30 ecologist at Elms College in Chicopee, Massachusetts. But, she adds, that idea hasn’t really been tested—and extra scent could well call in more beetles, too. To find out, she and Adler planted 168 Texas gourd vines in an Iowa field and,  
 35 throughout the August flowering season, made half the plants more fragrant by tucking dimethoxybenzene-treated swabs deep inside their flowers. Each treated flower emitted about 45 times more fragrance than a normal one; the other half of  
 40 the plants got swabs without fragrance.

The researchers also wanted to know whether extra beetles would impose a double cost by both damaging flowers and deterring bees, which might  
 45 not bother to visit (and pollinate) a flower laden with other insects and their feces. So every half hour throughout the experiments, the team plucked all the beetles off of half the fragrance-enhanced flowers and half the control flowers, allowing bees to respond to the blossoms with and without interference by  
 50 beetles.

Finally, they pollinated by hand half of the female flowers in each of the four combinations of fragrance and beetles. Hand-pollinated flowers should develop into fruits with the maximum number of seeds,  
 55 providing a benchmark to see whether the fragrance-related activities of bees and beetles resulted in reduced pollination.

“It was very labor intensive,” says Theis. “We would be out there at four in the morning, three  
 60 in the morning, to try and set up before these flowers open.” As soon as they did, the team spent the next several hours walking from flower to flower, observing each for two-minute intervals “and writing down everything we saw.”

What they saw was double the normal number of beetles on fragrance-enhanced blossoms. Pollinators, to their surprise, did not prefer the highly scented flowers. Squash bees were indifferent, and honey bees visited enhanced flowers less often  
 70 than normal ones. Theis thinks the bees were repelled not by the fragrance itself, but by the abundance of beetles: The data showed that the more beetles on a flower, the less likely a honey bee was to visit it.

That added up to less reproduction for fragrance-enhanced flowers. Gourds that developed from those blossoms weighed 9 percent less and had, on average, 20 fewer seeds than those from normal  
 75 flowers. Hand pollination didn’t rescue the seed set, indicating that beetles damaged flowers directly  
 80 —regardless of whether they also repelled pollinators. (Hand pollination did rescue fruit weight, a hard-to-interpret result that suggests that lost bee visits did somehow harm fruit development.)

85 The new results provide a reason that Texas gourd plants never evolved to produce a stronger scent: “If you really ramp up the odor, you don’t get more pollinators, but you can really get ripped apart by your enemies,” says Rob Raguso, a chemical ecologist  
90 at Cornell University who was not involved in the Texas gourd study.

22

The primary purpose of the passage is to

- A) discuss the assumptions and reasoning behind a theory.
- B) describe the aim, method, and results of an experiment.
- C) present and analyze conflicting data about a phenomenon.
- D) show the innovative nature of a procedure used in a study.

23

As presented in the passage, Theis and Adler’s research primarily relied on which type of evidence?

- A) Direct observation
- B) Historical data
- C) Expert testimony
- D) Random sampling

24

Which statement about striped cucumber beetles can most reasonably be inferred from the passage?

- A) They feed primarily on Texas gourd plants.
- B) They are less attracted to dimethoxybenzene than honey bees are.
- C) They experience only minor negative effects as a result of carrying bacterial wilt disease.
- D) They are attracted to the same compound in Texas gourd scent that squash bees are.

25

The author indicates that it seems initially plausible that Texas gourd plants could attract more pollinators if they

- A) did not have aromatic flowers.
- B) targeted insects other than bees.
- C) increased their floral scent.
- D) emitted more varied fragrant compounds.

26

As used in line 38, “treated” most nearly means

- A) altered.
- B) restored.
- C) provided.
- D) preserved.

27

What did Theis and Adler do as part of their study that most directly allowed Theis to reason that “bees were repelled not by the fragrance itself” (lines 70-71)?

- A) They observed the behavior of bees and beetles both before and after the flowers opened in the morning.
- B) They increased the presence of 1,4-dimethoxybenzene only during the August flowering season.
- C) They compared the gourds that developed from naturally pollinated flowers to the gourds that developed from hand-pollinated flowers.
- D) They gave bees a chance to choose between beetle-free enhanced flowers and beetle-free normal flowers.

28

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 45-50 (“So every . . . beetles”)
- B) Lines 51-53 (“Finally . . . beetles”)
- C) Lines 59-61 (“We would . . . open”)
- D) Lines 76-79 (“Gourds . . . flowers”)

29

The primary function of the seventh and eighth paragraphs (lines 65-84) is to

- A) summarize Theis and Adler’s findings.
- B) describe Theis and Adler’s hypotheses.
- C) illustrate Theis and Adler’s methods.
- D) explain Theis and Adler’s reasoning.

30

In describing squash bees as “indifferent” (line 68), the author most likely means that they

- A) could not distinguish enhanced flowers from normal flowers.
- B) visited enhanced flowers and normal flowers at an equal rate.
- C) largely preferred normal flowers to enhanced flowers.
- D) were as likely to visit beetle-infested enhanced flowers as to visit beetle-free enhanced flowers.

31

According to the passage, Theis and Adler’s research offers an answer to which of the following questions?

- A) How can Texas gourd plants increase the number of visits they receive from pollinators?
- B) Why is there an upper limit on the intensity of the aroma emitted by Texas gourd plants?
- C) Why does hand pollination rescue the fruit weight of beetle-infested Texas gourd plants?
- D) Why do Texas gourd plants stop producing fragrance attractive to pollinators when beetles are present?

32

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 17-20 (“In one . . . beetles”)
- B) Lines 22-25 (“The aroma . . . 1,4-dimethoxybenzene”)
- C) Lines 79-84 (“Hand . . . development”)
- D) Lines 85-86 (“The new . . . scent”)

**Questions 33-42 are based on the following passages.**

Passage 1 is adapted from Abraham Lincoln, "Address to the Young Men's Lyceum of Springfield, Illinois." Originally delivered in 1838. Passage 2 is from Henry David Thoreau, "Resistance to Civil Government." Originally published in 1849.

**Passage 1**

Let every American, every lover of liberty, every well wisher to his posterity, swear by the blood of the Revolution, never to violate in the least particular, the laws of the country; and never to tolerate their  
 5 violation by others. As the patriots of seventy-six did to the support of the Declaration of Independence, so to the support of the Constitution and Laws, let every American pledge his life, his property, and his sacred honor;—let every man remember that to violate the  
 10 law, is to trample on the blood of his father, and to tear the character of his own, and his children's liberty. Let reverence for the laws, be breathed by every American mother, to the lisping babe, that prattles on her lap—let it be taught in schools, in  
 15 seminaries, and in colleges;—let it be written in Primers, spelling books, and in Almanacs;—let it be preached from the pulpit, proclaimed in legislative halls, and enforced in courts of justice. And, in short, let it become the *political religion* of the nation;  
 20 and let the old and the young, the rich and the poor, the grave and the gay, of all sexes and tongues, and colors and conditions, sacrifice unceasingly upon its altars. . . .

When I so pressingly urge a strict observance of  
 25 all the laws, let me not be understood as saying there are no bad laws, nor that grievances may not arise, for the redress of which, no legal provisions have been made. I mean to say no such thing. But I do mean to say, that, although bad laws, if they exist,  
 30 should be repealed as soon as possible, still while they continue in force, for the sake of example, they should be religiously observed. So also in unprovided cases. If such arise, let proper legal provisions be made for them with the least possible delay; but, till  
 35 then, let them if not too intolerable, be borne with.

There is no grievance that is a fit object of redress by mob law. In any case that arises, as for instance, the promulgation of abolitionism, one of two positions is necessarily true; that is, the thing is right  
 40 within itself, and therefore deserves the protection of all law and all good citizens; or, it is wrong, and therefore proper to be prohibited by legal enactments; and in neither case, is the interposition of mob law, either necessary, justifiable, or excusable.

**Passage 2**

Unjust laws exist; shall we be content to obey them, or shall we endeavor to amend them, and obey them until we have succeeded, or shall we transgress them at once? Men generally, under such a  
 45 government as this, think that they ought to wait until they have persuaded the majority to alter them. They think that, if they should resist, the remedy would be worse than the evil. But it is the fault of the government itself that the remedy is worse than the evil. It makes it worse. Why is it not more apt to  
 50 anticipate and provide for reform? Why does it not cherish its wise minority? Why does it cry and resist before it is hurt? . . .

If the injustice is part of the necessary friction of the machine of government, let it go, let it go; perchance it will wear smooth—certainly the  
 55 machine will wear out. If the injustice has a spring, or a pulley, or a rope, or a crank, exclusively for itself, then perhaps you may consider whether the remedy will not be worse than the evil; but if it is of such a  
 60 nature that it requires you to be the agent of injustice to another, then, I say, break the law. Let your life be a counter friction to stop the machine. What I have to do is to see, at any rate, that I do not lend myself to the wrong which I condemn.

As for adopting the ways which the State has provided for remedying the evil, I know not of such ways. They take too much time, and a man's life will be gone. I have other affairs to attend to. I came into  
 65 this world, not chiefly to make this a good place to live in, but to live in it, be it good or bad. A man has not everything to do, but something; and because he cannot do everything, it is not necessary that he should do something wrong. . . .

I do not hesitate to say, that those who call  
 80 themselves Abolitionists should at once effectually  
 withdraw their support, both in person and property,  
 from the government . . . and not wait till they  
 constitute a majority of one, before they suffer the  
 right to prevail through them. I think that it is  
 85 enough if they have God on their side, without  
 waiting for that other one. Moreover, any man more  
 right than his neighbors constitutes a majority of one  
 already.

33

In Passage 1, Lincoln contends that breaking the law has which consequence?

- A) It slows the repeal of bad laws.
- B) It undermines and repudiates the nation's values.
- C) It leads slowly but inexorably to rule by the mob.
- D) It creates divisions between social groups.

34

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 9-12 (“let every man . . . liberty”)
- B) Lines 20-23 (“and let . . . altars”)
- C) Lines 33-35 (“If such . . . borne with”)
- D) Lines 36-37 (“There . . . law”)

35

As used in line 24, “urge” most nearly means

- A) hasten.
- B) stimulate.
- C) require.
- D) advocate.

36

The sentence in lines 24-28 (“When . . . made”) primarily serves which function in Passage 1?

- A) It raises and refutes a potential counterargument to Lincoln's argument.
- B) It identifies and concedes a crucial shortcoming of Lincoln's argument.
- C) It acknowledges and substantiates a central assumption of Lincoln's argument.
- D) It anticipates and corrects a possible misinterpretation of Lincoln's argument.

37

As used in line 32, “observed” most nearly means

- A) followed.
- B) scrutinized.
- C) contemplated.
- D) noticed.

38

In Passage 2, Thoreau indicates that some unjust aspects of government are

- A) superficial and can be fixed easily.
- B) subtle and must be studied carefully.
- C) self-correcting and may be beneficial.
- D) inevitable and should be endured.

39

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 45-48 (“Unjust . . . once”)
- B) Lines 51-52 (“They . . . evil”)
- C) Lines 58-59 (“If the injustice . . . go”)
- D) Lines 75-78 (“A man . . . wrong”)

40

The primary purpose of each passage is to

- A) make an argument about the difference between legal duties and moral imperatives.
- B) discuss how laws ought to be enacted and changed in a democracy.
- C) advance a view regarding whether individuals should follow all of the country's laws.
- D) articulate standards by which laws can be evaluated as just or unjust.

41

Based on the passages, Lincoln would most likely describe the behavior that Thoreau recommends in lines 64-66 ("if it . . . law") as

- A) an excusable reaction to an intolerable situation.
- B) a rejection of the country's proper forms of remedy.
- C) an honorable response to an unjust law.
- D) a misapplication of a core principle of the Constitution.

42

Based on the passages, one commonality in the stances Lincoln and Thoreau take toward abolitionism is that

- A) both authors see the cause as warranting drastic action.
- B) both authors view the cause as central to their argument.
- C) neither author expects the cause to win widespread acceptance.
- D) neither author embraces the cause as his own.



**Questions 43-52 are based on the following passage and supplementary material.**

This passage is adapted from Kevin Bullis, “What Tech Is Next for the Solar Industry?” ©2013 by MIT Technology Review.

Solar panel installations continue to grow quickly, but the solar panel manufacturing industry is in the doldrums because supply far exceeds demand. The poor market may be slowing innovation, but

Line advances continue; judging by the mood this week at the IEEE Photovoltaics Specialists Conference in Tampa, Florida, people in the industry remain optimistic about its long-term prospects.

The technology that’s surprised almost everyone is conventional crystalline silicon. A few years ago, silicon solar panels cost \$4 per watt, and Martin Green, professor at the University of New South Wales and one of the leading silicon solar panel researchers, declared that they’d never go

10 below \$1 a watt. “Now it’s down to something like 50 cents a watt, and there’s talk of hitting 36 cents per watt,” he says.

The U.S. Department of Energy has set a goal of reaching less than \$1 a watt—not just for the solar panels, but for complete, installed systems—by 2020. Green thinks the solar industry will hit that target even sooner than that. If so, that would bring the direct cost of solar power to six cents per kilowatt-hour, which is cheaper than the average cost

20 expected for power from new natural gas power plants.

All parts of the silicon solar panel industry have been looking for ways to cut costs and improve the power output of solar panels, and that’s led to steady

30 cost reductions. Green points to something as mundane as the pastes used to screen-print some of the features on solar panels. Green’s lab built a solar cell in the 1990s that set a record efficiency for silicon solar cells—a record that stands to this day. To

35 achieve that record, he had to use expensive lithography techniques to make fine wires for collecting current from the solar cell. But gradual improvements have made it possible to use screen printing to produce ever-finer lines. Recent research

40 suggests that screen-printing techniques can produce lines as thin as 30 micrometers—about the width of the lines Green used for his record solar cells, but at costs far lower than his lithography techniques.

Meanwhile, researchers at the National Renewable Energy Laboratory have made flexible solar cells on a new type of glass from Corning called Willow Glass, which is thin and can be rolled up. The type of solar cell they made is the only current challenger to silicon in terms of large-scale production—thin-film

50 cadmium telluride. Flexible solar cells could lower the cost of installing solar cells, making solar power cheaper.

One of Green’s former students and colleagues, Jianhua Zhao, cofounder of solar panel manufacturer China Sunergy, announced this week that he is building a pilot manufacturing line for a two-sided solar cell that can absorb light from both the front and back. The basic idea, which isn’t new, is that during some parts of the day, sunlight falls on the

60 land between rows of solar panels in a solar power plant. That light reflects onto the back of the panels and could be harvested to increase the power output. This works particularly well when the solar panels are built on sand, which is highly reflective. Where a

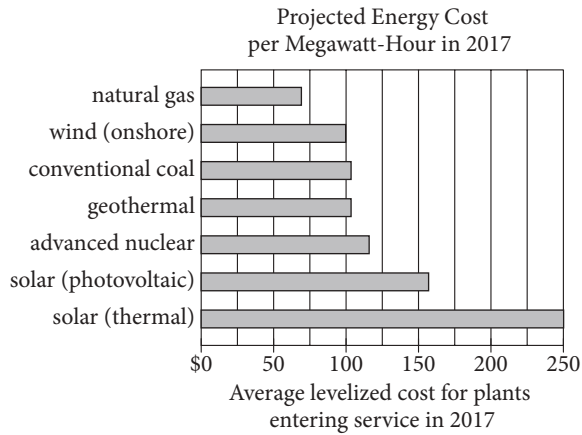
65 one-sided solar panel might generate 340 watts, a two-sided one might generate up to 400 watts. He expects the panels to generate 10 to 20 percent more electricity over the course of a year.

Even longer-term, Green is betting on silicon, aiming to take advantage of the huge reductions in cost already seen with the technology. He hopes to greatly increase the efficiency of silicon solar panels by combining silicon with one or two other

70 semiconductors, each selected to efficiently convert a part of the solar spectrum that silicon doesn’t convert efficiently. Adding one semiconductor could boost efficiencies from the 20 to 25 percent range to around 40 percent. Adding another could make

75 efficiencies as high as 50 percent feasible, which would cut in half the number of solar panels needed for a given installation. The challenge is to produce good connections between these semiconductors, something made challenging by the arrangement of silicon atoms in crystalline silicon.

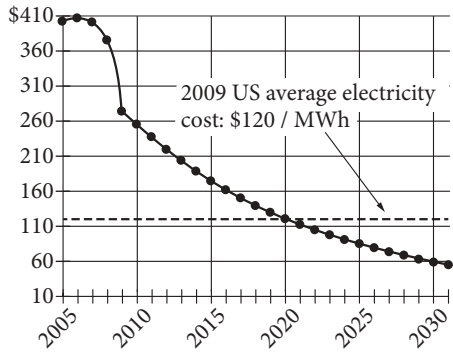
Figure 1



Adapted from Peter Schwartz, "Abundant Natural Gas and Oil Are Putting the Kibosh on Clean Energy." ©2012 by Condé Nast.

Figure 2

Solar Photovoltaic Cost per Megawatt-Hour (MWh)  
(Projected beyond 2009. All data in 2009 dollars.)



Adapted from Ramez Naam, "Smaller, Cheaper, Faster: Does Moore's Law Apply to Solar Cells?" ©2011 by Scientific American.

43

The passage is written from the point of view of a

- A) consumer evaluating a variety of options.
- B) scientist comparing competing research methods.
- C) journalist enumerating changes in a field.
- D) hobbyist explaining the capabilities of new technology.

44

As used in line 4, “poor” most nearly means

- A) weak.
- B) humble.
- C) pitiable.
- D) obsolete.

45

It can most reasonably be inferred from the passage that many people in the solar panel industry believe that

- A) consumers don’t understand how solar panels work.
- B) two-sided cells have weaknesses that have not yet been discovered.
- C) the cost of solar panels is too high and their power output too low.
- D) Willow Glass is too inefficient to be marketable.

46

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-3 (“Solar . . . demand”)
- B) Lines 10-15 (“A few . . . a watt”)
- C) Lines 22-26 (“If so . . . plants”)
- D) Lines 27-30 (“All . . . reductions”)

47

According to the passage, two-sided solar panels will likely raise efficiency by

- A) requiring little energy to operate.
- B) absorbing reflected light.
- C) being reasonably inexpensive to manufacture.
- D) preventing light from reaching the ground.

48

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 58-61 (“The basic . . . plant”)
- B) Lines 61-62 (“That . . . output”)
- C) Lines 63-64 (“This . . . reflective”)
- D) Lines 64-66 (“Where . . . 400 watts”)

49

As used in line 69, “betting on” most nearly means

- A) dabbling in.
- B) gambling with.
- C) switching from.
- D) optimistic about.

50

The last sentence of the passage mainly serves to

- A) express concern about the limitations of a material.
- B) identify a hurdle that must be overcome.
- C) make a prediction about the effective use of certain devices.
- D) introduce a potential new area of study.

51

According to figure 1, in 2017, the cost of which of the following fuels is projected to be closest to the 2009 US average electricity cost shown in figure 2?

- A) Natural gas
- B) Wind (onshore)
- C) Conventional coal
- D) Advanced nuclear

52

According to figure 2, in what year is the average cost of solar photovoltaic power projected to be equal to the 2009 US average electricity cost?

- A) 2018
- B) 2020
- C) 2025
- D) 2027

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### A Necessary Resource for Science

In the winter of 1968, scientists David Schindler and Gregg Brunskill poured nitrates and phosphates into Lake **1** 227, this is one of the 58 freshwater bodies that compose Canada’s remotely located Experimental Lakes Area. Schindler and Brunskill were contaminating the water not out of malice but in the name of research. While deliberately adding chemical compounds to a lake may seem **2** destructive and irresponsible, this method of experimenting is sometimes the most effective way to influence policy and save the environment from even more damaging pollution.

1

- A) NO CHANGE
- B) 227. Which is one
- C) 227. One
- D) 227, one

2

- A) NO CHANGE
- B) destructive, and irresponsible this method
- C) destructive and, irresponsible, this method
- D) destructive and irresponsible this method,

Schindler and Brunskill were investigating possible causes for the large blooms of blue-green algae, or cyanobacteria, that had been affecting bodies of water such as Lake Erie. **3** In addition to being unsightly and odorous, these algal blooms cause oxygen depletion. Oxygen depletion kills fish and other wildlife in the lakes. Just weeks after the scientists added the nitrates and phosphates, the water in Lake 227 turned bright **4** green. It was thick with: the same type of algal blooms that had plagued Lake Erie.

3

Which choice most effectively combines the underlined sentences?

- A) In addition to being unsightly and odorous, these algal blooms cause oxygen depletion: the result being that it kills fish and other wildlife in the lakes.
- B) In addition to being unsightly and odorous, these algal blooms cause oxygen depletion; the algal blooms cause oxygen depletion that kills fish and other wildlife in the lakes.
- C) In addition to being unsightly and odorous, these algal blooms cause oxygen depletion, and oxygen depletion caused by the algal blooms kills fish and other wildlife in the lakes.
- D) In addition to being unsightly and odorous, these algal blooms cause oxygen depletion, which kills fish and other wildlife in the lakes.

4

- A) NO CHANGE
- B) green: it was thick with
- C) green. It was thick with—
- D) green, it was thick with

5 One mission of the Experimental Lakes Area is to conduct research that helps people better understand threats to the environment. The scientists divided the lake in half by placing a nylon barrier through the narrowest part of its figure-eight shape. In one half of Lake 226, they added phosphates, nitrates, and a source of carbon; in the other, they added just nitrates 6 and a source of carbon was added. Schindler and Brunskill hypothesized that phosphates were responsible for the growth of cyanobacteria. The experiment confirmed their suspicions when the half of the lake containing the phosphates 7 was teeming with blue-green algae.

5

Which choice provides the best transition from the previous paragraph to this one?

- A) NO CHANGE
- B) The Experimental Lakes Area is located in a sparsely inhabited region that experiences few effects of human and industrial activity.
- C) To isolate the cause of the algae, Schindler and Brunskill performed another experiment, this time using Lake 226.
- D) The process by which water becomes enriched by dissolved nutrients, such as phosphates, is called eutrophication.

6

- A) NO CHANGE
- B) and a source of carbon.
- C) plus also a source of carbon.
- D) but also adding a source of carbon.

7

- A) NO CHANGE
- B) were teeming
- C) are teeming
- D) teems

Schindler and Brunskill's findings were **8** shown off by the journal *Science*. The research demonstrated a clear correlation between introducing phosphates and the growth of blue-green algae. **9** For example, legislators in Canada passed laws banning phosphates in laundry detergents, which had been entering the water supply. **10**

8

- A) NO CHANGE
- B) put in the spotlight of
- C) published in
- D) put into

9

- A) NO CHANGE
- B) Similarly,
- C) However,
- D) Subsequently,

10

At this point, the writer wants to add a second policy outcome of the research described. Which choice best accomplishes this goal?

- A) Lake 226 continued to develop blooms of blue-green algae for eight consecutive years after the experiment took place.
- B) In the United States, many individual states have also adopted legislation to eliminate, or at least reduce, phosphorous content in laundry detergents.
- C) In 1974, Schindler initiated a study of the effects of acid rain, using Lake 223 to examine how sulfuric acid altered aquatic ecosystems.
- D) Aerial photos of the lakes taken before and during algal blooms helped convey the effects of phosphates in water to the public.



Experiments like these can help people understand the unintended consequences of using certain household products. **11** Of course, regulating the use of certain chemical compounds can be a controversial issue. Selectively establishing remote study locations, such as the Experimental Lakes Area, can provide scientists with opportunities to safely conduct controlled research. This research can generate evidence solid enough to persuade policy makers to take action in favor of protecting the larger environment.

11

Which choice most effectively anticipates and addresses a relevant counterargument to the argument in favor of the types of experiments described in the passage?

- A) NO CHANGE
- B) Many companies now offer phosphate-free alternatives for household cleaning products.
- C) Obviously, scientists should not be allowed to randomly perform experiments on just any body of water.
- D) Phosphates are sometimes used in agricultural fertilizers, in addition to being used in cleaning products.

Questions 12-22 are based on the following passage.

**A Little to the Left, but Not Too Much!**

Italy's Tower of Pisa has been leaning southward since the initial **12** stages of its construction over 800 years ago. **13** Indeed, if the tower's construction had not taken two centuries and involved significant breaks due to war and civil unrest, which allowed the ground beneath the tower to settle, the tower would likely have collapsed before it was completed.

**12**

- A) NO CHANGE
- B) stage's of its'
- C) stage's of it's
- D) stages of its

**13**

- A) NO CHANGE
- B) Therefore,
- C) Nevertheless,
- D) However,

Luckily, the tower survived, and its tilt has made it an Italian **14** icon, it attracts visitors from all over who flock to Pisa to see one of the greatest architectural **15** weirdnesses in the world. **16** By the late twentieth century, the angle of the tower's tilt had reached an astonishing 5.5 degrees; in **17** 1990, Italy's government closed the tower to visitors and appointed a committee to find a way to save it.

14

- A) NO CHANGE
- B) icon, attracting
- C) icon, its attracting
- D) icon; attracting

15

- A) NO CHANGE
- B) deviations
- C) oddities
- D) abnormalities

16

At this point, the writer is considering adding the following sentence.

Unfortunately, the tower's tilt has steadily increased over the centuries, placing the structure in danger of collapse.

Should the writer make this addition here?

- A) Yes, because it provides an important restatement of the main claim in the previous sentence.
- B) Yes, because it establishes an important shift in emphasis in the paragraph's discussion about the tower's tilt.
- C) No, because it interrupts the paragraph's discussion with irrelevant information.
- D) No, because it repeats information that is already presented in the first paragraph.

17

- A) NO CHANGE
- B) 1990, Italy's government, closed
- C) 1990 Italy's government, closed,
- D) 1990: Italy's government closed

The committee was charged with saving the tower without ruining its aesthetic, **18** which no one had yet managed to achieve. The committee's first attempt to reduce the angle of the tower's tilt—placing 600 tons of iron ingots (molded pieces of metal) on the tower's north side to create a counterweight—was derided because the bulky weights ruined the tower's appearance. The attempt at a less visible solution—sinking anchors into the ground below the tower—almost caused the tower to fall.

18

Which choice best supports the main point of the paragraph?

- A) NO CHANGE
- B) although not everyone on the committee agreed completely about what that aesthetic was.
- C) which meant somehow preserving the tower's tilt while preventing that tilt from increasing and toppling the tower.
- D) which included the pristine white marble finish that has come to be widely associated with the tower's beauty.

[1] Enter committee member John Burland, **19** he is a geotechnical engineer from England who saved London’s clock tower Big Ben from collapse. [2] Burland began a years-long process of drilling out small amounts of soil from under the tower **20** that took several years to complete and then monitoring the tower’s resulting movement. [3] Twice daily, Burland evaluated these movements and made recommendations as to how much soil should be removed in the next drilling. [4] By 2001, almost 77 tons of soil had been removed, and the tower’s tilt had decreased by over 1.5 degrees; the ugly iron weights were removed, and the tower was reopened to visitors. [5] Burland **21** advocated using soil extraction: removing small amounts of soil from under the tower’s north side, opposite its tilt, to enable gravity to straighten the tower. **22**

The tower’s tilt has not increased since, and the committee is confident that the tower will be safe for another 200 years. Burland is now working on a more permanent solution for keeping the tower upright, but he is adamant that the tower never be completely straightened. In an interview with PBS’s *Nova*, Burland explained that it is very important “that we don’t really change the character of the monument. That would be quite wrong and quite inappropriate.”

19

- A) NO CHANGE
- B) Burland is
- C) his being
- D) DELETE the underlined portion.

20

- A) NO CHANGE
- B) —taking several years to complete—
- C) that took him several years to complete
- D) DELETE the underlined portion.

21

- A) NO CHANGE
- B) advocated to use
- C) advocated the using of
- D) advocating to use

22

To make this paragraph most logical, sentence 5 should be

- A) placed after sentence 1.
- B) placed after sentence 2.
- C) placed after sentence 3.
- D) DELETED from the paragraph.

Questions 23-33 are based on the following passage and supplementary material.

### The Physician Assistant Will See You Now

**23** The term “paramedics” refers to health care workers who provide routine and clinical services. While the pressures of an aging population, insurance reforms, and health epidemics have increased demand for care, the supply of physicians is not expected to **24** keep pace. The Association of American Medical Colleges predicts a shortage of over 90,000 physicians by 2020; by 2025, that number could climb to more than 130,000. In some parts of the country, shortages are already a sad fact of life. A 2009 report by the Bureau of Health Professions notes that although a fifth of the US population lives in rural areas, less than a tenth of US physicians serves that population. Because a traditionalist response to the crisis—**25** amping up medical-college enrollments and expanding physician training programs—is too slow and costly to address the near-term problem, alternatives are being explored. One promising avenue has been greater reliance on physician assistants (PAs).

23

Which choice is the best introduction to the paragraph?

- A) NO CHANGE
- B) For many Americans, finding a physician is likely to become a growing challenge.
- C) Getting treatment for an illness usually requires seeing either a general practitioner or a specialist.
- D) Worldwide the costs of health care are increasing at an alarming rate.

24

- A) NO CHANGE
- B) maintain the tempo.
- C) get in line.
- D) move along.

25

- A) NO CHANGE
- B) bolstering
- C) arousing
- D) revving up

26 By virtue of 27 there medical training, PAs can perform many of the jobs traditionally done by doctors, including treating chronic and acute conditions, performing minor 28 surgeries: and prescribing some medications. However, although well 29 compensated earning in 2012 a median annual salary of \$90,930, PAs cost health care providers less than do the physicians who

26

At this point, the writer is considering adding the following sentence.

Several factors argue in favor of such an expanded role.

Should the writer make this addition here?

- A) Yes, because it introduces a counterargument for balance.
- B) Yes, because it frames the points that the paragraph will examine.
- C) No, because it does not specify the education required to be a PA.
- D) No, because it presents information that is only tangential to the main argument.

27

- A) NO CHANGE
- B) they're
- C) their
- D) his or her

28

- A) NO CHANGE
- B) surgeries; and
- C) surgeries, and,
- D) surgeries, and

29

- A) NO CHANGE
- B) compensated (earning in 2012 a median annual salary of \$90,930),
- C) compensated, earning in 2012 a median annual salary of \$90,930
- D) compensated: earning in 2012 a median annual salary of \$90,930,

might otherwise undertake these tasks. Moreover, the training period for PAs is markedly shorter than **30** those for physicians—two to three years versus the seven to eleven required for physicians.

Physician assistants already offer vital primary care in many locations. Some 90,000 PAs were employed nationwide in 2012. Over and above their value in partially compensating for the general physician shortage has been their extraordinary contribution to rural health care. A recent review of the scholarly literature by Texas researchers found that PAs lend cost-efficient, widely appreciated services in underserved areas.

**31** In addition, rural-based PAs often provide a broader spectrum of such services than do their urban and suburban counterparts, possibly as a consequence of the limited pool of rural-based physicians.

30

- A) NO CHANGE
- B) that compared with
- C) that for
- D) DELETE the underlined portion.

31

- A) NO CHANGE
- B) Thus,
- C) Despite this,
- D) On the other hand,



Increasingly, PAs and other such medical practitioners have become a critical complement to physicians. A 2013 RAND Corporation report estimates that while the number of primary care physicians will increase slowly from 2010 to 2025, the number of physician assistants and nurse-practitioners in primary care will grow at much faster rates. **32** Both by merit and from necessity, PAs are likely to greet more **33** patience than ever before.

Supply of Physicians, Physician Assistants, and Nurse-Practitioners in Primary Care Clinical Practice in 2010 and 2025

Provider type	2010		2025 (predicted)	
	Number	Percent of total	Number	Percent of total
Physicians	210,000	71	216,000	60
Physician assistants	30,000	10	42,000	12
Nurse-practitioners	56,000	19	103,000	28
Total	296,000	100	361,000	100

Adapted from David I. Auerbach et al., "Nurse-Managed Health Centers and Patient-Centered Medical Homes Could Mitigate Expected Primary Care Physician Shortage." ©2013 by Project HOPE: The People-to-People Health Foundation, Inc.

32

At this point, the writer is considering adding the following sentence.

In fact, according to the data presented in the table, physician assistants will likely outnumber physicians by 2025.

Should the writer make this addition here?

- A) Yes, because it provides additional support for the main point of the paragraph.
- B) Yes, because it addresses a possible counterargument to the writer's main claim.
- C) No, because it is not an accurate interpretation of the data.
- D) No, because it introduces irrelevant information that interrupts the flow of the passage.

33

- A) NO CHANGE
- B) patience, than
- C) patients then
- D) patients than

Questions 34-44 are based on the following passage.

**Gold into Silver: The “Reverse Alchemy” of Superhero Comics History**

**34** Popular film franchises are often “rebooted” in an effort to make their characters and stories fresh and relevant for new audiences. Superhero comic books are periodically reworked to try to increase their appeal to contemporary readers. This practice is almost as

**35** elderly as the medium itself and has in large part established the “ages” that compose comic book history. The shift from the Golden to the Silver Age is probably the most successful **36** example: of publishers responding to changing times and tastes.

34

Which choice most effectively combines the underlined sentences?

- A) In an effort to make their characters and stories fresh and relevant for new audiences, popular film franchises, which are often “rebooted,” are similar to superhero comic books, which are periodically reworked to try to increase their appeal to contemporary readers.
- B) Just as popular film franchises are often “rebooted” in an effort to make their characters and stories fresh and relevant for new audiences, superhero comic books are periodically reworked to try to increase their appeal to contemporary readers.
- C) Superhero comic books are periodically reworked to try to increase their appeal to contemporary readers, while popular film franchises are often “rebooted” in an effort to make their characters and stories fresh and relevant for new audiences.
- D) Superhero comic books are much like popular film franchises in being often “rebooted” in an effort to make their characters and stories fresh and relevant for new audiences and periodically reworked to try to increase their appeal to contemporary readers.

35

- A) NO CHANGE
- B) old
- C) mature
- D) geriatric

36

- A) NO CHANGE
- B) example, of publishers
- C) example of publishers,
- D) example of publishers

The start of the first (“Golden”) age of comic books is often dated to 1938 with the debut of Superman in *Action Comics* #1. Besides beginning the age, Superman in many respects defined it, becoming the model on which many later superheroes were based. His characterization, as established in *Superman* #1 (1939), was relatively simple. He could “hurdle skyscrapers” and “leap an eighth of a mile”; “run faster than a streamline train”; withstand anything less than a “bursting shell”; and **37** lift a car over his head. Sent to Earth from the “doomed planet” Krypton, he was raised by human foster parents, whose love helped infuse him with an unapologetic desire to “benefit mankind.” Admirable but aloof, the Golden Age Superman was arguably more paragon than character, a problem only partially solved by giving him a human alter ego. Other Golden Age superheroes were similarly archetypal: Batman was a crime-fighting millionaire, Wonder Woman a warrior princess from a mythical island.

37

Which choice is most consistent with the previous examples in the sentence?

- A) NO CHANGE
- B) hold down a regular job as a newspaper reporter.
- C) wear a bright blue costume with a flowing red cape.
- D) live in the big city of Metropolis instead of the small town where he grew up.

By contrast, the second (“Silver”) age of comics was marked by characters that, though somewhat simplistic by today’s standards, **38** were provided with origin stories often involving scientific experiments gone wrong. In addition to super villains, the new, soon-to-be-iconic characters of the **39** age: Spider-Man, the Fantastic Four, and the Hulk among them—had to cope with mundane, real-life problems, including paying the rent, dealing with family squabbles, and facing anger, loneliness, and ostracism. Their interior lives were richer and their motivations more complex. Although sales remained strong for Golden Age stalwarts Superman and, to a lesser extent, Batman, **40** subsequent decades would show the enduring appeal of these characters.

38

Which choice most effectively sets up the main idea of the following two sentences?

- A) NO CHANGE
- B) reflected the increasing conservatism of the United States in the 1950s.
- C) engaged in bizarre adventures frequently inspired by science fiction.
- D) were more “realistic” than their Golden Age counterparts.

39

- A) NO CHANGE
- B) age;
- C) age,
- D) age—

40

The writer wants a conclusion to the sentence and paragraph that logically completes the discussion of the Silver Age and provides an effective transition into the next paragraph. Which choice best accomplishes these goals?

- A) NO CHANGE
- B) the distinctions between later stages of comic book history are less well defined than the one between the Golden and Silver Ages.
- C) readers increasingly gravitated to the upstarts as the 1960s and the Silver Age drew to a close.
- D) these characters themselves underwent significant changes over the course of the Silver Age.

More transformations would take place in the medium as the Silver Age gave way to the Bronze and Modern (and possibly Postmodern) Ages. Such efforts **41** have yielded diminishing returns, as even the complete relaunch of DC **42** Comics' superhero's, line in 2011 has failed to arrest the steep two-decade decline of comic book sales. For both commercial and, arguably, creative reasons, **43** then, no transition was more successful than **44** those from the Golden to Silver Age.

41

- A) NO CHANGE
- B) would have yielded
- C) were yielding
- D) will yield

42

- A) NO CHANGE
- B) Comic's superhero's
- C) Comics superhero's
- D) Comics' superhero

43

- A) NO CHANGE
- B) however,
- C) nevertheless,
- D) yet,

44

- A) NO CHANGE
- B) these
- C) that
- D) DELETE the underlined portion.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

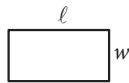
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE



$$A = \pi r^2$$

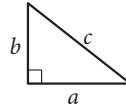
$$C = 2\pi r$$



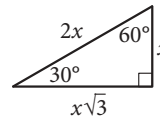
$$A = \ell w$$



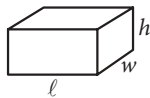
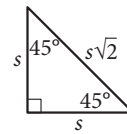
$$A = \frac{1}{2}bh$$



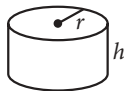
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



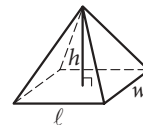
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

Salim wants to purchase tickets from a vendor to watch a tennis match. The vendor charges a one-time service fee for processing the purchase of the tickets. The equation  $T = 15n + 12$  represents the total amount  $T$ , in dollars, Salim will pay for  $n$  tickets. What does 12 represent in the equation?

- A) The price of one ticket, in dollars
- B) The amount of the service fee, in dollars
- C) The total amount, in dollars, Salim will pay for one ticket
- D) The total amount, in dollars, Salim will pay for any number of tickets

2

A gardener buys two kinds of fertilizer. Fertilizer A contains 60% filler materials by weight and Fertilizer B contains 40% filler materials by weight. Together, the fertilizers bought by the gardener contain a total of 240 pounds of filler materials. Which equation models this relationship, where  $x$  is the number of pounds of Fertilizer A and  $y$  is the number of pounds of Fertilizer B?

- A)  $0.4x + 0.6y = 240$
- B)  $0.6x + 0.4y = 240$
- C)  $40x + 60y = 240$
- D)  $60x + 40y = 240$

3

What is the sum of the complex numbers  $2 + 3i$  and  $4 + 8i$ , where  $i = \sqrt{-1}$  ?

- A) 17
- B)  $17i$
- C)  $6 + 11i$
- D)  $8 + 24i$

4

$$4x^2 - 9 = (px + t)(px - t)$$

In the equation above,  $p$  and  $t$  are constants. Which of the following could be the value of  $p$  ?

- A) 2
- B) 3
- C) 4
- D) 9

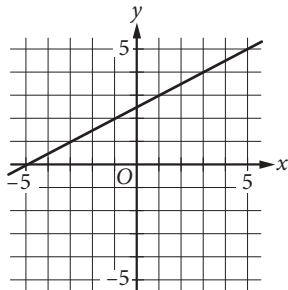




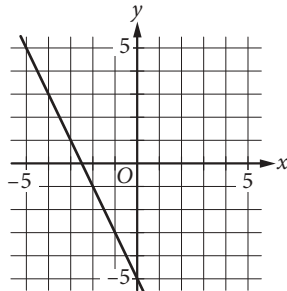
5

Which of the following is the graph of the equation  $y = 2x - 5$  in the  $xy$ -plane?

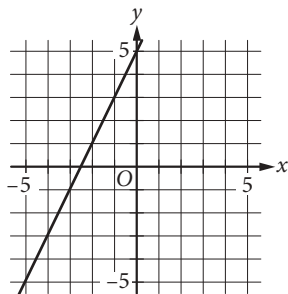
A)



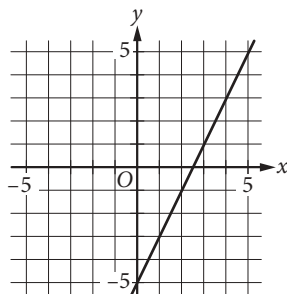
B)



C)



D)





6

If  $x = \frac{2}{3}y$  and  $y = 18$ , what is the value of  $2x - 3$  ?

- A) 21
- B) 15
- C) 12
- D) 10

7

A bricklayer uses the formula  $n = 7\ell h$  to estimate the number of bricks,  $n$ , needed to build a wall that is  $\ell$  feet long and  $h$  feet high. Which of the following correctly expresses  $\ell$  in terms of  $n$  and  $h$  ?

- A)  $\ell = \frac{7}{nh}$
- B)  $\ell = \frac{h}{7n}$
- C)  $\ell = \frac{n}{7h}$
- D)  $\ell = \frac{n}{7+h}$

8

$x$	$w(x)$	$t(x)$
1	-1	-3
2	3	-1
3	4	1
4	3	3
5	-1	5

The table above shows some values of the functions  $w$  and  $t$ . For which value of  $x$  is  $w(x) + t(x) = x$  ?

- A) 1
- B) 2
- C) 3
- D) 4

9

If  $\sqrt{x} + \sqrt{9} = \sqrt{64}$ , what is the value of  $x$  ?

- A)  $\sqrt{5}$
- B) 5
- C) 25
- D) 55

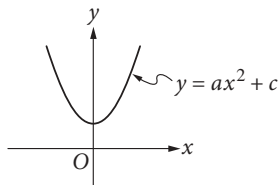


10

Jaime is preparing for a bicycle race. His goal is to bicycle an average of at least 280 miles per week for 4 weeks. He bicycled 240 miles the first week, 310 miles the second week, and 320 miles the third week. Which inequality can be used to represent the number of miles,  $x$ , Jaime could bicycle on the 4th week to meet his goal?

- A)  $\frac{240 + 310 + 320}{3} + x \geq 280$
- B)  $240 + 310 + 320 \geq x(280)$
- C)  $\frac{240}{4} + \frac{310}{4} + \frac{320}{4} + x \geq 280$
- D)  $240 + 310 + 320 + x \geq 4(280)$

11



The vertex of the parabola in the  $xy$ -plane above is  $(0, c)$ . Which of the following is true about the parabola with the equation  $y = -a(x - b)^2 + c$ ?

- A) The vertex is  $(b, c)$  and the graph opens upward.
- B) The vertex is  $(b, c)$  and the graph opens downward.
- C) The vertex is  $(-b, c)$  and the graph opens upward.
- D) The vertex is  $(-b, c)$  and the graph opens downward.

12

Which of the following is equivalent to  $\frac{4x^2 + 6x}{4x + 2}$ ?

- A)  $x$
- B)  $x + 4$
- C)  $x - \frac{2}{4x + 2}$
- D)  $x + 1 - \frac{2}{4x + 2}$

13

$$2x^2 - 4x = t$$

In the equation above,  $t$  is a constant. If the equation has no real solutions, which of the following could be the value of  $t$ ?

- A)  $-3$
- B)  $-1$
- C)  $1$
- D)  $3$



14

A laundry service is buying detergent and fabric softener from its supplier. The supplier will deliver no more than 300 pounds in a shipment. Each container of detergent weighs 7.35 pounds, and each container of fabric softener weighs 6.2 pounds. The service wants to buy at least twice as many containers of detergent as containers of fabric softener. Let  $d$  represent the number of containers of detergent, and let  $s$  represent the number of containers of fabric softener, where  $d$  and  $s$  are nonnegative integers. Which of the following systems of inequalities best represents this situation?

- A)  $7.35d + 6.2s \leq 300$   
 $d \geq 2s$
- B)  $7.35d + 6.2s \leq 300$   
 $2d \geq s$
- C)  $14.7d + 6.2s \leq 300$   
 $d \geq 2s$
- D)  $14.7d + 6.2s \leq 300$   
 $2d \geq s$

15

Which of the following is equivalent to  $\left(a + \frac{b}{2}\right)^2$ ?

- A)  $a^2 + \frac{b^2}{2}$
- B)  $a^2 + \frac{b^2}{4}$
- C)  $a^2 + \frac{ab}{2} + \frac{b^2}{2}$
- D)  $a^2 + ab + \frac{b^2}{4}$



**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \circ & \circ & \circ & \circ \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result. →

Answer: $\frac{7}{12}$			
7	/	1	2
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5			
2	.	5	
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3	
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

2	0	1	
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3

2	0	1	
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

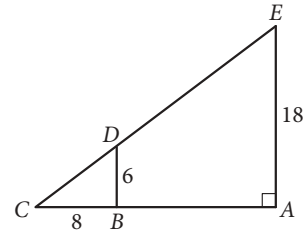
If  $a^{\frac{b}{4}} = 16$  for positive integers  $a$  and  $b$ , what is one possible value of  $b$  ?

17

$$\frac{2}{3}t = \frac{5}{2}$$

What value of  $t$  is the solution of the equation above?

18



In the figure above,  $\overline{BD}$  is parallel to  $\overline{AE}$ . What is the length of  $\overline{CE}$  ?



19

How many liters of a 25% saline solution must be added to 3 liters of a 10% saline solution to obtain a 15% saline solution?

20

Points  $A$  and  $B$  lie on a circle with radius 1, and arc  $\widehat{AB}$  has length  $\frac{\pi}{3}$ . What fraction of the circumference of the circle is the length of arc  $\widehat{AB}$  ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**





## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

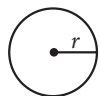
### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

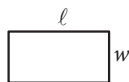
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

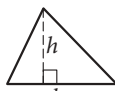


$$A = \pi r^2$$

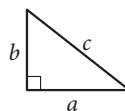
$$C = 2\pi r$$



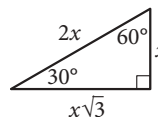
$$A = \ell w$$



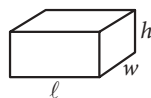
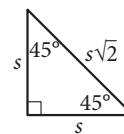
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



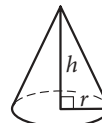
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

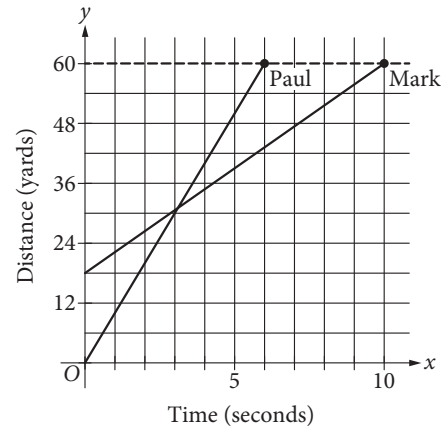


1

Which expression is equivalent to  $(2x^2 - 4) - (-3x^2 + 2x - 7)$  ?

- A)  $5x^2 - 2x + 3$
- B)  $5x^2 + 2x - 3$
- C)  $-x^2 - 2x - 11$
- D)  $-x^2 + 2x - 11$

2



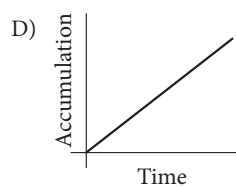
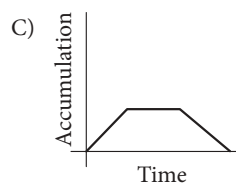
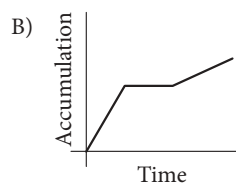
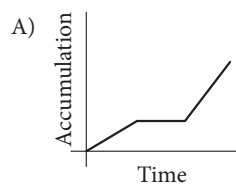
The graph above shows the positions of Paul and Mark during a race. Paul and Mark each ran at a constant rate, and Mark was given a head start to shorten the distance he needed to run. Paul finished the race in 6 seconds, and Mark finished the race in 10 seconds. According to the graph, Mark was given a head start of how many yards?

- A) 3
- B) 12
- C) 18
- D) 24



3

Snow fell and then stopped for a time. When the snow began to fall again, it fell at a faster rate than it had initially. Assuming that none of the snow melted during the time indicated, which of the following graphs could model the total accumulation of snow versus time?



4

A website-hosting service charges businesses a onetime setup fee of \$350 plus  $d$  dollars for each month. If a business owner paid \$1,010 for the first 12 months, including the setup fee, what is the value of  $d$  ?

- A) 25
- B) 35
- C) 45
- D) 55

5

$$6x - 9y > 12$$

Which of the following inequalities is equivalent to the inequality above?

- A)  $x - y > 2$
- B)  $2x - 3y > 4$
- C)  $3x - 2y > 4$
- D)  $3y - 2x > 2$



6

Where Do People Get Most of Their Medical Information?

Source	Percent of those surveyed
Doctor	63%
Internet	13%
Magazines/brochures	9%
Pharmacy	6%
Television	2%
Other/none of the above	7%

The table above shows a summary of 1,200 responses to a survey question. Based on the table, how many of those surveyed get most of their medical information from either a doctor or the Internet?

- A) 865
- B) 887
- C) 912
- D) 926

7

The members of a city council wanted to assess the opinions of all city residents about converting an open field into a dog park. The council surveyed a sample of 500 city residents who own dogs. The survey showed that the majority of those sampled were in favor of the dog park. Which of the following is true about the city council's survey?

- A) It shows that the majority of city residents are in favor of the dog park.
- B) The survey sample should have included more residents who are dog owners.
- C) The survey sample should have consisted entirely of residents who do not own dogs.
- D) The survey sample is biased because it is not representative of all city residents.



8

Ice Cream and Topping Selections

		Flavor	
		Vanilla	Chocolate
Topping	Hot fudge	8	6
	Caramel	5	6

The table above shows the flavors of ice cream and the toppings chosen by the people at a party. Each person chose one flavor of ice cream and one topping. Of the people who chose vanilla ice cream, what fraction chose hot fudge as a topping?

- A)  $\frac{8}{25}$   
 B)  $\frac{5}{13}$   
 C)  $\frac{13}{25}$   
 D)  $\frac{8}{13}$

9

The total area of a coastal city is 92.1 square miles, of which 11.3 square miles is water. If the city had a population of 621,000 people in the year 2010, which of the following is closest to the population density, in people per square mile of land area, of the city at that time?

- A) 6,740  
 B) 7,690  
 C) 55,000  
 D) 76,000



10

Between 1497 and 1500, Amerigo Vespucci embarked on two voyages to the New World. According to Vespucci's letters, the first voyage lasted 43 days longer than the second voyage, and the two voyages combined lasted a total of 1,003 days. How many days did the second voyage last?

- A) 460
- B) 480
- C) 520
- D) 540

11

$$7x + 3y = 8$$

$$6x - 3y = 5$$

For the solution  $(x, y)$  to the system of equations above, what is the value of  $x - y$  ?

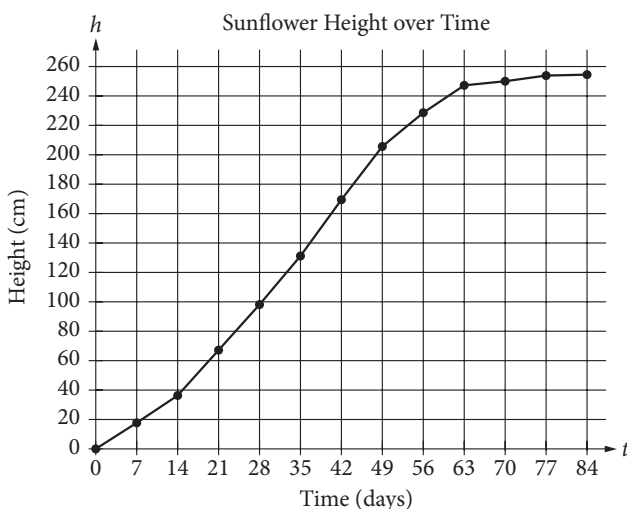
- A)  $-\frac{4}{3}$
- B)  $\frac{2}{3}$
- C)  $\frac{4}{3}$
- D)  $\frac{22}{3}$



Questions 12-14 refer to the following information.

Sunflower Growth

Day	Height (cm)
0	0.00
7	17.93
14	36.36
21	67.76
28	98.10
35	131.00
42	169.50
49	205.50
56	228.30
63	247.10
70	250.50
77	253.80
84	254.50



In 1919, H. S. Reed and R. H. Holland published a paper on the growth of sunflowers. Included in the paper were the table and graph above, which show the height  $h$ , in centimeters, of a sunflower  $t$  days after the sunflower begins to grow.

12

Over which of the following time periods is the average growth rate of the sunflower least?

- A) Day 0 to Day 21
- B) Day 21 to Day 42
- C) Day 42 to Day 63
- D) Day 63 to Day 84

13

The function  $h$ , defined by  $h(t) = at + b$ , where  $a$  and  $b$  are constants, models the height, in centimeters, of the sunflower after  $t$  days of growth during a time period in which the growth is approximately linear. What does  $a$  represent?

- A) The predicted number of centimeters the sunflower grows each day during the period
- B) The predicted height, in centimeters, of the sunflower at the beginning of the period
- C) The predicted height, in centimeters, of the sunflower at the end of the period
- D) The predicted total increase in the height of the sunflower, in centimeters, during the period



14

The growth rate of the sunflower from day 14 to day 35 is nearly constant. On this interval, which of the following equations best models the height  $h$ , in centimeters, of the sunflower  $t$  days after it begins to grow?

- A)  $h = 2.1t - 15$   
 B)  $h = 4.5t - 27$   
 C)  $h = 6.8t - 12$   
 D)  $h = 13.2t - 18$

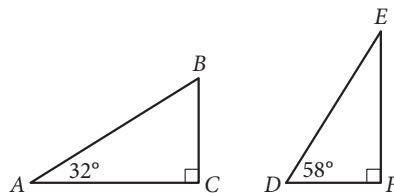
15

$x$	1	2	3	4	5
$y$	$\frac{11}{4}$	$\frac{25}{4}$	$\frac{39}{4}$	$\frac{53}{4}$	$\frac{67}{4}$

Which of the following equations relates  $y$  to  $x$  for the values in the table above?

- A)  $y = \frac{1}{2} \cdot \left(\frac{5}{2}\right)^x$   
 B)  $y = 2 \cdot \left(\frac{3}{4}\right)^x$   
 C)  $y = \frac{3}{4}x + 2$   
 D)  $y = \frac{7}{2}x - \frac{3}{4}$

16



Triangles  $ABC$  and  $DEF$  are shown above. Which

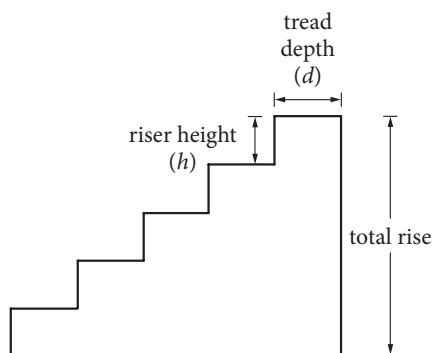
of the following is equal to the ratio  $\frac{BC}{AB}$  ?

- A)  $\frac{DE}{DF}$   
 B)  $\frac{DF}{DE}$   
 C)  $\frac{DF}{EF}$   
 D)  $\frac{EF}{DE}$





Questions 17-19 refer to the following information.



Note: Figure not drawn to scale.

When designing a stairway, an architect can use the riser-tread formula  $2h + d = 25$ , where  $h$  is the riser height, in inches, and  $d$  is the tread depth, in inches. For any given stairway, the riser heights are the same and the tread depths are the same for all steps in that stairway.

The number of steps in a stairway is the number of its risers. For example, there are 5 steps in the stairway in the figure above. The total rise of a stairway is the sum of the riser heights as shown in the figure.

17

Which of the following expresses the riser height in terms of the tread depth?

- A)  $h = \frac{1}{2}(25 + d)$
- B)  $h = \frac{1}{2}(25 - d)$
- C)  $h = -\frac{1}{2}(25 + d)$
- D)  $h = -\frac{1}{2}(25 - d)$

18

Some building codes require that, for indoor stairways, the tread depth must be at least 9 inches and the riser height must be at least 5 inches. According to the riser-tread formula, which of the following inequalities represents the set of all possible values for the riser height that meets this code requirement?

- A)  $0 \leq h \leq 5$
- B)  $h \geq 5$
- C)  $5 \leq h \leq 8$
- D)  $8 \leq h \leq 16$

19

An architect wants to use the riser-tread formula to design a stairway with a total rise of 9 feet, a riser height between 7 and 8 inches, and an odd number of steps. With the architect's constraints, which of the following must be the tread depth, in inches, of the stairway? (1 foot = 12 inches)

- A) 7.2
- B) 9.5
- C) 10.6
- D) 15



20

What is the sum of the solutions to  $(x - 6)(x + 0.7) = 0$  ?

- A) -6.7
- B) -5.3
- C) 5.3
- D) 6.7

21

A study was done on the weights of different types of fish in a pond. A random sample of fish were caught and marked in order to ensure that none were weighed more than once. The sample contained 150 largemouth bass, of which 30% weighed more than 2 pounds. Which of the following conclusions is best supported by the sample data?

- A) The majority of all fish in the pond weigh less than 2 pounds.
- B) The average weight of all fish in the pond is approximately 2 pounds.
- C) Approximately 30% of all fish in the pond weigh more than 2 pounds.
- D) Approximately 30% of all largemouth bass in the pond weigh more than 2 pounds.

22

Number of States with 10 or More Electoral Votes in 2008

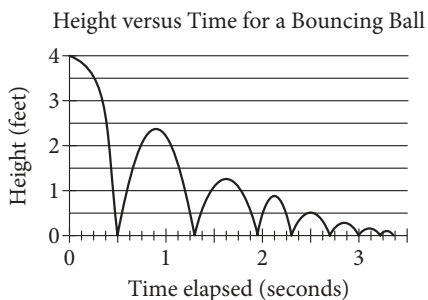
Electoral votes	Frequency
10	4
11	4
12	1
13	1
15	3
17	1
20	1
21	2
27	1
31	1
34	1
55	1

In 2008, there were 21 states with 10 or more electoral votes, as shown in the table above. Based on the table, what was the median number of electoral votes for the 21 states?

- A) 13
- B) 15
- C) 17
- D) 20



23



As part of an experiment, a ball was dropped and allowed to bounce repeatedly off the ground until it came to rest. The graph above represents the relationship between the time elapsed after the ball was dropped and the height of the ball above the ground. After it was dropped, how many times was the ball at a height of 2 feet?

- A) One
- B) Two
- C) Three
- D) Four

24

A customer's monthly water bill was \$75.74. Due to a rate increase, her monthly bill is now \$79.86. To the nearest tenth of a percent, by what percent did the amount of the customer's water bill increase?

- A) 4.1%
- B) 5.1%
- C) 5.2%
- D) 5.4%

25

$x$	$f(x)$
0	-2
2	4
6	16

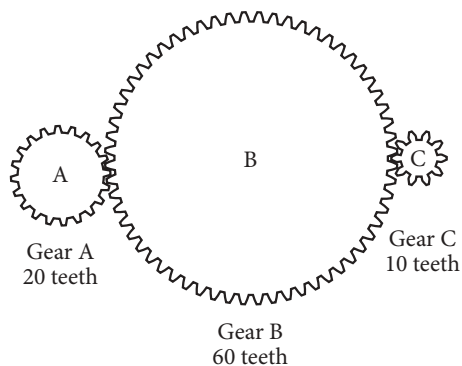
Some values of the linear function  $f$  are shown in the table above. What is the value of  $f(3)$  ?

- A) 6
- B) 7
- C) 8
- D) 9



26

A gear ratio  $r:s$  is the ratio of the number of teeth of two connected gears. The ratio of the number of revolutions per minute (rpm) of two gear wheels is  $s:r$ . In the diagram below, Gear A is turned by a motor. The turning of Gear A causes Gears B and C to turn as well.



If Gear A is rotated by the motor at a rate of 100 rpm, what is the number of revolutions per minute for Gear C?

- A) 50
- B) 110
- C) 200
- D) 1,000

27

In the  $xy$ -plane, the graph of  $2x^2 - 6x + 2y^2 + 2y = 45$  is a circle. What is the radius of the circle?

- A) 5
- B) 6.5
- C)  $\sqrt{40}$
- D)  $\sqrt{50}$

28

Two different points on a number line are both 3 units from the point with coordinate  $-4$ . The solution to which of the following equations gives the coordinates of both points?

- A)  $|x + 4| = 3$
- B)  $|x - 4| = 3$
- C)  $|x + 3| = 4$
- D)  $|x - 3| = 4$



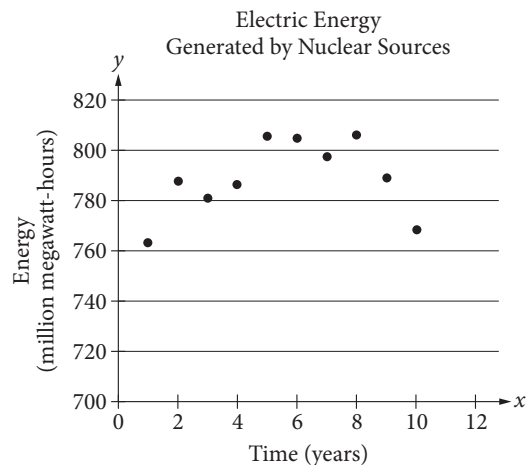
29

A motor powers a model car so that after starting from rest, the car travels  $s$  inches in  $t$  seconds, where  $s = 16t\sqrt{t}$ . Which of the following gives the average speed of the car, in inches per second, over the first  $t$  seconds after it starts?

- A)  $4\sqrt{t}$
- B)  $16\sqrt{t}$
- C)  $\frac{16}{\sqrt{t}}$
- D)  $16t$

30

The scatterplot below shows the amount of electric energy generated, in millions of megawatt-hours, by nuclear sources over a 10-year period.



Of the following equations, which best models the data in the scatterplot?

- A)  $y = 1.674x^2 + 19.76x - 745.73$
- B)  $y = -1.674x^2 - 19.76x - 745.73$
- C)  $y = 1.674x^2 + 19.76x + 745.73$
- D)  $y = -1.674x^2 + 19.76x + 745.73$

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \odot & \odot & \odot & \odot \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$				Answer: 2.5			
	7	/	12		2	.	5
	⊙	⊙	⊙		⊙	⊙	⊙
	0	0	0		0	0	0
①	①	⊙	①	①	①	①	①
②	②	⊙	⊙	②	⊙	②	②
③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⊙
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⊙	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2 / 3				.666				.667					
	2	/	3		.	6	6	6		.	6	6	7
	⊙	⊙	⊙		⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙
	0	0	0		0	0	0		0	0	0		
①	①	⊙	①	①	①	①	①	①	①	①	①		
②	⊙	②	②	②	②	②	②	②	②	②	②		
③	③	③	⊙	③	③	③	③	③	③	③	③		
④	④	④	④	④	④	④	④	④	④	④	④		
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤		
⑥	⑥	⑥	⑥	⑥	⊙	⊙	⊙	⑥	⊙	⊙	⑥		
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⊙		
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧		
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨		

Answer: 201 – either position is correct

2 0 1				2 0 1			
	2	0	1		2	0	1
	⊙	⊙	⊙		⊙	⊙	⊙
	0	⊙	0		⊙	0	0
①	①	①	⊙	①	①	⊙	①
②	⊙	②	②	⊙	②	②	②
③	③	③	③	③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

A group of friends decided to divide the \$800 cost of a trip equally among themselves. When two of the friends decided not to go on the trip, those remaining still divided the \$800 cost equally, but each friend's share of the cost increased by \$20. How many friends were in the group originally?

32

$$2(5x - 20) - (15 + 8x) = 7$$

What value of  $x$  satisfies the equation above?



33

A laboratory supply company produces graduated cylinders, each with an internal radius of 2 inches and an internal height between 7.75 inches and 8 inches. What is one possible volume, rounded to the nearest cubic inch, of a graduated cylinder produced by this company?

34

In the  $xy$ -plane, the graph of  $y = 3x^2 - 14x$  intersects the graph of  $y = x$  at the points  $(0, 0)$  and  $(a, a)$ . What is the value of  $a$  ?





35

The line with the equation  $\frac{4}{5}x + \frac{1}{3}y = 1$  is graphed in the  $xy$ -plane. What is the  $x$ -coordinate of the  $x$ -intercept of the line?

36

	Masses (kilograms)					
Andrew	2.4	2.5	3.6	3.1	2.5	2.7
Maria	$x$	3.1	2.7	2.9	3.3	2.8

Andrew and Maria each collected six rocks, and the masses of the rocks are shown in the table above. The mean of the masses of the rocks Maria collected is 0.1 kilogram greater than the mean of the masses of the rocks Andrew collected. What is the value of  $x$  ?



37

Jeremy deposited  $x$  dollars in his investment account on January 1, 2001. The amount of money in the account doubled each year until Jeremy had 480 dollars in his investment account on January 1, 2005. What is the value of  $x$  ?

38

A school district is forming a committee to discuss plans for the construction of a new high school. Of those invited to join the committee, 15% are parents of students, 45% are teachers from the current high school, 25% are school and district administrators, and the remaining 6 individuals are students. How many more teachers were invited to join the committee than school and district administrators?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**

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# **Answer Explanations**

## **SAT<sup>®</sup> Practice Test #6**

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## Answer Explanations

# SAT Practice Test #6

### Section 1: Reading Test

#### QUESTION 1

**Choice C is the best answer.** In the first paragraph the reader is introduced to Nawab, a father of twelve daughters who feels compelled to make more money to care for his family: “he must proliferate his sources of revenue” (lines 6-7). The remainder of the paragraph focuses on the way Nawab attempts to “proliferate” those income sources by identifying some of the moneymaking schemes Nawab undertakes, including setting up a flour mill and a fish farm and attempting to fix both radios and watches.

Choice A is incorrect because even if the first paragraph does indicate that Nawab is willing to work hard to take care of his family, it does not specifically address how he interacts with his daughters emotionally. Choice B is incorrect because the first paragraph describes some of Nawab’s activities but not the specifics of his schedule. Choice D is incorrect because the first paragraph introduces Harouni as Nawab’s employer but does not describe his lifestyle.

#### QUESTION 2

**Choice B is the best answer.** The passage states that Nawab earned “more kicks than kudos” (line 16) for his failed attempts at fixing watches. In the context of not doing a job well, this means Nawab was not given compliments (“kudos”) for his efforts but complaints (“kicks”) about them.

Choices A and D are incorrect because the passage clearly states that Nawab was not successful fixing watches, which earned him a negative response (“kicks,” or complaints). In this context it would be illogical to suggest that Nawab’s unsuccessful efforts at fixing watches would result in the sort of positive response implied by choice A (“thrills”) or choice D (“interests”). Choice C is incorrect because even though “jolts” might be unpleasant, they’re not the kind of negative response one would get instead of compliments.

#### QUESTION 3

**Choice D is the best answer.** The passage states that Nawab works “like an engineer tending the boilers on a foundering steamer in an Atlantic gale” (lines 26-28) in his attempts to keep his employer comfortable. The author likely uses this image because it highlights the challenging nature of Nawab’s work—work that is described in the next sentence as requiring “superhuman efforts” (line 28).

Choices A, B, and C are incorrect because the author's use of the image of an engineer working hard on a "foundering steamer" describes the effort Nawab is making in keeping his employer comfortable, not what Nawab might be dreaming about, anything to do with tube wells (which are not mentioned in the second paragraph), or that Nawab has had many different jobs in his life.

#### QUESTION 4

**Choice A is the best answer** because lines 28-32 show that Nawab is an efficient employee, stating that due to his "superhuman efforts," Nawab is able to keep his employer comfortable, or in almost "the same mechanical cocoon . . . that the landowner enjoyed in Lahore."

Choice B is incorrect because lines 40-42 describe the actions of Nawab's employer only and do not address the employer's feelings about Nawab's work. Choice C is incorrect because lines 46-49 show Nawab characterizing himself as an old and ineffective employee, not one who performs his job well. Choice D is incorrect because line 58 addresses the fact Nawab had always lived in his employer's household but not his effectiveness as an employee.

#### QUESTION 5

**Choice C is the best answer.** The main purpose of Nawab's comments in lines 43-52 is to highlight the labor and service he has provided for Harouni over the years. Nawab says "there is but one man, me, your servant" to take care of the tube wells on all Harouni's vast lands and that the extensive work has resulted in Nawab earning gray hairs on his employer's behalf.

Choice A is incorrect because even though lines 43-52 initially highlight the vastness of Harouni's lands, those lines primarily focus on Nawab's dedication and service to Harouni. Choice B is incorrect because lines 43-52 emphasize not that Nawab is competent and reliable but that Nawab feels he is no longer able to adequately fulfill his duties. Choice D is incorrect because in lines 43-52, Nawab doesn't say he intends to quit his job, asking instead only for help doing it.

#### QUESTION 6

**Choice D is the best answer.** In lines 61-62, Nawab says to his employer that he "cannot any longer bicycle about like a bridegroom from farm to farm." In this context, Nawab uses the word "bridegroom" to imply he is no longer a young man who can easily travel such great distances on his bike.

Choices A, B, and C are incorrect because in the context of Nawab not being able to bike so far, he uses the word "bridegroom" to imply that he is no longer young, not that he is no longer in love (choice A), naive (choice B), or busy (choice C).

#### QUESTION 7



**Choice B is the best answer.** Harouni’s reaction to Nawab’s request for a new motorcycle can be found in lines 66-68, where the employer is said not to “particularly care one way or the other, except that it touched on his comfort—a matter of great interest to him.” For Harouni, in other words, the issue of Nawab getting a new motorcycle came down to what was best for Harouni, not what was best for Nawab.

Choice A is incorrect because in the passage Harouni is said not to be particularly impressed with how hard Nawab works; he cares about the issue of the motorcycle only in regard to its effect on his own comfort. Choice C is incorrect because Harouni is said to find Nawab’s speech not eloquent but “florid” (line 54), meaning flamboyant or ostentatious. Choice D is incorrect because Nawab does not threaten to quit his job but politely asks his employer to “let me go” (line 64).

### QUESTION 8

**Choice B is the best answer.** The previous question asks why Harouni purchases his employee Nawab a new motorcycle, with the correct answer (that Harouni did so because it was in his own best interest) supported in lines 66-68: “He didn’t particularly care one way or the other, except that it touched on his comfort—a matter of great interest to him.”

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about why Harouni buys Nawab a new motorcycle. Instead, they simply identify the issue (choice A), note that Harouni also gave Nawab money for gas (choice C), and show how the motorcycle affects Nawab’s side businesses (choice D).

### QUESTION 9

**Choice A is the best answer.** The passage states that Nawab’s new motorcycle leads to the “disgust of the farm managers” (line 74).

Choices B, C, and D are incorrect because the passage specifically says Nawab’s new motorcycle leads to the “disgust of the farm managers,” not their happiness (choice B), envy (choice C), or indifference (choice D).

### QUESTION 10

**Choice D is the best answer.** The passage specifically states what Nawab considers the greatest part of his getting a new motorcycle: “Best of all, now he could spend every night with his wife” (lines 81-82).

Choices A, B, and C are incorrect because the passage explicitly states that Nawab believes the best thing about his new motorcycle is that he can “spend every night with his wife,” not that people start calling him “Uncle” (choice A), that he is able to expand his business (choice B), or that he is able to educate his daughters (choice C).

### QUESTION 11

**Choice B is the best answer.** The passage states that historically, “newspapers such as *The Times* and broadcasters such as the BBC were widely regarded as the trusted shapers of authoritative agendas and conventional wisdom” (lines 27-30). But it goes on to say that “there is a growing feeling . . . that the news media should be ‘informative rather than authoritative’” (lines 70-73). Together these lines indicate the main purpose of the passage, which is to discuss how people’s perception of the news media is changing from its being an authoritative voice to simply an informative one.

Choice A is incorrect because the passage deals with changes in the way news is perceived but does not primarily focus on the technological changes that may have resulted in those or other changes. Choice C is incorrect because even if the passage implies that viewers might increasingly believe a journalist’s values can affect the news stories being produced, it does not provide specific examples of that happening. Choice D is incorrect because the passage begins with the simple sentence “The news is a form of public knowledge” (line 1) and makes no attempt to refute that claim.

## QUESTION 12

**Choice D is the best answer.** Although the passage initially states that traditional news authorities were once implicitly “trusted” (line 29) regarding the content they produced, it goes on to note that “as part of the general process of the transformation of authority . . . the demand has been for all authority to make explicit the frames of value which determine their decisions” (lines 33-38). The modern audience, in other words, wants to hear not only the stories a news organization produces but also the values that form the foundation of that organization’s beliefs.

Choices A, B, and C are incorrect because lines 33-38 make clear that the expectation traditional authorities now face is the need to “make explicit the frames of value which determine their decisions,” not that they shouldn’t be affected by commercial interests (choice A), that they should work for the common good (choice B), or that they should consider the context of public versus private knowledge (choice C).

## QUESTION 13

**Choice C is the best answer.** The previous question asks what expectation traditional authorities now face, with the answer being that they must make their perspectives or beliefs clear to the audience. This is supported in lines 33-38: “As part of the general process of the transformation of authority . . . the demand has been for all authority to make explicit the frames of value which determine their decisions.”

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about what expectation traditional authorities now face, instead contrasting private and public knowledge (choice A), explaining the complexity of news dissemination (choice B), and providing one way news has changed in modern times (choice D).

## QUESTION 14

**Choice C is the best answer.** In lines 23-25, the passage states that “there is not always common agreement about what the public needs to know.” In this context, a “common” agreement is a widespread one shared by many people.

Choices A, B, and D are incorrect because in the context of something shared by many people, the word “common” implies that it is widespread, not that it is plentiful or abundant (choice A), recognizable to others (choice B), or normal (choice D).

### QUESTION 15

**Choice B is the best answer.** Two quotes are provided in lines 43-53, one highlighting the way editors work differently in modern times due to the demands of the audience and one offering an opinion about the perceived negative effects of that new reality of news. Those extended quotations were added by the authors most likely because they provide concrete examples of how some journalists feel about modern news dissemination.

Choice A is incorrect because the two quotations provided in lines 43-53 are not contradictory: the first offers a description of how news editors work differently in modern times, and the second describes how certain changes might affect news stories or the audience. Choices C and D are incorrect because the two quotations illustrate how some feel about the way the dissemination of news might be changing and are not used to either criticize or make suggestions.

### QUESTION 16

**Choice A is the best answer.** The passage explains that although the major news organizations were once considered “trusted shapers” (line 29) of public knowledge, that perception is changing due to the “growing feeling . . . that the news media should be ‘informative rather than authoritative’; the job of journalists should be to ‘give the news as raw as it is, without putting their slant on it’; and people should be given ‘sufficient information’ from which ‘we would be able to form opinions of our own’” (lines 70-77). In other words, the audience now wants raw facts about the world, not facts constructed in support of a certain opinion.

Choice B is incorrect because the passage presents the public as wanting information without any slant on it, not as wanting only a limited amount of information. Choices C and D are incorrect because the passage does not specifically identify the public’s feelings about including quotations from authorities in news stories or how they would want journalists to handle private details that the subjects of news stories do not want revealed.

### QUESTION 17

**Choice D is the best answer.** The previous question asks what the public is beginning to believe should be avoided in news stories, with the answer being the personal opinions or feelings of journalists. This is supported in lines 70-77: “There is a growing feeling . . . that the news media should be ‘informative rather than authoritative’; the job of journalists should be to ‘give the news as raw as it is, without

putting their slant on it'; and people should be given 'sufficient information' from which 'we would be able to form opinions of our own.'"

Choices A, B, and C are incorrect because the lines cited do not support the answer that the modern public wants journalists to avoid personal judgments when telling news stories, instead contrasting personal or private knowledge with public knowledge (choice A), characterizing how trusted broadcasters were once viewed (choice B), and explaining how some professional journalists feel about the new reality of the news (choice C).

### QUESTION 18

**Choice A is the best answer.** In lines 73-75, the passage states the modern belief that "the job of journalists should be to 'give the news as raw as it is, without putting their slant on it.'" In this context, the word "raw" means unfiltered or in its most basic state.

Choices B, C, and D are incorrect because in the context of news without any "slant on it," the word "raw" implies something unfiltered, not something unprotected or uncovered (choice B), severe (choice C), or untried or unproven (choice D).

### QUESTION 19

**Choice A is the best answer.** The table shows that in 1985, 55% of respondents believed news organizations "get the facts straight," which was the highest percentage for that choice for any of the years provided.

Choices B, C, and D are incorrect because the table shows that the percentage of respondents who believed news organizations "get the facts straight" was smaller in 1992 (49%), 2003 (36%), and 2011 (25%) than in 1985 (55%).

### QUESTION 20

**Choice C is the best answer.** The table shows that from 2003 to 2007, the percentage of people who believed news organizations "get the facts straight" rose only minimally, from 36 to 39%, while their perception of the independence and fairness of those organizations changed not at all, remaining at 23% and 26%, respectively.

Choice A is incorrect because the table indicates viewers' perceptions of the accuracy of news organizations but does not identify how many inaccurate news stories there were in any of the years listed. Choice B is incorrect because the number of people who believe news organizations "tend to favor one side" did not double between 1992 and 2003, rising only from 63% to 66%. Choice D is incorrect because the table shows that between 2007 and 2011, people's perception of the accuracy of news organizations decreased rather than increased, dropping from 39% to 25%.

### QUESTION 21

**Choice C is the best answer.** The 2011 data in the table indicate that only 25% of respondents believed news organizations were accurate, 15% believed they were independent, and 16% believed they were fair. Combined, these data support the idea put forth in lines 69-70 that modern audiences are becoming skeptical of the authority of experts.

Choices A, B, and D are incorrect because the 2011 data in the table show the public's lack of faith in the accuracy, independence, and fairness of news organizations but do not indicate how politically involved that public was (choice A), demonstrate the claims of experts (choice B), or reveal the importance of viewer mouse clicks in modern news (choice D).

## QUESTION 22

**Choice B is the best answer.** The first paragraph of the passage identifies and describes "Texas gourd vines" (line 1), but the primary focus of the passage is introduced in the first sentence of the second paragraph: "In one recent study, Nina Theis and Lynn Adler took on the specific problem of the Texas gourd—how to attract enough pollinators but not too many beetles" (lines 17-20). The remainder of the passage focuses on describing the purpose, process, and results of the recent research done on those Texas gourd vines.

Choice A is incorrect because the passage doesn't focus on the assumptions behind a theory but rather on the way in which that theory was tested. Choice C is incorrect because the passage does not present much conflicting data; most of it supports the idea there can be too much fragrance for the Texas gourd vine. Choice D is incorrect because the passage explains the procedures used in a study were "very labor intensive" (line 58) but does not present them as particularly innovative.

## QUESTION 23

**Choice A is the best answer.** The passage says that to test their hypothesis, the scientists "planted 168 Texas gourd vines in an Iowa field" (lines 33-34) and then ultimately walked "from flower to flower, observing each for two-minute intervals" (lines 62-63). Because they gathered data by looking at and studying the plants in question, the scientists' research is best characterized as relying on direct observation.

Choices B, C, and D are incorrect because lines 62-63 make clear that the research emphasized direct observation, not historical data (choice B), expert testimony (choice C), or random sampling (choice D).

## QUESTION 24

**Choice D is the best answer.** The passage states that by using the smell of their nectar to lure pollinators like bees, Texas gourd vines are employing an "open communication network" that attracts "not just the good guys, but . . . also . . . the bad guys" (lines 7-10). Because cucumber beetles are then identified as some of "the very bad guys" (line 12) as far as the Texas gourd plant is concerned, it can be inferred that both the beetles and the bees are attracted to the same scent.

Choices A and C are incorrect because they are not supported by the text; the passage states that cucumber beetles “chew up pollen and petals” (lines 12-13) from the Texas gourd vines but not that those vines are their “primary” food source, and the passage does not address any effects, positive or negative, that cucumber beetles experience as a result of carrying bacterial wilt disease. Choice B is incorrect because the passage states that treating the Texas gourd vines with dimethoxybenzene led to “double the normal number of beetles” (lines 65-66) but that pollinators like bees “did not prefer” (line 67) the treated flowers, which implies that cucumber beetles are not less attracted but more attracted to dimethoxybenzene than honey bees are.

### QUESTION 25

**Choice C is the best answer.** The author indicates that it is reasonable to think that the Texas gourd plants might lure more pollinators if their smell was stronger. This is clear from lines 26-27, which state that “intuition suggests that more of that aroma should be even more appealing to bees.”

Choices A and D are incorrect because lines 26-27 support the idea that it was initially thought that Texas gourd vines could lure more pollinators through “more of that aroma,” not by lacking an aroma (choice A) or giving off a more varied aroma (choice D). Choice B is incorrect because bees are the only pollinators specifically discussed in the passage, and there is no suggestion that targeting other insects would attract more bees.

### QUESTION 26

**Choice A is the best answer.** The passage explains that as part of their research the scientists “made half the plants more fragrant by tucking dimethoxybenzene-treated swabs deep inside their flowers. Each treated flower emitted about 45 times more fragrance than a normal one” (lines 35-39). In this context, a flower that was “treated” would be one that was changed or altered.

Choices B, C, and D are incorrect because in the context of a flower having a compound like dimethoxybenzene added to it, the word “treated” means changed or altered, not returned to normal (choice B), given (choice C), or kept for future use (choice D).

### QUESTION 27

**Choice D is the best answer.** In the passage Theis surmises that honey bees were likely repelled not by the enhanced fragrance of the dimethoxybenzene-treated flowers but “by the abundance of beetles” (lines 71-72) found on them. She was able to make that assumption because the honey bees were able to choose between both normal flowers and fragrance-enhanced flowers without any beetles on them, because one of the parameters of the research was that “every half hour throughout the experiments, the team plucked all the beetles off of half the fragrance-enhanced flowers and half the control flowers, allowing bees to respond to the blossoms with and without interference by beetles” (lines 45-50).

Choice A is incorrect because the passage states only that the scientists observed the bees and beetles on the flowers as soon as they opened (lines 59-61), not both before and after they opened. Choice B is

incorrect because although the passage does state that the experiment only took place during the “August flowering season” (line 35), it doesn’t state that this was a variable in the experiment or had any effect on it. Choice C is incorrect because comparing gourds based on the type of pollination is not related to the issue of what repelled bees from the fragrance-enhanced plants.

### QUESTION 28

**Choice A is the best answer.** The previous question asks what Theis and Adler did to allow Theis to theorize that the bees were repelled not by the enhanced fragrance of certain flowers but by the excessive number of beetles on them, with the answer (they give the bees the chance to visit both normal and fragrance-enhanced flowers that did not have beetles on them) being supported in lines 45-50: “So every half hour throughout the experiments, the team plucked all the beetles off of half the fragrance-enhanced flowers and half the control flowers, allowing bees to respond to the blossoms with and without interference by beetles.”

Choices B, C, and D are incorrect because the lines cited do not support the answer to the previous question about what allowed Theis and Adler to theorize that the bees were repelled not by fragrance but by insects, instead highlighting a variable that didn’t directly address the effect of fragrance on bees (choice B), describing the timing of one of the steps undertaken in the experiment (choice C), and discussing an aspect of gourd growth that was not related to the question of why bees may or may not have wanted to visit fragrance-enhanced flowers (choice D).

### QUESTION 29

**Choice A is the best answer.** The first six paragraphs (lines 1-64) of the passage introduce a plant (the Texas gourd vine) and its problem (luring enough insects to pollinate it but not too many of those that will harm it) and then describe a study undertaken to deal with “the specific problem of the Texas gourd—how to attract enough pollinators but not too many beetles” (lines 18-20). After the specifics of that experiment are described in detail, the results are explained and summarized in the seventh and eighth paragraphs (lines 65-84): “What they saw was double the normal number of beetles. . . . Squash bees were indifferent, and honey bees visited enhanced flowers less often. . . . That added up to less reproduction for fragrance-enhanced flowers” (lines 65-76).

Choice B is incorrect because Theis and Adler’s hypothesis (that more fragrance would make the flowers “even more appealing to bees,” line 27) is found in the third paragraph (lines 26-40). Choice C is incorrect because Theis and Adler’s methods are described in the third through sixth paragraphs (lines 26-64), not the seventh and eighth (lines 65-84). Choice D is incorrect because the seventh and eighth paragraphs detail the results in an experiment but do not focus on the researchers’ reasoning.

### QUESTION 30

**Choice B is the best answer.** To be “indifferent” is to be apathetic, or without care or concern. In the context of an experiment that tested whether or not insects preferred normally scented flowers or ones

with enhanced fragrance, describing the squash bees as “indifferent” implies they did not care about the scents and were equally drawn to both types of flowers.

Choice A is incorrect because “indifference” suggests the amount of concern one has about something but not anything to do with physical capabilities (such as being able to distinguish between the flowers). Choice C is incorrect because “indifference” suggests that one has no preference. Choice D is incorrect because the squash bees are said to be “indifferent” to certain flowers based on their fragrance, not on the number of beetles that may or may not be on them.

### QUESTION 31

**Choice B is the best answer.** Theis and Adler’s research clearly provided an answer to the question of why there is an upper limit on the intensity of the aroma emitted by Texas gourd plants, as their experiment was described as being able to “provide a reason that Texas gourd plants never evolved to produce a stronger scent” (lines 85-86).

Choice A is incorrect because Theis and Adler’s research was not able to show how to increase pollinator visits to the Texas gourd vine, as the results of their experiment showed that “pollinators, to their surprise, did not prefer the highly scented flowers” (lines 67-68). Choice C is incorrect because Theis and Adler’s research was not able to explain how hand pollination rescued fruit weight, a finding the passage describes as “a hard-to-interpret result” (line 83). Choice D is incorrect because the passage never indicates that the flowers stop producing fragrance when beetles are present.

### QUESTION 32

**Choice D is the best answer.** The previous question asks what question from among the answer choices Theis and Adler’s research was able to answer regarding Texas gourd vines. The answer (they determined why there was an upper limit to the amount of fragrance produced) is supported in lines 85-86: “The new results provide a reason that Texas gourd plants never evolved to produce a stronger scent.”

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question about what Theis and Adler’s research revealed about Texas gourd vines, instead explaining the goal of the experiment undertaken (choice A), identifying some of the fragrance compounds found in the plant’s aroma (choice B), and describing results related to hand pollination rather than fragrance (choice C).

### QUESTION 33

**Choice B is the best answer.** In Passage 1, Lincoln asserts that citizens of the United States should never break the laws of their land, for any reason, because to do so undermines the nation’s values. This is clearly demonstrated when he says, “let every man remember that to violate the law, is to trample on the blood of his father, and to tear the character of his own, and his children’s liberty” (lines 9-12).



Choice A is incorrect because Lincoln says that bad laws “should be repealed as soon as possible” (line 30), not that breaking the law would slow their repeals. Choice C is incorrect because Lincoln says that “there is no grievance that is a fit object of redress by mob law” (lines 36-37) but doesn’t argue that breaking the law will lead to mob rule. Choice D is incorrect because in his speech Lincoln doesn’t discuss divisions between social groups.

### QUESTION 34

**Choice A is the best answer.** The previous question asks what Lincoln believes is the result of breaking the laws, with the answer being that such actions undermine a nation’s values. This is supported in lines 9-12: “let every man remember that to violate the law, is to trample on the blood of his father, and to tear the character of his own, and his children’s liberty.”

Choices B, C, and D are incorrect because the lines cited do not support the answer to the previous question regarding what Lincoln contends happens when citizens break the law, instead explaining exactly which groups Lincoln believes should vow to follow the laws (choice B), illustrating how Lincoln believes unjust laws should be dealt with (choice C), and stating Lincoln’s belief that no law is ever improved through mob rule (choice D).

### QUESTION 35

**Choice D is the best answer.** In lines 24-25, Lincoln says, “I so pressingly urge a strict observance of all the laws.” In this context, the word “urge” most nearly means advocate, because when Lincoln urges people to obey the laws, he is pleading in favor of them doing so.

Choices A and C are incorrect because in the context of lines 24-25 (“I so pressingly urge a strict observance of all the laws”), to urge that laws be followed is to advocate for them to be obeyed, not to speed up such adherence (choice A) or make such adherence necessary (choice C). Choice B is incorrect because Lincoln is asking people to follow the laws but not directly causing people to obey them.

### QUESTION 36

**Choice D is the best answer.** After advocating for citizens “never to violate in the least particular, the laws of the country” (lines 3-4), Lincoln begins the second paragraph by making another point: “When I so pressingly urge a strict observance of all the laws, let me not be understood as saying there are no bad laws, nor that grievances may not arise, for the redress of which, no legal provisions have been made” (lines 24-28). This sentence is an attempt on Lincoln’s part to make clear what could be a misunderstanding of his position (“let me not be understood”) and to correct that possible misunderstanding. Lincoln doesn’t want people to believe he is saying all laws are always good, but rather that those laws need to be followed as long as they are on the books.

Choices A and B are incorrect because the sentence in lines 24-28 does not raise and refute a possible counterargument to Lincoln's argument or identify a shortcoming of his argument, but rather it is an attempt on Lincoln's part to make sure he is not misunderstood. Choice C is incorrect because that sentence does not acknowledge and provide support for a central assumption of Lincoln's argument but looks at a different aspect of the issue.

### QUESTION 37

**Choice A is the best answer.** In the passage Lincoln states his belief that any laws that "continue in force, for the sake of example, they should be religiously observed" (lines 31-32). In this context, "observed" most nearly means followed, as Lincoln is urging citizens to heed or follow the country's laws.

Choices B, C, and D are incorrect because in the context of Lincoln advocating that laws be religiously "observed," he means those laws should be followed, not that they should be studied closely (choice B), considered at length (choice C), or merely recognized (choice D).

### QUESTION 38

**Choice D is the best answer.** Passage 2 begins with Thoreau's statement that "unjust laws exist" (line 45). His philosophy regarding how to deal with those unjust laws is evident in lines 58-59: "If the injustice is part of the necessary friction of the machine of government, let it go, let it go." Thoreau believes, in other words, that some injustices are an unfortunate part of normal governance and just need to be endured ("let it go, let it go").

Choice A is incorrect because Thoreau does not say some unjust aspects of government can be fixed easily or that they are merely superficial. Choice B is incorrect because Thoreau does not argue that such injustices are subtle and should be studied, but rather that in certain cases it is best to "let it go, let it go" (line 59), while in other cases one should act or "break the law" (line 66). Choice C is incorrect because Thoreau does not say that any such unjust aspects of government are beneficial or helpful.

### QUESTION 39

**Choice C is the best answer.** The previous question asks what Thoreau feels about some unjust aspects of government, with the answer being that he finds them inevitable and something that needs to be endured. This is supported in lines 58-59: "If the injustice is part of the necessary friction of the machine of government, let it go, let it go."

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about Thoreau's thoughts regarding certain injustices in government, instead asking a theoretical question about how one should respond to unjust laws (choice A), providing an observation about how some view acting out against unjust laws (choice B), and acknowledging that in some questions of conscience, one may or may not choose to act (choice D).

## QUESTION 40

**Choice C is the best answer.** In Passage 1, Lincoln makes clear his belief that individuals should always heed the laws: “Let every American . . . swear . . . never to violate in the least particular, the laws of the country” (lines 1-4). Even bad laws, he states, “while they continue in force, for the sake of example, they should be religiously observed” (lines 30-32). In Passage 2, Thoreau is less rigid in his beliefs regarding the need for individuals to heed the laws of the country, arguing at times that some laws should be broken: “but if it is of such a nature that it requires you to be the agent of injustice to another, then, I say, break the law” (lines 64-66). While Lincoln and Thoreau can therefore be said to disagree about the moral imperative to follow existing laws, both passages advance an opinion regarding the need to follow or not follow all of the country’s laws.

Choice A is incorrect because the passages are not making arguments about differences between legal duties and moral imperatives but rather are addressing the need to follow (or not) the laws of a land. Choice B is incorrect. Both passages address the question of changing existing laws in the United States, but that is only a minor part of what is a greater debate about the need to follow or not follow existing laws. Choice D is incorrect because neither passage addresses the standards for determining whether or not laws are just, only whether laws should be heeded or not.

## QUESTION 41

**Choice B is the best answer.** In Passage 2, Thoreau says that if a law “is of such a nature that it requires you to be the agent of injustice to another, then, I say, break the law” (lines 64-66). It is clear from Passage 1 that Lincoln would reject this stance, as he says individuals should never break the law (“Let every American . . . swear . . . never to violate in the least particular, the laws of the country,” lines 1-4) and should wait for a bad law to be repealed (“bad laws, if they exist, should be repealed . . . still while they continue . . . they should be religiously observed,” lines 29-32).

Choices A and C are incorrect because in Passage 1, Lincoln is absolutely clear that all laws “should be religiously observed” (line 32); he does not describe anyone’s suggestion to break the law as either excusable (choice A) or honorable (choice C). Choice D is incorrect because it is not supported by the passage, as Lincoln does not discuss the core principles of the Constitution in Passage 1.

## QUESTION 42

**Choice D is the best answer.** In Passage 1, Lincoln uses abolitionism solely as an example to illustrate the argument he is making about heeding the law: “In any case that arises, as for instance, the promulgation of abolitionism, one of two positions is necessarily true” (lines 37-39). In Passage 2, Thoreau does the same thing by noting that “those who call themselves Abolitionists should at once effectually withdraw their support . . . from the government” (lines 79-82). Although Lincoln and Thoreau use the cause of abolitionism to argue different points, a commonality they share is that neither embraces the cause personally in the passage; Lincoln simply uses it as an example (“as for instance”) while Thoreau specifically talks of *other people* “who call themselves Abolitionists.”

Choice A is incorrect because in Passage 1, Lincoln argues against drastic action, saying that even in the case of abolitionism, such a response is not “necessary, justifiable, or excusable” (line 44). Choice B is incorrect because it’s not accurate to say abolitionism was central to the arguments, only that each used that subject as an example. Choice C is incorrect because neither Lincoln nor Thoreau offers an opinion about whether or not abolitionism will gain widespread acceptance, instead they incorporate it only as an example in their discussions of just and unjust laws.

### QUESTION 43

**Choice C is the best answer.** In lines 10-17, the passage illustrates how the cost of solar energy has dropped in recent years: “A few years ago, silicon solar panels cost \$4 per watt. . . . ‘Now it’s down to something like 50 cents a watt, and there’s talk of hitting 36 cents per watt.’” In lines 44-47, the passage describes some of the new technology that exists in the field: “Meanwhile, researchers at the National Renewable Energy Laboratory have made flexible solar cells on a new type of glass from Corning called Willow Glass, which is thin and can be rolled up.” Overall, the passage can be regarded as an objective overview of the solar panel industry delivered by a journalist covering the field.

Choices A and D are incorrect because the author does not present himself as either a consumer who plans to buy solar panels or a hobbyist with a personal interest in solar panel technology. Rather, the author focuses on developments in solar technology. Choice B is incorrect because the passage does not discuss research methods used in the solar panel field but rather the technologies that exist in the field.

### QUESTION 44

**Choice A is the best answer.** In the context of describing the solar panel manufacturing industry as being “in the doldrums because supply far exceeds demand” (lines 2-3), saying it is currently a “poor” market implies it is a weak, or slow, market.

Choices B, C, and D are incorrect because in the context of describing the solar panel manufacturing industry as being “in the doldrums,” saying it is a poor market implies it is a weak market, not a modest one (choice B), a pathetic one (choice C), or an outdated one (choice D).

### QUESTION 45

**Choice C is the best answer.** It can reasonably be inferred that much of the solar panel industry believes current solar technology is too expensive and inefficient because the passage states that the industry has been working to improve those two things: “All parts of the silicon solar panel industry have been looking for ways to cut costs and improve the power output of solar panels, and that’s led to steady cost reductions” (lines 27-30).

Choice A is incorrect because the passage explains how solar panels work but never states or implies that consumers do not understand the technology. Choice B is incorrect because while the passage explains how two-sided solar cells can increase solar electric output, it does not suggest that they have

any existing or possible weaknesses. Choice D is incorrect because the passage characterizes Willow Glass as entirely promising and doesn't imply that it is not efficient enough to be marketed.

#### QUESTION 46

**Choice D is the best answer.** The previous question asks what can be inferred from the passage about beliefs in the solar panel industry, with the answer being that many in the industry believe current solar technology is too expensive and too inefficient. This is supported in lines 27-30: "All parts of the silicon solar panel industry have been looking for ways to cut costs and improve the power output of solar panels, and that's led to steady cost reductions."

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question, which is that much of the solar panel industry believes current solar technology is too expensive and inefficient. Choice A highlights the industry's current limited sales. Choice B addresses the high cost of solar panels but not their inefficiency. Choice C addresses a potential decrease in the cost of solar panels and does not mention efficiency.

#### QUESTION 47

**Choice B is the best answer.** The passage clearly states how two-sided solar panels will increase the efficiency of solar electricity units, explaining that they will be able to absorb excess reflected light, especially if those panels are built on sand: "That light reflects onto the back of the panels and could be harvested to increase the power output" (lines 61-62).

Choices A, C, and D are incorrect because the passage explains only that two-sided solar panels can raise efficiency by harvesting reflected light, not that they can raise efficiency because they take little energy to operate (choice A), are cost-effective (choice C), or keep sunlight from reaching the ground (choice D).

#### QUESTION 48

**Choice B is the best answer.** The previous question asks how two-sided solar panels can raise the efficiency of solar electricity units, with the answer being they can increase solar power input by catching excess reflected light. This is supported in lines 61-62: "That light reflects onto the back of the panels and could be harvested to increase the power output."

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about how two-sided solar panels can raise the efficiency of solar electricity units, instead highlighting that some sunlight is missed by current units (choice A), explaining why two-sided solar panels work well in sand (choice C), and projecting how much more effective those two-sided solar panels could be (choice D).

#### QUESTION 49

**Choice D is the best answer.** In lines 69-71, the passage states that “even longer-term, Green is betting on silicon, aiming to take advantage of the huge reductions in cost already seen with the technology.” In this context, the phrase “betting on” most nearly means “optimistic about,” as the sentence implies that Green has positive expectations for silicon use now and in the future.

Choice A is incorrect because “dabbling in” a subject implies being only minimally involved with it, but in lines 69-71, Green is shown to be committed to silicon use. Choice B is incorrect because in this context the phrase “betting on” is figurative and implies believing in something, not actually being involved with games of chance. Choice C is incorrect because Green is said to want to “take advantage” of silicon use, meaning he does not intend to switch from it.

### QUESTION 50

**Choice B is the best answer.** The passage concludes by stating that “the challenge is to produce good connections between these semiconductors, something made challenging by the arrangement of silicon atoms in crystalline silicon” (lines 81-84). As this last sentence identifies an issue the solar panel industry still faces, and describes it as a “challenging” one at that, it mainly serves to identify a problem or hurdle that must be dealt with by the industry.

Choices A, C, and D are incorrect because the main point of the passage’s last sentence is that there is a “challenge” or hurdle that the solar panel industry has to deal with; it doesn’t express concerns about what a material won’t be able to do (choice A), make predictions (choice C), or introduce a new idea for study (choice D).

### QUESTION 51

**Choice D is the best answer.** Figure 2 shows that in 2009, the US average electricity cost per megawatt-hour (MWh) was \$120. Of the projected 2017 energy costs for fuels listed in figure 1, the one closest to the 2009 US average electricity cost 120 dollars per megawatt-hour is the projected cost of advanced nuclear energy, estimated at just below 125 dollars per megawatt-hour.

Choices A, B, and C are incorrect because figure 1 shows the projected energy costs of natural gas, wind (onshore), and conventional coal as just below 75 dollars per megawatt-hour, 100 dollars per megawatt-hour, and approximately 105 dollars per megawatt-hour, respectively. None of these costs is as close to the 2009 US average electricity cost of 120 dollars per megawatt-hour as the projected 2017 cost of advanced nuclear energy, which is just below 125 dollars per megawatt-hour.

### QUESTION 52

**Choice B is the best answer.** Figure 2 shows that the dropping cost of solar photovoltaic power per megawatt-hour is projected to intersect with the 2009 US average electricity cost of 120 dollars per megawatt-hour in the year 2020.

Choice A is incorrect because figure 2 projects that the solar photovoltaic cost per megawatt-hour in 2018 will be approximately \$140, which is more than the 2009 US average electricity cost of 120 dollars per megawatt-hour. Choices C and D are incorrect because figure 2 projects that the solar photovoltaic cost per megawatt-hour will be around \$90 in 2025 and \$70 in 2027, both of which are less than the 2009 US average electricity cost of 120 dollars per megawatt-hour.

## Section 2: Writing Test

### QUESTION 1

**Choice D is the best answer** because a comma is needed to separate the main independent clause (“In the winter . . . Lake 227”) from the dependent clause that describes the lake. The pronoun “one” is used correctly to refer to its antecedent “Lake 227.”

Choice A is incorrect because it creates a comma splice (two independent clauses joined by only a comma). Choices B and C are incorrect because in both choices the information that follows the period is not in the form of a complete sentence.

### QUESTION 2

**Choice A is the best answer** because the comma is used correctly to separate the introductory dependent clause (“While . . . irresponsible”) from the independent clause that follows it.

Choices B, C, and D are incorrect because the comma in each is misplaced. Choices B and D lack a comma where one is needed after the dependent clause (“While . . . irresponsible”). In choice C, while a comma is provided after “irresponsible,” there is an unnecessary comma after “and.”

### QUESTION 3

**Choice D is the best answer** because it most clearly and concisely combines the sentences using the correct punctuation. This choice eliminates unnecessary words, and the commas are placed correctly between the clauses.

Choice A is incorrect because the phrase “the result being that it” is wordy and could be replaced with the single word “which.” Choice B is incorrect because the words “algal blooms cause oxygen depletion” need not be repeated. Choice C is incorrect because there is unnecessary repetition of the words “oxygen depletion” and “algal blooms.”

### QUESTION 4

**Choice B is the best answer** because the colon is used properly to introduce an independent clause (“it was . . . Erie”) that explains or elaborates on the information that came before in the sentence.

Choice A is incorrect because the colon is misplaced. It should be placed after the word “green,” not after “with.” Choice C is incorrect because the dash is not placed correctly. If it were placed after the word “green,” it could be used. Choice D is incorrect because the comma creates a comma splice. A comma cannot be used without a conjunction to join two independent clauses.

### QUESTION 5

**Choice C is the best answer** because it contains the best transition between the two paragraphs. The previous paragraphs describe an experiment that Schindler and Brunskill conducted in Lake 227. This paragraph is about an experiment they performed in Lake 226. Only choice C provides a transition that introduces the new experiment performed in Lake 226.

Choice A is incorrect because it contains no specific reference to the previous paragraph and is too general to be tied to this paragraph. Choices B and D are incorrect because they contain unnecessary details that do not connect the ideas in the paragraphs.

### QUESTION 6

**Choice B is the best answer** because it is concise. It does not repeat the idea of addition.

Choices A, C, and D are incorrect because they are repetitive. The conjunction “and” is sufficient after “they added just nitrates” to indicate that “a source of carbon” was also added. Choice A needlessly contains “was added.” In choice C “plus also” and in choice D “also adding” are similarly repetitive.

### QUESTION 7

**Choice A is the best answer** because the singular past tense verb “was teeming” agrees in number with the singular subject “half” and is consistent with the other past tense verbs in the paragraph.

Choices B and C are incorrect because they contain plural verbs instead of the singular one that is needed to agree with the singular subject “half.” Choice D is incorrect because it contains a present tense verb that is inconsistent with the past tense verbs in the paragraph.

### QUESTION 8



**Choice C is the best answer** because the verb “published” most effectively indicates the relationship between research findings and a journal, *Science*. Scientific research is published in scientific journals.

Choices A, B, and D are incorrect because they don’t feature the specific vocabulary required, and the tone of the answer choices is too informal for the content of the passage.

### QUESTION 9

**Choice D is the best answer** because “subsequently” logically indicates that after the research demonstrated a clear correlation between the growth of blue-green algae and the introduction of phosphates into the water, Canadian legislators passed laws banning phosphates in laundry detergent.

Choices A, B, and C are incorrect because the transitional phrase “for example” and the conjunctive adverbs “similarly” and “however” do not indicate a logical relationship between what the research demonstrated and what the Canadian legislators did with that knowledge.

### QUESTION 10

**Choice B is the best answer** because it deals with a “policy outcome” related to the research. The adoption of legislation to reduce or eliminate phosphates in detergents is a policy outcome (a change in official policy concerning detergents) that was clearly informed by Schindler and Brunskill’s research.

Choices A, C, and D are incorrect because they do not mention legislation or policies that were adopted as a result of Schindler and Brunskill’s research on the effects of phosphates in laundry detergents.

### QUESTION 11

**Choice C is the best answer** because it offers a counterargument to the previous sentence’s claim in favor of “experiments like these.” Acknowledging that “scientists should not be allowed to randomly perform experiments on just any body of water” shows that the writer is aware of the potential problems with these experiments.

Choices A, B, and D are incorrect because none of them offers a counterargument. They all make factual statements.

### QUESTION 12

**Choice D is the best answer** because it correctly provides the plural noun “stages” and the singular possessive pronoun “its” (no apostrophe).

Choices A and C are incorrect because a possessive pronoun is needed to replace the proper noun “Tower of Pisa,” not the contraction “it’s.” Choices B and C are incorrect because there is no reason to make “stage” possessive; nothing belongs to it.

### QUESTION 13

**Choice A is the best answer** because the conjunctive adverb “indeed” appropriately points back to and elaborates on the fact provided in the previous sentence (that the Tower has been leaning from the very beginning).

Choices B, C, and D are incorrect because they do not accurately present the relationship between the first and second sentences. Choice B, “therefore,” indicates that what follows is a consequence of what came before. Choice C, “nevertheless,” and choice D, “however,” suggest that what follows contrasts with what was stated previously.

### QUESTION 14

**Choice B is the best answer** because the participle “attracting” introduces a dependent clause (“attracting . . . world”) that appropriately modifies the noun “icon.”

Choice A is incorrect because it creates a comma splice. A comma cannot be used without a conjunction to separate two independent clauses. Choice C is incorrect because the possessive pronoun “its” makes no sense in the context of the sentence. Choice D is incorrect because a semicolon is used to join two independent clauses, not an independent and a dependent clause.

### QUESTION 15

**Choice C is the best answer** because it would be appropriate to characterize a famous and unusual building like the Tower of Pisa as “one of the greatest architectural oddities in the world.”

Choices A, B, and D are incorrect. The words “weirdnesses,” “deviations,” and “abnormalities” would all result in inappropriate characterizations. The Tower is a beloved icon and tourist magnet; as such, it is more fitting to describe it as an architectural oddity than as an architectural weirdness, architectural deviation, or architectural abnormality.

### QUESTION 16

**Choice B is the best answer** because it confirms that the sentence should be added and provides the appropriate reason: it establishes a key shift in the passage between the introduction of the tower and the discussion of recent attempts to save it.

Choice A is incorrect because the suggested sentence does not repeat a previous idea. Choices C and D are incorrect because the sentence should be added. The suggested sentence does not contain irrelevant information that interrupts the flow of the paragraph, nor does it repeat information.

### QUESTION 17

**Choice A is the best answer** because the comma is used correctly after the prepositional phrase “in 1990” to introduce the independent clause “Italy’s government closed the tower. . . .”

Choices B and C are incorrect because each places a comma between the subject “government” and the verb “closed.” Choice D is incorrect because a comma can be used, but not a colon, after an introductory prepositional phrase.

### QUESTION 18

**Choice C is the best answer** because it supports the main point of the paragraph. The paragraph suggests that the committee’s goal was to maintain the tower’s “aesthetic” by reducing (but not eliminating) the tilt without ruining the tower’s appearance or causing it to fall.

Choices A, B, and D are incorrect because none of the choices supports the main point of the paragraph—the need to both keep the tower from falling and maintain its charming appearance. Choice A repeats an idea from earlier in the passage. Choices B and D provide information that is only loosely related to the paragraph’s discussion of efforts to save the tower.

### QUESTION 19

**Choice D is the best answer** because deleting “he is” eliminates the comma splice that exists in the original sentence. Two independent clauses cannot be joined by only a comma.

Choice A is incorrect because two independent clauses cannot be joined by only a comma. Choice B is incorrect because it creates a comma splice and also needlessly repeats Burland’s name. Choice C is incorrect because “his being” is unnecessary and unidiomatic in this context.

### QUESTION 20

**Choice D is the best answer** because the earlier phrase “a years-long process” is sufficient to indicate that Burland’s work spanned several years.

Choices A, B, and C are incorrect because they all repeat information provided in the earlier phrase “a years-long process.”

### **QUESTION 21**

**Choice A is the best answer** because the verb “advocated” and the participle “using” are appropriate in this context: “advocated” functions as the main verb and “using” introduces the clause that tells what Burland advocated.

Choices B and C are incorrect because they are unidiomatic. Choice D doesn’t provide a main verb necessary to create an independent clause before the semicolon.

### **QUESTION 22**

**Choice A is the best answer** because sentence 5 introduces Burland’s plan for using gravity to straighten the tower—a plan that is presented in detail in the subsequent sentences 2, 3, and 4.

Choices B and C are incorrect because if sentence 5 were to be placed after either sentence 2 or sentence 3, the sequencing and logic of the paragraph would be impaired. Choice D is incorrect because if sentence 5 were to be deleted, a key aspect of the plan—its use of gravity to straighten the tower—would never be mentioned. The reader would then have to infer what Burland was doing by “drilling out small amounts of soil from under the tower.”

### **QUESTION 23**

**Choice B is the best answer** because the main point of the paragraph is that the supply of physicians in the United States is not expected to keep up with the demand or need for them in the future. Choice B introduces the idea that it may become increasingly difficult for Americans to find a physician.

Choice A is not correct because it discusses “paramedics,” health care workers who are not mentioned elsewhere in the paragraph. Choice C is incorrect because it does not introduce the doctor shortage problem that is the main topic of the paragraph. Choice D is incorrect because the paragraph is not focused on the costs of health care.

### **QUESTION 24**

**Choice A is the best answer** because “keep pace” is an appropriate idiomatic expression that clearly indicates the writer’s concern that the supply of doctors won’t be able to match the growing demand for them.

Choices B, C, and D are incorrect because they are unidiomatic in the context of the sentence. The sentence discusses the mismatch between the “increased demand for care” and the limited “supply of physicians.” The writer is concerned with the extent to which supply can grow to meet the growth in demand—or, in other words, “keep pace” with increased demand. The phrases “maintain the tempo,” “get in line,” and “move along” are inappropriate to convey this idea.

### QUESTION 25

**Choice B is the best answer** because “bolstering” means supporting, which is appropriate in the context of “medical-college enrollments.” It makes sense in a discussion of a doctor shortage to mention the idea of providing support for enrollments—that is, maintaining and perhaps increasing the numbers of students enrolled in medical colleges.

Choices A and D are incorrect because they are excessively casual and unclear in context: it is not clear what it would mean for “medical-college enrollments” (the numbers of students enrolled in medical colleges) to be amped or revved up. Choice C is incorrect because it would be inappropriate to describe enrollments as being aroused.

### QUESTION 26

**Choice B is the best answer** because it provides an appropriate reason for adding the sentence. In context, the sentence sets up the “several factors” that follow in the paragraph: the services that a PA can provide, the monetary advantages associated with employing a PA, and the short training period required for becoming a PA.

Choice A is incorrect because the sentence does not introduce a counterargument; rather, it supports the claim made in the previous sentence. Choices C and D are incorrect because the sentence should be added.

### QUESTION 27

**Choice C is the best answer** because the plural possessive pronoun “their” correctly refers to its plural antecedent “PAs.”

Choice A is incorrect because the word “there” does not show possession and does not make sense in the context of the sentence. Choice B is incorrect because the contraction “they’re” does not show possession and does not make sense in the context of the sentence. Choice D is incorrect because the singular pronoun phrase “his or her” does not agree in number with the plural antecedent “PAs.”

### QUESTION 28

**Choice D is the best answer** because the comma is used correctly to separate the items in the list of jobs that PAs can perform.

Choice A is incorrect because a colon should not be used to separate items in a list. Choice B is incorrect because, while semicolons may be used to separate items in a list, they must be used consistently (that is, after “conditions” as well as after “surgeries”). Choice C is incorrect because a comma should not be used after the conjunction “and” in a list of items.

### QUESTION 29

**Choice B is the best answer** because the parentheses are used correctly to enclose information that is interesting but not essential to the sentence. If the parenthetical information were to be deleted, the sentence would still make sense.

Choice A is incorrect because a comma or other punctuation is necessary to separate “well compensated” from the nonessential clause “earning in 2012 a median annual salary of \$90,930.” Choice C is incorrect because a comma is necessary after “\$90,930” to set off the clause from the rest of the sentence. Choice D is incorrect because a colon is typically preceded by an independent clause and because a nonessential clause should be set off from the sentence by matching punctuation, such as two commas or parentheses.

### QUESTION 30

**Choice C is the best answer** because “that for” agrees with the singular antecedent “period” and compares two similar things: the training period for PAs and that (the training period) for physicians.

Choice A is incorrect because the plural pronoun “those” doesn’t agree with the singular antecedent “period.” Choice B is incorrect because “compared with” repeats the idea of comparison already provided in the word “shorter.” Choice D is incorrect because the underlined portion cannot be deleted without eliminating a necessary element in the comparison. A “training period” can’t be compared to “physicians.”

### QUESTION 31

**Choice A is the best answer** because the transitional phrase “in addition” correctly introduces another example of PAs’ “extraordinary contribution to rural health care.”

Choices B, C, and D are incorrect because they do not convey the appropriate relationship between ideas. In choice B, “Thus” does not make sense because the claim that PAs “provide a broader spectrum of such services” is not a result or consequence of the claim that they provide “cost-efficient, widely appreciated services.” Choices C and D, “despite this” and “on the other

hand,” incorrectly indicate that the claim about the “broader spectrum of such services” is in contrast to the previous claim rather than in addition to it.

### QUESTION 32

**Choice C is the best answer** because it gives an appropriate explanation for why the sentence should not be added. While relevant, the sentence does not accurately interpret the data in the table, which indicates that the number of physicians in 2025 will be 216,000 and the number of physician assistants will be 42,000.

Choices A and B are incorrect because the sentence incorrectly interprets the data in the table and should not be added. Choice D is incorrect because the sentence contains false information, not irrelevant information.

### QUESTION 33

**Choice D is the best answer** because the word “patients” correctly identifies the people served by PAs. Additionally, the comparative conjunction “than” is used correctly in the comparison introduced by the adverb “more.”

Choices A and B are incorrect because the noun “patience” refers to a human quality of tolerance or perseverance. It cannot be used to refer to people served by PAs. Choice C is incorrect because the word “then” refers to a time sequence or tells when something happened.

### QUESTION 34

**Choice B is the best answer** because it most effectively combines the underlined sentences. The introductory dependent clause clearly and concisely sets up the comparison between the “rebooting” of films and the reworking of comic books. It also provides a clear and logical referent for the phrase “This practice” in the second sentence.

Choices A, C, and D are incorrect because the combinations do not connect the two sentences logically and concisely to demonstrate the comparison between the “rebooting” of films and the reworking of comic books. In addition, none provides a clear and logical referent for the phrase “This practice” in the second sentence.

### QUESTION 35

**Choice B is the best answer** because the adjective “old” is used appropriately to describe a longstanding practice.

Choices A and D, “elderly” and “geriatric,” are incorrect in this context because they are generally used to refer to people, not to a practice. Choice C, “mature,” is incorrect because it does not fit the context of the sentence, which is about a longstanding practice, not a fully developed one.

### QUESTION 36

**Choice D is the best answer** because no punctuation is needed to set off the prepositional phrase “of publishers.”

Choices A and B are incorrect because neither a colon nor a comma is needed to separate the noun “example” from the prepositional phrase that describes it. Choice C is incorrect because no comma is needed to separate the noun “publishers” from the participle “responding” that describes it.

### QUESTION 37

**Choice A is the best answer** because the phrase “lift a car over his head” is consistent with the other examples of Superman’s superhuman physical abilities: “hurdle skyscrapers,” “leap an eighth of a mile,” etc.

Choices B, C, and D are incorrect because they are inconsistent with the other examples in the sentence of Superman’s superhuman physical abilities. Holding a job, wearing a costume, and living in a city describe the original Superman but do not characterize his physical abilities.

### QUESTION 38

**Choice D is the best answer** because it most effectively sets up the following sentences, which describe the “realistic” nature of superheroes in the Silver Age. According to these sentences, Silver Age superheroes dealt with everyday problems and had richer interior lives and more complex motivations than their Golden Age counterparts.

Choices A, B, and C are incorrect because neither “scientific experiments gone wrong,” conservatism in the United States in the 1950s, nor the influence of science fiction on comics is addressed in the following two sentences.

### QUESTION 39

**Choice D is the best answer** because it uses punctuation correctly. Because there is a dash between “them” and the verb “had,” another dash is required before “Spider-Man” to set off the nonessential clause “Spider-Man, the Fantastic Four, and the Hulk among them.” A



nonessential clause should be set off from the sentence by matching punctuation, such as two dashes or commas.

Choice A is incorrect because a colon needs to be preceded by an independent clause. Choice B is incorrect because, when used in this way, a semicolon needs to be preceded and followed by independent clauses. Choice C is incorrect because a comma and a dash cannot be used to enclose a nonessential clause. Two dashes or two commas should be used instead.

#### QUESTION 40

**Choice C is the best answer** because, as the only choice that focuses on Silver Age characters (“the upstarts”), it most logically completes the discussion of the Silver Age. It also provides an effective transition to the next paragraph: by indicating that “the Silver Age drew to a close,” it sets up the next paragraph’s discussion of the Bronze and other ages.

Choices A and D are incorrect because each focuses on Golden Age characters and thus fails to logically complete the discussion of the Silver Age. Choice B is incorrect because it prematurely discusses a topic that would be better addressed in the next paragraph.

#### QUESTION 41

**Choice A is the best answer** because the present perfect verb “have yielded” is used correctly to indicate that the action of the sentence began in the past and is ongoing in the present. In this case, the transformation of comics from the Silver Age to subsequent ages began in the past and continues today.

Choice B is incorrect because the verb “would have yielded” indicates that an action was possible but never happened. Choice C is incorrect because the past tense verb “were yielding” indicates that the action happened and ended in the past. Choice D is incorrect because the verb “will yield” means that the action will happen in the future, which is not necessarily true.

#### QUESTION 42

**Choice D is the best answer** because the possessive plural noun “Comics’” and adjective “superhero” appropriately indicate that the “superhero line” is a feature of the comics.

Choices A, B, and C are incorrect because the possessive singular noun “superhero’s” is not correctly used in the sentence. Nothing belongs to a singular “superhero” in the sentence. Furthermore, in choice B, the singular possessive noun “Comic’s” is used incorrectly since more than one comic is being referred to. In choice C, “Comics” is plural, but it needs to be possessive, too.

### QUESTION 43

**Choice A is the best answer** because the conjunctive adverb “then” correctly shows that given previously stated information, the conclusion that can be drawn is that the transition between the Golden and Silver Ages of comic books was more successful than others.

Choices B, C, and D are incorrect because they do not indicate the correct relationship between the information presented earlier and conclusions that can be drawn from the information. “However,” “nevertheless,” and “yet” are ordinarily used to indicate that in spite of some action, a different or unexpected result occurs.

### QUESTION 44

**Choice C is the best answer** because the singular pronoun “that” agrees in number with its singular antecedent “transition.”

Choices A and B are incorrect because the plural pronouns “those” and “these” do not agree with the singular antecedent “transition.” Additionally, choice B is incorrect because “these” implies that whatever is being referred to is at hand, not in the past. Choice D is incorrect because a pronoun is needed to complete the comparison of transitions between comic book ages.

## Section 3: Math Test - No Calculator

### QUESTION 1

**Choice B is correct.** The total amount  $T$ , in dollars, Salim will pay for  $n$  tickets is given by  $T = 15n + 12$ , which consists of both a per-ticket charge and a one-time service fee. Since  $n$  represents the number of tickets that Salim purchases, it follows that  $15n$  represents the price, in dollars, of  $n$  tickets. Therefore, 15 must represent the per-ticket charge. At the same time, no matter how many tickets Salim purchases, he will be charged the \$12 fee only once. Therefore, 12 must represent the amount of the service fee, in dollars.

Choice A is incorrect. Since  $n$  represents the total number of tickets that Salim purchases, it follows that  $15n$  represents the price, in dollars, of  $n$  tickets, excluding the service fee. Therefore, 15, not 12, must represent the price of 1 ticket. Choice C is incorrect. If Salim purchases only 1 ticket, the total amount, in dollars, Salim will pay can be found by substituting  $n = 1$  into the equation for  $T$ . If  $n = 1$ ,  $T = 15(1) + 12 = 27$ . Therefore, the total amount Salim will pay for one ticket is \$27, not \$12. Choice D is incorrect. The total amount, in dollars, Salim will

pay for  $n$  tickets is given by  $15n + 12$ . The value 12 represents only a portion of this total amount. Therefore, the value 12 does not represent the total amount, in dollars, for any number of tickets.

## QUESTION 2

**Choice B is correct.** Since Fertilizer A contains 60% filler materials by weight, it follows that  $x$  pounds of Fertilizer A consists of  $0.6x$  pounds of filler materials. Similarly,  $y$  pounds of Fertilizer B consists of  $0.4y$  pounds of filler materials. When  $x$  pounds of Fertilizer A and  $y$  pounds of Fertilizer B are combined, the result is 240 pounds of filler materials. Therefore, the total amount, in pounds, of filler materials in a mixture of  $x$  pounds of Fertilizer A and  $y$  pounds of Fertilizer B can be expressed as  $0.6x + 0.4y = 240$ .

Choice A is incorrect. This choice transposes the percentages of filler materials for Fertilizer A and Fertilizer B. Fertilizer A consists of  $0.6x$  pounds of filler materials and Fertilizer B consists of  $0.4y$  pounds of filler materials. Therefore,  $0.6x + 0.4y$  is equal to 240, not  $0.4x + 0.6y$ . Choice C is incorrect. This choice incorrectly represents how to take the percentage of a value mathematically. Fertilizer A consists of  $0.6x$  pounds of filler materials, not  $60x$  pounds of filler materials, and Fertilizer B consists of  $0.4y$  pounds of filler materials, not  $40y$  pounds of filler materials. Choice D is incorrect. This choice transposes the percentages of filler materials for Fertilizer A and Fertilizer B and incorrectly represents how to take the percentage of a value mathematically.

## QUESTION 3

**Choice C is correct.** For a complex number written in the form  $a + bi$ ,  $a$  is called the real part of the complex number and  $b$  is called the imaginary part. The sum of two complex numbers,  $a + bi$  and  $c + di$ , is found by adding real parts and imaginary parts, respectively; that is,  $(a + bi) + (c + di) = (a + c) + (b + d)i$ . Therefore, the sum of  $2 + 3i$  and  $4 + 8i$  is  $(2 + 4) + (3 + 8)i = 6 + 11i$ .

Choice A is incorrect and is the result of disregarding  $i$  and adding all parts of the two complex numbers together,  $2 + 3 + 4 + 8 = 17$ . Choice B is incorrect and is the result of adding all parts of the two complex numbers together and multiplying the sum by  $i$ . Choice D is incorrect and is the result of multiplying the real parts and imaginary parts of the two complex numbers,  $(2)(4) = 8$  and  $(3)(8) = 24$ , instead of adding those parts together.

## QUESTION 4

**Choice A is correct.** The right side of the equation can be multiplied using the distributive property:  $(px + t)(px - t) = p^2x^2 - ptx + ptx - t^2$ . Combining like terms gives  $p^2x^2 - t^2$ . Substituting this expression for the right side of the equation gives  $4x^2 - 9 = p^2x^2 - t^2$ , where  $p$  and  $t$  are

constants. This equation is true for all values of  $x$  only when  $4 = p^2$  and  $9 = t^2$ . If  $4 = p^2$ , then  $p = 2$  or  $p = -2$ . Therefore, of the given answer choices, only 2 could be the value of  $p$ .

Choices B, C, and D are incorrect. For the equation to be true for all values of  $x$ , the coefficients of  $x^2$  on both sides of the equation must be equal; that is,  $4 = p^2$ . Therefore, the value of  $p$  cannot be 3, 4, or 9.

### QUESTION 5

**Choice D is correct.** In the  $xy$ -plane, the graph of the equation  $y = mx + b$ , where  $m$  and  $b$  are constants, is a line with slope  $m$  and  $y$ -intercept  $(0, b)$ . Therefore, the graph of  $y = 2x - 5$  in the  $xy$ -plane is a line with slope 2 and a  $y$ -intercept  $(0, -5)$ . Having a slope of 2 means that for each increase in  $x$  by 1, the value of  $y$  increases by 2. Only the graph in choice D has a slope of 2 and crosses the  $y$ -axis at  $(0, -5)$ . Therefore, the graph shown in choice D must be the correct answer.

Choices A, B, and C are incorrect. The graph of  $y = 2x - 5$  in the  $xy$ -plane is a line with slope 2 and a  $y$ -intercept at  $(0, -5)$ . The graph in choice A crosses the  $y$ -axis at the point  $(0, 2.5)$ , not  $(0, -5)$ , and it has a slope of  $\frac{1}{2}$ , not 2. The graph in choice B crosses the  $y$ -axis at  $(0, -5)$ ; however, the slope of this line is  $-2$ , not 2. The graph in choice C has a slope of 2; however, the graph crosses the  $y$ -axis at  $(0, 5)$ , not  $(0, -5)$ .

### QUESTION 6

**Choice A is correct.** Substituting the given value of  $y = 18$  into the equation  $x = \frac{2}{3}y$  yields  $x = \left(\frac{2}{3}\right)(18)$ , or  $x = 12$ . The value of the expression  $2x - 3$  when  $x = 12$  is  $2(12) - 3 = 21$ .

Choice B is incorrect. If  $2x - 3 = 15$ , then adding 3 to both sides of the equation and then dividing both sides of the equation by 2 yields  $x = 9$ . Substituting 9 for  $x$  and 18 for  $y$  into the equation  $x = \frac{2}{3}y$  yields  $9 = \frac{2}{3}18 = 12$ , which is false. Therefore, the value of  $2x - 3$  cannot be

15. Choices C and D are also incorrect. As with choice B, assuming the value of  $2x - 3$  is 12 or 10 will lead to a false statement.

### QUESTION 7

**Choice C is correct.** By properties of multiplication, the formula  $n = 7\ell h$  can be rewritten as  $n = (7h)\ell$ . To solve for  $\ell$  in terms of  $n$  and  $h$ , divide both sides of the equation by the factor  $7h$ .

Solving this equation for  $\ell$  gives  $\ell = \frac{n}{7h}$ .

Choices A, B, and D are incorrect and may result from algebraic errors when rewriting the given equation.

### QUESTION 8

**Choice B is correct.** This question can be answered by making a connection between the table and the algebraic equation. Each row of the table gives a value of  $x$  and its corresponding values in both  $w(x)$  and  $t(x)$ . For instance, the first row gives  $x = 1$  and the corresponding values  $w(1) = -1$  and  $t(1) = -3$ . The row in the table where  $x = 2$  is the only row that has the property  $x = w(x) + t(x)$ :  $2 = 3 + (-1)$ . Therefore, choice B is the correct answer.

Choice A is incorrect because when  $x = 1$ , the equation  $w(x) + t(x) = x$  is not true. According to the table,  $w(1) = -1$  and  $t(1) = -3$ . Substituting the values of each term when  $x = 1$  gives  $-1 + (-3) = 1$ , an equation that is not true. Choice C is incorrect because when  $x = 3$ , the equation  $w(x) + t(x) = x$  is not true. According to the table,  $w(3) = 4$  and  $t(3) = 1$ . Substituting the values of each term when  $x = 3$  gives  $4 + 1 = 3$ , an equation that is not true. Choice D is incorrect because when  $x = 4$ , the equation  $w(x) + t(x) = x$  is not true. According to the table,  $w(4) = 3$  and  $t(4) = 3$ . Substituting the values of each term when  $x = 4$  gives  $3 + 3 = 4$ , an equation that is not true.

### QUESTION 9

**Choice C is correct.** The two numerical expressions in the given equation can be simplified as  $\sqrt{9} = 3$  and  $\sqrt{64} = 8$ , so the equation can be rewritten as  $\sqrt{x} + 3 = 8$ , or  $\sqrt{x} = 5$ . Squaring both sides of the equation gives  $x = 25$ .

Choice A is incorrect and may result from a misconception about how to square both sides of  $\sqrt{x} = 5$  to determine the value of  $x$ . Choice B is incorrect. The value of  $\sqrt{x}$ , not  $x$ , is 5. Choice D is incorrect and represents a misconception about the properties of radicals. While it is true that  $55 + 9 = 64$ , it is not true that  $\sqrt{55} + \sqrt{9} = \sqrt{64}$ .

### QUESTION 10

**Choice D is correct.** Jaime's goal is to average at least 280 miles per week for 4 weeks. If  $T$  is the total number of miles Jamie will bicycle for 4 weeks, then his goal can be represented

symbolically by the inequality:  $\frac{T}{4} \geq 280$ , or equivalently  $T \geq 4(280)$ . The total number of miles

Jamie will bicycle during this time is the sum of the distances he has completed and has yet to complete. Thus  $T = 240 + 310 + 320 + x$ . Substituting this expression into the inequality  $T \geq 4(280)$  gives  $240 + 310 + 320 + x \geq 4(280)$ . Therefore, choice D is the correct answer.

Choices A, B, and C are incorrect because they do not correctly capture the relationships between the total number of miles Jaime will ride his bicycle ( $240 + 310 + 320 + x$ ) and the minimum number of miles he is attempting to bicycle for the four weeks ( $280 + 280 + 280 + 280$ ).

### QUESTION 11

**Choice B is correct.** Since the shown parabola opens upward, the coefficient of  $x^2$  in the equation  $y = ax^2 + c$  must be positive. Given that  $a$  is positive,  $-a$  is negative, and therefore the graph of the equation  $y = -a(x - b)^2 + c$  will be a parabola that opens downward. The vertex of this parabola is  $(b, c)$ , because the maximum value of  $y, c$ , is reached when  $x = b$ . Therefore, the answer must be choice B.

Choices A and C are incorrect. The coefficient of  $x^2$  in the equation  $y = -a(x - b)^2 + c$  is negative. Therefore, the parabola with this equation opens downward, not upward. Choice D is incorrect because the vertex of this parabola is  $(b, c)$ , not  $(-b, c)$ , because the maximum value of  $y, c$ , is reached when  $x = b$ .

### QUESTION 12

**Choice D is correct.** Dividing  $4x^2 + 6x$  by  $4x + 2$  gives:

$$\begin{array}{r} x + 1 \\ 4x + 2 \overline{) 4x^2 + 6x} \\ \underline{-(4x + 2x)} \phantom{0} \\ 4x \\ \underline{-(4x + 2)} \\ -2 \end{array}$$

Therefore, the expression  $\frac{4x^2 + 6x}{4x + 2}$  is equivalent to  $x + 1 - \frac{2}{4x + 2}$ .

Alternate approach: The numerator of the given expression,  $4x^2 + 6x$ , can be rewritten in terms of the denominator,  $4x + 2$ , as follows:  $4x^2 + 2x + 4x + 2 - 2$ , or  $x(4x + 2) + (4x + 2) - 2$ . So the given expression can be rewritten as

$$\frac{x(4x + 2) + (4x + 2) - 2}{4x + 2} = x + 1 - \frac{2}{4x + 2}$$

Choices A and B are incorrect and may result from incorrectly factoring the numerator and denominator of the expression  $\frac{4x^2 + 6x}{4x + 2}$  and then incorrectly identifying common factors in the two factored expressions. Choice C is incorrect and may result from a variety of mistakes made when performing long division.

### QUESTION 13

**Choice A is correct.** The number of solutions to any quadratic equation in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are constants, can be found by evaluating the expression  $b^2 - 4ac$ , which is called the discriminant. If the value of  $b^2 - 4ac$  is a positive number, then there will be exactly two real solutions to the equation. If the value of  $b^2 - 4ac$  is zero, then there will be exactly one real solution to the equation. Finally, if the value of  $b^2 - 4ac$  is negative, then there will be no real solutions to the equation.

The given equation  $2x^2 - 4x = t$  is a quadratic equation in one variable, where  $t$  is a constant. Subtracting  $t$  from both sides of the equation gives  $2x^2 - 4x - t = 0$ . In this form,  $a = 2$ ,  $b = -4$ , and  $c = -t$ . The values of  $t$  for which the equation has no real solutions are the same values of  $t$  for which the discriminant of this equation is a negative value. The discriminant is equal to  $(-4)^2 - 4(2)(-t)$ ; therefore,  $(-4)^2 - 4(2)(-t) < 0$ . Simplifying the left side of the inequality gives  $16 + 8t < 0$ . Subtracting 16 from both sides of the inequality and then dividing both sides by 8 gives  $t < -2$ . Of the values given in the options,  $-3$  is the only value that is less than  $-2$ . Therefore, choice A must be the correct answer.

Choices B, C, and D are incorrect and may result from a misconception about how to use the discriminant to determine the number of solutions of a quadratic equation in one variable.

### QUESTION 14

**Choice A is correct.** The number of containers in a shipment must have a weight less than 300 pounds. The total weight, in pounds, of detergent and fabric softener that the supplier delivers can be expressed as the weight of each container multiplied by the number of each type of container, which is  $7.35d$  for detergent and  $6.2s$  for fabric softener. Since this total cannot exceed 300 pounds, it follows that  $7.35d + 6.2s \leq 300$ . Also, since the laundry service wants to buy at least twice as many containers of detergent as containers of fabric softener, the number of containers of detergent should be greater than or equal to two times the number of containers of fabric softener. This can be expressed by the inequality  $d \geq 2s$ .

Choice B is incorrect because it misrepresents the relationship between the numbers of each container that the laundry service wants to buy. Choice C is incorrect because the first inequality of the system incorrectly doubles the weight per container of detergent. The weight

of each container of detergent is 7.35, not 14.7 pounds. Choice D is incorrect because it doubles the weight per container of detergent and transposes the relationship between the numbers of containers.

### QUESTION 15

**Choice D is correct.** The expression can be rewritten as  $\left(a + \frac{b}{2}\right)\left(a + \frac{b}{2}\right)$ . Using the distributive property, the expression yields  $\left(a + \frac{b}{2}\right)\left(a + \frac{b}{2}\right) = a^2 + \frac{ab}{2} + \frac{ab}{2} + \frac{b^2}{4}$ . Combining like terms gives  $a^2 + ab + \frac{b^2}{4}$ .

Choices A, B, and C are incorrect and may result from errors using the distributive property on the given expression or combining like terms.

### QUESTION 16

**The correct answers are 1, 2, 4, 8, or 16.** Number 16 can be written in exponential form  $a^{\frac{b}{4}}$ , where  $a$  and  $b$  are positive integers as follows:  $2^4$ ,  $4^2$ ,  $16^1$ ,  $(16^2)^{\frac{1}{2}}$ ,  $(16^4)^{\frac{1}{4}}$ . Hence, if  $a^{\frac{b}{4}} = 16$ , where  $a$  and  $b$  are positive integers, then  $\frac{b}{4}$  can be 4, 2, 1,  $\frac{1}{2}$ , or  $\frac{1}{4}$ . So the value of  $b$  can be 16, 8, 4, 2, or 1. Any of these values may be gridded as the correct answer.

### QUESTION 17

**The correct answer is  $\frac{15}{4}$  or 3.75.** Multiplying both sides of the equation  $\frac{2}{3}t = \frac{5}{2}$  by  $\frac{3}{2}$  results in  $t = \frac{15}{4}$ , or  $t = 3.75$ .

### QUESTION 18

**The correct answer is 30.** In the figure given, since  $\overline{BD}$  is parallel to  $\overline{AE}$  and both segments are intersected by  $\overline{CE}$ , then angle  $BDC$  and angle  $AEC$  are corresponding angles and therefore congruent. Angle  $BCD$  and angle  $ACE$  are also congruent because they are the same angle. Triangle  $BCD$  and triangle  $ACE$  are similar because if two angles of one triangle are congruent to two angles of another triangle, the triangles are similar. Since triangle  $BCD$  and triangle  $ACE$  are similar, their corresponding sides are proportional. So in triangle  $BCD$  and triangle  $ACE$ ,  $\overline{BD}$  corresponds to  $\overline{AE}$  and  $\overline{CD}$  corresponds to  $\overline{CE}$ . Therefore,  $\frac{BD}{CD} = \frac{AE}{CE}$ . Since triangle  $BCD$  is a right triangle, the Pythagorean theorem can be used to give the value of  $CD$ :  $6^2 + 8^2 = CD^2$ . Taking the square root of each side gives  $CD = 10$ . Substituting the values in the proportion  $\frac{BD}{CD} = \frac{AE}{CE}$  yields



$\frac{6}{10} = \frac{18}{CE}$ . Multiplying each side by  $CE$ , and then multiplying by  $\frac{10}{6}$  yields  $CE = 30$ . Therefore, the length of  $\overline{CE}$  is 30.

### QUESTION 19

The correct answer is 1.5 or  $\frac{3}{2}$ . The total amount, in liters, of a saline solution can be expressed as the liters of each type of saline solution multiplied by the percent of the saline solution. This gives  $3(0.10)$ ,  $x(0.25)$ , and  $(x + 3)(0.15)$ , where  $x$  is the amount, in liters, of a 25% saline solution and 10%, 15%, and 25% are represented as 0.10, 0.15, and 0.25, respectively. Thus, the equation  $3(0.10) + 0.25x = 0.15(x + 3)$  must be true. Multiplying 3 by 0.10 and distributing 0.15 to  $(x + 3)$  yields  $0.30 + 0.25x = 0.15x + 0.45$ . Subtracting  $0.15x$  and 0.30 from each side of the equation gives  $0.10x = 0.15$ . Dividing each side of the equation by 0.10 yields  $x = 1.5$ , or  $x = \frac{3}{2}$ .

### QUESTION 20

The correct answer is  $\frac{1}{6}$ , .166, or .167. The circumference,  $C$ , of a circle is  $C = 2\pi r$ , where  $r$  is the radius of the circle. For the given circle with a radius of 1, the circumference is  $C = 2(\pi)(1)$ , or  $C = 2\pi$ . To find what fraction of the circumference the length of arc  $AB$  is, divide the length of the arc by the circumference, which gives  $\frac{\pi}{3} \div 2\pi$ . This division can be represented by  $\frac{\pi}{3} \cdot \frac{1}{2\pi} = \frac{1}{6}$ . The fraction  $\frac{1}{6}$  can also be rewritten as .166 or .167.

## Section 4: Math Test - Calculator

### QUESTION 1

Choice A is correct. The given expression  $(2x^2 - 4) - (-3x^2 + 2x - 7)$  can be rewritten as  $2x^2 - 4 + 3x^2 - 2x + 7$ . Combining like terms yields  $5x^2 - 2x + 3$ .

Choices B, C, and D are incorrect because they are the result of errors when applying the distributive property.

### QUESTION 2

Choice C is correct. The lines shown on the graph give the positions of Paul and Mark during the race. At the start of the race, 0 seconds have elapsed, so the  $y$ -intercept of the line that represents Mark's position during the race represents the number of yards Mark was from Paul's position (at 0 yards) at the start of the race. Because the  $y$ -intercept of the line that

represents Mark's position is at the grid line that is halfway between 12 and 24, Mark had a head start of 18 yards.

Choices A, B, and D are incorrect. The  $y$ -intercept of the line that represents Mark's position shows that he was 18 yards from Paul's position at the start of the race, so he did not have a head start of 3, 12, or 24 yards.

### QUESTION 3

**Choice A is correct.** The leftmost segment in choice A, which represents the first time period, shows that the snow accumulated at a certain rate; the middle segment, which represents the second time period, is horizontal, showing that the snow stopped accumulating; and the rightmost segment, which represents the third time period, is steeper than the first segment, indicating that the snow accumulated at a faster rate than it did during the first time period.

Choice B is incorrect. This graph shows snow accumulating faster during the first time period than during the third time period; however, the question says that the rate of snow accumulation in the third time period is higher than in the first time period. Choice C is incorrect. This graph shows snow accumulation increasing during the first time period, not accumulating during the second time period, and then decreasing during the third time period; however, the question says that no snow melted (accumulation did not decrease) during this time. Choice D is incorrect. This graph shows snow accumulating at a constant rate, not stopping for a period of time or accumulating at a faster rate during a third time period.

### QUESTION 4

**Choice D is correct.** The equation  $12d + 350 = 1,010$  can be used to determine  $d$ , the number of dollars charged per month. Subtracting 350 from both sides of this equation yields  $12d = 660$ , and then dividing both sides of the equation by 12 yields  $d = 55$ .

Choice A is incorrect. If  $d$  were equal to 25, the first 12 months would cost  $350 + (12)(25) = 650$  dollars, not \$1,010. Choice B is incorrect. If  $d$  were equal to 35, the first 12 months would cost  $350 + (12)(35) = 770$  dollars, not \$1,010. Choice C is incorrect. If  $d$  were equal to 45, the first 12 months would cost  $350 + (12)(45) = 890$  dollars, not \$1,010.

### QUESTION 5

**Choice B is correct.** Both sides of the given inequality can be divided by 3 to yield  $2x - 3y > 4$ .

Choices A, C, and D are incorrect because they are not equivalent to (do not have the same solution set as) the given inequality. For example, the ordered pair  $(0, -1.5)$  is a solution to the given inequality, but it is not a solution to any of the inequalities in choices A, C, or D.

## QUESTION 6

**Choice C is correct.** According to the table, 63% of survey respondents get most of their medical information from a doctor and 13% get most of their medical information from the Internet. Therefore, 76% of the 1,200 survey respondents get their information from either a doctor or the Internet, and 76% of 1,200 is 912.

Choices A, B, and D are incorrect. According to the table, 76% of survey respondents get their information from either a doctor or the Internet. Choice A is incorrect because 865 is about 72% (the percent of survey respondents who get most of their medical information from a doctor or from magazines/brochures), not 76%, of 1,200. Choice B is incorrect because 887 is about 74%, not 76%, of 1,200. Choice D is incorrect because 926 is about 77%, not 76%, of 1,200.

## QUESTION 7

**Choice D is correct.** The members of the city council wanted to assess opinions of all city residents. To gather an unbiased sample, the council should have used a random sampling design to select subjects from all city residents. The given survey introduced a sampling bias because the 500 city residents surveyed were all dog owners. This sample is not representative of all city residents.

Choice A is incorrect because when the sampling method isn't random, there is no guarantee that the survey results will be reliable; hence, they cannot be generalized to the entire population. Choice B is incorrect because a larger sample size would not correct the sampling bias. Choice C is incorrect because a survey sample of non-dog owners would likely have a biased opinion, just as a sample of dog owners would likely have a biased opinion.

## QUESTION 8

**Choice D is correct.** According to the table, 13 people chose vanilla ice cream. Of those people, 8 chose hot fudge as a topping. Therefore, of the people who chose vanilla ice cream, the fraction who chose hot fudge as a topping is  $\frac{8}{13}$ .

Choice A is incorrect because it represents the fraction of people at the party who chose hot fudge as a topping. Choice B is incorrect because it represents the fraction of people who chose vanilla ice cream with caramel as a topping. Choice C is incorrect because it represents the fraction of people at the party who chose vanilla ice cream.

## QUESTION 9

**Choice B is correct.** The land area of the coastal city can be found by subtracting the area of the water from the total area of the coastal city; that is,  $92.1 - 11.3 = 80.8$  square miles. The population density is the population divided by the land area, or  $\frac{621,000}{80.8} = 7,685$ , which is closest to 7,690 people per square mile.

Choice A is incorrect and may be the result of dividing the population by the total area, instead of the land area. Choice C is incorrect and may be the result of dividing the population by the area of water. Choice D is incorrect and may be the result of making a computational error with the decimal place.

### QUESTION 10

**Choice B is correct.** Let  $x$  represent the number of days the second voyage lasted. The number of days the first voyage lasted is then  $x + 43$ . Since the two voyages combined lasted a total of 1,003 days, the equation  $x + (x + 43) = 1,003$  must hold. Combining like terms yields  $2x + 43 = 1,003$ , and solving for  $x$  gives  $x = 480$ .

Choice A is incorrect because  $460 + (460 + 43) = 963$ , not 1,003 days. Choice C is incorrect because  $520 + (520 + 43) = 1,083$ , not 1,003 days. Choice D is incorrect because  $540 + (540 + 43) = 1,123$ , not 1,003 days.

### QUESTION 11

**Choice B is correct.** Adding the equations side-by-side eliminates  $y$ , as shown below.

$$\begin{array}{r} 7x + 3y = 8 \\ 6x - 3y = 5 \\ \hline 13x + 0 = 13 \end{array}$$

Solving the obtained equation for  $x$  gives  $x = 1$ . Substituting 1 for  $x$  in the first equation gives  $7(1) + 3y = 8$ . Subtracting 7 from both sides of the equation yields  $3y = 1$ , so  $y = \frac{1}{3}$ . Therefore, the value of  $x - y$  is  $1 - \frac{1}{3}$ , or  $\frac{2}{3}$ .

Choice C is incorrect because  $1 + \frac{1}{3} = \frac{4}{3}$  is the value of  $x + y$ , not  $x - y$ . Choices A and D are incorrect and may be the result of some computational errors.

### QUESTION 12

**Choice D is correct.** The average growth rate of the sunflower over a certain time period is the increase in height of the sunflower over the period divided by the time. Symbolically, this rate is  $\frac{h(b) - h(a)}{b - a}$ , where  $a$  and  $b$  are the first and the last day of the time period, respectively. Since the time period for each option is the same (21 days), the total growth over the period can be used to evaluate in which time period the sunflower grew the least. According to the graph, the sunflower grew the least over the period from day 63 to day 84. Therefore, the sunflower's average growth rate was the least from day 63 to day 84.

Alternate approach: The average growth rate of the sunflower over a certain time period is the slope of the line segment that joins the point on the graph at the beginning of the time period with the point on the graph at the end of the time period. Based on the graph, of the four time periods, the slope of the line segment is least between the sunflower's height on day 63 and its height on day 84.

Choices A, B, and C are incorrect. On the graph, the line segment from day 63 to 84 is less steep than each of the three other line segments representing other periods. Therefore, the average growth rate of the sunflower is the least from day 63 to 84.

### QUESTION 13

**Choice A is correct.** Based on the definition and contextual interpretation of the function  $h$ , when the value of  $t$  increases by 1, the height of the sunflower increases by  $a$  centimeters. Therefore,  $a$  represents the predicted amount, in centimeters, by which the sunflower grows each day during the period the function models.

Choice B is incorrect. In the given model, the beginning of the period corresponds to  $t = 0$ , and since  $h(0) = b$ , the predicted height, in centimeters, of the sunflower at the beginning of the period is represented by  $b$ , not by  $a$ . Choice C is incorrect. If the period of time modeled by the function is  $c$  days long, then the predicted height, in centimeters, of the sunflower at the end of the period is represented by  $ac + b$ , not by  $a$ . Choice D is incorrect. If the period of time modeled by the function is  $c$  days long, the predicted total increase in the height of the sunflower, in centimeters, during that period is represented by the difference  $h(c) - h(0) = (ac + b) - (a \cdot 0 + b)$ , which is equivalent to  $ac$ , not  $a$ .

### QUESTION 14

**Choice B is correct.** According to the table, the height of the sunflower is 36.36 cm on day 14 and 131.00 cm on day 35. Since the height of the sunflower between day 14 and day 35 changes at a nearly constant rate, the height of the sunflower increases by approximately

$\frac{131.00 - 36.36}{35 - 14} \approx 4.5$  cm per day. Therefore, the equation that models the height of the sunflower  $t$  days after it begins to grow is of the form  $h = 4.5t + b$ . Any ordered pair  $(t, h)$  from the table between day 14 and day 35 can be used to estimate the value of  $b$ . For example, substituting the ordered pair  $(14, 36.36)$  for  $(t, h)$  into the equation  $h = 4.5t + b$  gives  $36.36 = 4.5(14) + b$ . Solving this for  $b$  yields  $b = -26.64$ . Therefore, of the given choices, the equation  $h = 4.5t - 27$  best models the height  $h$ , in centimeters, of the sunflower  $t$  days after it begins to grow.

Choices A, C, and D are incorrect because the growth rates of the sunflower from day 14 to day 35 in these choices are significantly higher or lower than the true growth rate of the sunflower as shown in the graph or the table. These choices may result from considering time periods different from the period indicated in the question or from calculation errors.

### QUESTION 15

**Choice D is correct.** According to the table, the value of  $y$  increases by  $\frac{14}{4} = \frac{7}{2}$  every time the value of  $x$  increases by 1. It follows that the simplest equation relating  $y$  to  $x$  is linear and of the form  $y = \frac{7}{2}x + b$  for some constant  $b$ . Furthermore, the ordered pair  $\left(1, \frac{11}{4}\right)$  from the table must satisfy this equation. Substituting 1 for  $x$  and  $\frac{11}{4}$  for  $y$  in the equation  $y = \frac{7}{2}x + b$  gives  $\frac{11}{4} = \frac{7}{2}(1) + b$ . Solving this equation for  $b$  gives  $b = -\frac{3}{4}$ . Therefore, the equation in choice D correctly relates  $y$  to  $x$ .

Choices A and B are incorrect. The relationship between  $x$  and  $y$  cannot be exponential because the differences, not the ratios, of  $y$ -values are the same every time the  $x$ -values change by the same amount. Choice C is incorrect because the ordered pair  $\left(2, \frac{25}{4}\right)$  is not a solution to the equation  $y = \frac{3}{4}x + 2$ . Substituting 2 for  $x$  and  $\frac{25}{4}$  for  $y$  in this equation gives  $\frac{25}{4} = \frac{3}{4} + 2$ , which is false.

### QUESTION 16

**Choice B is correct.** In right triangle  $ABC$ , the measure of angle  $B$  must be  $58^\circ$  because the sum of the measure of angle  $A$ , which is  $32^\circ$ , and the measure of angle  $B$  is  $90^\circ$ . Angle  $D$  in the right triangle  $DEF$  has measure  $58^\circ$ . Hence, triangles  $ABC$  and  $DEF$  are similar. Since  $BC$  is the side

opposite to the angle with measure  $32^\circ$  and  $AB$  is the hypotenuse in right triangle  $ABC$ , the ratio  $\frac{BC}{AB}$  is equal to  $\frac{DF}{DE}$ .

Alternate approach: The trigonometric ratios can be used to answer this question. In right triangle  $ABC$ , the ratio  $\frac{BC}{AB} = \sin(32^\circ)$ . The angle  $E$  in triangle  $DEF$  has measure  $32^\circ$  because

$m(\angle D) + m(\angle E) = 90^\circ$ . In triangle  $DEF$ , the ratio  $\frac{DF}{DE} = \sin(32^\circ)$ . Therefore,  $\frac{DF}{DE} = \frac{BC}{AB}$ .

Choice A is incorrect because  $\frac{DE}{DF}$  is the inverse of the ratio  $\frac{BC}{AB}$ . Choice C is incorrect because

$\frac{DF}{EF} = \frac{BC}{AC}$ , not  $\frac{BC}{AB}$ . Choice D is incorrect because  $\frac{EF}{DE} = \frac{AC}{AB}$ , not  $\frac{BC}{AB}$ .

### QUESTION 17

**Choice B is correct.** Isolating the term that contains the riser height,  $h$ , in the formula  $2h + d = 25$  gives  $2h = 25 - d$ . Dividing both sides of this equation by 2 yields  $h = \frac{25 - d}{2}$ , or

$$h = \frac{1}{2}(25 - d).$$

Choices A, C, and D are incorrect and may result from incorrect transformations of the riser-tread formula  $2h + d = 25$  when expressing  $h$  in terms of  $d$ .

### QUESTION 18

**Choice C is correct.** Since the tread depth,  $d$ , must be at least 9 inches, and the riser height,  $h$ , must be at least 5 inches, it follows that  $d \geq 9$  and  $h \geq 5$ , respectively. Solving for  $d$  in the riser-tread formula  $2h + d = 25$  gives  $d = 25 - 2h$ . Thus the first inequality,  $d \geq 9$ , is equivalent to  $25 - 2h \geq 9$ . This inequality can be solved for  $h$  as follows:

$$-2h \geq 9 - 25$$

$$2h \leq 25 - 9$$

$$2h \leq 16$$

$$h \leq 8$$

Therefore, the inequality  $5 \leq h \leq 8$ , derived from combining the inequalities  $h \geq 5$  and  $h \leq 8$ , represents the set of all possible values for the riser height that meets the code requirement.

Choice A is incorrect because the riser height,  $h$ , cannot be less than 5 inches. Choices B and D are incorrect because the riser height,  $h$ , cannot be greater than 8. For example, if  $h = 10$ , then according to the riser-tread formula  $2h + d = 25$ , it follows that  $d = 5$  inches. However,  $d$  must be at least 9 inches according to the building codes, so  $h$  cannot be 10.

### QUESTION 19

**Choice C is correct.** Let  $h$  be the riser height, in inches, and  $n$  be the number of the steps in the stairway. According to the architect's design, the total rise of the stairway is 9 feet, or  $9 \times 12 = 108$  inches. Hence,  $nh = 108$ , and solving for  $n$  gives  $n = \frac{108}{h}$ . It is given that  $7 < h < 8$ . It follows that  $\frac{108}{8} < \frac{108}{h} < \frac{108}{7}$ , or equivalently,  $\frac{108}{8} < n < \frac{108}{7}$ . Since  $\frac{108}{8} < 14$  and  $\frac{108}{7} > 15$  and  $n$  is an integer, it follows that  $14 \leq n \leq 15$ . Since  $n$  can be an odd number,  $n$  can only be 15; therefore,  $h = \frac{108}{15} = 7.2$  inches. Substituting 7.2 for  $h$  in the riser-tread formula  $2h + d = 25$  gives  $14.4 + d = 25$ . Solving for  $d$  gives  $d = 10.6$  inches.

Choice A is incorrect because 7.2 inches is the riser height, not the tread depth of the stairs. Choice B is incorrect and may be the result of calculation errors. Choice D is incorrect because 15 is the number of steps, not the tread depth of the stairs.

### QUESTION 20

**Choice C is correct.** Since the product of  $x - 6$  and  $x + 0.7$  equals 0, by the zero product property either  $x - 6 = 0$  or  $x + 0.7 = 0$ . Therefore, the solutions to the equation are 6 and  $-0.7$ . The sum of 6 and  $-0.7$  is 5.3.

Choice A is incorrect and is the result of subtracting 6 from  $-0.7$  instead of adding. Choice B is incorrect and may be the result of erroneously calculating the sum of  $-6$  and  $0.7$  instead of 6 and  $-0.7$ . Choice D is incorrect and is the sum of 6 and  $0.7$ , not 6 and  $-0.7$ .

### QUESTION 21

**Choice D is correct.** The sample of 150 largemouth bass was selected at random from all the largemouth bass in the pond, and since 30% of them weighed more than 2 pounds, it can be concluded that approximately 30% of all largemouth bass in the pond weigh more than 2 pounds.



Choices A, B, and C are incorrect. Since the sample contained 150 largemouth bass, of which 30% weighed more than 2 pounds, the largest population to which this result can be generalized is the population of the largemouth bass in the pond.

### QUESTION 22

**Choice B is correct.** The median of a list of numbers is the middle value when the numbers are listed in order from least to greatest. For the electoral votes shown in the table, their frequency should also be taken into account. Since there are 21 states represented in the table, the middle number will be the eleventh number in the ordered list. Counting the frequencies from the top of the table ( $4 + 4 + 1 + 1 + 3 = 13$ ) shows that the median number of electoral votes for the 21 states is 15.

Choice A is incorrect. If the electoral votes are ordered from least to greatest taking into account the frequency, 13 will be in the tenth position, not the middle. Choice C is incorrect because 17 is in the fourteenth position, not in the middle, of the ordered list. D is incorrect because 20 is in the fifteenth position, not in the middle, of the ordered list.

### QUESTION 23

**Choice C is correct.** Since the graph shows the height of the ball above the ground after it was dropped, the number of times the ball was at a height of 2 feet is equal to the number of times the graph crosses the horizontal grid line that corresponds to a height of 2 feet. The graph crosses this grid line three times.

Choices A, B, and D are incorrect. According to the graph, the ball was at a height of 2 feet three times, not one, two, or four times.

### QUESTION 24

**Choice D is correct.** To find the percent increase of the customer's water bill, the absolute increase of the bill, in dollars, is divided by the original amount of the bill, and the result is multiplied by 100%, as follows:  $\frac{79.86 - 75.74}{75.74} \approx 0.054$ ;  $0.054 \times 100\% = 5.4\%$ .

Choice A is incorrect. This choice is the difference  $79.86 - 75.74$  rounded to the nearest tenth, which is the (absolute) increase of the bill's amount, not its percent increase. Choice B is incorrect and may be the result of some calculation errors. Choice C is incorrect and is the result of dividing the difference between the two bill amounts by the new bill amount instead of the original bill amount.

### QUESTION 25

**Choice B is correct.** A linear function has a constant rate of change, and any two rows of the shown table can be used to calculate this rate. From the first row to the second, the value of  $x$  is increased by 2 and the value of  $f(x)$  is increased by 6 = 4 - (-2). So the values of  $f(x)$  increase by 3 for every increase by 1 in the value of  $x$ . Since  $f(2) = 4$ , it follows that  $f(2 + 1) = 4 + 3 = 7$ . Therefore,  $f(3) = 7$ .

Choice A is incorrect. This is the third  $x$ -value in the table, not  $f(3)$ . Choices C and D are incorrect and may result from errors when calculating the function's rate of change.

### QUESTION 26

**Choice C is correct.** Since Gear A has 20 teeth and Gear B has 60 teeth, the gear ratio for Gears A and B is 20:60. Thus the ratio of the number of revolutions per minute (rpm) for the two gears is 60:20, or 3:1. That is, when Gear A turns at 3 rpm, Gear B turns at 1 rpm. Similarly, since Gear B has 60 teeth and Gear C has 10 teeth, the gear ratio for Gears B and C is 60:10, and the ratio of the rpms for the two gears is 10:60. That is, when Gear B turns at 1 rpm, Gear C turns at 6 rpm. Therefore, if Gear A turns at 100 rpm, then Gear B turns at  $\frac{100}{3}$  rpm, and Gear C turns at  $\frac{100}{3} \times 6 = 200$  rpm.

Alternate approach: Gear A and Gear C can be considered as directly connected since their "contact" speeds are the same. Gear A has twice as many teeth as Gear C, and since the ratios of the number of teeth are equal to the reverse of the ratios of rotation speeds, in rpm, Gear C would be rotated at a rate that is twice the rate of Gear A. Therefore, Gear C will be rotated at a rate of 200 rpm since Gear A is rotated at 100 rpm.

Choice A is incorrect and may result from using the gear ratio instead of the ratio of the rpm when calculating the rotational speed of Gear C. Choice B is incorrect and may result from comparing the rpm of the gears using addition instead of multiplication. Choice D is incorrect and may be the result of multiplying the 100 rpm for Gear A by the number of teeth in Gear C.

### QUESTION 27

**Choice A is correct.** One way to find the radius of the circle is to put the given equation in standard form,  $(x - h)^2 + (y - k)^2 = r^2$ , where  $(h, k)$  is the center of the circle and the radius of the circle is  $r$ . To do this, divide the original equation,  $2x^2 - 6x + 2y^2 + 2y = 45$ , by 2 to make the leading coefficients of  $x^2$  and  $y^2$  each equal to 1:  $x^2 - 3x + y^2 + y = 22.5$ . Then complete the square to put the equation in standard form. To do so, first rewrite  $x^2 - 3x + y^2 + y = 22.5$  as  $(x^2 - 3x + 2.25) - 2.25 + (y^2 + y + 0.25) - 0.25 = 22.5$ . Second, add 2.25 and 0.25 to both sides of the equation:  $(x^2 - 3x + 2.25) + (y^2 + y + 0.25) = 25$ . Since  $x^2 - 3x + 2.25 = (x - 1.5)^2$ ,  $y^2 + y + 0.25 = (y + 0.5)^2$ , the equation becomes  $(x - 1.5)^2 + (y + 0.5)^2 = 25$ .

$-0.5)^2$ , and  $25 = 5^2$ , it follows that  $(x - 1.5)^2 + (y - 0.5)^2 = 5^2$ . Therefore, the radius of the circle is 5.

Choices B, C, and D are incorrect and may be the result of errors in manipulating the equation or of a misconception about the standard form of the equation of a circle in the  $xy$ -plane.

### QUESTION 28

**Choice A is correct.** The coordinates of the points at a distance  $d$  units from the point with coordinate  $a$  on the number line are the solutions to the equation  $|x - a| = d$ . Therefore, the coordinates of the points at a distance of 3 units from the point with coordinate  $-4$  on the number line are the solutions to the equation  $|x - (-4)| = 3$ , which is equivalent to  $|x + 4| = 3$ .

Choice B is incorrect. The solutions of  $|x - 4| = 3$  are the coordinates of the points on the number line at a distance of 3 units from the point with coordinate 4. Choice C is incorrect. The solutions of  $|x + 3| = 4$  are the coordinates of the points on the number line at a distance of 4 units from the point with coordinate  $-3$ . Choice D is incorrect. The solutions of  $|x - 3| = 4$  are the coordinates of the points on the number line at a distance of 4 units from the point with coordinate 3.

### QUESTION 29

**Choice B is correct.** The average speed of the model car is found by dividing the total distance traveled by the car by the total time the car traveled. In the first  $t$  seconds after the car starts, the time changes from 0 to  $t$  seconds. So the total distance the car traveled is the distance it traveled at  $t$  seconds minus the distance it traveled at 0 seconds. At 0 seconds, the car has traveled  $16(0)\sqrt{0}$  inches, which is equal to 0 inches. According to the equation given, after  $t$  seconds, the car has traveled  $16t\sqrt{t}$  inches. In other words, after the car starts, it travels a total of  $16t\sqrt{t}$  inches in  $t$  seconds. Dividing this total distance traveled by the total time shows the car's average speed:  $\frac{16t\sqrt{t}}{t} = 16\sqrt{t}$  inches per second.

Choices A, C, and D are incorrect and may result from misconceptions about how average speed is calculated.

### QUESTION 30

**Choice D is correct.** The data in the scatterplot roughly fall in the shape of a downward-opening parabola; therefore, the coefficient for the  $x^2$  term must be negative. Based on the location of

the data points, the  $y$ -intercept of the parabola should be somewhere between 740 and 760. Therefore, of the equations given, the best model is  $y = -1.674x^2 + 19.76x + 745.73$ .

Choices A and C are incorrect. The positive coefficient of the  $x^2$  term means that these equations each define upward-opening parabolas, whereas a parabola that fits the data in the scatterplot must open downward. Choice B is incorrect because it defines a parabola with a  $y$ -intercept that has a negative  $y$ -coordinate, whereas a parabola that fits the data in the scatterplot must have a  $y$ -intercept with a positive  $y$ -coordinate.

### QUESTION 31

**The correct answer is 10.** Let  $n$  be the number of friends originally in the group. Since the cost of the trip was \$800, the share, in dollars, for each friend was originally  $\frac{800}{n}$ . When two friends decided not to go on the trip, the number of friends who split the \$800 cost became  $n - 2$ , and each friend's cost became  $\frac{800}{n - 2}$ . Since this share represented a \$20 increase over the original share, the equation  $\frac{800}{n} + 20 = \frac{800}{n - 2}$  must be true. Multiplying each side of  $\frac{800}{n} + 20 = \frac{800}{n - 2}$  by  $n(n - 2)$  to clear all the denominators gives

$$800(n - 2) + 20n(n - 2) = 800n$$

This is a quadratic equation and can be rewritten in the standard form by expanding, simplifying, and then collecting like terms on one side, as shown below:

$$800n - 1600 + 20n^2 - 40n = 800n$$

$$40n - 80 + n^2 - 2n = 40n$$

$$n^2 - 2n - 80 = 0$$

After factoring, this becomes  $(n + 8)(n - 10) = 0$ .

The solutions of this equation are  $-8$  and  $10$ . Since a negative solution makes no sense for the number of people in a group, the number of friends originally in the group was  $10$ .

### QUESTION 32

**The correct answer is 31.** The equation can be solved using the steps shown below.

$$2(5x - 20) - 15 - 8x = 7$$

$$2(5x) - 2(20) - 15 - 8x = 7 \text{ (Apply the distributive property.)}$$

$$10x - 40 - 15 - 8x = 7 \text{ (Multiply.)}$$

$$2x - 55 = 7 \text{ (Combine like terms.)}$$

$$2x = 62 \text{ (Add 55 to both sides of the equation.)}$$

$$x = 31 \text{ (Divide both sides of the equation by 2.)}$$

### QUESTION 33

**The possible correct answers are 97, 98, 99, 100, and 101.** The volume of a cylinder can be found by using the formula  $V = \pi r^2 h$ , where  $r$  is the radius of the circular base and  $h$  is the height of the cylinder. The smallest possible volume, in cubic inches, of a graduated cylinder produced by the laboratory supply company can be found by substituting 2 for  $r$  and 7.75 for  $h$ , giving  $V = \pi(2^2)(7.75)$ . This gives a volume of approximately 97.39 cubic inches, which rounds to 97 cubic inches. The largest possible volume, in cubic inches, can be found by substituting 2 for  $r$  and 8 for  $h$ , giving  $V = \pi(2^2)(8)$ . This gives a volume of approximately 100.53 cubic inches, which rounds to 101 cubic inches. Therefore, the possible volumes are all the integers greater than or equal to 97 and less than or equal to 101, which are 97, 98, 99, 100, and 101. Any of these numbers may be gridded as the correct answer.

### QUESTION 34

**The correct answer is 5.** The intersection points of the graphs of  $y = 3x^2 - 14x$  and  $y = x$  can be found by solving the system consisting of these two equations. To solve the system, substitute  $x$  for  $y$  in the first equation. This gives  $x = 3x^2 - 14x$ . Subtracting  $x$  from both sides of the equation gives  $0 = 3x^2 - 15x$ . Factoring  $3x$  out of each term on the left-hand side of the equation gives  $0 = 3x(x - 5)$ . Therefore, the possible values for  $x$  are 0 and 5. Since  $y = x$ , the two intersection points are (0, 0) and (5, 5). Therefore,  $a = 5$ .

### QUESTION 35

**The correct answer is 1.25 or  $\frac{5}{4}$ .** The  $y$ -coordinate of the  $x$ -intercept is 0, so 0 can be

substituted for  $y$ , giving  $\frac{4}{5}x + \frac{1}{3}(0) = 1$ . This simplifies to  $\frac{4}{5}x = 1$ . Multiplying both sides of  $\frac{4}{5}x$

= 1 by 5 gives  $4x = 5$ . Dividing both sides of  $4x = 5$  by 4 gives  $x = \frac{5}{4}$ , which is equivalent to 1.25.

Either  $\frac{5}{4}$  or 1.25 may be gridded as the correct answer.

### QUESTION 36

**The correct answer is 2.6 or  $\frac{13}{5}$ .** Since the mean of a set of numbers can be found by adding the numbers together and dividing by how many numbers there are in the set, the mean mass, in kilograms, of the rocks Andrew collected is  $\frac{2.4+2.5+3.6+3.1+2.5+2.7}{6} = \frac{16.8}{6} = 2.8$ . Since

the mean mass of the rocks Maria collected is 0.1 kilogram greater than the mean mass of rocks Andrew collected, the mean mass of the rocks Maria collected is  $2.8 + 0.1 = 2.9$  kilograms. The value of  $x$  can be found by using the algorithm for finding the mean:

$\frac{x+3.1+2.7+2.9+3.3+2.8}{6} = 2.9$ . Solving this equation gives  $x = 2.6$ , which is equivalent to  $\frac{13}{5}$

. Either 2.6 or  $\frac{13}{5}$  may be gridded as the correct answer.

### QUESTION 37

**The correct answer is 30.** The situation can be represented by the equation  $x(2^4) = 480$ , where the 2 represents the fact that the amount of money in the account doubled each year and the 4 represents the fact that there are 4 years between January 1, 2001, and January 1, 2005. Simplifying  $x(2^4) = 480$  gives  $16x = 480$ . Therefore,  $x = 30$ .

### QUESTION 38

**The correct answer is 8.** The 6 students represent  $(100 - 15 - 45 - 25)\% = 15\%$  of those invited to join the committee. If  $x$  people were invited to join the committee, then  $0.15x = 6$ . Thus, there were  $\frac{6}{0.15} = 40$  people invited to join the committee. It follows that there were  $0.45(40) = 18$  teachers and  $0.25(40) = 10$  school and district administrators invited to join the committee. Therefore, there were 8 more teachers than school and district administrators invited to join the committee.

# The SAT<sup>®</sup>

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# Practice Test #7

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from George Eliot, *Silas Marner*. Originally published in 1861. Silas was a weaver and a notorious miser, but then the gold he had hoarded was stolen. Shortly after, Silas adopted a young child, Eppie, the daughter of an impoverished woman who had died suddenly.

Unlike the gold which needed nothing, and must be worshipped in close-locked solitude—which was hidden away from the daylight, was deaf to the song of birds, and started to no human tones—Eppie was a  
 Line 5 creature of endless claims and ever-growing desires, seeking and loving sunshine, and living sounds, and living movements; making trial of everything, with trust in new joy, and stirring the human kindness in all eyes that looked on her. The gold had kept his  
 10 thoughts in an ever-repeated circle, leading to nothing beyond itself; but Eppie was an object compacted of changes and hopes that forced his thoughts onward, and carried them far away from their old eager pacing towards the same blank  
 15 limit—carried them away to the new things that would come with the coming years, when Eppie would have learned to understand how her father Silas cared for her; and made him look for images of that time in the ties and charities that bound together  
 20 the families of his neighbors. The gold had asked that

he should sit weaving longer and longer, deafened and blinded more and more to all things except the monotony of his loom and the repetition of his web; but Eppie called him away from his weaving, and  
 25 made him think all its pauses a holiday, reawakening his senses with her fresh life, even to the old winter-flies that came crawling forth in the early spring sunshine, and warming him into joy because *she* had joy.  
 30 And when the sunshine grew strong and lasting, so that the buttercups were thick in the meadows, Silas might be seen in the sunny mid-day, or in the late afternoon when the shadows were lengthening under the hedgerows, strolling out with uncovered  
 35 head to carry Eppie beyond the Stone-pits to where the flowers grew, till they reached some favorite bank where he could sit down, while Eppie toddled to pluck the flowers, and make remarks to the winged things that murmured happily above the bright  
 40 petals, calling “Dad-dad’s” attention continually by bringing him the flowers. Then she would turn her ear to some sudden bird-note, and Silas learned to please her by making signs of hushed stillness, that they might listen for the note to come again: so that  
 45 when it came, she set up her small back and laughed with gurgling triumph. Sitting on the banks in this way, Silas began to look for the once familiar herbs again; and as the leaves, with their unchanged outline and markings, lay on his palm, there was a sense of  
 50 crowding remembrances from which he turned away timidly, taking refuge in Eppie’s little world, that lay lightly on his enfeebled spirit.

As the child’s mind was growing into knowledge, his mind was growing into memory: as her life  
55 unfolded, his soul, long stupefied in a cold narrow prison, was unfolding too, and trembling gradually into full consciousness.

It was an influence which must gather force with every new year: the tones that stirred Silas’ heart  
60 grew articulate, and called for more distinct answers; shapes and sounds grew clearer for Eppie’s eyes and ears, and there was more that “Dad-dad” was imperatively required to notice and account for. Also, by the time Eppie was three years old, she  
65 developed a fine capacity for mischief, and for devising ingenious ways of being troublesome, which found much exercise, not only for Silas’ patience, but for his watchfulness and penetration. Sorely was poor Silas puzzled on such occasions by the incompatible  
70 demands of love.

1

Which choice best describes a major theme of the passage?

- A) The corrupting influence of a materialistic society
- B) The moral purity of young children
- C) The bittersweet brevity of childhood naïveté
- D) The restorative power of parental love

2

As compared with Silas’s gold, Eppie is portrayed as having more

- A) vitality.
- B) durability.
- C) protection.
- D) self-sufficiency.

3

Which statement best describes a technique the narrator uses to represent Silas’s character before he adopted Eppie?

- A) The narrator emphasizes Silas’s former obsession with wealth by depicting his gold as requiring certain behaviors on his part.
- B) The narrator underscores Silas’s former greed by describing his gold as seeming to reproduce on its own.
- C) The narrator hints at Silas’s former antisocial attitude by contrasting his present behavior toward his neighbors with his past behavior toward them.
- D) The narrator demonstrates Silas’s former lack of self-awareness by implying that he is unable to recall life before Eppie.

4

The narrator uses the phrase “making trial of everything” (line 7) to present Eppie as

- A) friendly.
- B) curious.
- C) disobedient.
- D) judgmental.

5

According to the narrator, one consequence of Silas adopting Eppie is that he

- A) has renounced all desire for money.
- B) better understands his place in nature.
- C) seems more accepting of help from others.
- D) looks forward to a different kind of future.

6

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 9-11 (“The gold . . . itself”)
- B) Lines 11-16 (“but Eppie . . . years”)
- C) Lines 41-43 (“Then . . . stillness”)
- D) Lines 61-63 (“shapes . . . for”)

7

What function does the second paragraph (lines 30-52) serve in the passage as a whole?

- A) It presents the particular moment at which Silas realized that Eppie was changing him.
- B) It highlights Silas’s love for Eppie by depicting the sacrifices that he makes for her.
- C) It illustrates the effect that Eppie has on Silas by describing the interaction between them.
- D) It reveals a significant alteration in the relationship between Silas and Eppie.

8

In describing the relationship between Eppie and Silas, the narrator draws a connection between Eppie’s

- A) physical vulnerability and Silas’s emotional fragility.
- B) expanding awareness and Silas’s increasing engagement with life.
- C) boundless energy and Silas’s insatiable desire for wealth.
- D) physical growth and Silas’s painful perception of his own mortality.

9

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-9 (“Unlike . . . her”)
- B) Lines 30-41 (“And when . . . flowers”)
- C) Lines 46-48 (“Sitting . . . again”)
- D) Lines 53-57 (“As the . . . consciousness”)

10

As used in line 65, “fine” most nearly means

- A) acceptable.
- B) delicate.
- C) ornate.
- D) keen.

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from David Rotman, “How Technology Is Destroying Jobs.” ©2013 by MIT Technology Review.

MIT business scholars Erik Brynjolfsson and Andrew McAfee have argued that impressive advances in computer technology—from improved industrial robotics to automated translation  
 Line 5 services—are largely behind the sluggish employment growth of the last 10 to 15 years. Even more ominous for workers, they foresee dismal prospects for many types of jobs as these powerful new technologies are increasingly adopted not only  
 10 in manufacturing, clerical, and retail work but in professions such as law, financial services, education, and medicine.

That robots, automation, and software can replace people might seem obvious to anyone who’s worked  
 15 in automotive manufacturing or as a travel agent. But Brynjolfsson and McAfee’s claim is more troubling and controversial. They believe that rapid technological change has been destroying jobs faster than it is creating them, contributing to the  
 20 stagnation of median income and the growth of inequality in the United States. And, they suspect, something similar is happening in other technologically advanced countries.

As evidence, Brynjolfsson and McAfee point to a  
 25 chart that only an economist could love. In economics, productivity—the amount of economic value created for a given unit of input, such as an hour of labor—is a crucial indicator of growth and wealth creation. It is a measure of progress. On the  
 30 chart Brynjolfsson likes to show, separate lines represent productivity and total employment in the United States. For years after World War II, the two lines closely tracked each other, with increases in jobs corresponding to increases in productivity. The  
 35 pattern is clear: as businesses generated more value from their workers, the country as a whole became richer, which fueled more economic activity and created even more jobs. Then, beginning in 2000, the

lines diverge; productivity continues to rise robustly,  
 40 but employment suddenly wilts. By 2011, a significant gap appears between the two lines, showing economic growth with no parallel increase in job creation. Brynjolfsson and McAfee call it the “great decoupling.” And Brynjolfsson says he is  
 45 confident that technology is behind both the healthy growth in productivity and the weak growth in jobs.

It’s a startling assertion because it threatens the faith that many economists place in technological progress. Brynjolfsson and McAfee still believe that  
 50 technology boosts productivity and makes societies wealthier, but they think that it can also have a dark side: technological progress is eliminating the need for many types of jobs and leaving the typical worker worse off than before. Brynjolfsson can point to a  
 55 second chart indicating that median income is failing to rise even as the gross domestic product soars. “It’s the great paradox of our era,” he says. “Productivity is at record levels, innovation has never been faster, and yet at the same time, we have a falling median  
 60 income and we have fewer jobs. People are falling behind because technology is advancing so fast and our skills and organizations aren’t keeping up.”

While technological changes can be painful for workers whose skills no longer match the needs of  
 65 employers, Lawrence Katz, a Harvard economist, says that no historical pattern shows these shifts leading to a net decrease in jobs over an extended period. Katz has done extensive research on how technological advances have affected jobs over the  
 70 last few centuries—describing, for example, how highly skilled artisans in the mid-19th century were displaced by lower-skilled workers in factories. While it can take decades for workers to acquire the  
 75 expertise needed for new types of employment, he says, “we never have run out of jobs. There is no long-term trend of eliminating work for people. Over the long term, employment rates are fairly stable. People have always been able to create new jobs. People come up with new things to do.”

80 Still, Katz doesn’t dismiss the notion that there is something different about today’s digital technologies—something that could affect an even broader range of work. The question, he says, is whether economic history will serve as a useful

85 guide. Will the job disruptions caused by technology  
 be temporary as the workforce adapts, or will we see  
 a science-fiction scenario in which automated  
 processes and robots with superhuman skills take  
 over a broad swath of human tasks? Though Katz  
 90 expects the historical pattern to hold, it is “genuinely  
 a question,” he says. “If technology disrupts enough,  
 who knows what will happen?”

Figure 1

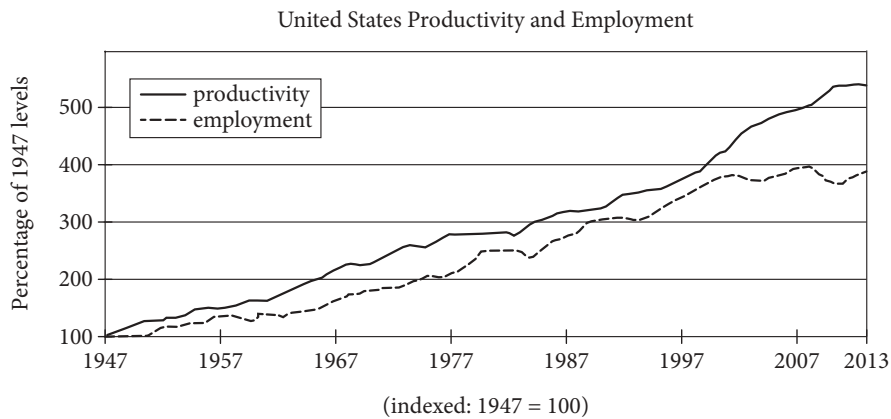
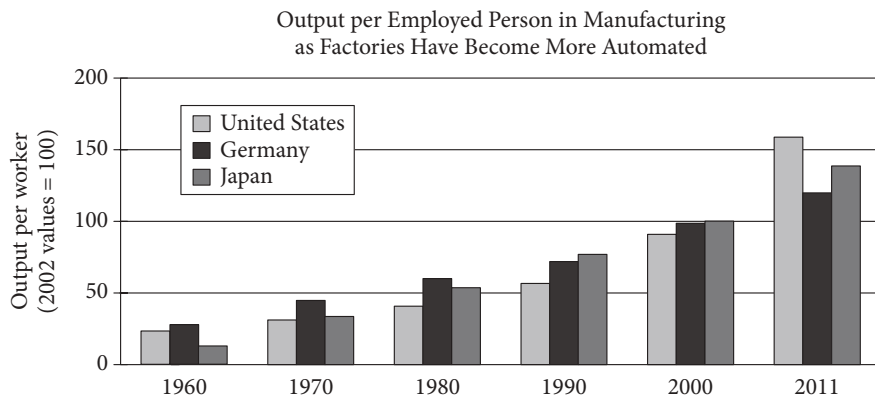


Figure 2



11

The main purpose of the passage is to

- A) examine the role of technology in workers' lives during the last century.
- B) advocate for better technology to enhance workplace conditions.
- C) argue for changes in how technology is deployed in the workplace.
- D) assess the impact of advancements in technology on overall job growth.

12

According to Brynjolfsson and McAfee, advancements in technology since approximately the year 2000 have resulted in

- A) low job growth in the United States.
- B) global workplace changes.
- C) more skilled laborers in the United States.
- D) no global creation of new jobs.

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-6 (“MIT . . . years”)
- B) Lines 13-15 (“That . . . agent”)
- C) Lines 21-23 (“And . . . countries”)
- D) Lines 35-38 (“as businesses . . . jobs”)

14

The primary purpose of lines 26-28 (“the amount . . . labor”) is to

- A) describe a process.
- B) highlight a dilemma.
- C) clarify a claim.
- D) explain a term.

15

As used in line 35, “clear” most nearly means

- A) pure.
- B) keen.
- C) untroubled.
- D) unmistakable.

16

Which of the following best characterizes Katz’s attitude toward “today’s digital technologies” (lines 81-82)?

- A) He is alarmed about countries’ increasing reliance on them.
- B) He is unconcerned about their effect on the economy.
- C) He is uncertain how they might affect job growth.
- D) He is optimistic that they will spur job creation to a degree not seen since the mid-nineteenth century.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 68-72 (“Katz . . . factories”)
- B) Lines 73-75 (“While . . . jobs”)
- C) Line 79 (“People come . . . do”)
- D) Lines 91-92 (“If . . . happen”)

18

As used in line 83, “range” most nearly means

- A) region.
- B) scope.
- C) distance.
- D) position.

19

According to figure 1, which of the following years showed the widest gap between percentages of productivity and employment?

- A) 1987
- B) 1997
- C) 2007
- D) 2013

20

Which statement is supported by figure 2?

- A) The country with the greatest growth in output per manufacturing worker from 1960 to 1990 was Germany.
- B) Japan experienced its smallest increase in output per manufacturing worker from 2000 to 2011.
- C) Each of the three countries experienced an increase in its output per manufacturing worker from 1960 to 2011.
- D) Of the three countries, the United States had the greatest output per manufacturing worker for each of the years shown.

21

Which additional information, if presented in figure 2, would be most useful in evaluating the statement in lines 57-60 (“Productivity . . . jobs”)?

- A) The median income of employees as it compares across all three countries in a single year
- B) The number of people employed in factories from 1960 to 2011
- C) The types of organizations at which output of employed persons was measured
- D) The kinds of manufacturing tasks most frequently taken over by machines



**Questions 22-31 are based on the following passage.**

This passage is adapted from Patricia Waldron, “Why Birds Fly in a V Formation.” ©2014 by American Association for the Advancement of Science.

Anyone watching the autumn sky knows that migrating birds fly in a V formation, but scientists have long debated why. A new study of ibises finds that these big-winged birds carefully position their  
 Line 5 wingtips and sync their flapping, presumably to catch the preceding bird’s updraft—and save energy during flight.

There are two reasons birds might fly in a V formation: It may make flight easier, or they’re  
 10 simply following the leader. Squadrons of planes can save fuel by flying in a V formation, and many scientists suspect that migrating birds do the same. Models that treated flapping birds like fixed-wing airplanes estimate that they save energy by drafting  
 15 off each other, but currents created by airplanes are far more stable than the oscillating eddies coming off of a bird. “Air gets pretty unpredictable behind a flapping wing,” says James Usherwood, a locomotor biomechanist at the Royal Veterinary College at the  
 20 University of London in Hatfield, where the research took place.

The study, published in *Nature*, took advantage of an existing project to reintroduce endangered northern bald ibises (*Geronticus eremita*) to Europe.  
 25 Scientists used a microlight plane to show hand-raised birds their ancestral migration route from Austria to Italy. A flock of 14 juveniles carried data loggers specially built by Usherwood and his lab. The device’s GPS determined each bird’s flight  
 30 position to within 30 cm, and an accelerometer showed the timing of the wing flaps.

Just as aerodynamic estimates would predict, the birds positioned themselves to fly just behind and to the side of the bird in front, timing their wing beats  
 35 to catch the uplifting eddies. When a bird flew directly behind another, the timing of the flapping reversed so that it could minimize the effects of the downdraft coming off the back of the bird’s body. “We didn’t think this was possible,” Usherwood  
 40 says, considering that the feat requires careful flight and incredible awareness of one’s neighbors. “Perhaps these big V formation birds can be thought of quite like an airplane with wings that go up and down.”

45 The findings likely apply to other long-winged birds, such as pelicans, storks, and geese, Usherwood says. Smaller birds create more complex wakes that would make drafting too difficult. The researchers did not attempt to calculate the bird’s energy savings  
 50 because the necessary physiological measurements would be too invasive for an endangered species. Previous studies estimate that birds can use 20 percent to 30 percent less energy while flying in a V.

55 “From a behavioral perspective it’s really a breakthrough,” says David Lentink, a mechanical engineer at Stanford University in Palo Alto, California, who was not involved in the work. “Showing that birds care about syncing their wing  
 60 beats is definitely an important insight that we didn’t have before.”

Scientists do not know how the birds find that aerodynamic sweet spot, but they suspect that the animals align themselves either by sight or  
 65 by sensing air currents through their feathers. Alternatively, they may move around until they find the location with the least resistance. In future studies, the researchers will switch to more common birds, such as pigeons or geese. They plan to  
 70 investigate how the animals decide who sets the course and the pace, and whether a mistake made by the leader can ripple through the rest of the flock to cause traffic jams.

“It’s a pretty impressive piece of work as it is, but  
 75 it does suggest that there’s a lot more to learn,” says Ty Hedrick, a biologist at the University of North Carolina, Chapel Hill, who studies flight aerodynamics in birds and insects. However they do it, he says, “birds are awfully good hang-glider  
 80 pilots.”

22

The main purpose of the passage is to

- A) describe how squadrons of planes can save fuel by flying in a V formation.
- B) discuss the effects of downdrafts on birds and airplanes.
- C) explain research conducted to study why some birds fly in a V formation.
- D) illustrate how birds sense air currents through their feathers.

23

The author includes the quotation “Air gets pretty unpredictable behind a flapping wing” (lines 17-18) to

- A) explain that the current created by a bird differs from that of an airplane.
- B) stress the amount of control exerted by birds flying in a V formation.
- C) indicate that wind movement is continuously changing.
- D) emphasize that the flapping of a bird’s wings is powerful.

24

What can reasonably be inferred about the reason Usherwood used northern bald ibises as the subjects of his study?

- A) The ibises were well acquainted with their migration route.
- B) Usherwood knew the ibises were familiar with carrying data loggers during migration.
- C) The ibises have a body design that is similar to that of a modern airplane.
- D) The ibises were easily accessible for Usherwood and his team to track and observe.

25

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-7 (“A new . . . flight”)
- B) Lines 10-12 (“Squadrons . . . same”)
- C) Lines 22-24 (“The study . . . Europe”)
- D) Lines 29-31 (“The device’s . . . flaps”)

26

What is the most likely reason the author includes the 30 cm measurement in line 30?

- A) To demonstrate the accuracy with which the data loggers collected the data
- B) To present recorded data about how far an ibis flies between successive wing flaps
- C) To provide the wingspan length of a juvenile ibis
- D) To show how far behind the microlight plane each ibis flew

27

What does the author imply about pelicans, storks, and geese flying in a V formation?

- A) They communicate with each other in the same way as do ibises.
- B) They have the same migration routes as those of ibises.
- C) They create a similar wake to that of ibises.
- D) They expend more energy than do ibises.

28

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 35-38 (“When . . . body”)
- B) Lines 47-48 (“Smaller . . . difficult”)
- C) Lines 52-54 (“Previous . . . a V”)
- D) Lines 66-67 (“Alternatively . . . resistance”)

29

What is a main idea of the seventh paragraph (lines 62-73)?

- A) Different types of hierarchies exist in each flock of birds.
- B) Mistakes can happen when long-winged birds create a V formation.
- C) Future research will help scientists to better understand V formations.
- D) Long-winged birds watch the lead bird closely to keep a V formation intact.

30

The author uses the phrase “aerodynamic sweet spot” in line 63 most likely to

- A) describe how the proper structural design of an airplane helps to save fuel.
- B) show that flying can be an exhilarating experience.
- C) describe the birds’ synchronized wing movement.
- D) suggest that a certain position in a V formation has the least amount of wind resistance.

31

As used in line 72, “ripple” most nearly means

- A) fluctuate.
- B) spread.
- C) wave.
- D) undulate.

**Questions 32-41 are based on the following passages.**

Passage 1 is adapted from Alexis de Tocqueville, *Democracy in America, Volume 2*. Originally published in 1840. Passage 2 is adapted from Harriet Taylor Mill, "Enfranchisement of Women." Originally published in 1851. As United States and European societies grew increasingly democratic during the nineteenth century, debates arose about whether freedoms enjoyed by men should be extended to women as well.

**Passage 1**

I have shown how democracy destroys or modifies the different inequalities which originate in society; but is this all? or does it not ultimately affect that great inequality of man and woman which has  
 5 seemed, up to the present day, to be eternally based in human nature? I believe that the social changes which bring nearer to the same level the father and son, the master and servant, and superiors and inferiors generally speaking, will raise woman and  
 10 make her more and more the equal of man. But here, more than ever, I feel the necessity of making myself clearly understood; for there is no subject on which the coarse and lawless fancies of our age have taken a freer range.

15 There are people in Europe who, confounding together the different characteristics of the sexes, would make of man and woman beings not only equal but alike. They would give to both the same functions, impose on both the same duties, and grant  
 20 to both the same rights; they would mix them in all things—their occupations, their pleasures, their business. It may readily be conceived, that by thus attempting to make one sex equal to the other, both are degraded; and from so preposterous a medley of  
 25 the works of nature nothing could ever result but weak men and disorderly women.

It is not thus that the Americans understand that species of democratic equality which may be established between the sexes. They admit, that as  
 30 nature has appointed such wide differences between the physical and moral constitution of man and woman, her manifest design was to give a distinct employment to their various faculties; and they hold

that improvement does not consist in making beings  
 35 so dissimilar do pretty nearly the same things, but in getting each of them to fulfill their respective tasks in the best possible manner. The Americans have applied to the sexes the great principle of political economy which governs the manufactures of our age,  
 40 by carefully dividing the duties of man from those of woman, in order that the great work of society may be the better carried on.

**Passage 2**

As society was constituted until the last few generations, inequality was its very basis; association  
 45 grounded on equal rights scarcely existed; to be equals was to be enemies; two persons could hardly cooperate in anything, or meet in any amicable relation, without the law's appointing that one of them should be the superior of the other.  
 50 Mankind have outgrown this state, and all things now tend to substitute, as the general principle of human relations, a just equality, instead of the dominion of the strongest. But of all relations, that between men and women, being the nearest and  
 55 most intimate, and connected with the greatest number of strong emotions, was sure to be the last to throw off the old rule, and receive the new; for, in proportion to the strength of a feeling is the tenacity with which it clings to the forms and  
 60 circumstances with which it has even accidentally become associated. . . .

. . . The proper sphere for all human beings is the largest and highest which they are able to attain to. What this is, cannot be ascertained without complete  
 65 liberty of choice. . . . Let every occupation be open to all, without favor or discouragement to any, and employments will fall into the hands of those men or women who are found by experience to be most capable of worthily exercising them. There need be  
 70 no fear that women will take out of the hands of men any occupation which men perform better than they. Each individual will prove his or her capacities, in the only way in which capacities can be proved,—by trial; and the world will have the benefit of the best  
 75 faculties of all its inhabitants. But to interfere beforehand by an arbitrary limit, and declare that whatever be the genius, talent, energy, or force of

mind, of an individual of a certain sex or class, those faculties shall not be exerted, or shall be exerted only  
80 in some few of the many modes in which others are permitted to use theirs, is not only an injustice to the individual, and a detriment to society, which loses what it can ill spare, but is also the most effectual way of providing that, in the sex or class so fettered, the  
85 qualities which are not permitted to be exercised shall not exist.

32

As used in line 9, “raise” most nearly means

- A) increase.
- B) cultivate.
- C) nurture.
- D) elevate.

33

In Passage 1, Tocqueville implies that treatment of men and women as identical in nature would have which consequence?

- A) Neither sex would feel oppressed.
- B) Both sexes would be greatly harmed.
- C) Men would try to reclaim their lost authority.
- D) Men and women would have privileges they do not need.

34

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 15-18 (“There . . . alike”)
- B) Lines 18-20 (“They . . . rights”)
- C) Lines 22-24 (“It may . . . degraded”)
- D) Lines 27-29 (“It is . . . sexes”)

35

As used in line 53, “dominion” most nearly means

- A) omnipotence.
- B) supremacy.
- C) ownership.
- D) territory.

36

In Passage 2, Mill most strongly suggests that gender roles are resistant to change because they

- A) have long served as the basis for the formal organization of society.
- B) are matters of deeply entrenched tradition.
- C) can be influenced by legislative reforms only indirectly.
- D) benefit the groups and institutions currently in power.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 43-44 (“As society . . . basis”)
- B) Lines 46-49 (“two . . . other”)
- C) Lines 58-61 (“in proportion . . . associated”)
- D) Lines 67-69 (“employments . . . them”)

38

Both authors would most likely agree that the changes in gender roles that they describe would be

- A) part of a broad social shift toward greater equality.
- B) unlikely to provide benefits that outweigh their costs.
- C) inevitable given the economic advantages of gender equality.
- D) at odds with the principles of American democracy.

39

Tocqueville in Passage 1 would most likely characterize the position taken by Mill in lines 65-69 in Passage 2 (“Let . . . them”) as

- A) less radical about gender roles than it might initially seem.
- B) persuasive in the abstract but difficult to implement in practice.
- C) ill-advised but consistent with a view held by some other advocates of gender equality.
- D) compatible with economic progress in the United States but not in Europe.

40

Which choice best describes the ways that the two authors conceive of the individual’s proper position in society?

- A) Tocqueville believes that an individual’s position should be defined in important ways by that individual’s sex, while Mill believes that an individual’s abilities should be the determining factor.
- B) Tocqueville believes that an individual’s economic class should determine that individual’s position, while Mill believes that class is not a legitimate consideration.
- C) Tocqueville believes that an individual’s temperament should determine that individual’s position, while Mill believes that temperament should not be a factor in an individual’s position.
- D) Tocqueville believes that an individual’s position should be determined by what is most beneficial to society, while Mill believes it should be determined by what an individual finds most rewarding.

41

Based on Passage 2, Mill would most likely say that the application of the “great principle of political economy” (lines 38-39, Passage 1) to gender roles has which effect?

- A) It prevents many men and women from developing to their full potential.
- B) It makes it difficult for men and women to sympathize with each other.
- C) It unintentionally furthers the cause of gender equality.
- D) It guarantees that women take occupations that men are better suited to perform.

**Questions 42-52 are based on the following passage and supplementary material.**

This passage is adapted from Brian Greene, “How the Higgs Boson Was Found.” ©2013 by Smithsonian Institution. The Higgs boson is an elementary particle associated with the Higgs field. Experiments conducted in 2012–2013 tentatively confirmed the existence of the Higgs boson and thus of the Higgs field.

Nearly a half-century ago, Peter Higgs and a handful of other physicists were trying to understand the origin of a basic physical feature: mass. You can think of mass as an object’s heft or, a little more precisely, as the resistance it offers to having its motion changed. Push on a freight train (or a feather) to increase its speed, and the resistance you feel reflects its mass. At a microscopic level, the freight train’s mass comes from its constituent molecules and atoms, which are themselves built from fundamental particles, electrons and quarks. But where do the masses of these and other fundamental particles come from?

When physicists in the 1960s modeled the behavior of these particles using equations rooted in quantum physics, they encountered a puzzle. If they imagined that the particles were all massless, then each term in the equations clicked into a perfectly symmetric pattern, like the tips of a perfect snowflake. And this symmetry was not just mathematically elegant. It explained patterns evident in the experimental data. But—and here’s the puzzle—physicists knew that the particles did have mass, and when they modified the equations to account for this fact, the mathematical harmony was spoiled. The equations became complex and unwieldy and, worse still, inconsistent.

What to do? Here’s the idea put forward by Higgs. Don’t shove the particles’ masses down the throat of the beautiful equations. Instead, keep the equations pristine and symmetric, but consider them operating within a peculiar environment. Imagine that all of space is uniformly filled with an invisible substance—now called the Higgs field—that exerts a drag force on particles when they accelerate through it. Push on a fundamental particle in an effort to increase its speed and, according to Higgs, you would

feel this drag force as a resistance. Justifiably, you would interpret the resistance as the particle’s mass.

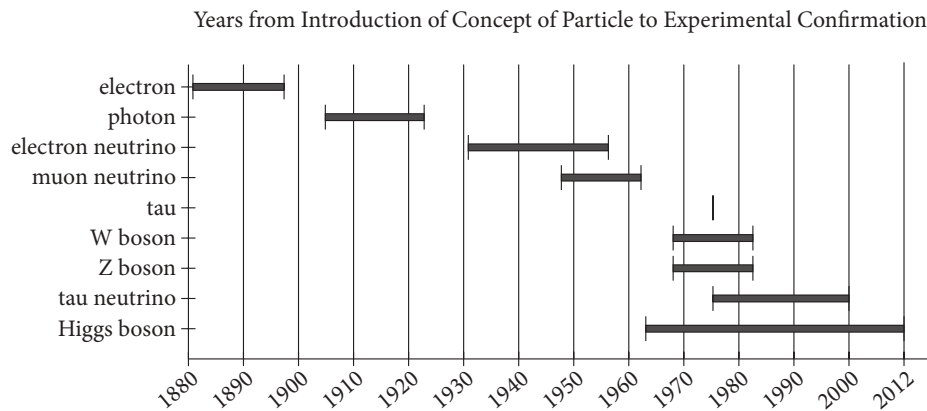
40 For a mental toehold, think of a ping-pong ball submerged in water. When you push on the ping-pong ball, it will feel much more massive than it does outside of water. Its interaction with the watery environment has the effect of endowing it with mass.

45 So with particles submerged in the Higgs field.

In 1964, Higgs submitted a paper to a prominent physics journal in which he formulated this idea mathematically. The paper was rejected. Not because it contained a technical error, but because the premise of an invisible something permeating space, interacting with particles to provide their mass, well, it all just seemed like heaps of overwrought speculation. The editors of the journal deemed it “of no obvious relevance to physics.”

55 But Higgs persevered (and his revised paper appeared later that year in another journal), and physicists who took the time to study the proposal gradually realized that his idea was a stroke of genius, one that allowed them to have their cake and eat it too. In Higgs’s scheme, the fundamental equations can retain their pristine form because the dirty work of providing the particles’ masses is relegated to the environment.

While I wasn’t around to witness the initial rejection of Higgs’s proposal in 1964 (well, I was around, but only barely), I can attest that by the mid-1980s, the assessment had changed. The physics community had, for the most part, fully bought into the idea that there was a Higgs field permeating space. In fact, in a graduate course I took that covered what’s known as the Standard Model of Particle Physics (the quantum equations physicists have assembled to describe the particles of matter and the dominant forces by which they influence each other), the professor presented the Higgs field with such certainty that for a long while I had no idea it had yet to be established experimentally. On occasion, that happens in physics. Mathematical equations can sometimes tell such a convincing tale, they can seemingly radiate reality so strongly, that they become entrenched in the vernacular of working physicists, even before there’s data to confirm them.



Adapted from the editors of *The Economist*, "Worth the Wait." ©2012 by The Economist Newspaper Limited.

42

Over the course of the passage, the main focus shifts from

- A) a technical account of the Higgs field to a description of it aimed at a broad audience.
- B) a review of Higgs's work to a contextualization of that work within Higgs's era.
- C) an explanation of the Higgs field to a discussion of the response to Higgs's theory.
- D) an analysis of the Higgs field to a suggestion of future discoveries that might build upon it.

43

The main purpose of the analogy of the ping-pong ball (line 40) is to

- A) popularize a little-known fact.
- B) contrast competing scientific theories.
- C) criticize a widely accepted explanation.
- D) clarify an abstract concept.

44

The author most strongly suggests that the reason the scientific community initially rejected Higgs's idea was that the idea

- A) addressed a problem unnoticed by other physicists.
- B) only worked if the equations were flawless.
- C) rendered accepted theories in physics obsolete.
- D) appeared to have little empirical basis.

45

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 30-32 ("Instead . . . environment")
- B) Lines 46-48 ("In 1964 . . . mathematically")
- C) Lines 48-53 ("Not . . . speculation")
- D) Lines 67-70 ("The physics . . . space")



46

The author notes that one reason Higgs’s theory gained acceptance was that it

- A) let scientists accept two conditions that had previously seemed irreconcilable.
- B) introduced an innovative approach that could be applied to additional problems.
- C) answered a question that earlier scientists had not even raised.
- D) explained why two distinct phenomena were being misinterpreted as one phenomenon.

47

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 36-39 (“Push . . . mass”)
- B) Lines 43-45 (“Its interaction . . . field”)
- C) Lines 55-63 (“But . . . environment”)
- D) Lines 78-83 (“On occasion . . . them”)

48

Which statement best describes the technique the author uses to advance the main point of the last paragraph?

- A) He recounts a personal experience to illustrate a characteristic of the discipline of physics.
- B) He describes his own education to show how physics has changed during his career.
- C) He provides autobiographical details to demonstrate how Higgs’s theory was confirmed.
- D) He contrasts the status of Higgs’s theory at two time periods to reveal how the details of the theory evolved.

49

As used in line 77, “established” most nearly means

- A) validated.
- B) founded.
- C) introduced.
- D) enacted.

50

What purpose does the graph serve in relation to the passage as a whole?

- A) It indicates that the scientific community’s quick acceptance of the Higgs boson was typical.
- B) It places the discussion of the reception of the Higgs boson into a broader scientific context.
- C) It demonstrates that the Higgs boson was regarded differently than were other hypothetical particles.
- D) It clarifies the ways in which the Higgs boson represented a major discovery.

51

Which statement is best supported by the data presented in the graph?

- A) The W boson and the Z boson were proposed and experimentally confirmed at about the same time.
- B) The Higgs boson was experimentally confirmed more quickly than were most other particles.
- C) The tau neutrino was experimentally confirmed at about the same time as the tau.
- D) The muon neutrino took longer to experimentally confirm than did the electron neutrino.

52

Based on the graph, the author's depiction of Higgs's theory in the mid-1980s is most analogous to which hypothetical situation?

- A) The muon neutrino was widely disputed until being confirmed in the early 1960s.
- B) Few physicists in 2012 doubted the reality of the tau neutrino.
- C) No physicists prior to 1960 considered the possibility of the W or Z boson.
- D) Most physicists in 1940 believed in the existence of the electron neutrino.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

#### NASA: A Space Program with Down-to-Earth Benefits

The National Aeronautics and Space Administration (NASA) is a US government agency whose budget is frequently **1** many times contested. Many people think of NASA’s programs as trivial. In truth, the agency has a widespread positive **2** effect on society by serving as a catalyst for innovation and scientific understanding,

1

- A) NO CHANGE
- B) oftentimes
- C) repeatedly
- D) DELETE the underlined portion.

2

- A) NO CHANGE
- B) affect on
- C) effect to
- D) affects on

**3** to create jobs, and showing humanity its place within the universe.

In 1958, the program's first year, very few people believed that it was even possible for a manned spacecraft to leave the atmosphere and orbit Earth. But by initiating and collaborating on projects such as the Apollo Moon missions, the space shuttle program, the Hubble Space

**4** Telescope, and unmanned planetary exploration, NASA has continually challenged its scientists and engineers to do things that were previously thought impossible. All along, these NASA projects have **5** greatly increased international cooperation. A short list of inventions **6** elaborated by NASA includes communications satellites, invisible braces, and cordless tools. All these inventions **7** spawns new industries, and with those industries, jobs. NASA also sponsors the Small Business Innovation Research and Small Business Technology Transfer programs, which are specifically designed to support technological development in the private sector.

3

- A) NO CHANGE
- B) creating jobs,
- C) for job creation,
- D) the creation of jobs,

4

- A) NO CHANGE
- B) Telescope; and
- C) Telescope and;
- D) Telescope and,

5

Which choice most effectively sets up the list of examples that follows in the next sentence?

- A) NO CHANGE
- B) garnered national publicity for the agency.
- C) generated a steady stream of new technology.
- D) made a lot of money for the agency.

6

- A) NO CHANGE
- B) evolved
- C) developed
- D) progressed

7

- A) NO CHANGE
- B) spawned
- C) has spawned
- D) spawning

[1] A report by the Space Foundation estimated that NASA contributed \$180 billion to the economy in 2005.

[2] More than 60 percent of the contribution **8** coming from commercial goods and services created by companies using space-related technology. [3] This translates as excellent returns from an agency that received approximately 17.7 billion in tax dollars in 2014.

[4] This investment by taxpayers enhances not only the national economy but also the United States' competitiveness in the international market.

[5] Moreover, the benefits of NASA funding extend beyond the purely economic, as astrophysicist Neil deGrasse Tyson indicated in his testimony before the US Senate: "For . . . a penny on a dollar—we can transform the country from a sullen, dispirited nation, weary of economic struggle, to one where it has reclaimed its twentieth-century birthright to dream of tomorrow." **9**

8

- A) NO CHANGE
- B) which came
- C) to come
- D) came

9

To make this paragraph most logical, sentence 1 should be placed

- A) where it is now.
- B) after sentence 2.
- C) after sentence 3.
- D) after sentence 4.

Tyson’s expansive vision for the agency hints at another mission of NASA’s, illuminated in this observation by Apollo 14 astronaut Edgar Mitchell: “You develop an instant global consciousness, a people orientation, an intense dissatisfaction with the state of the world, and a compulsion to do something about it.”

**10** With world population topping seven billion, humanity is in need of some perspective. **11** Therefore, we should continue to support NASA not only for practical reasons but also because it is a necessary vehicle for increasing our awareness of how we can fulfill our responsibilities to the planet and each other.

**10**

At this point, the writer is considering adding the following sentence.

In addition, NASA has facilities in Washington, DC, Florida, Texas, California, and other states.

Should the writer make this addition here?

- A) Yes, because it serves as a counterargument to the quotation from astrophysicist Neil deGrasse Tyson.
- B) Yes, because it reinforces the passage’s point about the importance of NASA’s work.
- C) No, because it undermines the passage’s claim about the economic benefits of NASA’s work.
- D) No, because it blurs the paragraph’s focus by introducing information that does not support the paragraph’s claim about the importance of NASA’s work.

**11**

- A) NO CHANGE
- B) Instead,
- C) For example,
- D) However,

Questions 12-22 are based on the following passage and supplementary material.

**Professional Development: A Shared Responsibility**

New theories, **12** new practices too, and technologies are transforming the twenty-first-century workplace at lightning speed. To perform their jobs successfully in this dynamic environment, workers in many **13** fields—from social services to manufacturing, must continually acquire relevant knowledge and update key skills. This practice of continued education, also known as professional development, benefits not only employees but also their employers. **14** Accordingly, meaningful professional development is a shared responsibility: it is the responsibility of employers to provide useful programs, and it is also the responsibility of employees to take advantage of the opportunities offered to them.

Critics of employer-provided professional development argue that employees **15** might consider a popular career path. If employees find themselves falling behind in the workplace, these critics **16** contend. Then it is the duty of those employees to identify, and even pay

12

- A) NO CHANGE
- B) also new practices,
- C) in addition to practices,
- D) practices,

13

- A) NO CHANGE
- B) fields
- C) fields,
- D) fields;

14

- A) NO CHANGE
- B) Nevertheless,
- C) Regardless,
- D) Similarly,

15

Which choice best establishes the argument that follows?

- A) NO CHANGE
- B) should lean heavily on their employers.
- C) must be in charge of their own careers.
- D) will be ready for changes in the job market.

16

- A) NO CHANGE
- B) contend; then
- C) contend then
- D) contend, then



for, appropriate resources to **17** show them how and why they are falling behind and what they should do about it. This argument ignores research pointing to high employee turnover and training of new staff as significant costs plaguing employers in many fields. Forward-thinking employers recognize the importance of investing in the employees they have rather than hiring new staff when the skills of current workers **18** get old and worn out.

17

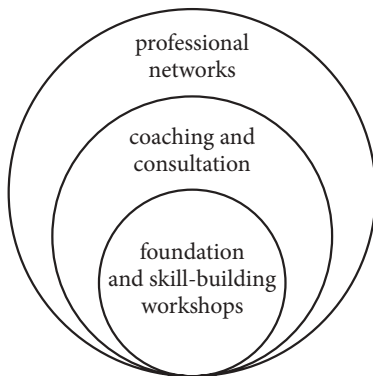
- A) NO CHANGE
- B) address their deficiencies.
- C) deal with their flaws and shortcomings.
- D) allow them to meet their employers' needs in terms of the knowledge they are supposed to have.

18

- A) NO CHANGE
- B) are no good anymore.
- C) become obsolete.
- D) have lost their charm.

The most common forms of professional development provided to employees **19** includes coaching, mentoring, technical assistance, and workshops. Some employers utilize several approaches simultaneously, developing a framework that suits the particular needs of their employees. **20** Around the same time, the figure illustrates a simple yet comprehensive professional-development model created for special education personnel. As the figure suggests, **21** receiving coaching and consultation is the overarching framework, while the opportunity to belong to professional networks and participate in activities such as foundation and skill-building workshops is relatively unimportant.

Professional-Development Framework



Adapted from Northern Suburban Special Education District, "Professional Development Framework." ©2014 by Northern Suburban Special Education Program.

19

- A) NO CHANGE
- B) include
- C) including
- D) has included

20

- A) NO CHANGE
- B) Besides that,
- C) Nevertheless,
- D) DELETE the underlined portion and begin the sentence with a capital letter.

21

Which choice makes the writer's description of the figure most accurate?

- A) NO CHANGE
- B) participation in foundation and skill-building workshops is the overarching framework within which staff receive coaching and consultation as well as the opportunity to belong to a professional network.
- C) membership in a professional network is the overarching framework within which staff receive coaching and consultation as well as the opportunity to attend foundation and skill-building workshops.
- D) receiving coaching and consultation is the overarching framework within which staff have the opportunity to belong to a professional network as well as attend foundation and skill-building workshops.

A recent trend in professional development that has provided advantages to both employers and employees is online instruction. From an employer perspective, the first and perhaps most obvious advantage is the lower cost of online professional development compared with that of in-person workshops and training. Employers can also **22** identify, which employees have successfully completed instructional modules and which need to be offered additional training. For employees, online professional development provides the opportunity to receive instruction at their own pace and interact with other professionals online. This exciting trend has the potential to make the shared responsibility of professional development less burdensome for both employers and employees.

22

- A) NO CHANGE
- B) identify:
- C) identify
- D) identify—

Questions 23-33 are based on the following passage.

### The Evolution of Slow Food

In 1986, McDonald's caused a stir in Italy when it opened a restaurant next to Rome's historic Spanish Steps. Young, on-the-go eaters were thrilled; **23** specifically, those who prized regional foods and Italy's convivial culture built on cooking and long meals feared that the restaurant signaled the death of a way of life. To counter the rise of fast food and fast **24** life, a cohort of chefs, journalists, and sociologists spearheaded a Slow Food movement, declaring loyalty to unhurried enjoyment. **25**

From its beginning, the movement **26** had opposed the standardization of taste that fast food chains promote. For example, a McDonald's hamburger made in Boston tastes more or less the same as one made in Beijing. This consistency is made possible by industrial mass production. Slow Food supporters, by contrast, back methods of growing and preparing food based on regional culinary traditions. When produced using traditional methods, goat cheese made in France tastes different from goat cheese made in Vermont. A goat

23

- A) NO CHANGE
- B) for example,
- C) however,
- D) in fact,

24

- A) NO CHANGE
- B) life; a
- C) life: a
- D) life. A

25

At this point, the writer is considering adding the following sentence.

The group's philosophy was connected to the tale of the hare and the tortoise, in which the tortoise wins the race.

Should the writer make this addition here?

- A) Yes, because it explains the primary belief that led to the development of the Slow Food movement.
- B) Yes, because it reinforces a claim that the writer makes earlier in the paragraph.
- C) No, because it blurs the paragraph's focus by introducing a new idea that is not clearly explained.
- D) No, because it distracts from the paragraph's emphasis on the Slow Food movement's origins and beliefs.

26

- A) NO CHANGE
- B) opposes
- C) will oppose
- D) has opposed

ingests the vegetation particular to the meadow in which it grazes, which, along with other environmental **27** factors such as altitude and weather shapes the cheese’s taste and texture. If all foods were produced under the industrial model, **28** we would have meals that are not very flavorful.

During **29** their early years, the movement also focused on the value of **30** spending lots of time with friends and family during long meals. It emphasized the importance of preserving these “easygoing, slow

27

- A) NO CHANGE
- B) factors, such as altitude and weather,
- C) factors such as, altitude and weather,
- D) factors, such as altitude and weather

28

Which choice most effectively supports the central point of the paragraph?

- A) NO CHANGE
- B) the public would not be interested in learning about traditional foods.
- C) people would not be able to determine how a particular food was made.
- D) consumers would lose this diversity of flavors.

29

- A) NO CHANGE
- B) there
- C) its
- D) it’s

30

- A) NO CHANGE
- B) leisurely meals with friends and family.
- C) eating slowly and in the company of loved ones such as friends and family.
- D) joining friends as well as family for time-consuming meals.

pleasures.” As the movement grew beyond Italy’s borders—today Slow Food International boasts more than 100,000 members in 150 countries—this emphasis on pleasure **31** pictured criticism for being elitist. Critics have also asked if growing food using traditional methods, as opposed to mass production, **32** can adequately and affordably feed the world? Given the hectic pace of modern life, who among us has the time and resources for elaborate meals? Such questions, in addition to environmental concerns, are at the heart of perennial debates about food production.

Over time, Slow Food has broadened its mission to focus on food that is good, clean, and fair for all. Members assert that food should be flavorful, carrying the properties of a particular region; it should be raised using environmentally sustainable practices that preserve biodiversity; and it should be accessible to all without exploiting the labors of those who produced it. **33** In short, Slow Food runs programs that support small-scale producers in marketing regional foods in a world where food corporations threaten to drive them out of the marketplace and homogenize food choices.

31

- A) NO CHANGE
- B) portrayed
- C) drew
- D) sketched

32

- A) NO CHANGE
- B) adequately and affordably can feed the world?
- C) can adequately and affordably feed the world.
- D) adequately and affordably can feed the world.

33

- A) NO CHANGE
- B) Nonetheless,
- C) To these ends,
- D) By the same token,

Questions 34-44 are based on the following passage.

**Was the Hoax a Hoax?**

For an hour on the evening of October 30, 1938, Orson Welles and other performers from the Mercury Theatre flooded the airwaves with alarming “news bulletins” about a Martian invasion supposedly occurring in Grover’s Mill, New Jersey. They were performing a radio play adapted from *The War of the Worlds*, a science fiction novel by H. G. Wells. The next day, a front-page **34** headline in the *New York Times* declared, “Radio Listeners in Panic, Taking War Drama as Fact.” **35** The *Times* article claimed that people had fled their homes and that police stations had been swamped with calls. This version of events persisted, and the legend became that Welles’s broadcast had as many as twelve million people **36** who feared that Martians had invaded Earth.

Recently, however, scholars have questioned the accuracy of this legend, suggesting the degree of public hysteria has been grossly exaggerated. The authors of an article published in October 2013 go **37** so far to assign blame for the distortion to the newspaper industry.

34

- A) NO CHANGE
- B) headline in the *New York Times*, declared
- C) headline, in the *New York Times* declared,
- D) headline, in the *New York Times*, declared

35

The writer wants to add a supporting detail to indicate that the story was widely reported. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Other newspapers also ran stories claiming that the broadcast had incited mass hysteria.
- C) In 2013, many newspapers and magazines featured articles about the seventy-fifth anniversary of the broadcast.
- D) The *Times* was then and is now one of the United States’ most popular news sources.

36

- A) NO CHANGE
- B) that feared
- C) fearing
- D) to fear

37

- A) NO CHANGE
- B) as far
- C) as far and
- D) so far as

**38** At this time, Jefferson Pooley and Michael Socolow, both professors of communication studies, argue that the newspaper industry sought to discredit the newly emerging technology of radio, which was cutting into newspapers' **39** profits. The newspaper industry tried to do this by portraying the new medium as irresponsible.

[1] Proof of ulterior motives is scarce,

**40** consequently weakening Pooley and Socolow's argument. [2] For instance, the C. E. Hooper ratings indicate that a mere 2 percent of households had tuned in to the broadcast. [3] Pooley and Socolow also call into question the validity of an oft-cited report that was based on a survey conducted six weeks after the broadcast. [4] Just because some people found the broadcast unsettling, the authors contend, doesn't mean they believed it and reacted with real terror. [5] According to this report, one million people indicated that they had been "frightened" by the broadcast. [6] Ratings, however, reveal that **41** far fewer than a million people had been

38

- A) NO CHANGE
- B) On one hand,
- C) In the article,
- D) Next,

39

Which choice most effectively combines the sentences at the underlined portion?

- A) profits, which is what the newspaper industry tried to do when it portrayed
- B) profits, by which the newspaper industry portrayed
- C) profits and tried to do this by portraying
- D) profits, by portraying

40

Which choice best establishes the main idea of the paragraph?

- A) NO CHANGE
- B) but evidence does suggest that reports of panic have been overblown.
- C) yet Pooley and Socolow maintain that the newspaper industry intentionally distorted the story.
- D) making it difficult to determine what really happened in 1938.

41

- A) NO CHANGE
- B) many less than
- C) much less then
- D) much fewer then



listening to the broadcast. [7] Furthermore, Pooley and Socolow note that this survey “conflated being ‘frightened,’ ‘disturbed,’ or ‘excited’ by the program with being ‘panicked.’” 42

Pooley and Socolow describe a more likely scenario: most people who heard the broadcast understood they were listening to a piece of fiction, but 43 some being influenced by the sensationalized news coverage afterward, later “remembered” being more afraid than they had been. The researchers also suggest that, 44 not unlike people who got caught up in the excitement of the story when reading about it in the newspaper, the American public may have been willing to embrace the legend because of its appeal to the imagination.

42

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) after sentence 2.
- C) after sentence 5.
- D) after sentence 7.

43

- A) NO CHANGE
- B) some, they were
- C) some,
- D) some

44

Which choice most effectively signals the comparison the writer is making between the two groups mentioned?

- A) NO CHANGE
- B) unlike
- C) not like
- D) different from

## STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

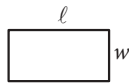
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

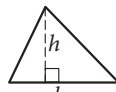


$$A = \pi r^2$$

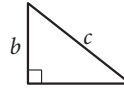
$$C = 2\pi r$$



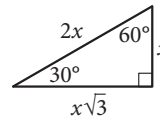
$$A = \ell w$$



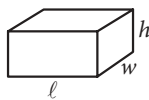
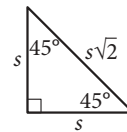
$$A = \frac{1}{2}bh$$



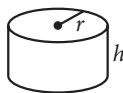
$$c^2 = a^2 + b^2$$



Special Right Triangles



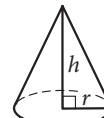
$$V = \ell wh$$



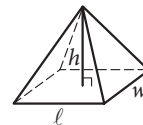
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

$$x + y = 75$$

The equation above relates the number of minutes,  $x$ , Maria spends running each day and the number of minutes,  $y$ , she spends biking each day. In the equation, what does the number 75 represent?

- A) The number of minutes spent running each day
- B) The number of minutes spent biking each day
- C) The total number of minutes spent running and biking each day
- D) The number of minutes spent biking for each minute spent running

2

Which of the following is equivalent to  $3(x + 5) - 6$  ?

- A)  $3x - 3$
- B)  $3x - 1$
- C)  $3x + 9$
- D)  $15x - 6$

3

$$x = y - 3$$

$$\frac{x}{2} + 2y = 6$$

Which ordered pair  $(x, y)$  satisfies the system of equations shown above?

- A)  $(-3, 0)$
- B)  $(0, 3)$
- C)  $(6, -3)$
- D)  $(36, -6)$

4

Which of the following complex numbers is equal to  $(5 + 12i) - (9i^2 - 6i)$ , for  $i = \sqrt{-1}$  ?

- A)  $-14 - 18i$
- B)  $-4 - 6i$
- C)  $4 + 6i$
- D)  $14 + 18i$



5

If  $f(x) = \frac{x^2 - 6x + 3}{x - 1}$ , what is  $f(-1)$ ?

- A) -5
- B) -2
- C) 2
- D) 5

6

A company that makes wildlife videos purchases camera equipment for \$32,400. The equipment depreciates in value at a constant rate for 12 years, after which it is considered to have no monetary value. How much is the camera equipment worth 4 years after it is purchased?

- A) \$10,800
- B) \$16,200
- C) \$21,600
- D) \$29,700

7

$$x^2 + 6x + 4$$

Which of the following is equivalent to the expression above?

- A)  $(x + 3)^2 + 5$
- B)  $(x + 3)^2 - 5$
- C)  $(x - 3)^2 + 5$
- D)  $(x - 3)^2 - 5$

8

Ken is working this summer as part of a crew on a farm. He earned \$8 per hour for the first 10 hours he worked this week. Because of his performance, his crew leader raised his salary to \$10 per hour for the rest of the week. Ken saves 90% of his earnings from each week. What is the least number of hours he must work the rest of the week to save at least \$270 for the week?

- A) 38
- B) 33
- C) 22
- D) 16



9

Marisa needs to hire at least 10 staff members for an upcoming project. The staff members will be made up of junior directors, who will be paid \$640 per week, and senior directors, who will be paid \$880 per week. Her budget for paying the staff members is no more than \$9,700 per week. She must hire at least 3 junior directors and at least 1 senior director. Which of the following systems of inequalities represents the conditions described if  $x$  is the number of junior directors and  $y$  is the number of senior directors?

- A)  $640x + 880y \geq 9,700$   
 $x + y \leq 10$   
 $x \geq 3$   
 $y \geq 1$
- B)  $640x + 880y \leq 9,700$   
 $x + y \geq 10$   
 $x \geq 3$   
 $y \geq 1$
- C)  $640x + 880y \geq 9,700$   
 $x + y \geq 10$   
 $x \leq 3$   
 $y \leq 1$
- D)  $640x + 880y \leq 9,700$   
 $x + y \leq 10$   
 $x \leq 3$   
 $y \leq 1$

10

$$ax^3 + bx^2 + cx + d = 0$$

In the equation above,  $a$ ,  $b$ ,  $c$ , and  $d$  are constants. If the equation has roots  $-1$ ,  $-3$ , and  $5$ , which of the following is a factor of  $ax^3 + bx^2 + cx + d$  ?

- A)  $x - 1$   
B)  $x + 1$   
C)  $x - 3$   
D)  $x + 5$



11

The expression  $\frac{x^{-2}y^{\frac{1}{2}}}{x^{\frac{1}{3}}y^{-1}}$ , where  $x > 1$  and  $y > 1$ , is

equivalent to which of the following?

- A)  $\frac{\sqrt{y}}{\sqrt[3]{x^2}}$
- B)  $\frac{y\sqrt{y}}{\sqrt[3]{x^2}}$
- C)  $\frac{y\sqrt{y}}{x\sqrt{x}}$
- D)  $\frac{y\sqrt{y}}{x^2\sqrt[3]{x}}$

12

The function  $f$  is defined by  $f(x) = (x+3)(x+1)$ . The graph of  $f$  in the  $xy$ -plane is a parabola. Which of the following intervals contains the  $x$ -coordinate of the vertex of the graph of  $f$ ?

- A)  $-4 < x < -3$
- B)  $-3 < x < 1$
- C)  $1 < x < 3$
- D)  $3 < x < 4$



13

Which of the following expressions is equivalent to

$$\frac{x^2 - 2x - 5}{x - 3} ?$$

- A)  $x - 5 - \frac{20}{x - 3}$   
B)  $x - 5 - \frac{10}{x - 3}$   
C)  $x + 1 - \frac{8}{x - 3}$   
D)  $x + 1 - \frac{2}{x - 3}$

14

A shipping service restricts the dimensions of the boxes it will ship for a certain type of service. The restriction states that for boxes shaped like rectangular prisms, the sum of the perimeter of the base of the box and the height of the box cannot exceed 130 inches. The perimeter of the base is determined using the width and length of the box. If a box has a height of 60 inches and its length is 2.5 times the width, which inequality shows the allowable width  $x$ , in inches, of the box?

- A)  $0 < x \leq 10$   
B)  $0 < x \leq 11\frac{2}{3}$   
C)  $0 < x \leq 17\frac{1}{2}$   
D)  $0 < x \leq 20$

15

The expression  $\frac{1}{3}x^2 - 2$  can be rewritten as  $\frac{1}{3}(x - k)(x + k)$ , where  $k$  is a positive constant.

What is the value of  $k$  ?

- A) 2  
B) 6  
C)  $\sqrt{2}$   
D)  $\sqrt{6}$



**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If 

3	1	/	2
○	○	○	○

 is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer:  $\frac{7}{12}$

7	/	1	2
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

← Fraction line

Answer: 2.5

2	.	5
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

.	6	6	6
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

.	6	6	7
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

Answer: 201 – either position is correct

2	0	1
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

2	0	1	
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

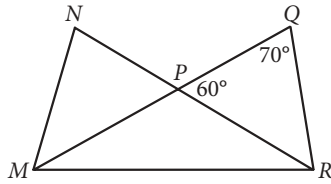




16

If  $2x + 8 = 16$ , what is the value of  $x + 4$  ?

17



In the figure above,  $\overline{MN}$  and  $\overline{QR}$  are parallel, and  $\overline{NP}$  and  $\overline{RP}$  intersect at point  $P$ .  $NP = QP$ , and  $MP = PR$ . What is the measure, in degrees, of  $\angle QMR$  ? (Disregard the degree symbol when gridding your answer.)

18

The number of radians in a 720-degree angle can be written as  $a\pi$ , where  $a$  is a constant. What is the value of  $a$  ?



19

The graph of a line in the  $xy$ -plane passes through the point  $(1, 4)$  and crosses the  $x$ -axis at the point  $(2, 0)$ . The line crosses the  $y$ -axis at the point  $(0, b)$ . What is the value of  $b$  ?

20

$$(7532 + 100y^2) + 10(10y^2 - 110)$$

The expression above can be written in the form  $ay^2 + b$ , where  $a$  and  $b$  are constants. What is the value of  $a + b$  ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**No Test Material On This Page**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

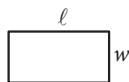
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

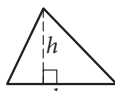


$$A = \pi r^2$$

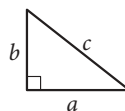
$$C = 2\pi r$$



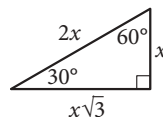
$$A = \ell w$$



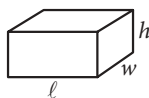
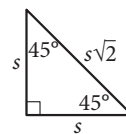
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



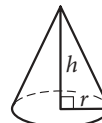
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

Feeding Information for Boarded Pets

	Fed only dry food	Fed both wet and dry food	Total
Cats	5	11	16
Dogs	2	23	25
Total	7	34	41

The table above shows the kinds of foods that are fed to the cats and dogs currently boarded at a pet care facility. What fraction of the dogs are fed only dry food?

- A)  $\frac{2}{41}$   
 B)  $\frac{2}{25}$   
 C)  $\frac{7}{41}$   
 D)  $\frac{2}{7}$

2

$$(x^2 - 3) - (-3x^2 + 5)$$

Which of the following expressions is equivalent to the one above?

- A)  $4x^2 - 8$   
 B)  $4x^2 - 2$   
 C)  $-2x^2 - 8$   
 D)  $-2x^2 - 2$

3

A certain package requires 3 centimeters of tape to be closed securely. What is the maximum number of packages of this type that can be secured with 6 meters of tape? (1 meter = 100 cm)

- A) 100  
 B) 150  
 C) 200  
 D) 300

4

A market researcher selected 200 people at random from a group of people who indicated that they liked a certain book. The 200 people were shown a movie based on the book and then asked whether they liked or disliked the movie. Of those surveyed, 95% said they disliked the movie. Which of the following inferences can appropriately be drawn from this survey result?

- A) At least 95% of people who go see movies will dislike this movie.  
 B) At least 95% of people who read books will dislike this movie.  
 C) Most people who dislike this book will like this movie.  
 D) Most people who like this book will dislike this movie.



5

Which of the following ordered pairs  $(x, y)$  satisfies the inequality  $5x - 3y < 4$  ?

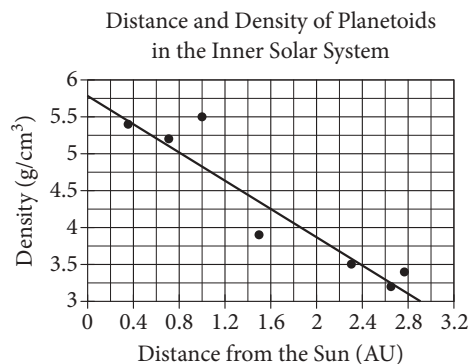
- I. (1, 1)
  - II. (2, 5)
  - III. (3, 2)
- A) I only  
 B) II only  
 C) I and II only  
 D) I and III only

6

In the equation  $(ax + 3)^2 = 36$ ,  $a$  is a constant. If  $x = -3$  is one solution to the equation, what is a possible value of  $a$  ?

- A) -11  
 B) -5  
 C) -1  
 D) 0

Questions 7 and 8 refer to the following information.



The scatterplot above shows the densities of 7 planetoids, in grams per cubic centimeter, with respect to their average distances from the Sun in astronomical units (AU). The line of best fit is also shown.

7

According to the scatterplot, which of the following statements is true about the relationship between a planetoid's average distance from the Sun and its density?

- A) Planetoids that are more distant from the Sun tend to have lesser densities.  
 B) Planetoids that are more distant from the Sun tend to have greater densities.  
 C) The density of a planetoid that is twice as far from the Sun as another planetoid is half the density of that other planetoid.  
 D) The distance from a planetoid to the Sun is unrelated to its density.



8

An astronomer has discovered a new planetoid about 1.2 AU from the Sun. According to the line of best fit, which of the following best approximates the density of the planetoid, in grams per cubic centimeter?

- A) 3.6
- B) 4.1
- C) 4.6
- D) 5.5

9

$$9ax + 9b - 6 = 21$$

Based on the equation above, what is the value of  $ax + b$  ?

- A) 3
- B) 6
- C) 8
- D) 12

10

Lani spent 15% of her 8-hour workday in meetings. How many minutes of her workday did she spend in meetings?

- A) 1.2
- B) 15
- C) 48
- D) 72

11

A software company is selling a new game in a standard edition and a collector's edition. The box for the standard edition has a volume of 20 cubic inches, and the box for the collector's edition has a volume of 30 cubic inches. The company receives an order for 75 copies of the game, and the total volume of the order to be shipped is 1,870 cubic inches. Which of the following systems of equations can be used to determine the number of standard edition games,  $s$ , and collector's edition games,  $c$ , that were ordered?

- A) 
$$\begin{aligned} 75 - s &= c \\ 20s + 30c &= 1,870 \end{aligned}$$
- B) 
$$\begin{aligned} 75 - s &= c \\ 30s + 20c &= 1,870 \end{aligned}$$
- C) 
$$\begin{aligned} s - c &= 75 \\ 25(s + c) &= 1,870 \end{aligned}$$
- D) 
$$\begin{aligned} s - c &= 75 \\ 30s + 20c &= 1,870 \end{aligned}$$

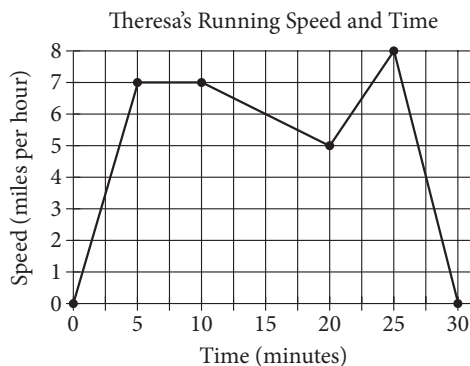


12

A customer paid \$53.00 for a jacket after a 6 percent sales tax was added. What was the price of the jacket before the sales tax was added?

- A) \$47.60
- B) \$50.00
- C) \$52.60
- D) \$52.84

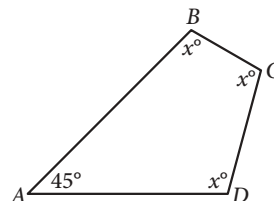
13



Theresa ran on a treadmill for thirty minutes, and her time and speed are shown on the graph above. According to the graph, which of the following statements is NOT true concerning Theresa's run?

- A) Theresa ran at a constant speed for five minutes.
- B) Theresa's speed was increasing for a longer period of time than it was decreasing.
- C) Theresa's speed decreased at a constant rate during the last five minutes.
- D) Theresa's speed reached its maximum during the last ten minutes.

14



In the figure above, what is the value of  $x$  ?

- A) 45
- B) 90
- C) 100
- D) 105

15

If 50 one-cent coins were stacked on top of each other in a column, the column would be approximately  $3\frac{7}{8}$  inches tall. At this rate, which of the following is closest to the number of one-cent coins it would take to make an 8-inch-tall column?

- A) 75
- B) 100
- C) 200
- D) 390





16

If  $a - b = 12$  and  $\frac{b}{2} = 10$ , what is the value

of  $a + b$  ?

- A) 2
- B) 12
- C) 32
- D) 52

17

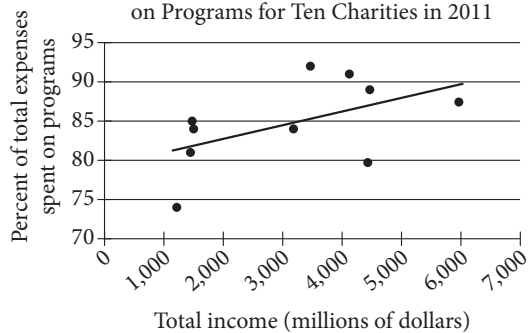
$$y = 19.99 + 1.50x$$

The equation above models the total cost  $y$ , in dollars, that a company charges a customer to rent a truck for one day and drive the truck  $x$  miles. The total cost consists of a flat fee plus a charge per mile driven. When the equation is graphed in the  $xy$ -plane, what does the  $y$ -intercept of the graph represent in terms of the model?

- A) A flat fee of \$19.99
- B) A charge per mile of \$1.50
- C) A charge per mile of \$19.99
- D) Total daily charges of \$21.49

18

Income and Percent of Total Expenses Spent on Programs for Ten Charities in 2011



The scatterplot above shows data for ten charities along with the line of best fit. For the charity with the greatest percent of total expenses spent on programs, which of the following is closest to the difference of the actual percent and the percent predicted by the line of best fit?

- A) 10%
- B) 7%
- C) 4%
- D) 1%



Questions 19 and 20 refer to the following information.

$$\text{Mosteller's formula: } A = \frac{\sqrt{hw}}{60}$$

$$\text{Current's formula: } A = \frac{4 + w}{30}$$

The formulas above are used in medicine to estimate the body surface area  $A$ , in square meters, of infants and children whose weight  $w$  ranges between 3 and 30 kilograms and whose height  $h$  is measured in centimeters.

19

Based on Current's formula, what is  $w$  in terms of  $A$  ?

- A)  $w = 30A - 4$
- B)  $w = 30A + 4$
- C)  $w = 30(A - 4)$
- D)  $w = 30(A + 4)$

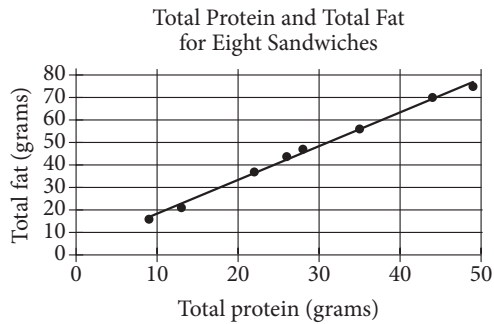
20

If Mosteller's and Current's formulas give the same estimate for  $A$ , which of the following expressions is equivalent to  $\sqrt{hw}$  ?

- A)  $\frac{4 + w}{2}$
- B)  $\frac{4 + w}{1,800}$
- C)  $2(4 + w)$
- D)  $\frac{(4 + w)^2}{2}$



21



The scatterplot above shows the numbers of grams of both total protein and total fat for eight sandwiches on a restaurant menu. The line of best fit for the data is also shown. According to the line of best fit, which of the following is closest to the predicted increase in total fat, in grams, for every increase of 1 gram in total protein?

- A) 2.5
- B) 2.0
- C) 1.5
- D) 1.0

22

Percent of Residents Who Earned  
a Bachelor's Degree or Higher

State	Percent of residents
State A	21.9%
State B	27.9%
State C	25.9%
State D	19.5%
State E	30.1%
State F	36.4%
State G	35.5%

A survey was given to residents of all 50 states asking if they had earned a bachelor's degree or higher.

The results from 7 of the states are given in the table above. The median percent of residents who earned a bachelor's degree or higher for all 50 states was 26.95%. What is the difference between the median percent of residents who earned a bachelor's degree or higher for these 7 states and the median for all 50 states?

- A) 0.05%
- B) 0.95%
- C) 1.22%
- D) 7.45%



23

A cylindrical can containing pieces of fruit is filled to the top with syrup before being sealed. The base of the can has an area of  $75 \text{ cm}^2$ , and the height of the can is 10 cm. If  $110 \text{ cm}^3$  of syrup is needed to fill the can to the top, which of the following is closest to the total volume of the pieces of fruit in the can?

- A)  $7.5 \text{ cm}^3$
- B)  $185 \text{ cm}^3$
- C)  $640 \text{ cm}^3$
- D)  $750 \text{ cm}^3$

24

$$h(t) = -16t^2 + 110t + 72$$

The function above models the height  $h$ , in feet, of an object above ground  $t$  seconds after being launched straight up in the air. What does the number 72 represent in the function?

- A) The initial height, in feet, of the object
- B) The maximum height, in feet, of the object
- C) The initial speed, in feet per second, of the object
- D) The maximum speed, in feet per second, of the object

Questions 25 and 26 refer to the following information.

Energy per Gram of Typical Macronutrients

Macronutrient	Food calories	Kilojoules
Protein	4.0	16.7
Fat	9.0	37.7
Carbohydrate	4.0	16.7

The table above gives the typical amounts of energy per gram, expressed in both food calories and kilojoules, of the three macronutrients in food.

25

If  $x$  food calories is equivalent to  $k$  kilojoules, of the following, which best represents the relationship between  $x$  and  $k$ ?

- A)  $k = 0.24x$
- B)  $k = 4.2x$
- C)  $x = 4.2k$
- D)  $xk = 4.2$



26

If the 180 food calories in a granola bar come entirely from  $p$  grams of protein,  $f$  grams of fat, and  $c$  grams of carbohydrate, which of the following expresses  $f$  in terms of  $p$  and  $c$ ?

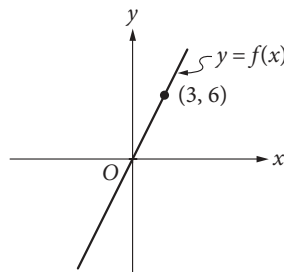
- A)  $f = 20 + \frac{4}{9}(p + c)$   
 B)  $f = 20 - \frac{4}{9}(p + c)$   
 C)  $f = 20 - \frac{4}{9}(p - c)$   
 D)  $f = 20 + \frac{9}{4}(p + c)$

27

The world's population has grown at an average rate of 1.9 percent per year since 1945. There were approximately 4 billion people in the world in 1975. Which of the following functions represents the world's population  $P$ , in billions of people,  $t$  years since 1975? (1 billion = 1,000,000,000)

- A)  $P(t) = 4(1.019)^t$   
 B)  $P(t) = 4(1.9)^t$   
 C)  $P(t) = 1.19t + 4$   
 D)  $P(t) = 1.019t + 4$

28



In the  $xy$ -plane above, a point (not shown) with coordinates  $(s, t)$  lies on the graph of the linear function  $f$ . If  $s$  and  $t$  are positive integers, what is the ratio of  $t$  to  $s$ ?

- A) 1 to 3  
 B) 1 to 2  
 C) 2 to 1  
 D) 3 to 1



29

A circle in the  $xy$ -plane has equation  $(x + 3)^2 + (y - 1)^2 = 25$ . Which of the following points does NOT lie in the interior of the circle?

- A)  $(-7, 3)$
- B)  $(-3, 1)$
- C)  $(0, 0)$
- D)  $(3, 2)$

30

Year	Subscriptions sold
2012	5,600
2013	5,880

The manager of an online news service received the report above on the number of subscriptions sold by the service. The manager estimated that the percent increase from 2012 to 2013 would be double the percent increase from 2013 to 2014. How many subscriptions did the manager expect would be sold in 2014?

- A) 6,020
- B) 6,027
- C) 6,440
- D) 6,468

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \odot & \odot & \odot & \odot \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

Answer: $\frac{7}{12}$			
7	/	1	2
⊙	⊙	⊙	⊙
0	0	0	0
①	①	●	①
②	②	②	●
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
●	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 2.5			
2	.	5	
⊙	⊙	●	⊙
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	●
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3	
⊙	⊙	⊙	⊙
0	0	0	0
①	①	①	①
②	●	②	②
③	③	③	●
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	6
⊙	⊙	⊙	⊙
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	●
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

.	6	6	7
⊙	⊙	⊙	⊙
0	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	⑥
⑦	⑦	⑦	●
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

2	0	1	
⊙	⊙	⊙	⊙
0	●	0	0
①	①	①	●
②	●	②	②
③	③	③	③

2	0	1	
⊙	⊙	⊙	⊙
0	●	0	0
①	①	●	①
②	●	②	②
③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

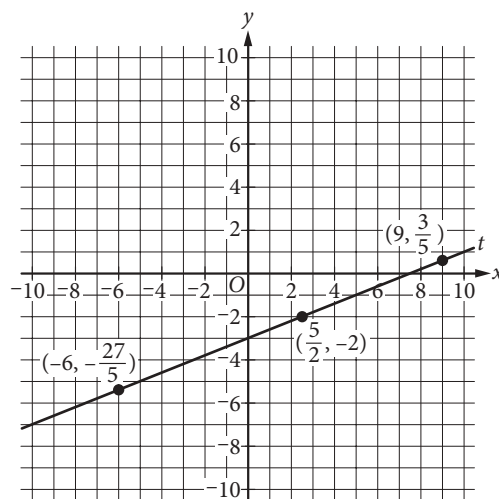


31

In 1854, during the California gold rush, each ounce of gold was worth \$20, and the largest known mass of gold found in California was worth \$62,400 in that year. What was the weight, in pounds, of this mass of gold? (16 ounces = 1 pound)

32

Line  $t$  is shown in the  $xy$ -plane below.



What is the slope of line  $t$  ?

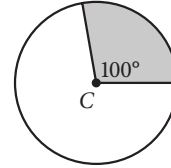




33

The score on a trivia game is obtained by subtracting the number of incorrect answers from twice the number of correct answers. If a player answered 40 questions and obtained a score of 50, how many questions did the player answer correctly?

34



Point  $C$  is the center of the circle above. What fraction of the area of the circle is the area of the shaded region?

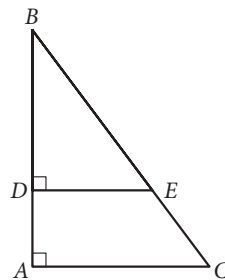


35

$$y = x^2 - 4x + 4$$
$$y = 4 - x$$

If the ordered pair  $(x, y)$  satisfies the system of equations above, what is one possible value of  $x$  ?

36



In the figure above,  $\tan B = \frac{3}{4}$ . If  $BC = 15$  and  $DA = 4$ , what is the length of  $\overline{DE}$  ?



Questions 37 and 38 refer to the following information.

Number of Contestants by Score and Day

	5 out of 5	4 out of 5	3 out of 5	2 out of 5	1 out of 5	0 out of 5	Total
Day 1	2	3	4	6	2	3	20
Day 2	2	3	5	5	4	1	20
Day 3	3	3	4	5	3	2	20
Total	7	9	13	16	9	6	60

The same 20 contestants, on each of 3 days, answered 5 questions in order to win a prize. Each contestant received 1 point for each correct answer. The number of contestants receiving a given score on each day is shown in the table above.

37

What was the mean score of the contestants on Day 1?

38

No contestant received the same score on two different days. If a contestant is selected at random, what is the probability that the selected contestant received a score of 5 on Day 2 or Day 3, given that the contestant received a score of 5 on one of the three days?

# STOP

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.

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# **Answer Explanations**

## **SAT® Practice Test #7**



## Answer Explanations

# SAT Practice Test #7

## Section 1: Reading Test

### QUESTION 1.

**Choice D is the best answer.** The final sentence of the first paragraph makes clear that before adopting his daughter, the weaver Silas was greedy for gold and chained to his work, “deafened and blinded more and more to all things except the monotony of his loom.” But after adopting Eppie, Silas became more interested in life outside his job: “Eppie called him away from his weaving, and made him think all its pauses a holiday, reawakening his senses with her fresh life.” A major theme of the passage can be seen in this transformation, as it represents how loving a child can improve or change a parent’s life.

Choice A is incorrect because even if the passage implies that Silas was too materialistic before his daughter’s arrival in his life, his greediness was a personal characteristic only, not a societal one; whether the society Silas lives in is overly materialistic is never addressed. Choice B is incorrect because even if the passage represents the “moral purity” of children, it does so only indirectly and not as a major theme. Choice C is incorrect because the passage addresses childhood enthusiasm and curiosity more than “naïveté” and never discusses the length or “brevity” of that naïveté.

### QUESTION 2.

**Choice A is the best answer.** The first sentence of the first paragraph notes that “Unlike the gold . . . Eppie was a creature of endless claims and ever-growing desires, seeking and loving sunshine, and living sounds, and living movements; making trial of everything, with trust in new joy, and stirring the human kindness in all eyes that looked on her.” These lines make clear that in contrast to Silas’s gold, his new daughter is vibrant and alive.

Choices B, C, and D are incorrect because the lines from the first paragraph cited above reveal Eppie’s interest in “living sounds” and “living movements” and thus characterize her vitality in comparison to the gold, rather than her durability, protection, or self-sufficiency.



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### QUESTION 3.

**Choice A is the best answer.** In the first paragraph, the narrator describes Silas as having been so obsessed as to have felt required to worship the gold “in close-locked solitude,” with “his thoughts in an ever-repeated circle” centered on his hoard. Moreover, this obsession compelled him to “sit weaving longer and longer, deafened and blinded more and more to all things except the monotony of his loom and the repetition of his web.” These lines convey the extent to which Silas’s behaviors were determined by his obsession.

Choice B is incorrect because the narrator does not make it seem as if Silas’s gold could reproduce on its own, with the first paragraph suggesting that his hoard was a consequence of hard work, his being “deafened and blinded more and more to all things except the monotony of his loom and the repetition of his web.” Choice C is incorrect because even if the first paragraph mentions that, after Eppie’s arrival, Silas thinks about “the ties and charities that bound together the families of his neighbors,” the passage never addresses how Silas interacted with those neighbors previously. Choice D is incorrect because the third paragraph makes clear that Silas is not only able to recall life before Eppie, but that with her in his life, “his mind was growing into memory.”

### QUESTION 4.

**Choice B is the best answer.** The first paragraph of the passage describes Eppie as “a creature of endless claims and ever-growing desires,” one who is “making trial of everything.” In this context, her “making trial of everything” can be read as her acting on her curiosity by striving to experience the world around her.

Choices A, C, and D are incorrect because in the context of her “making trial of everything,” Eppie can be seen as curious, not friendly (choice A), disobedient (choice C), or judgmental (choice D).

### QUESTION 5.

**Choice D is the best answer.** In the first paragraph, the narrator indicates that with the arrival of Eppie, Silas’s thoughts turn from his work and his gold toward Eppie’s future and his life with her: “Eppie was an object compacted of changes and hopes that forced his thoughts onward, and carried them far away from their old eager pacing towards the same blank limit — carried them away to the new things that would come with the coming years.” By influencing Silas to think “onward” and of “the coming years,” Eppie prompts Silas to envision a far different future than he would experience otherwise.

Choice A is incorrect because although the passage implies that Silas is less obsessed with money than before, there is no indication that he has actually renounced his desire for it. Choice B is incorrect because although the passage explains that Silas spends time outdoors after the arrival of Eppie, there is no indication that her presence has

necessarily changed his understanding of his place in nature. Choice C is incorrect because at no point in the passage is Silas shown accepting help from anyone.

### QUESTION 6.

**Choice B is the best answer.** The previous question asks what consequence Silas has experienced as a result of adopting Eppie. The answer, that he begins to imagine a new future for himself and her, is supported in the first paragraph: “but Eppie was an object compacted of changes and hopes that forced his thoughts onward, and carried them far away from their old eager pacing towards the same blank limit — carried them away to the new things that would come with the coming years.”

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question about the consequence of Silas’s adoption of Eppie, instead describing Silas’s life before Eppie entered it (choice A), how he occasionally acts in her presence (choice C), and the changes in Eppie’s perception of the world as she ages (choice D).

### QUESTION 7.

**Choice C is the best answer.** In the second paragraph, the description of Silas and Eppie’s interaction outdoors conveys the extent to which he has changed since her arrival: where he once worked all day at his loom to earn more and more money, he now “might be seen in the sunny mid-day” strolling with her, accepting the flowers she brings him, or listening to birdcalls with her. With these experiences also come “crowding remembrances” of his early life — the life he led before amassing his hoard of gold. In its entirety, the paragraph can therefore be seen as illustrating the profound change into a more sociable being that Silas has undergone as a result of parenting Eppie.

Choice A is incorrect because the second paragraph does not present a particular moment when Silas realizes that Eppie has changed him but instead describes a pattern of behavior indicative of that change. Choice B is incorrect because the second paragraph shows the benefits Silas derives from Eppie’s presence, rather than any sacrifices he has made for her. Choice D is incorrect because the second paragraph dramatizes a change in Silas’s life overall, rather than showing a change in the dynamic that has arisen between Silas and Eppie.

### QUESTION 8.

**Choice B is the best answer.** The third paragraph of the passage shows that as Eppie learns more and more, Silas reengages with life: “As the child’s mind was growing into knowledge, his mind was growing into memory: as her life unfolded, his soul, long stupefied in a cold narrow prison, was unfolding too, and trembling gradually into full consciousness.” As Eppie grows into a world that is new to her, Silas recovers a world he’d largely forgotten.

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Choice A is incorrect because the narrator portrays Eppie as being curious and eager, not physically vulnerable, and also implies that Silas is becoming ever more emotionally robust, not psychologically fragile. Choice C is incorrect because the only connection the narrator makes regarding Silas's former greed and Eppie's presence in his life is that she has brought an end to his obsessive pursuit of wealth. Choice D is incorrect because the narrator does not address Silas's mortality in any way but rather shows him becoming more and more alive through Eppie's love.

### QUESTION 9.

**Choice D is the best answer.** The previous question asks what connection the narrator draws between Eppie and Silas. The answer, that as she learns more about the world, he becomes more involved in it, is supported in the third paragraph: "As the child's mind was growing into knowledge, his mind was growing into memory: as her life unfolded, his soul, long stupefied in a cold narrow prison, was unfolding too, and trembling gradually into full consciousness."

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question about the connection between Eppie and Silas, instead contrasting Silas's fixation on his gold with Eppie's curiosity (choice A) and describing Silas's habitual behavior when accompanying Eppie outdoors (choices B and C).

### QUESTION 10.

**Choice D is the best answer.** In the last paragraph, the narrator states, "Also, by the time Eppie was three years old, she developed a fine capacity for mischief, and for devising ingenious ways of being troublesome." In this context, the word "fine" most nearly means keen, or acute.

Choices A, B, and C are incorrect because in the context of a description in which Eppie was said to have a "fine capacity for mischief," the word "fine" most nearly means keen, or acute, not acceptable (choice A), delicate (choice B), or ornate (choice C).

### QUESTION 11.

**Choice D is the best answer.** The first paragraph of the passage explains the theory of two MIT business scholars who believe that technological advances in the workplace could lead to fewer jobs for human workers, explaining that they "foresee dismal prospects for many types of jobs as these powerful new technologies are increasingly adopted not only in manufacturing, clerical, and retail work but in professions such as law, financial services, education, and medicine." The fifth paragraph of the passage, however, offers a contrasting view, citing a Harvard economist who "says that no historical pattern shows these shifts leading to a net decrease in

jobs over an extended period.” Combined, these different opinions indicate the main purpose of the passage, which is to assess how new technologies in the workplace might affect job growth as a whole.

Choice A is incorrect because the passage does not examine how workers’ lives have been affected by technology during the last century. Choices B and C are incorrect because the passage does not advocate or argue for a course of action; instead, the passage considers both sides of an issue, taking no position of its own.

## QUESTION 12.

**Choice A is the best answer.** In the first paragraph of the passage, Brynjolfsson and McAfee clearly state that technological advances since the year 2000 have led to low job growth in the United States: “MIT business scholars Erik Brynjolfsson and Andrew McAfee have argued that impressive advances in computer technology — from improved industrial robotics to automated translation services — are largely behind the sluggish employment growth of the last 10 to 15 years.”

Choice B is incorrect because although Brynjolfsson and McAfee assert that certain “changes” have occurred in the workplace as a result of technological advancement, they offer only tentative speculation that those changes may be reflected globally. Choice C is incorrect because the passage notes a decrease, rather than an increase, in skilled laborers. Choice D is incorrect because the passage makes no mention of the global creation of new jobs, even speculating that jobs may have been negatively impacted in technologically advanced nations.

## QUESTION 13.

**Choice A is the best answer.** The previous question asks what Brynjolfsson and McAfee say has resulted in the workplace from advances in technology since the year 2000. The answer, that low job growth has resulted from these advances, is supported in the first sentence of the first paragraph: “MIT business scholars Erik Brynjolfsson and Andrew McAfee have argued that impressive advances in computer technology — from improved industrial robotics to automated translation services — are largely behind the sluggish employment growth of the last 10 to 15 years.”

Choices B, C, and D are incorrect because the lines cited do not support the answer to the previous question about what Brynjolfsson and McAfee say has resulted in the workplace from advances in technology since the year 2000; instead they point to industries not under specific consideration by Brynjolfsson and McAfee (choice B), speculate as to whether changes might also be happening in other countries (choice C), and explain the importance of productivity in the marketplace in the decades following World War II. (choice D).

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### QUESTION 14.

**Choice D is the best answer.** The second sentence of the third paragraph reads, “In economics, productivity — the amount of economic value created for a given unit of input, such as an hour of labor — is a crucial indicator of growth and wealth creation.” In this context, the primary purpose of the appositive (“the amount of economic value . . . such as an hour of labor”) is to define “productivity.”

Choices A, B, and C are incorrect because in the context of the third paragraph, the appositive (“the amount of economic value . . . such as an hour of labor”) is clearly provided to help explain the term “productivity,” not to describe a process (choice A), highlight a dilemma (choice B), or clarify a claim (choice C).

### QUESTION 15.

**Choice D is the best answer.** The third paragraph states that “the pattern is clear: as businesses generated more value from their workers, the country as a whole became richer.” In this context, the word “clear” most nearly means obvious, or unmistakable.

Choices A, B, and C are incorrect because in the context of the third paragraph, the word “clear” can be seen to mean obvious, or unmistakable, not pure (choice A), keen (choice B), or untroubled (choice C).

### QUESTION 16.

**Choice C is the best answer.** Katz doesn’t necessarily agree with Brynjolfsson and McAfee that new technologies will lead to sluggish job growth, saying in the fifth paragraph that “no historical pattern shows these shifts leading to a net decrease in jobs over an extended period.” However, he’s not sure that will remain true, explaining in the sixth paragraph that no one can be certain what is going to happen to the workplace as a result of these new technologies: “If technology disrupts enough, who knows what will happen?”

Choices A, B, and D are incorrect because it would not be accurate to characterize Katz as being alarmed (choice A), unconcerned (choice B), or optimistic (choice D) about today’s digital technologies. Rather, it’s clear from the conclusion of the sixth paragraph that Katz isn’t sure how technological advancement will affect the workplace: “If technology disrupts enough, who knows what will happen?”

### QUESTION 17.

**Choice D is the best answer.** The previous question asks how Katz’s attitude toward “today’s digital technologies” can best be characterized. The answer, that he is uncertain about their possible effects, is supported in the final sentence of the sixth paragraph: “If technology disrupts enough, who knows what will happen?”

Choices A, B, and C are incorrect because the lines cited do not support the answer to the previous question Katz’s attitude toward “today’s digital technologies”; instead, they describe some of his earlier research (choice A) and provide insight only into his initial thoughts but not his final conclusion on the matter (choices B and C).

### QUESTION 18.

**Choice B is the best answer.** The sixth paragraph of the passage states that “Katz doesn’t dismiss the notion that there is something different about today’s digital technologies — something that could affect an even broader range of work.” In the context of this sentence, the “range” of work being discussed means the scope of work or all the various kinds of work.

Choices A, C, and D are incorrect because in the context of the sentence, the “range” of work being discussed means the array or scope of work, not a physical delineation like a region (choice A) or distance (choice C), or the professional position of those who perform particular jobs (choice D).

### QUESTION 19.

**Choice D is the best answer.** Figure 1 shows the highest gap between the percentages of productivity and employment in relation to 1947 levels occurring in 2013, when there was a difference of approximately 150 percentage points between 2013 employment (under 400%) and 2013 productivity (well over 500%).

Choices A, B, and C are incorrect because Figure 1 shows a gap of well over 100 percentage points between 2013 employment and 2013 productivity in relation to 1947 levels, while 1987 (choice A) and 1997 (choice B) show a difference of about 30 percentage points or less between employment and productivity, and 2007 (choice C) indicates a difference of approximately 100 percentage points.

### QUESTION 20.

**Choice C is the best answer.** Figure 2 clearly shows an increase of worker output in all three countries between 1960 and 2011, with workers in each country producing on average less than 50 units of output in 1960 but more than 100 units by 2011.

Choice A is incorrect because figure 2 shows that Japan saw greater growth in output between 1960 and 1990 than Germany saw. Choice B is incorrect because figure 2 shows that Japan experienced its greatest increase in output from 2000 to 2011, not its smallest. Choice D is incorrect because figure 2 shows that the United States had the greatest output of all three countries only in 2011, not in each of the years shown.

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## QUESTION 21.

**Choice B is the best answer.** In the fourth paragraph, Brynjolfsson asserts, “Productivity is at record levels, innovation has never been faster, and yet at the same time, we have a falling median income and we have fewer jobs.” In order to evaluate his statement that today “we have fewer jobs,” figure 2 would need to include accurate information about the number of jobs held by people employed in factories from 1960 to 2011. Without knowing those numbers, it’s not possible to determine whether Brynjolfsson’s statement is correct.

Choice A is incorrect because a comparison of the median income of all three nations’ factory workers within a single year would not aid in the evaluation of Brynjolfsson’s statement regarding changes in worker productivity over a span of 10 to 15 years. Choices C and D are incorrect because knowing either the types of organizations where those outputs were measured or which specific manufacturing jobs might have been lost to new technologies would not be helpful in evaluating Brynjolfsson’s statement about how median incomes have fallen and job growth has reduced over time.

## QUESTION 22.

**Choice C is the best answer.** The main purpose of the passage is conveyed by the first sentence: “Anyone watching the autumn sky knows that migrating birds fly in a V formation, but scientists have long debated why.” The first paragraph continues by focusing on new research that might answer the question of why birds fly in that formation (“presumably to catch the preceding bird’s updraft — and save energy during flight”). As a whole, the passage can therefore be seen as a discussion of the biological motivation behind migrating birds’ reliance on the V formation.

Choice A is incorrect because the squadrons of planes mentioned in the second paragraph are used as an example to discuss migrating birds but are not themselves the main subject of this passage.

Choice B is incorrect because although the fourth paragraph does discuss the role of downdrafts in V-formation flight, this discussion is brief and does not constitute a main purpose. Choice D is incorrect because the passage does not illustrate how birds sense air currents through their feathers; instead, the seventh paragraph suggests in passing that such sensation may play a role in maintaining the V formation: “Scientists do not know how the birds find that aerodynamic sweet spot, but they suspect that the animals align themselves either by sight or by sensing air currents through their feathers.”

## QUESTION 23.

**Choice A is the best answer.** In the second paragraph of the passage, the quotation “Air gets pretty unpredictable behind a flapping wing” immediately follows the statement that “currents created by airplanes are far more stable than the oscillating eddies coming off of a bird.”

The inclusion of the above quotation can therefore be seen as a way to explain that the current created by a bird's flapping wings is different from the current coming off the fixed wing of an airplane.

Choice B is incorrect because the quotation's explanation that air is "unpredictable" behind a bird's wing stresses the bird's lack of control over the air current. Choice C is incorrect because the quotation attributes the unpredictability of the current "behind a flapping wind" to the action of the wing rather than to wind, and in fact the passage makes no mention of wind. Choice D is incorrect because the quotation characterizes the flapping of the bird's wings in terms of the unpredictability of its effects, not of its comparative strength.

### QUESTION 24.

**Choice D is the best answer.** The reason Usherwood used northern bald ibises as the subjects of his study is clearly stated at the beginning of the third paragraph: "The study, published in *Nature*, took advantage of an existing project to reintroduce endangered northern bald ibises (*Geronticus eremita*) to Europe." Because the project reintroducing those birds was already underway, it was therefore easy for Usherwood and his team to join it.

Choice A is incorrect because it would not be accurate to say that ibises were well acquainted with their migration route, as the third paragraph explains that scientists needed to "show hand-raised birds their ancestral migration route." Choice B is incorrect because the third paragraph states that the ibises wore "data loggers specially built by Usherwood and his lab" but never indicates that they had worn any such device before or undertaken migration previously. Choice C is incorrect because the passage never claims that ibises' body shape is similar to the design of a modern airplane, instead comparing only a V formation of birds to an airplane in the fourth paragraph.

### QUESTION 25.

**Choice C is the best answer.** The previous question asks why Usherwood used northern bald ibises as the subject of his study. The answer, that he had easy access to them because they were being used in another scientific study, is supported at the beginning of the passage's third paragraph: "The study, published in *Nature*, took advantage of an existing project to reintroduce endangered northern bald ibises (*Geronticus eremita*) to Europe."

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question as to why Usherwood chose northern bald ibises as the subject of his study; instead, they describe the results of the study (choice A), compare birds and planes in flight (choice B), and describe one element of the actual study (choice D) but not the reason ibises were chosen.



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### QUESTION 26.

**Choice A is the best answer.** At the end of the third paragraph the author notes that the GPS tracking devices attached to the birds “determined each bird’s flight position to within 30 cm.” This detail, along with the author’s mention in the same sentence of another device that measured the timing of the wing flaps, provides evidence for the inference that the author likely specified 30 cm to underscore Usherwood’s use of precise data-collection methods.

Choice B is incorrect because the passage does not state that the distance an ibis flies between wing flaps was something that could be ascertained by Usherwood’s study. Choice C is incorrect because the passage does not discuss the wingspan length of juvenile ibises or suggest that this length could be determined from Usherwood’s tracking data. Choice D is incorrect because the passage does not discuss the distance maintained between the plane and the ibises in flight.

### QUESTION 27.

**Choice C is the best answer.** At the beginning of the fifth paragraph the passage states that “the findings likely apply to other long-winged birds, such as pelicans, storks, and geese, Usherwood says. Smaller birds create more complex wakes that would make drafting too difficult.” In these lines the author therefore implies that unlike smaller birds, pelicans, storks, and geese flying in a V formation likely create a similar wake to that of ibises.

Choice A is incorrect because the passage focuses entirely on bird flight, not bird communication. Choices B and D are incorrect because the passage discusses pelicans, storks, and geese only with respect to their drafting behavior, not in terms of their migration routes or how much energy they might expend when flying.

### QUESTION 28.

**Choice B is the best answer.** The previous question asks what the author implies about pelicans, storks, and geese flying in a V formation. The answer, that they produce a similar wake to ibises, is supported at the beginning of the fifth paragraph: “Smaller birds create more complex wakes that would make drafting too difficult.” This sentence, in conjunction with the preceding sentence’s assertion of the probable applicability of Usherwood’s findings to pelicans, storks, and geese, underscores that the point of probable similarity between ibises and those other species is in their wake and the drafting it makes possible.

Choices A, C, and D are incorrect because the lines cited do not support the answer to the previous question regarding what the author implies about pelicans, storks, and geese flying in a V formation. Instead, they explain one finding in the ibis study, with no reference to other long-winged species (choice A); highlight the findings of a previous study of energy use in bird flight, with no reference to the relationship between ibises and other species (choice C); and offer a theory about ibises in flight, again with no reference to other species (choice D).

### QUESTION 29.

**Choice C is the best answer.** The seventh paragraph speculates that further research may provide insight into how and why birds fly in formation: “In future studies, the researchers will switch to more common birds, such as pigeons or geese. They plan to investigate how the animals decide who sets the course and the pace.” In sum, the seventh paragraph can therefore be seen as recognizing that more research is needed to explain the phenomenon of flight formation more completely.

Choice A is incorrect because neither the seventh paragraph nor the passage as a whole is concerned with bird hierarchies; the decision as to which bird sets the “course” or “pace” is mentioned only as another aspect of bird flight that scientists have yet to explain fully. Choice B is incorrect because the seventh paragraph only briefly mentions mistakes in V-formation flight, and this subject is not a central focus of the paragraph. Choice D is incorrect because although the seventh paragraph mentions the sighting of a lead bird or “leader” as a possible factor in the V formation, this factor is mentioned briefly and in conjunction with other factors, so that to describe it as a main idea would misrepresent the paragraph as a whole.

### QUESTION 30.

**Choice D is the best answer.** In describing the way that long-winged birds like ibises fly in a V formation by drafting off each other, the seventh paragraph begins by stating, “scientists do not know how the birds find that aerodynamic sweet spot.” In context, the phrase “aerodynamic sweet spot” characterizes the particular spatial relationship among birds in the formation that affords the least amount of wind resistance and is thus beneficial for flock members to maintain.

Choice A is incorrect because the author uses the phrase “aerodynamic sweet spot” in relation to bird flight, not plane flight. Choice B is incorrect because the phrase is not meant to imply the joy of flight so much as the optimum efficiency that can be found by flying in a certain position. Choice C is incorrect because the phrase is not used to discuss synchronized wing movement among birds, nor is synchronization addressed anywhere in the seventh paragraph.

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### QUESTION 31.

**Choice B is the best answer.** In the seventh paragraph, the passage explains that one aspect of bird flight that awaits further study by scientists is the question of whether “a mistake made by the leader can ripple through the rest of the flock to cause traffic jams.” In this context, to say that a mistake might “ripple” through the flock most nearly means that it might progressively spread through the flock.

Choices A, C, and D are incorrect because in the context of the seventh paragraph, to “ripple” through the flock means to spread through it progressively, not to fluctuate (choice A), to wave, or move in the pattern of the ebb and flow of waves (choice C), or to undulate, or move in a manner that creates a textured, undulating appearance (choice D).

### QUESTION 32.

**Choice D is the best answer.** In the first paragraph of Passage 1, Tocqueville predicts that “the social changes which bring nearer to the same level the father and son, the master and servant, and superiors and inferiors generally speaking, will raise woman and make her more and more the equal of man.” In this context, to “raise” women to a higher social position most nearly means to elevate, or lift, them.

Choices A, B, and C are incorrect because in the context of Tocqueville’s prediction that women will attain a higher social position, the word “raise” most nearly means elevate, not increase (choice A), cultivate, or support (choice B), or nurture (choice C).

### QUESTION 33.

**Choice B is the best answer.** In Passage 1, Tocqueville expresses concern that treating men and women as identical would likely harm both genders, rather than benefit them. This sentiment can be seen most clearly in the second paragraph, when he writes that “it may readily be conceived, that by thus attempting to make one sex equal to the other, both are degraded.”

Choice A is incorrect because Tocqueville says treating men and women as identical in nature would result in the degradation of both genders, a condition closer to oppression than to freedom from oppression. Choice C is incorrect because Tocqueville does not address the issue of whether men might ultimately try to reclaim any authority they lost as a result of the treatment of both genders as identical. Choice D is incorrect because in the passage, Tocqueville never claims that treating men and women the same would result in superfluous privileges for either.

**QUESTION 34.**

**Choice C is the best answer.** The previous question asks what Tocqueville implies would result from treating men and women as identical in nature. The answer, that he believes such treatment would harm both men and women, is supported in the second paragraph of Passage 1: “It may readily be conceived, that by thus attempting to make one sex equal to the other, both are degraded.”

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about what Tocqueville implies would result from treating men and women as identical; instead, they discuss European approaches to such treatment, with no reference to the actual effects of it on men and women (choices A and B), and what Tocqueville considers Americans’ proper conception of equality as it relates to gender roles (choice D).

**QUESTION 35.**

**Choice B is the best answer.** In the first paragraph of Passage 2, when discussing changing social relations, Mill writes that in her time there had come to exist “a just equality, instead of the dominion of the strongest.” In this context of a society where some had once wielded much greater power than others, the word “dominion” most nearly means supremacy, or greater power.

Choices A, C, and D are incorrect because in the context of a paragraph discussing differences in the amount of power possessed by members of a society, “dominion” means supremacy, or greater power, not omnipotence, or the state of being all-powerful (choice A), ownership (choice C), or territory (choice D).

**QUESTION 36.**

**Choice B is the best answer.** In the first paragraph of Passage 2, Mill suggests that social roles are resistant to change in part because of their being entrenched in the cultural tradition: “for, in proportion to the strength of a feeling is the tenacity with which it clings to the forms and circumstances with which it has even accidentally become associated.” In the context of a discussion of equality between men and women, Mill’s statement serves to imply that gender roles change so slowly precisely because they are so deeply ingrained in society and culture.

Choice A is incorrect because although Mill suggests in Passage 2 that gender roles are deeply entrenched, she does not imply that they serve as the foundation of society. Choice C is incorrect because Passage 2 does not address the issue of legislative reforms, only societal ones. Choice D is incorrect because although Mill addresses the difficulty of reforming traditional gender roles, she does not attribute it to the benefits that certain groups or institutions derive from those roles.

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### QUESTION 37.

**Choice C is the best answer.** The previous question asks about what Mill implies is the reason it is hard to change gender roles. The answer, that they are deeply entrenched in tradition, is supported in the first paragraph of Passage 2: “In proportion to the strength of a feeling is the tenacity with which it clings to the forms and circumstances with which it has even accidentally become associated.”

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about what Mill implies is the reason it is hard to change gender roles, instead describing the condition of general inequality in prior eras (choices A and B) and optimistically considering a future society that she imagines will be less unequal (choice D).

### QUESTION 38.

**Choice A is the best answer.** Although the authors generally disagree about the roles men and women should occupy, both Tocqueville and Mill share the idea that gender equality is one small part of a societal shift toward equality in general. This can be seen in the first paragraph of Passage 1, where Tocqueville explains that raising woman to be “more and more the equal of man” is part of the overall “social changes which bring nearer to the same level the father and son, the master and servant,” and in the first paragraph of Passage 2, where Mill writes that “mankind have outgrown” the state of inequality and “now tend to substitute, as the general principle of human relations, a just equality,” with gender roles being the last of these relations to undergo such a shift.

Choice B is incorrect because although in Passage 1 Tocqueville argues that there are costs to treating men and women the same, in Passage 2 Mill characterizes gender equality as a source of benefits only. Choice C is incorrect because neither author considers changing gender roles in terms of economic ramifications, focusing instead on questions of fairness and justice and the fulfillment of people’s potential. Choice D is incorrect because Mill does not discuss the issue in terms of American democracy, though Tocqueville does.

### QUESTION 39.

**Choice C is the best answer.** In the second paragraph of Passage 2, Mill writes that she believes job opportunities in her society should be open to all: “Let every occupation be open to all, without favor or discouragement to any, and employments will fall into the hands of those men or women who are found by experience to be most capable of worthily exercising them.” In the second paragraph of Passage 1, Tocqueville argues that equality between men and women would leave both degraded; nonetheless, he recognizes that the belief in such equality is widespread: “There are people in Europe who . . . would give to both the same functions, impose on both the same duties, and

grant to both the same rights; they would mix them in all things — their occupations.” It can be inferred, then, that although Tocqueville would consider Mill’s position ill-advised, he does recognize this position as one that is held by a number of reformers.

Choice A is incorrect because Tocqueville in Passage 1 never characterizes advocacy on behalf of gender equality (such as Mill engages in, in Passage 2) as less radical than it initially seems. Choice B is incorrect because Mill’s stated belief that all jobs should be open to both men and women would clearly be refuted by Tocqueville as harmful to men and women alike. Choice D is incorrect because what Tocqueville praises the United States for is not gender equality as a component of economic progress, but rather the United States’ division of activity into masculine and feminine spheres, which he likens to the division of labor in industrial production.

#### QUESTION 40.

**Choice A is the best answer.** In Passage 1, Tocqueville argues that equality is generally beneficial for society, but he moderates that claim in the third paragraph by further stating that even if men and women should be considered equal, they should not work in the same jobs: “As nature has appointed such wide differences between the physical and moral constitution of man and woman, her manifest design was to give a distinct employment to their various faculties.” In contrast, Mill argues in the second paragraph of Passage 2 that men and women should be awarded work based on individual ability: “Let every occupation be open to all, without favor or discouragement to any, and employments will fall into the hands of those men or women who are found by experience to be most capable of worthily exercising them.” It can therefore be said that Tocqueville believes one’s gender should play a determining factor in one’s position in society, whereas Mill believes it should not.

Choice B is incorrect because both Tocqueville in Passage 1 and Mill in Passage 2 would likely argue against limiting an individual to the social class he or she was born to. Choice C is incorrect because it is Mill, not Tocqueville, who argues that individual temperament is the proper determining factor for social position. Choice D is incorrect because although it accurately represents Tocqueville’s implicit stance that an individual’s social position should contribute to society as a whole, it misrepresents Mill’s argument, which conceives of social position in relation to individual aptitude, not individual satisfaction.

#### QUESTION 41.

**Choice A is the best answer.** In the third paragraph of Passage 1, Tocqueville credits the Americans of his time for applying “to the sexes the great principle of political economy . . . by carefully dividing the duties of man from those of woman.” In contrast, in the second paragraph of Passage 2, Mill argues that rigid social roles function to

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“declare that whatever be the genius, talent, energy, or force of mind, of an individual of a certain sex or class, those faculties shall not be exerted.” It can be inferred, then, that Mill would argue that the principle praised by Tocqueville tends to limit both men and women from developing their full potential.

Choice B is incorrect because in Passage 2, Mill focuses her argument on gender roles and equality between sexes but never addresses the idea of sympathy between them. Choice C is incorrect because Mill considers the division of professions by gender as a perpetuation of a long tradition of gender inequality. Choice D is incorrect because although Mill suggests that gender equality would involve rethinking the professional options available to men and women, she dismisses the notion that one gender is better suited to certain professions or would displace the other gender in certain professions.

#### QUESTION 42.

**Choice C is the best answer.** The passage’s first two paragraphs describe how “Peter Higgs and a handful of other physicists were trying to understand the origin of a basic physical feature: mass,” and the third paragraph discusses the idea put forth (“now called the Higgs field”) to explain the environment where mathematical equations are most helpful in understanding mass. The passage shifts its focus, however: the fourth and fifth paragraphs describe how the idea of the Higgs field was not initially well-received in the scientific community, and the last paragraph illustrates that in modern times, the idea ultimately became an accepted fact to most scientists. Over the course of the passage, then, it can be seen that the main focus of the passage changes from an explanation of what the Higgs field is to an explanation of how the theory of it was received.

Choice A is incorrect because the passage makes no shift from a more to a less technical mode of description, and indeed the entire passage is aimed at readers with no specialized knowledge of physics. Choice B is incorrect because the passage never provides any contextualization of Higgs’s work within other lines of inquiry in physics contemporary to Higgs. Choice D is incorrect because the passage offers no speculation regarding future discoveries that may result from the confirmation of the Higgs field’s existence.

#### QUESTION 43.

**Choice D is the best answer.** The third paragraph of the passage provides the following analogy: “For a mental toehold, think of a ping-pong ball submerged in water.” Since this analogy occurs in a discussion of how mass operates within the Higgs field, it functions to explain an abstract concept in terms more readily grasped by readers with no background in physics.

Choices A, B, and C are incorrect because the analogy of the ping-pong ball is used in the passage to help laypeople understand the difficult concept of the Higgs field, rather than to make a little-known fact more widely known (choice A), draw a contrast between oppositional scientific theories (choice B), or refute any established explanation (choice C).

#### QUESTION 44.

**Choice D is the best answer.** The fourth paragraph of the passage explains why Higgs’s idea of the Higgs field was initially rebuffed by the scientific community: “The paper was rejected. Not because it contained a technical error, but because the premise of an invisible something permeating space, interacting with particles to provide their mass, well, it all just seemed like heaps of overwrought speculation.” In other words, the scientific community was skeptical of Higgs’s idea because it appeared to be mere theoretical speculation, with no empirical evidence to support it.

Choice A is incorrect because the passage makes clear that Higgs’s idea addressed a theoretical problem already recognized by scientists, rather than a problem yet to be noticed by them. Choice B is incorrect because the fourth paragraph implies that Higgs’s paper was rigorous (free from “technical error”), rather than problematic at the level of its equations. Choice C is incorrect because the passage never indicates that the acceptance of the Higgs field had the effect of rendering other, earlier theories in physics obsolete.

#### QUESTION 45.

**Choice C is the best answer.** The previous question asks why the scientific community initially rejected the idea of the Higgs field. The answer, that Higgs offered only theoretical speculation for the existence of the field, not actual evidence, is supported in the fourth paragraph: “The paper was rejected. Not because it contained a technical error, but because the premise of an invisible something permeating space, interacting with particles to provide their mass, well, it all just seemed like heaps of overwrought speculation.”

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about why the scientific community initially rejected the idea of the Higgs field, instead discussing how Higgs dealt with established equations in physics when he theorized the field (choice A), describing the circumstances in which Higgs revealed his theory to the scientific community (choice B), and illustrating the fact that the Higgs field eventually came to be an accepted fact to most scientists (choice D).



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### QUESTION 46.

**Choice A is the best answer.** The fifth paragraph of the passage explains how the idea of the Higgs field eventually came to be accepted in the scientific community: “But Higgs persevered (and his revised paper appeared later that year in another journal), and physicists who took the time to study the proposal gradually realized that his idea was a stroke of genius, one that allowed them to have their cake and eat it too. In Higgs’s scheme, the fundamental equations can retain their pristine form because the dirty work of providing the particles’ masses is relegated to the environment.” In saying that the Higgs field came to be accepted because it allowed scientists to “have their cake and eat it too,” the author suggests that Higgs’s theory was ultimately accepted as fact in part because it allowed physicists to reconcile what had seemed to be contradictory conditions: the harmony of the mathematical equations and the particles’ apparent mass.

Choice B is incorrect because the passage does not suggest that the Higgs field was necessarily a concept that could be applied to other problems in physics than those immediately under Higgs’s consideration. Choice C is incorrect because the passage does not suggest that Higgs’s theory was accepted because it provided an answer to a question that earlier scientists had failed to anticipate. Choice D is incorrect because the passage never addresses any two phenomena being misinterpreted as a single phenomenon.

### QUESTION 47.

**Choice C is the best answer.** The previous question asks for one reason Higgs’s theory eventually gained acceptance in the scientific community. The answer, that it reconciled two seemingly irreconcilable conditions, is supported in the passage’s fifth paragraph: “But Higgs persevered (and his revised paper appeared later that year in another journal), and physicists who took the time to study the proposal gradually realized that his idea was a stroke of genius, one that allowed them to have their cake and eat it too. In Higgs’s scheme, the fundamental equations can retain their pristine form because the dirty work of providing the particles’ masses is relegated to the environment.” These lines make clear that Higgs’s theory allowed for the particles’ mass, while at the same time accepting the fundamental equations as valid.

Choices A, B, and D are incorrect because the lines cited do not support the answer to the previous question about why the Higgs field eventually gained acceptance in the scientific community, instead explaining certain aspects of the Higgs field (choices A and B) and discussing how certain scientific theories become accepted as fact even before they are proven (choice D).

**QUESTION 48.**

**Choice A is the best answer.** The main point of the last paragraph can be seen in its final sentence, which states that “mathematical equations can sometimes tell such a convincing tale, they can seemingly radiate reality so strongly, that they become entrenched in the vernacular of working physicists, even before there’s data to confirm them.” This point is borne out by the preceding lines of the paragraph, which recount the author’s own experience of studying the still unproven Higgs field as if it were already a settled fact.

Choice B is incorrect because the anecdote the author shares about his own education does not demonstrate that physics, as a discipline, has come to operate differently over the course of his career. Choice C is incorrect because the details of the author’s experience do not point to the process by which the existence of the Higgs field was confirmed, and indeed the passage does not describe that process at all. Choice D is incorrect because the passage broadly discusses the status of Higgs’s theory at two different times (its initial rejection and later acceptance by physicists) and never considers how the details of the theory may have evolved.

**QUESTION 49.**

**Choice A is the best answer.** In the last paragraph, the author states that “the professor presented the Higgs field with such certainty that for a long while I had no idea it had yet to be established experimentally.” In this context, for a scientific theory to be established most nearly means that it is validated, or proven.

Choices B, C, and D are incorrect because in the context of the last paragraph describing a scientific theory as being “established experimentally,” the word “established” means validated, or proven, not founded (choice B), introduced (choice C), or enacted (choice D).

**QUESTION 50.**

**Choice B is the best answer.** The graph shows the periods of time that transpired between the moment when certain scientific concepts were introduced and the moment when those concepts were scientifically proven. Given the passage’s discussion of the Higgs field, which was initially rejected by the scientific community before ultimately being accepted by it, the graph can therefore be seen as a means to put Higgs’s work on mass into a greater context with other radical concepts that were ultimately accepted by the scientific community.

Choice A is incorrect because the graph illustrates that the Higgs boson required significantly more time to be confirmed than did any of the other theorized particles. Choice C is incorrect because the graph displays information only on the length of time necessary for any of the particles to be confirmed experimentally and does not indicate how any

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of them were regarded by scientists. Choice D is incorrect because the graph does not clarify anything about the Higgs boson other than the time that transpired between its being introduced and being confirmed.

### QUESTION 51.

**Choice A is the best answer.** Both the W boson and Z boson were introduced in the late 1960s and experimentally confirmed in the early 1980s. It is therefore accurate to say that they were both proposed and proven at about the same time.

Choice B is incorrect because the graph shows that it took more than forty years for the Higgs boson to be experimentally confirmed, while all the other particles were confirmed in a significantly shorter period of time than that. Choice C is incorrect because the graph shows that the tau neutrino was experimentally confirmed in 2000, while tau itself was experimentally confirmed in approximately 1975. Choice D is incorrect because the muon neutrino took approximately fifteen years to be confirmed, while the electron neutrino took well over twenty years.

### QUESTION 52.

**Choice D is the best answer.** In the last paragraph of the passage, the author explains that by the mid-1980s, “the physics community had, for the most part, fully bought into the idea that there was a Higgs field permeating space.” That was fifteen years after the concept was introduced but decades before it would be confirmed, which would be analogous to most physicists believing in the existence of the electron neutrino in 1940, well after it had been introduced but many years before it was confirmed via experiment.

Choices A, B, and C are incorrect because the author depicts the Higgs field in the mid-1980s as being virtually an accepted fact, even though it had not yet been proven experimentally. This situation is not analogous to a proposed particle that is widely disputed until it is confirmed experimentally (choice A), a particle that has already been confirmed and consequently elicits widespread acceptance (choice B), or particles that are not considered as possibilities before the date on which they are formally proposed (choice C).

## Section 2: Writing Test

### QUESTION 1.

**Choice D is the best answer.** Since “frequently” and “many times” repeat the same idea, “many times” can be deleted without changing the meaning of the sentence.

Choices A, B, and C are incorrect. They all provide options that repeat the idea of “frequently” and are unnecessary in the sentence.

### QUESTION 2.

**Choice A is the best answer.** The noun “effect” is needed in the sentence to provide a direct object for the verb “has.” Furthermore, the article “a” indicates that a noun will follow. In this sentence the noun “effect” is used to suggest a positive influence. The preposition “on” is idiomatic when used with “effect.”

Choice B is incorrect because “affect” is a verb and the noun “effect” is needed in the sentence. (There is also the noun “affect,” but it means a “display of emotion” and is not appropriate in this context.) Choice C is incorrect because the preposition “to” is not idiomatic in this context. Choice D is incorrect because a noun is needed, not the verb “affects.”

### QUESTION 3.

**Choice B is the best answer.** The participle “creating” is consistent with “serving” and “showing,” the other participles in the sentence, and provides parallel structure in the sentence.

Choices A, C, and D are incorrect and do not provide options that create parallel structure in the sentence.

### QUESTION 4.

**Choice A is the best answer.** The comma between “Telescope” and the conjunction “and” correctly separates the series of projects listed in the sentence.

Choices B and C are incorrect because there is no reason to use a semicolon in the sentence. Choices C and D are incorrect because when listing a series of items in a sentence, punctuation should be placed before the conjunction.

### QUESTION 5.

**Choice C is the best answer.** It most effectively sets up the list of examples of new technology that are listed in the sentence that follows: “communications satellites, invisible braces, and cordless tools.”

Choices A, B, and D are incorrect because they mention “international cooperation,” “national publicity,” and “money for the agency,” respectively; however, the sentence that follows lists examples of technology.

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### QUESTION 6.

**Choice C is the best answer** because this option makes the most sense within the context of the paragraph. The inventions listed in the sentence were created or “developed” by NASA.

Choices A, B, and D are incorrect because they don’t clearly convey the idea that NASA created the inventions.

### QUESTION 7.

**Choice B is the best answer.** The past tense verb “spawned” is consistent with the other past tense verbs in the paragraph.

Choice A is incorrect because the present tense verb “spawns” is inconsistent with the past tense verbs in the paragraph. Choice C is incorrect because the helping verb “has” is not needed since the action took place in the past. Choice D is incorrect because the sentence needs a simple verb to create a complete sentence, and the participle “spawning” doesn’t provide that.

### QUESTION 8.

**Choice D is the best answer.** The contribution of money occurred in 2005, so the simple past tense verb “came” makes the most sense in the sentence. It also acts as a main verb, which creates a complete sentence.

Choices A, B, and C are incorrect because the participle “coming,” the relative clause that begins “which came,” and the infinitive phrase “to come” would each result in a sentence fragment and not a complete sentence in this context.

### QUESTION 9.

**Choice A is the best answer.** Leaving the sentence where it is now makes the paragraph logical. Sentence 1 serves as a topic sentence for the paragraph by introducing the idea that NASA contributed a significant amount of money to the economy in 2005. The supporting sentences that follow develop the topic sentence by explaining why the benefits of the NASA funding are significant.

Choices B, C, and D are incorrect because if sentence 1 were to be placed after any other sentence, the paragraph would not be logical and would therefore be confusing.

### QUESTION 10.

**Choice D is the best answer.** The sentence should not be added because the information it contains — the locations of various NASA facilities — is not relevant to the claim about the importance of NASA’s work.

Choices A and B are incorrect because the sentence should not be added. Choice C is incorrect because the information it contains is not true. A statement about the locations of various NASA facilities does not undermine the claim about the economic benefits of NASA's work.

### QUESTION 11.

**Choice A is the best answer.** "Therefore" conveys the true relationship between the previous sentence and the statement that follows by indicating that, in addition to the practical benefits it contributes to the economy and society, NASA needs to be supported for global reasons as well.

Choices B, C, and D are incorrect because the transitional words "instead," "for example," and "however" would change the meaning of the sentence and do not convey the idea that a result or reason will follow.

### QUESTION 12.

**Choice D is the best answer** because it is clear and concise and provides parallel structure in the sentence. This choice eliminates unnecessary words and creates a list in which the topics "theories," "practices," and "technologies" are equally important.

Choices A, B, and C are incorrect because they contain words that are unnecessary and interrupt the flow of the sentence.

### QUESTION 13.

**Choice C is the best answer.** A pair of commas is needed to set off the phrase "from social services to manufacturing" to indicate that this information is explanatory but not crucial for understanding the sentence.

Choices A and D are incorrect because they both provide an incorrect punctuation mark. Choice B is incorrect because it doesn't provide a comma.

### QUESTION 14.

**Choice A is the best answer.** The adverb "accordingly" indicates correctly that because professional development provides a joint benefit to employers and employees, both parties share a joint responsibility to take advantage of the opportunities offered.

Choices B, C, and D are incorrect because they provide transitions that don't indicate the true relationship of shared responsibility between employees and employers.

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### QUESTION 15.

**Choice C is the best answer.** Employees “must be in charge of their own careers.” This claim provides an argument for what follows — “it is the duty of . . . employees to identify . . . resources” should they find themselves “falling behind in the workplace” — and supports the previous statement about shared responsibility, as well.

Choices A, B, and D are incorrect because they do not provide an argument for what must happen if employees find themselves “falling behind in the workplace.”

### QUESTION 16.

**Choice D is the best answer.** A comma is needed between the dependent and independent clauses in order to create one sentence. The introductory conditional dependent clause beginning with “if” cannot stand alone and needs to be separated from the independent clause by a comma.

Choice A is incorrect because the dependent clause needs to be attached to an independent clause. Choice B is incorrect because a semicolon would be correct in this context only if it were connecting two independent clauses. Choice C is incorrect because there is no comma between the dependent and independent clauses.

### QUESTION 17.

**Choice B is the best answer.** It provides a clear and concise sentence that doesn’t repeat ideas and specifically focuses on workers’ “deficiencies.”

Choices A and D are incorrect because they are wordy and repeat previously stated ideas. Choice C uses the casual expression “deal with,” which is not the appropriate tone for the passage, and “flaws and shortcomings” mean the same thing.

### QUESTION 18.

**Choice C is the best answer.** “Obsolete” clearly and concisely conveys the idea that skills can become outdated.

Choices A, B, and D are incorrect either because they are not clear or they convey a tone that is inappropriate for the passage.

### QUESTION 19.

**Choice B is the best answer.** “Include” is a plural, present tense verb that agrees in number with the plural noun “forms” and the other present tense verbs in the paragraph.

Choice A is incorrect because the singular verb “includes” does not agree in number with the plural noun “forms.” Choice C is incorrect because a simple present tense verb is needed to provide a predicate

for the sentence. The participle “including” doesn’t provide a predicate. Choice D is incorrect because the present perfect verb form is inconsistent with the present tense verbs in the paragraph.

### QUESTION 20.

**Choice D is the best answer.** No transitional link is needed between the two sentences.

In addition to the fact that no transition is needed, choice A is incorrect because “around the same time” indicates that time has been discussed earlier in the passage, but it hasn’t. Choice B incorrectly indicates that additional information will be added to the previous statement. Choice C wrongly indicates that regardless of what has been said already, what follows is true.

### QUESTION 21.

**Choice C is the best answer.** Since “professional networks” is the largest circle in the illustration, it is therefore the overarching framework “within which staff receive coaching and consultation as well as the opportunity to attend foundation and skill-building workshops.”

Choices A, B, and D are incorrect because as shown in the illustration, “coaching and consultation” and “foundation and skill-building workshops” occupy smaller circles within the professional-development framework, and thus cannot be the overarching framework.

### QUESTION 22.

**Choice C is the best answer.** No punctuation is needed between the main verb “can identify” and the clause that begins with “which” and functions as the object of the verb.

Choices A, B, and D are incorrect because they all contain punctuation marks.

### QUESTION 23.

**Choice C is the best answer.** The transition “however” indicates that a contrast or difference will follow. In this sentence two types of diners are being contrasted: “on-the-go eaters” and those who value “regional foods” and “culture built on cooking and long meals.”

Choices A, B, and D are incorrect because these transitions do not indicate the contrast that sets up the resistance to the Slow Food movement discussed in the passage.



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### QUESTION 24.

**Choice A is the best answer.** A comma is needed to separate the introductory infinitive phrase beginning with “to counter” from the independent main clause of the sentence beginning with “a cohort.”

Choice B is incorrect because a semicolon is used in this context between two independent clauses. Choice C is incorrect because a colon is used before a list or to set off an important idea. Choice D is incorrect because the infinitive phrase beginning with “to counter” is not a complete sentence.

### QUESTION 25.

**Choice C is the best answer.** The sentence should not be added because the fact that the Slow Food movement’s philosophy “was connected to the tale of the hare and the tortoise” blurs the focus of the paragraph, which is the contrast between two attitudes toward eating. The idea is also not clearly explained.

Choices A and B are incorrect because the sentence is irrelevant without further explanation. Choice D is incorrect because the paragraph doesn’t emphasize the “Slow Food movement’s origins and beliefs.”

### QUESTION 26.

**Choice D is the best answer.** The auxiliary verb “has” correctly indicates that the Slow Food movement’s opposition to fast food’s standardization of taste is ongoing.

Choices A, B, and C provide verb tenses that do not indicate an opposition that began in the past and is ongoing: choice A provides a past perfect tense verb; choice B, a present tense verb; and choice C, a future tense verb.

### QUESTION 27.

**Choice B is the best answer.** The comma, which is necessary to set off information that may be informative but is not necessary for understanding the sentence, is placed correctly after the noun “factors” and after the noun “weather.”

Choice A is incorrect because commas are needed to set off the nonrestrictive phrase. Choice C is incorrect because the first comma is misplaced. Choice D is incorrect because there should be a comma after “weather.”

**QUESTION 28.**

**Choice D is the best answer.** This choice most effectively supports the central point of the paragraph — the factors that influence the diversity of food flavors.

Choices A, B, and C are incorrect because they contain ideas that are not consistent with those in the paragraph. Choice A is subjective and mentions flavor quality instead of diversity, choice B addresses learning about traditional food, and choice C addresses how food is made.

**QUESTION 29.**

**Choice C is the best answer.** The singular possessive pronoun “its” refers correctly to the singular noun “movement.”

Choice A is incorrect because “their” is a plural possessive pronoun, which cannot be used with a singular noun. Choice B is incorrect because the pronoun “there” refers to a place or is used to introduce a clause, and it is not possessive. Choice D is incorrect because “it’s” is a contraction for “it is,” not a possessive pronoun, and does not make sense in the sentence.

**QUESTION 30.**

**Choice B is the best answer.** “Leisurely meals with friends and family” is clear and concise and eliminates unnecessary repetition.

Choices A and C are wordy and contain unnecessary repetition: In choice A, “lots of time” and “long meals” are the same. In choice C, “loved ones such as friends and family” is redundant. In choice D, “time-consuming meals” has a negative connotation, which is not consistent with the Slow Food movement’s belief that long, leisurely meals are beneficial.

**QUESTION 31.**

**Choice C is the best answer.** “Drew criticism” is an idiomatic phrase meaning “caused criticism to flow forth,” which fits in the context of the sentence.

Choices A, B, and D are incorrect. All contain synonyms for “drew,” but they refer to drawing as an artistic exercise. None of these choices works, within the context of the sentence, since drawing here means enticing or attracting.

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### QUESTION 32.

**Choice C is the best answer.** The sentence contains an indirect question, which does not take a question mark.

Choices A and B are incorrect because they contain question marks. Choice D is incorrect because the word order is confusing.

### QUESTION 33.

**Choice C is the best answer.** The prepositional phrase “to these ends” is used correctly as a transition to show that the three beliefs identified in the previous sentence cause the action (supporting small-scale producers) in the sentence that the prepositional phrase introduces.

Choices A, B, and D are incorrect. None of these options shows the true relationship between the sentences. “In short” (choice A) means that a summary will follow; “nonetheless” (choice B) means that in spite of the fact that something has been stated as being a certain way, an exception or contrasting statement will follow; and “by the same token” (choice D) indicates that a similar idea will follow.

### QUESTION 34.

**Choice A is the best answer.** The comma is placed correctly after “declared” to set off the headline that follows.

Choices B, C, and D are incorrect because they contain misplaced commas. Additionally, the inclusion of a second comma in choices C and D suggests incorrectly that the information between the commas could be eliminated without changing the meaning of the sentence.

### QUESTION 35.

**Choice B is the best answer.** This choice clearly says that “other newspapers also ran stories claiming that the broadcast had incited mass hysteria,” which suggests that the story was widely reported.

Choice A is incorrect because it identifies only one news source. Choices C and D are incorrect because they are not relevant to the paragraph.

### QUESTION 36.

**Choice C is the best answer.** The participle “fearing” clearly describes the people who thought that Martians had invaded Earth and places the focus on “fear.”

Choice A is incorrect because it changes the meaning of the sentence. A broadcast can’t “have” people. Choice A would also require a comma before “who feared” to make it grammatically correct. Choice B is incorrect because the relative pronoun “that” isn’t used to begin clauses describing people. Choice D is incorrect because the infinitive “to fear” doesn’t make sense in the sentence.

**QUESTION 37.**

**Choice D is the best answer.** “Go so far as to” is an idiomatic expression meaning “proceed to the point of doing something.”

Choices A, B, and C are incorrect because they are not idiomatic.

**QUESTION 38.**

**Choice C is the best answer.** The prepositional phrase “in the article” is used correctly to link the article mentioned in the previous sentence to a statement that was made in the article.

Choices A, B, and D are incorrect because they don’t show the true relationship between the sentences. The previous sentence makes a statement that the following sentence expands upon.

**QUESTION 39.**

**Choice D is the best answer.** The prepositional phrase “by portraying the new medium as irresponsible” clearly and concisely tells how the newspaper industry “sought to discredit the newly emerging technology of radio.”

Choices A and B are incorrect because they include unnecessary words that do not add meaning to the sentence. Choice C is incorrect because the conjunction “and” is unnecessary and confusing.

**QUESTION 40.**

**Choice B is the best answer.** It best establishes the main idea of the paragraph by focusing on the overblown reports of panic. The paragraph lists various pieces of evidence to support the claim that reports were exaggerated; for instance, “a mere 2 percent of households had tuned in to the broadcast” and the validity of “an oft-cited report” is called into question.

Choices A, C, and D are incorrect. Choice A is too specific since the paragraph doesn’t evaluate the strength of Pooley and Socolow’s argument. Choice C is too specific since the paragraph doesn’t focus on Pooley and Socolow’s insistence on newspapers’ distortions. Choice D is too general and doesn’t focus on a topic.

**QUESTION 41.**

**Choice A is the best answer.** “Fewer” is an adjective that is used with things that can be counted and therefore is used correctly in this sentence to describe “people.” “Far” is an adverb that describes the adjective “fewer” and is used to indicate the extent to which the number of people listening to the broadcast differed from a million.

Choices B and C are incorrect because the adjective “less” is used when describing things that cannot be counted. Choices C and D are incorrect because they use “then” and not the appropriate comparison preposition “than.”

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### QUESTION 42.

**Choice D is the best answer.** Sentence 4 is most logically placed after sentence 7 because sentence 7 implies that the words used in the survey were used synonymously, even though the words convey different levels of reaction. Sentence 4 supports this idea with further explanation.

Choices A, B, and C are incorrect because it would be illogical and confusing to place sentence 4 after sentence 2, 3, or 5.

### QUESTION 43.

**Choice C is the best answer.** The pronoun “some” is used correctly as the subject of the independent clause. The comma after “some” is needed to set off the nonrestrictive clause (“influenced by the sensationalized news coverage afterward”) that follows it.

Choice A is incorrect because without a comma, the resulting restrictive clause changes the meaning of the sentence. Choice B is incorrect because the pronoun “they” introduces an independent clause and provides another, unnecessary subject for the sentence. Choice D is incorrect because a comma is needed to set off the nonrestrictive clause.

### QUESTION 44.

**Choice A is the best answer.** “Not unlike,” which means the same as “like,” most effectively signals the similarity between the two groups mentioned by the researchers.

Choices B, C, and D are incorrect because they all indicate difference instead of similarity.

## Section 3: Math Test — No Calculator

### QUESTION 1.

**Choice C is correct.** Maria spends  $x$  minutes running each day and  $y$  minutes biking each day. Therefore,  $x + y$  represents the total number of minutes Maria spent running and biking each day. Because  $x + y = 75$ , it follows that 75 is the total number of minutes that Maria spent running and biking each day.

Choices A and B are incorrect. The problem states that Maria spends time in both activities each day, therefore  $x$  and  $y$  must be positive. If 75 represents the number of minutes Maria spent running each day, then Maria spent no minutes biking each day. Similarly, if 75 represents the number of minutes Maria spent biking each day, then Maria spent no minutes running each day. The number of minutes Maria spends running each day and biking each day may vary; however, the total number of minutes she spends each day on these activities is constant and equal to 75. Choice D is incorrect. The number of minutes Maria spent biking for each minute spent running cannot be determined from the information provided.

**QUESTION 2.**

**Choice C is correct.** Using the distributive property to multiply 3 and  $(x + 5)$  gives  $3x + 15 - 6$ , which can be rewritten as  $3x + 9$ .

Choice A is incorrect and may result from rewriting the given expression as  $3(x + 5 - 6)$ . Choice B is incorrect and may result from incorrectly rewriting the expression as  $(3x + 5) - 6$ . Choice D is incorrect and may result from incorrectly rewriting the expression as  $3(5x) - 6$ .

Alternatively, evaluating the given expression and each answer choice for the same value of  $x$ , for example  $x = 0$ , will reveal which of the expressions is equivalent to the given expression.

**QUESTION 3.**

**Choice B is correct.** The first equation can be rewritten as  $y - x = 3$  and the second as  $\frac{x}{4} + y = 3$ , which implies that  $-x = \frac{x}{4}$ , and so  $x = 0$ . The ordered pair  $(0, 3)$  satisfies the first equation and also the second, since  $0 + 2(3) = 6$  is a true equality.

Alternatively, the first equation can be rewritten as  $y = x + 3$ .

Substituting  $x + 3$  for  $y$  in the second equation gives  $\frac{x}{2} + 2(x + 3) = 6$ .

This can be rewritten using the distributive property as  $\frac{x}{2} + 2x + 6 = 6$ .

It follows that  $2x + \frac{x}{2}$  must be 0. Thus,  $x = 0$ . Substituting 0 for  $x$  in the equation  $y = x + 3$  gives  $y = 3$ . Therefore, the ordered pair  $(0, 3)$  is the solution to the system of equations shown.

Choice A is incorrect; it satisfies the first equation but not the second. Choices C and D are incorrect because neither satisfies the first equation,  $x = y - 3$ .

**QUESTION 4.**

**Choice D is correct.** Applying the distributive property, the original expression is equivalent to  $5 + 12i - 9i^2 + 6i$ . Since  $i = \sqrt{-1}$ , it follows that  $i^2 = -1$ . Substituting  $-1$  for  $i^2$  into the expression and simplifying yields  $5 + 12i + 9 + 6i$ , which is equal to  $14 + 18i$ .

Choices A, B, and C are incorrect and may result from substituting 1 for  $i^2$  or errors made when rewriting the given expression.

**QUESTION 5.**

**Choice A is correct.** Substituting  $-1$  for  $x$  in the equation that defines

$f$  gives  $f(-1) = \frac{(-1)^2 - 6(-1) + 3}{(-1) - 1}$ . Simplifying the expressions in the numerator and denominator yields  $\frac{1 + 6 + 3}{-2}$ , which is equal to  $\frac{10}{-2}$  or  $-5$ .

Choices B, C, and D are incorrect and may result from misapplying the order of operations when substituting  $-1$  for  $x$ .

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### QUESTION 6.

**Choice C is correct.** The value of the camera equipment depreciates from its original purchase value at a constant rate for 12 years. So if  $x$  is the amount, in dollars, by which the value of the equipment depreciates each year, the value of the camera equipment, in dollars,  $t$  years after it is purchased would be  $32,400 - xt$ . Since the value of the camera equipment after 12 years is \$0, it follows that  $32,400 - 12x = 0$ . To solve for  $x$ , rewrite the equation as  $32,400 = 12x$ . Dividing both sides of the equation by 12 gives  $x = 2,700$ . It follows that the value of the camera equipment depreciates by \$2,700 each year. Therefore, the value of the equipment after 4 years, represented by the expression  $32,400 - 2,700(4)$ , is \$21,600.

Choice A is incorrect. The value given in choice A is equivalent to  $\$2,700 \times 4$ . This is the amount, in dollars, by which the value of the camera equipment depreciates 4 years after it is purchased, not the dollar value of the camera equipment 4 years after it is purchased.

Choice B is incorrect. The value given in choice B is equal to  $\$2,700 \times 6$ , which is the amount, in dollars, by which the value of the camera equipment depreciates 6 years after it is purchased, not the dollar value of the camera equipment 4 years after it is purchased.

Choice D is incorrect. The value given in choice D is equal to  $\$32,400 - \$2,700$ . This is the dollar value of the camera equipment 1 year after it is purchased.

### QUESTION 7.

**Choice B is correct.** Each of the options is a quadratic expression in vertex form. To rewrite the given expression in this form, the number 9 needs to be added to the first two terms, because  $x^2 + 6x + 9$  is equivalent to  $(x + 3)^2$ . Rewriting the number 4 as  $9 - 5$  in the given expression yields  $x^2 + 6x + 9 - 5$ , which is equivalent to  $(x + 3)^2 - 5$ .

Choice A is incorrect. Squaring the binomial and simplifying the expression in option A gives  $x^2 + 6x + 9 + 5$ . Combining like terms gives  $x^2 + 6x + 14$ , not  $x^2 + 6x + 4$ . Choice C is incorrect. Squaring the binomial and simplifying the expression in choice C gives  $x^2 - 6x + 9 + 5$ .

Combining like terms gives  $x^2 - 6x + 14$ , not  $x^2 + 6x + 4$ . Choice D is incorrect. Squaring the binomial and simplifying, the expression in choice D gives  $x^2 - 6x + 9 - 5$ . Combining like terms gives  $x^2 - 6x + 4$ , not  $x^2 + 6x + 4$ .

### QUESTION 8.

**Choice C is correct.** Ken earned \$8 per hour for the first 10 hours he worked, so he earned a total of \$80 for the first 10 hours he worked. For the rest of the week, Ken was paid at the rate of \$10 per hour. Let  $x$  be the number of hours he will work for the rest of the week. The total of Ken's earnings, in dollars, for the week will be  $10x + 80$ . He saves

90% of his earnings each week, so this week he will save  $0.9(10x + 80)$  dollars. The inequality  $0.9(10x + 80) \geq 270$  represents the condition that he will save at least \$270 for the week. Factoring 10 out of the expression  $10x + 80$  gives  $10(x + 8)$ . The product of 10 and 0.9 is 9, so the inequality can be rewritten as  $9(x + 8) \geq 270$ . Dividing both sides of this inequality by 9 yields  $x + 8 \geq 30$ , so  $x \geq 22$ . Therefore, the least number of hours Ken must work the rest of the week to save at least \$270 for the week is 22.

Choices A and B are incorrect because Ken can save \$270 by working fewer hours than 38 or 33 for the rest of the week. Choice D is incorrect. If Ken worked 16 hours for the rest of the week, his total earnings for the week will be  $\$80 + \$160 = \$240$ , which is less than \$270. Since he saves only 90% of his earnings each week, he would save even less than \$240 for the week.

### QUESTION 9.

**Choice B is correct.** Marisa will hire  $x$  junior directors and  $y$  senior directors. Since she needs to hire at least 10 staff members,  $x + y \geq 10$ . Each junior director will be paid \$640 per week, and each senior director will be paid \$880 per week. Marisa's budget for paying the new staff is no more than \$9,700 per week; in terms of  $x$  and  $y$ , this condition is  $640x + 880y \leq 9,700$ . Since Marisa must hire at least 3 junior directors and at least 1 senior director, it follows that  $x \geq 3$  and  $y \geq 1$ . All four of these conditions are represented correctly in choice B.

Choices A and C are incorrect. For example, the first condition,  $640x + 880y \geq 9,700$ , in each of these options implies that Marisa can pay the new staff members more than her budget of \$9,700. Choice D is incorrect because Marisa needs to hire at least 10 staff members, not at most 10 staff members, as the inequality  $x + y \leq 10$  implies.

### QUESTION 10.

**Choice B is correct.** In general, a binomial of the form  $x + f$ , where  $f$  is a constant, is a factor of a polynomial when the remainder of dividing the polynomial by  $x + f$  is 0. Let  $R$  be the remainder resulting from the division of the polynomial  $P(x) = ax^3 + bx^2 + cx + d$  by  $x + 1$ . So the polynomial  $P(x)$  can be rewritten as  $P(x) = (x + 1)q(x) + R$ , where  $q(x)$  is a polynomial of second degree and  $R$  is a constant. Since  $-1$  is a root of the equation  $P(x) = 0$ , it follows that  $P(-1) = 0$ .

Since  $P(-1) = 0$  and  $P(-1) = R$ , it follows that  $R = 0$ . This means that  $x + 1$  is a factor of  $P(x)$ .



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Choices A, C, and D are incorrect because none of these choices can be a factor of the polynomial  $P(x) = ax^3 + bx^2 + cx + d$ . For example, if  $x - 1$  were a factor (choice A), then  $P(x) = (x - 1)h(x)$ , for some polynomial function  $h$ . It follows that  $P(1) = (1 - 1)h(1) = 0$ , so 1 would be another root of the given equation, and thus the given equation would have at least 4 roots. However, a third-degree equation cannot have more than three roots. Therefore,  $x - 1$  cannot be a factor of  $P(x)$ .

### QUESTION 11.

**Choice D is correct.** For  $x > 1$  and  $y > 1$ ,  $x^{\frac{1}{3}}$  and  $y^{\frac{1}{2}}$  are equivalent to  $\sqrt[3]{x}$  and  $\sqrt{y}$ , respectively. Also,  $x^{-2}$  and  $y^{-1}$  are equivalent to  $\frac{1}{x^2}$  and  $\frac{1}{y}$ , respectively. Using these equivalences, the given expression can be rewritten as  $\frac{y\sqrt{y}}{x^2\sqrt[3]{x}}$ .

Choices A, B, and C are incorrect because these choices are not equivalent to the given expression for  $x > 1$  and  $y > 1$ .

For example, for  $x = 2$  and  $y = 2$ , the value of the given expression is  $2^{\frac{5}{6}}$ ; the values of the choices, however, are  $2^{\frac{1}{3}}$ ,  $2^{\frac{5}{6}}$ , and 1, respectively.

### QUESTION 12.

**Choice B is correct.** The graph of a quadratic function in the  $xy$ -plane is a parabola. The axis of symmetry of the parabola passes through the vertex of the parabola. Therefore, the vertex of the parabola and the midpoint of the segment between the two  $x$ -intercepts of the graph have the same  $x$ -coordinate. Since  $f(-3) = f(-1) = 0$ , the  $x$ -coordinate of the vertex is  $\frac{(-3) + (-1)}{2} = -2$ . Of the shown intervals, only the interval in choice B contains  $-2$ .

Choices A, C, and D are incorrect and may result from either calculation errors or misidentification of the graph's  $x$ -intercepts.

### QUESTION 13.

**Choice D is correct.** The numerator of the given expression can be rewritten in terms of the denominator,  $x - 3$ , as follows:

$x^2 - 2x - 5 = x^2 - 3x + x - 3 - 2$ , which is equivalent to  $x(x - 3) + (x - 3) - 2$ . So the given expression is equivalent

to  $\frac{x(x - 3) + (x - 3) - 2}{x - 3} = \frac{x(x - 3)}{x - 3} + \frac{x - 3}{x - 3} - \frac{2}{x - 3}$ . Since the given expression is defined for  $x \neq 3$ , the expression can be rewritten as  $x + 1 - \frac{2}{x - 3}$ .

Long division can also be used as an alternate approach.

Choices A, B, and C are incorrect and may result from errors made when dividing the two polynomials or making use of structure.

**QUESTION 14.**

**Choice A is correct.** If  $x$  is the width, in inches, of the box, then the length of the box is  $2.5x$  inches. It follows that the perimeter of the base is  $2(2.5x + x)$ , or  $7x$  inches. The height of the box is given to be 60 inches. According to the restriction, the sum of the perimeter of the base and the height of the box should not exceed 130 inches. Algebraically, that is  $7x + 60 \leq 130$ , or  $7x \leq 70$ . Dividing both sides of the inequality by 7 gives  $x \leq 10$ . Since  $x$  represents the width of the box,  $x$  must also be a positive number. Therefore, the inequality  $0 < x \leq 10$  represents all the allowable values of  $x$  that satisfy the given conditions.

Choices B, C, and D are incorrect and may result from calculation errors or misreading the given information.

**QUESTION 15.**

**Choice D is correct.** Factoring out the coefficient  $\frac{1}{3}$ , the given expression can be rewritten as  $\frac{1}{3}(x^2 - 6)$ . The expression  $x^2 - 6$  can be approached as a difference of squares and rewritten as  $(x - \sqrt{6})(x + \sqrt{6})$ . Therefore,  $k$  must be  $\sqrt{6}$ .

Choice A is incorrect. If  $k$  were 2, then the expression given would be rewritten as  $\frac{1}{3}(x - 2)(x + 2)$ , which is equivalent to  $\frac{1}{3}x^2 - \frac{4}{3}$ , not  $\frac{1}{3}x^2 - 2$ .

Choice B is incorrect. This may result from incorrectly factoring the expression and finding  $(x - 6)(x + 6)$  as the factored form of the expression. Choice C is incorrect. This may result from incorrectly distributing the  $\frac{1}{3}$  and rewriting the expression as  $\frac{1}{3}(x^2 - 2)$ .

**QUESTION 16.**

**The correct answer is 8.** The expression  $2x + 8$  contains a factor of  $x + 4$ . It follows that the original equation can be rewritten as  $2(x + 4) = 16$ . Dividing both sides of the equation by 2 gives  $x + 4 = 8$ .

**QUESTION 17.**

**The correct answer is 30.** It is given that the measure of  $\angle QPR$  is  $60^\circ$ . Angle  $MPR$  and  $\angle QPR$  are collinear and therefore are supplementary angles. This means that the sum of the two angle measures is  $180^\circ$ , and so the measure of  $\angle MPR$  is  $120^\circ$ . The sum of the angles in a triangle is  $180^\circ$ . Subtracting the measure of  $\angle MPR$  from  $180^\circ$  yields the sum of the other angles in the triangle  $MPR$ . Since  $180 - 120 = 60$ , the sum of the measures of  $\angle QMR$  and  $\angle NRM$  is  $60^\circ$ . It is given that  $MP = PR$ , so it follows that triangle  $MPR$  is isosceles. Therefore  $\angle QMR$  and  $\angle NRM$  must be congruent. Since the sum of the measure of these two angles is  $60^\circ$ , it follows that the measure of each angle is  $30^\circ$ .

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An alternate approach would be to use the exterior angle theorem, noting that the measure of  $\angle QPR$  is equal to the sum of the measures of  $\angle QMR$  and  $\angle NRM$ . Since both angles are equal, each of them has a measure of  $30^\circ$ .

#### QUESTION 18.

**The correct answer is 4.** There are  $\pi$  radians in a  $180^\circ$  angle. A  $720^\circ$  angle is 4 times greater than a  $180^\circ$  angle. Therefore, the number of radians in a  $720^\circ$  angle is  $4\pi$ .

#### QUESTION 19.

**The correct answer is 8.** Since the line passes through the point  $(2, 0)$ , its equation is of the form  $y = m(x - 2)$ . The coordinates of the point  $(1, 4)$  must also satisfy this equation. So  $4 = m(1 - 2)$ , or  $m = -4$ . Substituting  $-4$  for  $m$  in the equation of the line gives  $y = -4(x - 2)$ , or equivalently  $y = -4x + 8$ . Therefore,  $b = 8$ .

Alternate approach: Given the coordinates of two points through which the line passes, the slope of the line is  $\frac{4 - 0}{1 - 2} = -4$ . So, the equation of the line is of the form  $y = -4x + b$ . Since  $(2, 0)$  satisfies this equation,  $0 = -4(2) + b$  must be true. Solving this equation for  $b$  gives  $b = 8$ .

#### QUESTION 20.

**The correct answer is 6632.** Applying the distributive property to the expression yields  $7532 + 100y^2 + 100y^2 - 1100$ . Then adding together  $7532 + 100y^2$  and  $100y^2 - 1100$  and collecting like terms results in  $200y^2 + 6432$ . This is written in the form  $ay^2 + b$ , where  $a = 200$  and  $b = 6432$ . Therefore  $a + b = 200 + 6432 = 6632$ .

## Section 4: Math Test - Calculator

#### QUESTION 1.

**Choice B is correct.** There are 2 dogs that are fed only dry food and a total of 25 dogs. Therefore, the fraction of dogs fed only dry food is  $\frac{2}{25}$ .

Choice A is incorrect. This fraction is the number of dogs fed only dry food divided by the total number of pets instead of the total number of dogs. Choice C is incorrect because it is the fraction of all pets fed only dry food. Choice D is incorrect. This fraction is the number of dogs fed only dry food divided by the total number of pets fed only dry food.

#### QUESTION 2.

**Choice A is correct.** Applying the distributive property, the given expression can be rewritten as  $x^2 - 3 + 3x^2 - 5$ . Combining like terms yields  $4x^2 - 8$ .

Choice B is incorrect and is the result of disregarding the negative sign in front of the first 3 before combining like terms. Choice C is incorrect and is the result of not multiplying  $-3x^2$  by  $-1$  before combining like terms. Choice D is incorrect and is the result of disregarding the negative sign in front of the first 3 and not multiplying  $-3x^2$  by  $-1$  before combining like terms.

### QUESTION 3.

**Choice C is correct.** Multiplying each side of 1 meter = 100 cm by 6 gives 6 meters = 600 cm. Each package requires 3 centimeters of tape. The number of packages that can be secured with 600 cm of tape is  $\frac{600}{3}$ , or 200 packages.

Choices A, B, and D are incorrect and may be the result of incorrect interpretations of the given information or of computation errors.

### QUESTION 4.

**Choice D is correct.** The survey was given to a group of people who liked the book, and therefore, the survey results can be applied only to the population of people who liked the book. Choice D is the most appropriate inference from the survey results because it describes a conclusion about people who liked the book, and the results of the survey indicate that most people who like the book disliked the movie.

Choices A, B, and C are incorrect because none of these inferences can be drawn from the survey results. Choices A and B need not be true. The people surveyed all liked the book on which the movie was based, which is not true of all people who go see movies or all people who read books. Thus, the people surveyed are not representative of all people who go see movies or all people who read books. Therefore, the results of this survey cannot appropriately be extended to at least 95% of people who go see movies or to at least 95% of people who read books. Choice C need not be true because the sample includes only people who liked the book, and so the results do not extend to people who dislike the book.

### QUESTION 5.

**Choice C is correct.** Substituting (1, 1) into the inequality gives  $5(1) - 3(1) < 4$ , or  $2 < 4$ , which is a true statement. Substituting (2, 5) into the inequality gives  $5(2) - 3(5) < 4$ , or  $-5 < 4$ , which is a true statement. Substituting (3, 2) into the inequality gives  $5(3) - 3(2) < 4$ , or  $9 < 4$ , which is not a true statement. Therefore, (1, 1) and (2, 5) are the only ordered pairs that satisfy the given inequality.

Choice A is incorrect because the ordered pair (2, 5) also satisfies the inequality. Choice B is incorrect because the ordered pair (1, 1) also satisfies the inequality. Choice D is incorrect because the ordered pair (3, 2) does not satisfy the inequality.

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### QUESTION 6.

**Choice C is correct.** Since  $x = -3$  is a solution to the equation, substituting  $-3$  for  $x$  gives  $(-3a + 3)^2 = 36$ . Taking the square root of each side of this equation gives the two equations  $-3a + 3 = 6$  and  $-3a + 3 = -6$ . Solving each of these for  $a$  yields  $a = -1$  and  $a = 3$ . Therefore,  $-1$  is a possible value of  $a$ .

Choice A is incorrect and may be the result of ignoring the squared expression and solving  $-3a + 3 = 36$  for  $a$ . Choice B is incorrect and may be the result of dividing 36 by 2 instead of taking the square root of 36 when solving for  $a$ . Choice D is incorrect and may be the result of taking the sum of the value of  $x$ ,  $-3$ , and the constant, 3.

### QUESTION 7.

**Choice A is correct.** The slope of the line of best fit is negative, meaning as the distance of planetoids from the Sun increases, the density of the planetoids decreases. Therefore, planetoids that are more distant from the Sun tend to have lesser densities.

Choice B is incorrect because as the distance of planetoids from the sun increases, the density of the planetoids decreases. Choice C is incorrect. For example, according to the line of best fit, a planetoid that is 0.8 AU from the Sun has a density of 5 g/cm<sup>3</sup>, but a planetoid that is twice as far from the Sun with a distance of 1.6 AU has a density of 4.25 g/cm<sup>3</sup>. However, the density of 4.25 g/cm<sup>3</sup> is not half the density of 5 g/cm<sup>3</sup>. Choice D is incorrect because there is a relationship between the distance from a planetoid to the Sun and density, as shown by the line of best fit.

### QUESTION 8.

**Choice C is correct.** According to the line of best fit, a planetoid with a distance from the Sun of 1.2 AU has a density between 4.5 g/cm<sup>3</sup> and 4.75 g/cm<sup>3</sup>. The only choice in this range is 4.6.

Choices A, B, and D are incorrect and may result from misreading the information in the scatterplot.

### QUESTION 9.

**Choice A is correct.** To isolate the terms that contain  $ax$  and  $b$ , 6 can be added to both sides of the equation, which gives  $9ax + 9b = 27$ . Then, both sides of this equation can be divided by 9, which gives  $ax + b = 3$ .

Choices B, C, and D are incorrect and may result from computation errors.

### QUESTION 10.

**Choice D is correct.** There are 60 minutes in one hour, so an 8-hour workday has  $(60)(8) = 480$  minutes. To calculate 15% of 480, multiply 0.15 by 480:  $(0.15)(480) = 72$ . Therefore, Lani spent 72 minutes of her workday in meetings.

Choice A is incorrect because 1.2 is 15% of 8, which gives the time Lani spent of her workday in meetings in hours, not minutes. Choices B and C are incorrect and may be the result of computation errors.

### QUESTION 11.

**Choice A is correct.** The total number of copies of the game the company will ship is 75, so one equation in the system is  $s + c = 75$ , which can be written as  $75 - s = c$ . Because each standard edition of the game has a volume of 20 cubic inches and  $s$  represents the number of standard edition games, the expression  $20s$  represents the volume of the shipment that comes from standard edition copies of the game. Similarly, the expression  $30c$  represents the volume of the shipment that comes from collector's edition copies of the games. Because these volumes combined are 1,870 cubic inches, the equation  $20s + 30c = 1,870$  represents this situation. Therefore, the correct answer is choice A.

Choice B is incorrect. This equation gives the volume of each standard edition game as 30 cubic inches and the volume of each collector's edition game as 20 cubic inches. Choice C is incorrect. This is the result of finding the average volume of the two types of games, using that average volume (25) for both types of games, and assuming that there are 75 more standard editions of the game than there are collector's editions of the game. Choice D is incorrect. This is the result of assuming that the volume of each standard edition game is 30 cubic inches, that the volume of each collector's edition game is 20 cubic inches, and that there are 75 more standard editions than there are collector's editions.

### QUESTION 12.

**Choice B is correct.** Let  $x$  be the price, in dollars, of the jacket before sales tax. The price of the jacket after the 6% sales tax is added was \$53. This can be expressed by the equation  $x + 0.06x = 53$ , or  $1.06x = 53$ . Dividing each side of this equation by 1.06 gives  $x = 50$ . Therefore, the price of the jacket before sales tax was \$50.

Choices A, C, and D are incorrect and may be the result of computation errors.

### QUESTION 13.

**Choice B is correct.** Theresa's speed was increasing from 0 to 5 minutes and from 20 to 25 minutes, which is a total of 10 minutes. Theresa's speed was decreasing from 10 minutes to 20 minutes and from 25 to 30 minutes, which is a total of 15 minutes. Therefore, Theresa's speed was NOT increasing for a longer period of time than it was decreasing.

Choice A is incorrect. Theresa ran at a constant speed for the 5-minute period from 5 to 10 minutes. Choice C is incorrect. Theresa's speed decreased at a constant rate during the last 5 minutes. Choice D is incorrect. Theresa's speed reached its maximum at 25 minutes, which is within the last 10 minutes.

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### QUESTION 14.

**Choice D is correct.** The figure is a quadrilateral, so the sum of the measures of its interior angles is  $360^\circ$ . The value of  $x$  can be found by using the equation  $45 + 3x = 360$ . Subtracting 45 from both sides of the equation results in  $3x = 315$ , and dividing both sides of the resulting equation by 3 yields  $x = 105$ . Therefore, the value of  $x$  in the figure is 105.

Choice A is incorrect. If the value of  $x$  were 45, the sum of the measures of the angles in the figure would be  $45 + 3(45)$ , or  $180^\circ$ , but the sum of the measures of the angles in a quadrilateral is  $360^\circ$ .

Choice B is incorrect. If the value of  $x$  were 90, the sum of the measures of the angles in the figure would be  $45 + 3(90)$ , or  $315^\circ$ , but the sum of the measures of the angles in a quadrilateral is  $360^\circ$ .

Choice C is incorrect. If the value of  $x$  were 100, the sum of the measures of the angles in the figure would be  $45 + 3(100)$ , or  $345^\circ$ , but the sum of the measures of the angles in a quadrilateral is  $360^\circ$ .

### QUESTION 15.

**Choice B is correct.** A column of 50 stacked one-cent coins is about  $3\frac{7}{8}$  inches tall, which is slightly less than 4 inches tall. Therefore a column of stacked one-cent coins that is 4 inches tall would contain slightly more than 50 one-cent coins. It can then be reasoned that because 8 inches is twice 4 inches, a column of stacked one-cent coins that is 8 inches tall would contain slightly more than twice as many coins; that is, slightly more than 100 one-cent coins. An alternate approach is to set up a proportion comparing the column height to the

number of one-cent coins, or  $\frac{3\frac{7}{8} \text{ inches}}{50 \text{ coins}} = \frac{8 \text{ inches}}{x \text{ coins}}$ , where  $x$  is the

number of coins in an 8-inch-tall column. Multiplying each side of the proportion by  $50x$  gives  $3\frac{7}{8}x = 400$ . Solving for  $x$  gives  $x = \frac{400 \times 8}{31}$ , which is approximately 103. Therefore, of the given choices, 100 is closest to the number of one-cent coins it would take to build an 8-inch-tall column.

Choice A is incorrect. A column of 75 stacked one-cent coins would be slightly less than 6 inches tall. Choice C is incorrect. A column of 200 stacked one-cent coins would be more than 15 inches tall. Choice D is incorrect. A column of 390 stacked one-cent coins would be over 30 inches tall.

### QUESTION 16.

**Choice D is correct.** If  $\frac{b}{2} = 10$ , then multiplying each side of this equation by 2 gives  $b = 20$ . Substituting 20 for  $b$  in the equation  $a - b = 12$  gives  $a - 20 = 12$ . Adding 20 to each side of this equation gives  $a = 32$ . Since  $a = 32$  and  $b = 20$ , it follows that the value of  $a + b$  is  $32 + 20$ , or 52.

Choice A is incorrect. If the value of  $a + b$  were less than the value of  $a - b$ , it would follow that  $b$  is negative. But if  $\frac{b}{2} = 10$ , then  $b$  must be positive. This contradiction shows that the value of  $a + b$  cannot be 2. Choice B is incorrect. If the value of  $a + b$  were equal to the value of  $a - b$ , then it would follow that  $b = 0$ . However,  $b$  cannot equal zero because it is given that  $\frac{b}{2} = 10$ . Choice C is incorrect. This is the value of  $a$ , but the question asks for the value of  $a + b$ .

### QUESTION 17.

**Choice A is correct.** The  $y$ -intercept of the graph of  $y = 19.99 + 1.50x$  in the  $xy$ -plane is the point on the graph with an  $x$ -coordinate equal to 0. In the model represented by the equation, the  $x$ -coordinate represents the number of miles a rental truck is driven during a one-day rental, and so the  $y$ -intercept represents the charge, in dollars, for the rental when the truck is driven 0 miles; that is, the  $y$ -intercept represents the cost, in dollars, of the flat fee. Since the  $y$ -intercept of the graph of  $y = 19.99 + 1.50x$  is  $(0, 19.99)$ , the  $y$ -intercept represents a flat fee of \$19.99 in terms of the model.

Choice B is incorrect. The slope of the graph of  $y = 19.99 + 1.50x$  in the  $xy$ -plane, not the  $y$ -intercept, represents a driving charge per mile of \$1.50 in terms of the model. Choice C is incorrect. Since the coefficient of  $x$  in the equation is 1.50, the charge per mile for driving the rental truck is \$1.50, not \$19.99. Choice D is incorrect. The sum of 19.99 and 1.50, which is 21.49, represents the cost, in dollars, for renting the truck for one day and driving the truck 1 mile; however, the total daily charges for renting the truck does not need to be \$21.49.

### QUESTION 18.

**Choice B is correct.** The charity with the greatest percent of total expenses spent on programs is represented by the highest point on the scatterplot; this is the point that has a vertical coordinate slightly less than halfway between 90 and 95 and a horizontal coordinate slightly less than halfway between 3,000 and 4,000. Thus, the charity represented by this point has a total income of about \$3,400 million and spends about 92% of its total expenses on programs. The percent predicted by the line of best fit is the vertical coordinate of the point on the line of best fit with horizontal coordinate \$3,400 million; this vertical coordinate is very slightly more than 85. Thus, the line of best fit predicts that the charity with the greatest percent of total expenses spent on programs will spend slightly more than 85% on programs. Therefore, the difference between the actual percent (92%) and the prediction (slightly more than 85%) is slightly less than 7%.

Choice A is incorrect. There is no charity represented in the scatterplot for which the difference between the actual percent of total expenses spent on programs and the percent predicted by the line of best fit is as much as 10%. Choices C and D are incorrect. These choices may result



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from misidentifying in the scatterplot the point that represents the charity with the greatest percent of total expenses spent on programs.

### QUESTION 19.

**Choice A is correct.** Current's formula is  $A = \frac{4+w}{30}$ . Multiplying each side of the equation by 30 gives  $30A = 4 + w$ . Subtracting 4 from each side of  $30A = 4 + w$  gives  $w = 30A - 4$ .

Choices B, C, and D are incorrect and may result from errors in choosing and applying operations to isolate  $w$  as one side of the equation in Current's formula.

### QUESTION 20.

**Choice C is correct.** If Mosteller's and Current's formulas give the same estimate for  $A$ , then the right-hand sides of these two equations are equal; that is,  $\frac{\sqrt{hw}}{60} = \frac{4+w}{30}$ . Multiplying each side of this equation by 60 to isolate the expression  $\sqrt{hw}$  gives  $\sqrt{hw} = 60\left(\frac{4+w}{30}\right)$  or  $\sqrt{hw} = 2(4+w)$ . Therefore, if Mosteller's and Current's formulas give the same estimate for  $A$ , then  $\sqrt{hw}$  is equivalent to  $2(4+w)$ .

An alternate approach is to multiply the numerator and denominator of Current's formula by 2, which gives  $\frac{2(4+w)}{60}$ . Since it is given that Mosteller's and Current's formulas give the same estimate for  $A$ ,  $\frac{2(4+w)}{60} = \frac{\sqrt{hw}}{60}$ . Therefore,  $\sqrt{hw} = 2(4+w)$ .

Choices A, B, and D are incorrect and may result from errors in the algebraic manipulation of the equations.

### QUESTION 21.

**Option C is correct.** The predicted increase in total fat, in grams, for every increase of 1 gram in total protein is represented by the slope of the line of best fit. Any two points on the line can be used to calculate the slope of the line as the change in total fat over the change in total protein. For instance, it can be estimated that the points (20, 34) and (30, 48) are on the line of best fit, and the slope of the line that passes through them is  $\frac{48-34}{30-20} = \frac{14}{10}$ , or 1.4. Of the choices given, 1.5 is the closest to the slope of the line of best fit.

Choices A, B, and D are incorrect and may be the result of incorrectly finding ordered pairs that lie on the line of best fit or of incorrectly calculating the slope.

### QUESTION 22.

**Choice B is correct.** The median of a set of numbers is the middle value of the set values when ordered from least to greatest. If the percents in the table are ordered from least to greatest, the middle value is 27.9%. The difference between 27.9% and 26.95% is 0.95%.

Choice A is incorrect and may be the result of calculation errors or not finding the median of the data in the table correctly. Choice C is incorrect and may be the result of finding the mean instead of the median. Choice D is incorrect and may be the result of using the middle value of the unordered list.

### QUESTION 23.

**Choice C is correct.** The total volume of the cylindrical can is found by multiplying the area of the base of the can,  $75 \text{ cm}^2$ , by the height of the can, 10 cm, which yields  $750 \text{ cm}^3$ . If the syrup needed to fill the can has a volume of  $110 \text{ cm}^3$ , then the remaining volume for the pieces of fruit is  $750 - 110 = 640 \text{ cm}^3$ .

Choice A is incorrect because if the fruit had a volume of  $7.5 \text{ cm}^3$ , there would be  $750 - 7.5 = 742.5 \text{ cm}^3$  of syrup needed to fill the can to the top. Choice B is incorrect because if the fruit had a volume of  $185 \text{ cm}^3$ , there would be  $750 - 185 = 565 \text{ cm}^3$  of syrup needed to fill the can to the top. Choice D is incorrect because it is the total volume of the can, not just of the pieces of fruit.

### QUESTION 24.

**Choice A is correct.** The variable  $t$  represents the seconds after the object is launched. Since  $h(0) = 72$ , this, means that the height, in feet, at 0 seconds, or the initial height, is 72 feet.

Choices B, C, and D are incorrect and may be the result of misinterpreting the function in context.

### QUESTION 25.

**Choice B is correct.** The relationship between  $x$  food calories and  $k$  kilojoules can be modeled as a proportional relationship. Let  $(x_1, k_1)$  and  $(x_2, k_2)$  represent the values in the first two rows in the table:

$(4.0, 16.7)$  and  $(9.0, 37.7)$ . The rate of change, or  $\frac{(k_2 - k_1)}{(x_2 - x_1)}$ , is  $\frac{21}{5} = 4.2$ ;

therefore, the equation that best represents the relationship between  $x$  and  $k$  is  $k = 4.2x$ .

Choice A is incorrect and may be the result of calculating the rate of change using  $\frac{(x_2 - x_1)}{(k_2 - k_1)}$ . Choice C is incorrect and may be the result of confusing the independent and dependent variables. Choice D is incorrect and may be the result of an error when setting up the equation.

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### QUESTION 26.

**Choice B is correct.** It is given that there are 4.0 food calories per gram of protein, 9.0 food calories per gram of fat, and 4.0 food calories per gram of carbohydrate. If 180 food calories in a granola bar came from  $p$  grams of protein,  $f$  grams of fat, and  $c$  grams of carbohydrate, then the situation can be represented by the equation  $180 = 4p + 9f + 4c$ . The equation can then be rewritten in terms of  $f$  by subtracting  $4p$  and  $4c$  from both sides of the equation and then dividing both sides of the equation by 9. The result is the equation  $f = 20 - \frac{4}{9}(p + c)$ .

Choices A, C, and D are incorrect and may be the result of not representing the situation with the correct equation or incorrectly rewriting the equation in terms of  $f$ .

### QUESTION 27.

**Choice A is correct.** Because the world's population has grown at an average rate of 1.9% per year since 1945, it follows that the world's population has been growing by a constant factor of 1.019 since 1945. If the world's population in 1975 was about 4 billion, in 1976 the world's population would have been about  $4(1.019)$ ; in 1977 the world's population would have been about  $4(1.019)(1.019)$ , or  $4(1.019)^2$ ; and so forth. Therefore, the world's population,  $P(t)$ ,  $t$  years since 1975 could be represented by the function  $P(t) = 4(1.019)^t$ .

Choice B is incorrect because it represents a 90% increase in population each year. Choices C and D are incorrect because they are linear models, which represent situations that have a constant growth.

### QUESTION 28.

**Choice C is correct.** The line shown has a slope of  $\frac{6-0}{3-0} = 2$  and a  $y$ -intercept of  $(0, 0)$ ; therefore, the equation of the line is  $y = 2x$ . This means that for each point on the line, the value of the  $y$ -coordinate is twice the value of the  $x$ -coordinate. Therefore, for the point  $(s, t)$ , the ratio of  $t$  to  $s$  is 2 to 1.

Choice A is incorrect and would be the ratio of  $t$  to  $s$  if the slope of the line were  $\frac{1}{3}$ . Choice B is incorrect and would be the ratio of  $t$  to  $s$  if the slope of the line were  $\frac{1}{2}$ . Choice D is incorrect and would be the ratio of  $t$  to  $s$  if the slope of the line were 3.

### QUESTION 29.

**Choice D is correct.** The circle with equation  $(x + 3)^2 + (y - 1)^2 = 25$  has center  $(-3, 1)$  and radius 5. For a point to be inside of the circle, the distance from that point to the center must be less than the radius, 5. The distance between  $(3, 2)$  and  $(-3, 1)$  is  $\sqrt{(-3 - 3)^2 + (1 - 2)^2} = \sqrt{(-6)^2 + (-1)^2} = \sqrt{37}$ , which is greater than 5. Therefore,  $(3, 2)$  does NOT lie in the interior of the circle.

Choice A is incorrect. The distance between  $(-7, 3)$  and  $(-3, 1)$  is  $\sqrt{(-7 + 3)^2 + (3 - 1)^2} = \sqrt{(-4)^2 + (2)^2} = \sqrt{20}$ , which is less than 5, and therefore  $(-7, 3)$  lies in the interior of the circle. Choice B is incorrect because it is the center of the circle. Choice C is incorrect because the distance between  $(0, 0)$  and  $(-3, 1)$  is  $\sqrt{(0 + 3)^2 + (0 - 1)^2} = \sqrt{(3)^2 + (1)^2} = \sqrt{8}$ , which is less than 5, and therefore  $(0, 0)$  lies in the interior of the circle.

### QUESTION 30.

**Choice B is correct.** The percent increase from 2012 to 2013 was  $\frac{5,880 - 5,600}{5,600} = 0.05$ , or 5%. Since the percent increase from 2012 to 2013 was estimated to be double the percent increase from 2013 to 2014, the percent increase from 2013 to 2014 was expected to be 2.5%. Therefore, the number of subscriptions sold in 2014 is expected to be the number of subscriptions sold in 2013 multiplied by  $(1 + 0.025)$ , or  $5,880(1.025) = 6,027$ .

Choices A and C are incorrect and may be the result of a conceptual or calculation error. Choice D is incorrect and is the result of interpreting the percent increase from 2013 to 2014 as double the percent increase from 2012 to 2013.

### QUESTION 31.

**The correct answer is 195.** Since the mass of gold was worth \$62,400 and each ounce of gold was worth \$20, the mass of the gold was  $\frac{62,400}{20} = 3,120$  ounces. Since 1 pound = 16 ounces, 3,120 ounces is equivalent to  $\frac{3,120}{16} = 195$  pounds.

### QUESTION 32.

**The correct answer is  $\frac{2}{5}$ .** The slope of the line can be found by selecting any two points  $(x_1, y_1)$  and  $(x_2, y_2)$  on the line and then dividing the difference of the  $y$ -coordinates  $(y_2 - y_1)$  by the difference of the  $x$ -coordinates  $(x_2 - x_1)$ . Using the points  $(-6, -\frac{27}{5})$  and  $(9, \frac{3}{5})$ , the slope is  $\frac{\frac{3}{5} - (-\frac{27}{5})}{9 - (-6)} = \frac{\frac{30}{5}}{15}$ . This can be rewritten as  $\frac{6}{15}$ , which reduces to  $\frac{2}{5}$ . Any of the following equivalent expressions can be gridded as the correct answer:  $\frac{2}{5}$ ,  $.4$ ,  $.40$ ,  $.400$ ,  $\frac{4}{10}$ ,  $\frac{8}{20}$ .

### QUESTION 33.

**The correct answer is 30.** Let  $x$  represent the number of correct answers from the player and  $y$  represent the number of incorrect answers from the player. Since the player answered 40 questions in total, the equation  $x + y = 40$  represents this situation. Also, since the score is found by subtracting the number of incorrect answers from twice the number of correct answers and the player received a score of 50, the equation  $2x - y = 50$  represents this situation. Adding the system of

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two equations together yields  $(x + y) + (2x - y) = 40 + 50$ . This can be rewritten as  $3x = 90$ . Finally, solving for  $x$  by dividing both sides of the equation by 3 yields  $x = 30$ .

#### QUESTION 34.

**The correct answer is  $\frac{5}{18}$ .** There are  $360^\circ$  in a circle, and it is shown that the central angle of the shaded region is  $100^\circ$ . Therefore, the area of the shaded region can be represented as a fraction of the area of the entire circle,  $\frac{100}{360}$ , which can be reduced to  $\frac{5}{18}$ . Either  $5/18$ ,  $.277$ , or  $.288$  can be gridded as the correct answer.

#### QUESTION 35.

**The correct answer is 0 or 3.** For an ordered pair to satisfy a system of equations, both the  $x$ - and  $y$ -values of the ordered pair must satisfy each equation in the system. Both expressions on the right-hand side of the given equations are equal to  $y$ , therefore it follows that both expressions on the right-hand side of the equations are equal to each other:  $x^2 - 4x + 4 = 4 - x$ . This equation can be rewritten as  $x^2 - 3x = 0$ , and then through factoring, the equation becomes  $x(x - 3) = 0$ . Because the product of the two factors is equal to 0, it can be concluded that either  $x = 0$  or  $x - 3 = 0$ , or rather,  $x = 0$  or  $x = 3$ .

#### QUESTION 36.

**The correct answer is 6.** Since  $\tan B = \frac{3}{4}$ ,  $\triangle ABC$  and  $\triangle DBE$  are both 3-4-5 triangles. This means that they are both similar to the right triangle with sides of lengths 3, 4, and 5. Since  $BC = 15$ , which is 3 times as long as the hypotenuse of the 3-4-5 triangle, the similarity ratio of  $\triangle ABC$  to the 3-4-5 triangle is 3:1. Therefore, the length of  $\overline{AC}$  (the side opposite to  $B$ ) is  $3 \times 3 = 9$ , and the length of  $\overline{AB}$  (the side adjacent to angle  $B$ ) is  $4 \times 3 = 12$ . It is also given that  $DA = 4$ . Since  $AB = DA + DB$  and  $AB = 12$ , it follows that  $DB = 8$ , which means that the similarity ratio of  $\triangle DBE$  to the 3-4-5 triangle is 2:1 ( $\overline{DB}$  is the side adjacent to angle  $B$ ). Therefore, the length of  $\overline{DE}$ , which is the side opposite to angle  $B$ , is  $3 \times 2 = 6$ .

#### QUESTION 37.

**The correct answer is 2.4.** The mean score of the 20 contestants on Day 1 is found by dividing the sum of the total scores of the contestants by the number of contestants. It is given that each contestant received 1 point for each correct answer. The table shows that on Day 1, 2 contestants each answered 5 questions correctly, so those 2 contestants scored 10 points in total ( $2 \times 5 = 10$ ). Similarly, the table shows 3 contestants each answered 4 questions correctly, so those 3 contestants scored 12 points in total ( $3 \times 4 = 12$ ). Continuing these calculations reveals that the 4 contestants who answered 3 questions correctly scored 12 points in total ( $4 \times 3 = 12$ );

the 6 contestants who answered 2 questions correctly scored 12 points in total ( $6 \times 2 = 12$ ); the 2 contestants who answered 1 question correctly scored 2 points in total ( $2 \times 1 = 2$ ); and the 3 contestants who answered 0 questions correctly scored 0 points in total ( $3 \times 0 = 0$ ). Adding up the total of points scored by these 20 contestants gives  $10 + 12 + 12 + 12 + 2 + 0 = 48$ . Therefore, the mean score of the contestants is  $\frac{48}{20} = 2.4$ . Either  $12/5$ , 2.4, or 2.40 can be gridded as the correct answer.

### QUESTION 38.

**The correct answer is  $\frac{5}{7}$ .** It is given that no contestant received the same score on two different days, so each of the contestants who received a score of 5 is represented in the “5 out of 5” column of the table exactly once. Therefore, the probability of selecting a contestant who received a score of 5 on Day 2 or Day 3, given that the contestant received a score of 5 on one of the three days, is found by dividing the total number of contestants who received a score of 5 on Day 2 or Day 3 ( $2 + 3 = 5$ ) by the total number of contestants who received a score of 5, which is given in the table as 7. So the probability is  $\frac{5}{7}$ . Either  $5/7$  or .714 can be gridded as the correct answer.



# The SAT<sup>®</sup>

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# Practice Test #8

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# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is from Carlos Ruiz Zafón, *The Angel's Game*. ©2008 by Dragonworks, S.L. Translation ©2009 by Lucia Graves. The narrator, a writer, recalls his childhood in early twentieth-century Barcelona.

Even then my only friends were made of paper and ink. At school I had learned to read and write long before the other children. Where my school friends saw notches of ink on incomprehensible  
 5 pages, I saw light, streets, and people. Words and the mystery of their hidden science fascinated me, and I saw in them a key with which I could unlock a boundless world, a safe haven from that home, those streets, and those troubled days in which even I  
 10 could sense that only a limited fortune awaited me. My father didn't like to see books in the house. There was something about them—apart from the letters he could not decipher—that offended him. He used to tell me that as soon as I was ten he would  
 15 send me off to work and that I'd better get rid of all my scatterbrained ideas if I didn't want to end up a loser, a nobody. I used to hide my books under the mattress and wait for him to go out or fall asleep so that I could read. Once he caught me reading at night  
 20 and flew into a rage. He tore the book from my hands and flung it out of the window.

"If I catch you wasting electricity again, reading all this nonsense, you'll be sorry."

My father was not a miser and, despite the  
 25 hardships we suffered, whenever he could he gave me a few coins so that I could buy myself some treats like

the other children. He was convinced that I spent them on licorice sticks, sunflower seeds, or sweets, but I would keep them in a coffee tin under the bed,  
 30 and when I'd collected four or five reales I'd secretly rush out to buy myself a book.

My favorite place in the whole city was the Sempere & Sons bookshop on Calle Santa Ana. It smelled of old paper and dust and it was my  
 35 sanctuary, my refuge. The bookseller would let me sit on a chair in a corner and read any book I liked to my heart's content. He hardly ever allowed me to pay for the books he placed in my hands, but when he wasn't looking I'd leave the coins I'd managed to  
 40 collect on the counter before I left. It was only small change—if I'd had to buy a book with that pittance, I would probably have been able to afford only a booklet of cigarette papers. When it was time for me to leave, I would do so dragging my feet, a weight on  
 45 my soul. If it had been up to me, I would have stayed there forever.

One Christmas Sempere gave me the best gift I have ever received. It was an old volume, read and experienced to the full.  
 50 "*Great Expectations*, by Charles Dickens," I read on the cover.

I was aware that Sempere knew a few authors who frequented his establishment and, judging by the care with which he handled the volume, I thought  
 55 perhaps this Mr. Dickens was one of them.

"A friend of yours?"

"A lifelong friend. And from now on, he's your friend too."

That afternoon I took my new friend home,  
 60 hidden under my clothes so that my father wouldn't  
 see it. It was a rainy winter, with days as gray as lead,  
 and I read *Great Expectations* about nine times,  
 partly because I had no other book at hand, partly  
 because I did not think there could be a better one in  
 65 the whole world and I was beginning to suspect that  
 Mr. Dickens had written it just for me. Soon I was  
 convinced that I didn't want to do anything else in  
 life but learn to do what Mr. Dickens had done.

1

Over the course of the passage, the main focus shifts from a

- A) general discussion of the narrator's love of reading to a portrayal of an influential incident.
- B) depiction of the narrator's father to an examination of an author with whom the narrator becomes enchanted.
- C) symbolic representation of a skill the narrator possesses to an example of its application.
- D) tale about the hardships of the narrator's childhood to an analysis of the effects of those hardships.

2

The main purpose of lines 1-10 ("Even . . . awaited me") is to

- A) introduce the characters who play a part in the narrator's story.
- B) list the difficult conditions the narrator endured in childhood.
- C) describe the passion that drives the actions the narrator recounts.
- D) depict the narrator's aspirations before he met Sempere.

3

With which of the following statements about his father would the narrator most likely agree?

- A) He lacked affection for the narrator.
- B) He disliked any unnecessary use of money.
- C) He would not have approved of Sempere's gift.
- D) He objected to the writings of Charles Dickens.

4

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 24-27 ("My father . . . children")
- B) Lines 35-37 ("The bookseller . . . content")
- C) Lines 37-38 ("He hardly . . . hands")
- D) Lines 59-61 ("That afternoon . . . see it")

5

It can reasonably be inferred from the passage that the main reason that the narrator considers *Great Expectations* to be the best gift he ever received is because

- A) reading the book convinced him that he wanted to be a writer.
- B) he'd only ever been given sweets and snacks as gifts in the past.
- C) the gift meant that Sempere held him in high regard.
- D) Sempere was a friend of the book's author.

6

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 38-40 ("when . . . left")
- B) Lines 48-49 ("It was . . . full")
- C) Lines 52-55 ("I was . . . them")
- D) Lines 66-68 ("Soon . . . done")

7

The narrator indicates that he pays Sempere

- A) less than Sempere expects him to pay for the books.
- B) nothing, because Sempere won't take his money.
- C) the money he makes selling sweets to the other children.
- D) much less for the books than they are worth.

8

As used in line 44, "weight" most nearly means

- A) bulk.
- B) burden.
- C) force.
- D) clout.

9

The word "friend" is used twice in lines 57-58 to

- A) underline the importance of the narrator's connection to Sempere.
- B) stress how friendships helped the narrator deal with his difficult home situation.
- C) emphasize the emotional connection Sempere feels to reading.
- D) imply that the narrator's sentiments caused him to make an irrational decision.

10

Which statement best characterizes the relationship between Sempere and Charles Dickens?

- A) Sempere models his own writing after Dickens's style.
- B) Sempere is an avid admirer of Dickens's work.
- C) Sempere feels a personal connection to details of Dickens's biography.
- D) Sempere considers himself to be Dickens's most appreciative reader.

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from Jeffrey Mervis, "Why Null Results Rarely See the Light of Day." ©2014 by American Association for the Advancement of Science.

The question of what to do with null results—when researchers fail to see an effect that should be detectable—has long been hotly debated among those conducting medical trials, where the results can have a big impact on lives and corporate bottom lines. More recently, the debate has spread to the social and behavioral sciences, which also have the potential to sway public and social policy. There were little hard data, however, on how often or why null results were squelched. "Yes, it's true that null results are not as exciting," political scientist Gary King of Harvard University says. "But I suspect another reason they are rarely published is that there are many, many ways to produce null results by messing up. So they are much harder to interpret."

In a recent study, Stanford political economist Neil Malhotra and two of his graduate students examined every study since 2002 that was funded by a competitive grants program called TESS (Time-sharing Experiments for the Social Sciences). TESS allows scientists to order up Internet-based surveys of a representative sample of US adults to test a particular hypothesis (for example, whether voters tend to favor legislators who boast of bringing federal dollars to their districts over those who tout a focus on policy matters).

Malhotra's team tracked down working papers from most of the experiments that weren't published, and for the rest asked grantees what had happened to their results. In their e-mailed responses, some scientists cited deeper problems with a study or more pressing matters—but many also believed the journals just wouldn't be interested. "The unfortunate reality of the publishing world [is] that null effects do not tell a clear story," said one scientist. Said another, "Never published, definitely disappointed to not see any major effects."

Their answers suggest to Malhotra that rescuing findings from the file drawer will require a shift in expectations. "What needs to change is the culture—the author's belief about what will happen if the research is written up," he says.

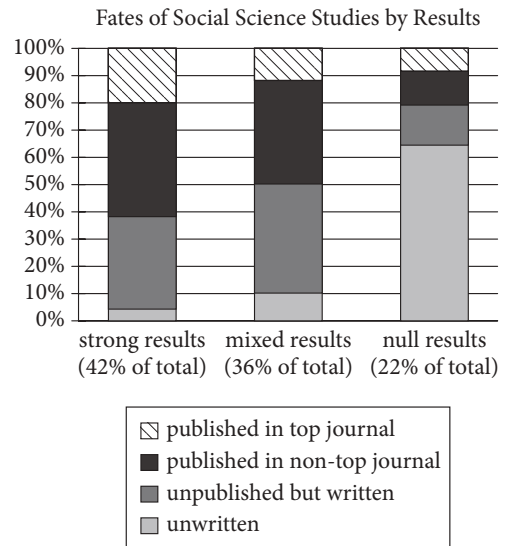
Not unexpectedly, the statistical strength of the findings made a huge difference in whether they were ever published. Overall, 42% of the experiments

produced statistically significant results. Of those, 62% were ultimately published, compared with 21% of the null results. However, the Stanford team was surprised that researchers didn't even write up 50 65% of the experiments that yielded a null finding.

Scientists not involved in the study praise its "clever" design. "It's a very important paper" that "starts to put numbers on things we want to understand," says economist Edward Miguel of the 55 University of California, Berkeley.

He and others note that the bias against null studies can waste time and money when researchers devise new studies replicating strategies already found to be ineffective. Worse, if researchers publish 60 significant results from similar experiments in the future, they could look stronger than they should because the earlier null studies are ignored. Even more troubling to Malhotra was the fact that two scientists whose initial studies "didn't work out" 65 went on to publish results based on a smaller sample. "The non-TESS version of the same study, in which we used a student sample, did yield fruit," noted one investigator.

A registry for data generated by all experiments 70 would address these problems, the authors argue. They say it should also include a "preanalysis" plan, that is, a detailed description of what the scientist hopes to achieve and how the data will be analyzed. Such plans would help deter researchers from 75 tweaking their analyses after the data are collected in search of more publishable results.



Adapted from Annie Franco, Neil Malhotra, and Gabor Simonovits, "Publication Bias in the Social Sciences: Unlocking the File Drawer." ©2014 by American Association for the Advancement of Science.

11

The passage primarily serves to

- A) discuss recent findings concerning scientific studies and dispute a widely held belief about the publication of social science research.
- B) explain a common practice in the reporting of research studies and summarize a study that provides support for a change to that practice.
- C) describe the shortcomings in current approaches to medical trials and recommend the implementation of a government database.
- D) provide context as part of a call for stricter controls on social science research and challenge publishers to alter their mindsets.

12

As used in line 21, “allows” most nearly means

- A) admits.
- B) tolerates.
- C) grants.
- D) enables.

13

As used in line 43, “strength” most nearly means

- A) attribution.
- B) exertion.
- C) toughness.
- D) significance.

14

The passage indicates that a problem with failing to document null results is that

- A) the results of related studies will be misleading.
- B) researchers may overlook promising areas of study.
- C) mistakes in the collection of null results may be overlooked.
- D) the bias against null results will be disregarded.

15

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 38-40 (“Their . . . expectations”)
- B) Lines 48-50 (“However . . . finding”)
- C) Lines 56-59 (“He and . . . ineffective”)
- D) Lines 59-62 (“Worse . . . ignored”)

16

Based on the passage, to which of the following hypothetical situations would Malhotra most strongly object?

- A) A research team refuses to publish null results in anything less than a top journal.
- B) A research team excludes the portion of data that produced null results when reporting its results in a journal.
- C) A research team unknowingly repeats a study that produced null results for another research team.
- D) A research team performs a follow-up study that expands the scope of an initial study that produced null results.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 36-37 (“Said . . . effects”)
- B) Lines 45-48 (“Overall . . . null results”)
- C) Lines 62-68 (“Even . . . investigator”)
- D) Lines 69-73 (“A registry . . . analyzed”)

18

The last paragraph serves mainly to

- A) propose a future research project to deal with some of the shortcomings of current publishing practices noted in the passage.
- B) introduce a possible solution to problems discussed in the passage regarding the reporting of social science studies.
- C) summarize the findings of a study about experimental results explained in the passage.
- D) reinforce the importance of reexamining the results of all social science trials.

19

According to the graph, social science studies yielding strong results were

- A) unwritten over 50 percent of the time.
- B) unpublished but written 50 percent of the time.
- C) published in a top journal approximately 20 percent of the time.
- D) published in a non-top journal almost 80 percent of the time.

20

Which of the following statements is supported by the graph?

- A) Studies with mixed results were just as likely to be published as they were to be left either unpublished or unwritten.
- B) Studies with mixed results occurred more frequently than did studies with strong and null results combined.
- C) Studies with mixed results were more likely to be published in top journals than they were to be published in non-top journals.
- D) Studies with mixed results were the most common type of social science studies.

21

Which statement from the passage is most directly reflected by the data presented in the graph?

- A) Lines 30-33 (“In their . . . interested”)
- B) Lines 33-36 (“The unfortunate . . . scientist”)
- C) Lines 43-45 (“Not unexpectedly . . . published”)
- D) Lines 52-55 (“It’s a . . . Berkeley”)



**Questions 22-31 are based on the following passage and supplementary material.**

This passage is adapted from Rachel Ehrenberg, “Salt Stretches in Nanoworld.” ©2009 by Society for Science & the Public. The “nanoworld” is the world observed on a scale one billionth that of ordinary human experience.

Inflexible old salt becomes a softy in the nanoworld, stretching like taffy to more than twice its length, researchers report. The findings may lead to new approaches for making nanowires that could  
 Line 5 end up in solar cells or electronic circuits. The work also suggests that these ultra-tiny salt wires may already exist in sea spray and large underground salt deposits.

“We think nanowires are special and go to great  
 10 lengths to make them,” says study coauthor Nathan Moore of Sandia National Laboratories in Albuquerque. “Maybe they are more common than we think.”

Metals such as gold or lead, in which bonding  
 15 angles are loosey-goosey, can stretch out at temperatures well below their melting points. But scientists don’t expect this superplasticity in a rigid, crystalline material like salt, Moore says.

This unusual behavior highlights that different  
 20 forces rule the nanoworld, says theoretical physicist Krzysztof Kempa of Boston College. “Forget about gravity. It plays no role,” he says. Surface tension and electrostatic forces are much more important at this scale.

Moore and his colleagues discovered salt’s  
 25 stretchiness accidentally. They were investigating how water sticks to a surface such as salt and created a super-dry salt sample for testing. After cleaving a chunk of salt about the size of a sugar cube with a  
 30 razor, the scientists guided a microscope that detects forces toward the surface. When the tip was far away there was no measured force, but within about seven nanometers a very strong attraction rapidly developed between the diamond tip of the  
 35 microscope and the salt. The salt actually stretched out to glom on to the microscope tip. Using an electron microscope to see what was happening, the researchers observed the nanowires.

The initial attraction between the tip and salt  
 40 might be due to electrostatic forces, perhaps good old van der Waals interactions,<sup>1</sup> the researchers

speculate. Several mechanisms might lead to the elasticity, including the excessive surface tension found in the nanoworld (the same tension that allows  
 45 a water strider to skim the surface of a pond).

The surface tension is so strong that as the microscope pulls away from the salt, the salt stretches, Kempa says. “The inside has no choice but to rearrange the atoms, rather than break,” he says.

This bizarre behavior is actually mirrored in the  
 50 macroworld, the researchers say. Huge underground deposits of salt can bend like plastic, but water is believed to play a role at these scales. Perhaps salty nanowires are present in these deposits as well.

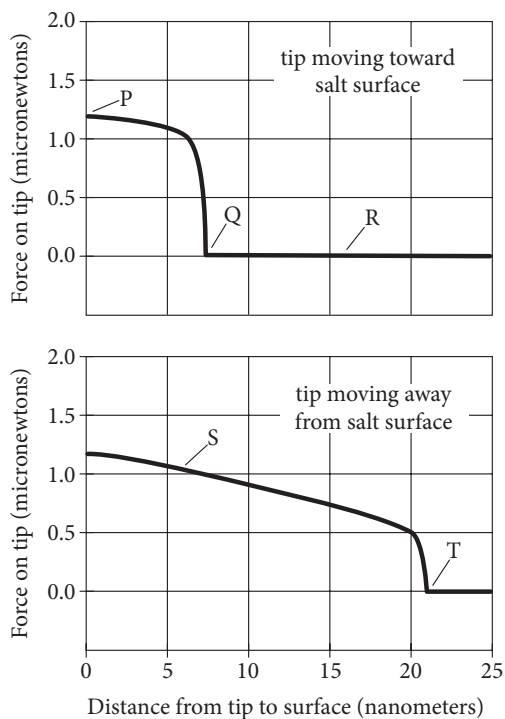
“Sodium chloride<sup>2</sup> is everywhere—in the air, in our bodies,” Moore says. “This may change our view of things, of what’s happening at the nanoscale.”

The work also suggests new techniques for making nanowires, which are often created through  
 60 nano-imprinting techniques, Kempa says. “We invoke the intuition of the macroworld,” he says. “Maybe instead of stamping [nanowires] we should be nano-pulling them.”

<sup>1</sup> Attractive forces between nearby atoms

<sup>2</sup> Common salt

Interaction of Microscope Tip with Salt Surface



Adapted from Moore et al., "Superplastic Nanowires Pulled from the Surface of Common Salt." ©2009 by American Chemical Society.

22

One central idea of the passage is that

- A) sometimes materials behave contrary to expectations.
- B) systems can be described in terms of inputs and outputs.
- C) models of materials have both strengths and weaknesses.
- D) properties of systems differ from the properties of their parts.

23

Which choice best describes the overall structure of the passage?

- A) A list of several ways in which salt's properties differ from researchers' expectations
- B) A presentation of a hypothesis regarding salt behavior, description of an associated experiment, and explanation of why the results weaken the hypothesis
- C) A description of two salt crystal experiments, the apparent disagreement in their results, and the resolution by more sensitive equipment
- D) An introduction to an interesting salt property, description of its discovery, and speculation regarding its application

24

Which choice provides the best evidence for the claim that Moore's group was surprised to observe salt stretching?

- A) Lines 17-18 ("But . . . says")
- B) Lines 26-28 ("They were . . . testing")
- C) Lines 36-38 ("Using . . . nanowires")
- D) Lines 55-56 ("Sodium . . . says")

25

As used in line 20, "rule" most nearly means

- A) mark.
- B) control.
- C) declare.
- D) restrain.

26

According to the passage, researchers have identified which mechanism as potentially responsible for the initial attraction between the microscope tip and the salt?

- A) Gravity
- B) Nano-imprinting
- C) Surface tension
- D) Van der Waals interactions

27

As used in line 42, “lead to” most nearly means

- A) guide to.
- B) result in.
- C) point toward.
- D) start with.

28

Based on the passage, which choice best describes the relationship between salt behavior in the nanoworld and in the macroworld?

- A) In both the nanoworld and the macroworld, salt can be flexible.
- B) Salt flexibility is expected in the nanoworld but is surprising in the macroworld.
- C) Salt nanowires were initially observed in the nanoworld and later observed in the macroworld.
- D) In the nanoworld, salt’s interactions with water lead to very different properties than they do in the macroworld.

29

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 12-13 (“Maybe . . . think”)
- B) Lines 22-24 (“Surface . . . scale”)
- C) Lines 39-42 (“The initial . . . speculate”)
- D) Lines 51-53 (“Huge . . . scales”)

30

According to the information in the graph, when the microscope tip is moving away from the salt surface and is 15 nanometers from the surface, what is the approximate force on the microscope tip, in micronewtons?

- A) 0
- B) 0.25
- C) 0.75
- D) 1.25

31

Based on the passage and the graph, which label on the graph indicates the point at which a salt nanowire breaks?

- A) P
- B) Q
- C) R
- D) T

**Questions 32-41 are based on the following passages.**

These passages are adapted from the Lincoln-Douglas debates. Passage 1 is from a statement by Stephen Douglas. Passage 2 is from a statement by Abraham Lincoln. Douglas and Lincoln engaged in a series of debates while competing for a US Senate seat in 1858.

**Passage 1**

Mr. Lincoln likens that bond of the Federal Constitution, joining Free and Slave States together, to a house divided against itself, and says that it is  
 Line contrary to the law of God, and cannot stand.  
 5 When did he learn, and by what authority does he proclaim, that this Government is contrary to the law of God and cannot stand? It has stood thus divided into Free and Slave States from its organization up to this day. During that period we have increased from  
 10 four millions to thirty millions of people; we have extended our territory from the Mississippi to the Pacific Ocean; we have acquired the Floridas and Texas, and other territory sufficient to double our geographical extent; we have increased in population,  
 15 in wealth, and in power beyond any example on earth; we have risen from a weak and feeble power to become the terror and admiration of the civilized world; and all this has been done under a Constitution which Mr. Lincoln, in substance, says is  
 20 in violation of the law of God; and under a Union divided into Free and Slave States, which Mr. Lincoln thinks, because of such division, cannot stand. Surely, Mr. Lincoln is a wiser man than those who framed the Government. . . .  
 25 I now come back to the question, why cannot this Union exist forever, divided into Free and Slave States, as our fathers made it? It can thus exist if each State will carry out the principles upon which our institutions were founded; to wit, the right of each  
 30 State to do as it pleases, without meddling with its neighbors. Just act upon that great principle, and this Union will not only live forever, but it will extend and expand until it covers the whole continent, and makes this confederacy one grand, ocean-bound  
 35 Republic. We must bear in mind that we are yet a young nation, growing with a rapidity unequalled in the history of the world, that our national increase is great, and that the emigration from the old world is increasing, requiring us to expand and acquire new  
 40 territory from time to time, in order to give our people land to live upon. If we live upon the principle

of State rights and State sovereignty, each State regulating its own affairs and minding its own business, we can go on and extend indefinitely, just  
 45 as fast and as far as we need the territory. . . .

**Passage 2**

In complaining of what I said in my speech at Springfield, in which he says I accepted my nomination for the Senatorship . . . he again quotes that portion in which I said that “a house divided  
 50 against itself cannot stand.” Let me say a word in regard to that matter. He tries to persuade us that there must be a variety in the different institutions of the States of the Union; that that variety necessarily proceeds from the variety of soil, climate, of the face  
 55 of the country, and the difference in the natural features of the States. I agree to all that. Have these very matters ever produced any difficulty among us? Not at all. Have we ever had any quarrel over the fact that they have laws in Louisiana designed to regulate  
 60 the commerce that springs from the production of sugar? Or because we have a different class relative to the production of flour in this State? Have they produced any differences? Not at all. They are the very cements of this Union. They don’t make the  
 65 house a “house divided against itself.” They are the props that hold up the house and sustain the Union.

But has it been so with this element of slavery? Have we not always had quarrels and difficulties over it? And when will we cease to have quarrels over it?  
 70 Like causes produce like effects. It is worth while to observe that we have generally had comparative peace upon the slavery question, and that there has been no cause for alarm until it was excited by the effort to spread it into new territory. Whenever it has  
 75 been limited to its present bounds, and there has been no effort to spread it, there has been peace. All the trouble and convulsion has proceeded from efforts to spread it over more territory. It was thus at the date of the Missouri Compromise. It was so again  
 80 with the annexation of Texas; so with the territory acquired by the Mexican War; and it is so now. Whenever there has been an effort to spread it there has been agitation and resistance. . . . Do you think that the nature of man will be changed, that the same  
 85 causes that produced agitation at one time will not have the same effect at another?

32

In the first paragraph of Passage 1, the main purpose of Douglas’s discussion of the growth of the territory and population of the United States is to

- A) provide context for Douglas’s defense of continued expansion.
- B) suggest that the division into free and slave states does not endanger the Union.
- C) imply that Lincoln is unaware of basic facts concerning the country.
- D) account for the image of the United States as powerful and admirable.

33

What does Passage 1 suggest about the US government’s provisions for the institution of slavery, as framed in the Constitution?

- A) They included no means for reconciling differences between free states and slave states.
- B) They anticipated the Union’s expansion into western territories.
- C) They provided a good basic structure that does not need to be changed.
- D) They were founded on an assumption that slavery was necessary for economic growth.

34

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 10-16 (“we have . . . earth”)
- B) Lines 25-27 (“I now . . . made it”)
- C) Lines 35-39 (“We must . . . increasing”)
- D) Lines 41-45 (“If we . . . territory”)

35

As used in line 67, “element” most nearly means

- A) ingredient.
- B) environment.
- C) factor.
- D) quality.

36

Based on Passage 2, Lincoln would be most likely to agree with which claim about the controversy over slavery?

- A) It can be ended only if Northern states act unilaterally to abolish slavery throughout the United States.
- B) It would abate if attempts to introduce slavery to regions where it is not practiced were abandoned.
- C) It has been exacerbated by the ambiguity of laws regulating the holding of slaves.
- D) It is fueled in part by differences in religion and social values from state to state.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 56-61 (“I agree . . . sugar”)
- B) Lines 64-66 (“They don’t . . . Union”)
- C) Lines 74-76 (“Whenever . . . peace”)
- D) Lines 83-86 (“Do you . . . another”)

38

As used in line 84, “nature” most nearly means

- A) force.
- B) simplicity.
- C) world.
- D) character.

39

Which choice identifies a central tension between the two passages?

- A) Douglas proposes changes to federal policies on slavery, but Lincoln argues that such changes would enjoy no popular support.
- B) Douglas expresses concerns about the economic impact of abolition, but Lincoln dismisses those concerns as irrelevant.
- C) Douglas criticizes Lincoln for finding fault with the Constitution, and Lincoln argues that this criticism misrepresents his position.
- D) Douglas offers an interpretation of federal law that conflicts with Lincoln’s, and Lincoln implies that Douglas’s interpretation is poorly reasoned.

40

Both passages discuss the issue of slavery in relationship to

- A) the expansion of the Union.
- B) questions of morality.
- C) religious toleration.
- D) laws regulating commerce.

41

In the context of each passage as a whole, the questions in lines 25-27 of Passage 1 and lines 67-69 of Passage 2 primarily function to help each speaker

- A) cast doubt on the other’s sincerity.
- B) criticize the other’s methods.
- C) reproach the other’s actions.
- D) undermine the other’s argument.

**Questions 42-52 are based on the following passage.**

This passage is adapted from Daniel Chamovitz, *What a Plant Knows: A Field Guide to the Senses*. ©2012 by Daniel Chamovitz.

The Venus flytrap [*Dionaea muscipula*] needs to know when an ideal meal is crawling across its leaves. Closing its trap requires a huge expense of energy, and reopening the trap can take several hours, so

Line 5 *Dionaea* only wants to spring closed when it's sure that the dawdling insect visiting its surface is large enough to be worth its time. The large black hairs on their lobes allow the Venus flytraps to literally feel their prey, and they act as triggers that spring the

10 trap closed when the proper prey makes its way across the trap. If the insect touches just one hair, the trap will not spring shut; but a large enough bug will likely touch two hairs within about twenty seconds, and that signal springs the Venus flytrap into action.

15 We can look at this system as analogous to short-term memory. First, the flytrap encodes the information (forms the memory) that something (it doesn't know what) has touched one of its hairs. Then it stores this information for a number of

20 seconds (retains the memory) and finally retrieves this information (recalls the memory) once a second hair is touched. If a small ant takes a while to get from one hair to the next, the trap will have forgotten the first touch by the time the ant brushes up against

25 the next hair. In other words, it loses the storage of the information, doesn't close, and the ant happily meanders on. How does the plant encode and store the information from the unassuming bug's encounter with the first hair? How does it

30 remember the first touch in order to react upon the second?

Scientists have been puzzled by these questions ever since John Burdon-Sanderson's early report on the physiology of the Venus flytrap in 1882. A

35 century later, Dieter Hodick and Andreas Sievers at the University of Bonn in Germany proposed that the flytrap stored information regarding how many hairs have been touched in the electric charge of its leaf. Their model is quite elegant in its simplicity.

40 In their studies, they discovered that touching a trigger hair on the Venus flytrap causes an electric action potential [a temporary reversal in the electrical polarity of a cell membrane] that induces calcium channels to open in the trap (this

45 coupling of action potentials and the opening of

calcium channels is similar to the processes that occur during communication between human neurons), thus causing a rapid increase in the concentration of calcium ions.

50 They proposed that the trap requires a relatively high concentration of calcium in order to close and that a single action potential from just one trigger hair being touched does not reach this level. Therefore, a second hair needs to be stimulated to

55 push the calcium concentration over this threshold and spring the trap. The encoding of the information requires maintaining a high enough level of calcium so that a second increase (triggered by touching the second hair) pushes the total concentration of

60 calcium over the threshold. As the calcium ion concentrations dissipate over time, if the second touch and potential don't happen quickly, the final concentration after the second trigger won't be high enough to close the trap, and the memory is lost.

65 Subsequent research supports this model. Alexander Volkov and his colleagues at Oakwood University in Alabama first demonstrated that it is indeed electricity that causes the Venus flytrap to close. To test the model they rigged up very fine

70 electrodes and applied an electrical current to the open lobes of the trap. This made the trap close without any direct touch to its trigger hairs (while they didn't measure calcium levels, the current likely led to increases). When they modified this

75 experiment by altering the amount of electrical current, Volkov could determine the exact electrical charge needed for the trap to close. As long as fourteen microcoulombs—a tiny bit more than the static electricity generated by rubbing two balloons

80 together—flowed between the two electrodes, the trap closed. This could come as one large burst or as a series of smaller charges within twenty seconds. If it took longer than twenty seconds to accumulate the total charge, the trap would remain open.

42

The primary purpose of the passage is to

- A) discuss findings that offer a scientific explanation for the Venus flytrap's closing action.
- B) present research that suggests that the Venus flytrap's predatory behavior is both complex and unique among plants.
- C) identify the process by which the Venus flytrap's closing action has evolved.
- D) provide a brief overview of the Venus flytrap and its predatory behavior.

43

Based on the passage, a significant advantage of the Venus flytrap's requirement for multiple triggers is that it

- A) enables the plant to identify the species of its prey.
- B) conserves the plant's calcium reserves.
- C) safeguards the plant's energy supply.
- D) prevents the plant from closing before capturing its prey.

44

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-7 ("Closing . . . time")
- B) Lines 7-11 ("The large . . . across the trap")
- C) Lines 11-14 ("If the . . . action")
- D) Lines 16-18 ("First . . . hairs")

45

The use of the phrases "dawdling insect" (line 6), "happily meanders" (line 27), and "unassuming bug's encounter" (lines 28-29) in the first two paragraphs establishes a tone that is

- A) academic.
- B) melodramatic.
- C) informal.
- D) mocking.



46

In the second paragraph (lines 15-31), the discussion of short-term memory primarily functions to

- A) clarify an explanation of what prompts the Venus flytrap to close.
- B) advance a controversial hypothesis about the function of electric charges found in the leaf of the Venus flytrap.
- C) stress the distinction between the strategies of the Venus flytrap and the strategies of human beings.
- D) emphasize the Venus flytrap's capacity for retaining detailed information about its prey.

47

According to the passage, which statement best explains why the Venus flytrap requires a second trigger hair to be touched within a short amount of time in order for its trap to close?

- A) The second trigger produces an electrical charge that reverses the charge produced by the first trigger.
- B) The second trigger stabilizes the surge of calcium ions created by the first trigger.
- C) The second trigger prompts the calcium channels to open.
- D) The second trigger provides a necessary supplement to the calcium concentration released by the first trigger.

48

Which choice describes a scenario in which Hodick and Sievers's model predicts that a Venus flytrap will NOT close around an insect?

- A) A large insect's second contact with the plant's trigger hairs results in a total calcium ion concentration above the trap's threshold.
- B) A large insect makes contact with a second trigger hair after a period of inactivity during which calcium ion concentrations have diminished appreciably.
- C) A large insect's contact with the plant's trigger hairs causes calcium channels to open in the trap.
- D) A large insect's contact with a second trigger hair occurs within ten seconds of its contact with the first trigger hair.

49

As used in line 67, "demonstrated" most nearly means

- A) protested.
- B) established.
- C) performed.
- D) argued.

50

Based on the passage, what potential criticism might be made of Volkov's testing of Hodick and Sievers's model?

- A) Volkov's understanding of Hodick and Sievers's model was incorrect.
- B) Volkov's measurements did not corroborate a central element of Hodick and Sievers's model.
- C) Volkov's direct application of an electrical current would have been objectionable to Hodick and Sievers.
- D) Volkov's technology was not available to Hodick and Sievers.

51

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 66-69 ("Alexander . . . close")
- B) Lines 69-71 ("To test . . . trap")
- C) Lines 71-74 ("This . . . increases")
- D) Lines 74-77 ("When . . . close")

52

Based on the passage, in studying the Venus flytrap, Volkov and his colleagues made the most extensive use of which type of evidence?

- A) Mathematical models to predict the electrical charge required to close the Venus flytrap
- B) Analysis of data collected from previous researchers' work involving the Venus flytrap's response to electricity
- C) Information obtained from monitoring the Venus flytrap's response to varying amounts of electrical current
- D) Published theories of scientists who developed earlier models of the Venus flytrap

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage and supplementary material.

### Compost: Don't Waste This Waste

Over the past generation, people in many parts of the United States have become accustomed to dividing their household waste products into different categories for recycling. **1** Regardless, paper may go in one container, glass and aluminum in another, regular garbage in a third. Recently, some US cities have added a new category: compost, organic matter such as food scraps and yard debris. Like paper or glass recycling, composting demands a certain amount of effort from the

1

- A) NO CHANGE
- B) However,
- C) Furthermore,
- D) For example,

public in order to be successful. But the inconveniences of composting are far outweighed by its benefits.

Most people think of banana peels, eggshells, and dead leaves as “waste,” but compost is actually a valuable resource with multiple practical uses. When utilized as a garden fertilizer, compost provides nutrients to soil and improves plant growth while deterring or killing pests and preventing some plant diseases. It also enhances soil texture, encouraging healthy roots and minimizing or **2** annihilating the need for chemical fertilizers. Better than soil at holding moisture, compost minimizes water waste and storm runoff, **3** it increases savings on watering costs, and helps reduce erosion on embankments near bodies of water. In large **4** quantities, which one would expect to see when it is collected for an entire municipality), compost can be converted into a natural gas that can be used as fuel for transportation or heating and cooling systems.

2

Which choice best maintains the style and tone of the passage?

- A) NO CHANGE
- B) eliminating
- C) ousting
- D) closing the door on

3

- A) NO CHANGE
- B) savings increase
- C) increases savings
- D) also it increases savings

4

- A) NO CHANGE
- B) quantities (which
- C) quantities which
- D) quantities; (which

In spite of all compost's potential uses, however, most of this so-called waste is wasted. According to the Environmental Protection Agency (EPA), over **5** 13 million tons of metal ended up in US landfills in 2009, along with over 13 million tons of yard debris. Remarkably, **6** less glass was discarded in landfills in that year than any other substance, including plastics or paper. Even **7** worse, then the squandering of this useful resource is the fact that compost in landfills cannot break down due to the lack of necessary air and moisture.

5

The writer wants to include information from the graph that is consistent with the description of compost in the passage. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) 6 million tons of rubber and leather
- C) 10 million tons of textiles
- D) 33 million tons of food waste

6

The writer wants to support the paragraph's main idea with accurate, relevant information from the graph. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) more metal
- C) more food waste
- D) more yard waste

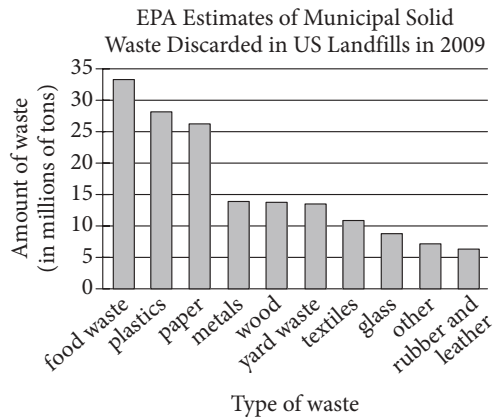
7

- A) NO CHANGE
- B) worse than
- C) worse then
- D) worse, than

As a result, organic material that is sent to landfills

8 contribute to the release of methane, a very

9 potent greenhouse gas.



Adapted from Food Waste Disposal. ©n.d. by Food Waste Disposal, LLC.

8

- A) NO CHANGE
- B) are contributing
- C) contributes
- D) have contributed

9

- A) NO CHANGE
- B) sturdy
- C) influential
- D) commanding

10 While composting can sometimes lead to accidental pollution through the release of methane gas, cities such as San Francisco and Seattle have instituted mandatory composting laws requiring individuals and businesses to use separate bins for compostable waste. This strict approach may not work everywhere. However, given the clear benefits of composting and the environmental costs of not composting, all municipalities should encourage their residents either to create their own compost piles for use in backyard gardens 11 or to dispose of compostable materials in bins for collection.

10

Which choice provides the most effective transition from the previous paragraph?

- A) NO CHANGE
- B) Though government regulations vary,
- C) Armed with these facts,
- D) Mindful of this setback,

11

- A) NO CHANGE
- B) nor
- C) but
- D) and

Questions 12-22 are based on the following passage.

### A Lion's Share of Luck

It's the beginning of February, and as they do every year, thousands of people line H Street, the heart of Chinatown in Washington, DC. The crowd has gathered to celebrate Lunar New Year. The street is a sea of **12** red. Red is the traditional Chinese color of luck and happiness. Buildings are **13** draped with festive, red, banners, and garlands. Lampposts are strung with crimson paper lanterns, which bob in the crisp winter breeze. The eager spectators await the highlight of the New Year parade: the lion dance.

Experts agree that the lion dance originated in the Han dynasty (206 BCE–220 CE); however, there is little agreement about the dance's original purpose. Some evidence suggests that the earliest version of the dance was an attempt to ward off an evil spirit; **14** lions are obviously very fierce. Another theory is that an emperor, upon waking from a dream about a lion, hired an artist to

12

Which choice most effectively combines the sentences at the underlined portion?

- A) red,
- B) red; in addition, red is
- C) red; in other words, red is
- D) red, the color; that is

13

- A) NO CHANGE
- B) draped, with festive red banners,
- C) draped with festive red banners—
- D) draped with festive red banners

14

Which choice most effectively completes the explanation of a possible origin of the lion dance?

- A) NO CHANGE
- B) the evil spirit was called Nian.
- C) villagers dressed in lion costumes to scare the spirit away.
- D) the precise location of the village remains lost to history.



choreograph the dance. **15** The current function of the dance is celebration.

The lion dance requires the strength, grace, and coordination of two dancers, **16** both of whom are almost completely hidden by the elaborate bamboo and papier-mâché lion costume that they maneuver. One person operates the lion's head as the other guides the torso and tail. Many of the moves in the dance, such as jumps, rolls, and kicks, are similar to **17** martial arts and acrobatics. The dancers must be synchronized with the music accompanying the dance—drums, cymbals, and gongs that supply the lion's roar—as well as with each other.

15

Which choice most effectively concludes the paragraph?

- A) NO CHANGE
- B) It turns out that the origins of the lion dance are irrelevant.
- C) Whatever its origins, today the lion dance is a joyous spectacle, a celebration of the promise of the New Year.
- D) Things are different these days, of course.

16

- A) NO CHANGE
- B) of which both
- C) both of them
- D) both

17

- A) NO CHANGE
- B) the disciplines of martial arts and acrobatics.
- C) martial artists and acrobats.
- D) those in martial arts and acrobatics.

[1] While there are many regional variations of the lion dance costume, all make extensive use of symbols and colors. [2] The lion's head is often adorned with a phoenix **18** (a mythical bird) or a tortoise (for longevity). [3] Green lions encourage friendliness. [4] Golden and red lions represent liveliness and bravery, respectively. [5] Their older counterparts, yellow and white lions, dance more slowly and deliberately. [6] In some variations, lions of different colors are different ages, and they move accordingly. [7] Black lions are the youngest; therefore, they dance quickly and playfully. [8] The appearance of the lions varies, but their message is consistent: Happy New Year. **19**

18

Which choice provides information that is most consistent in style and content with the information about the symbolism of the tortoise?

- A) NO CHANGE
- B) (for new beginnings)
- C) (from Chinese mythology)
- D) (for symbolic reasons)

19

To make this paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 3.
- D) after sentence 7.

As the parade winds its way through Chinatown, the music crescendos, and the lion dance reaches **20** it's climax with the “plucking of the greens.” Approaching a doorway in which dangles a red envelope filled with green paper money, the **21** lion's teeth snare the envelope. It then chews up the bills and spits out the **22** money-filled envelope instead of chewing it up. The crowd cheers for the lion dancers and for the prosperity and good fortune their dance foretells.

20

- A) NO CHANGE
- B) its
- C) there
- D) their

21

- A) NO CHANGE
- B) lion snares the envelope with its teeth.
- C) envelope is snared by the lion with its teeth.
- D) teeth of the lion snare the envelope.

22

- A) NO CHANGE
- B) envelope that had been dangling from the doorway.
- C) envelope that had the money in it.
- D) envelope.

Questions 23-33 are based on the following passage.

**Court Reporting: Humans v. Machines**

Court reporters for years have been the record keepers of the court, taking **23** scrupulous notes during **24** hearings; depositions, and other legal proceedings. Despite the increasing use of digital recording technologies, court reporters still play a vital role in

**23**

Which choice best fits with the tone of the rest of the passage?

- A) NO CHANGE
- B) super-rigorous
- C) spot-on
- D) intense

**24**

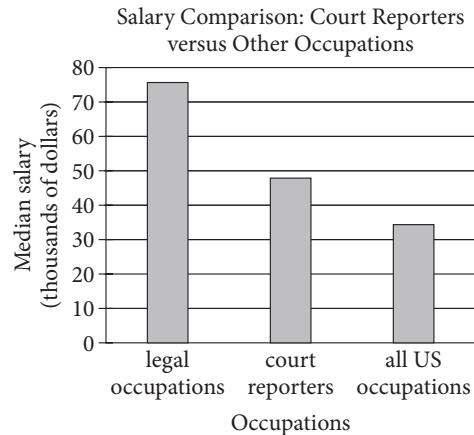
- A) NO CHANGE
- B) hearings; depositions;
- C) hearings, depositions,
- D) hearings, depositions;

courtrooms. <sup>25</sup> Although machines can easily make digital audio recordings of court events, they lack the nuance of human court reporters in providing a precise record.

[1] Court reporters record the spoken word in real time, most commonly using the technique of stenography. [2] A stenotype machine allows a person to type about 200 words per minute (the speed of speech is about 180 words per minute). [3] The typed words are instantaneously translated onto a computer screen for the judge to view, and the transcript is used later by people who want to review the case, such as journalists and lawyers. [4] Digital audio recording is becoming increasingly popular in courtrooms across the United States, with six states using solely audio recordings for

25

At this point, the writer is considering adding the following graph.



Adapted from Bureau of Labor Statistics, US Department of Labor, *Occupational Outlook Handbook, 2014–15 Edition*.

Should the writer make this addition here?

- A) Yes, because it supports the claim that court reporting is an important part of a trial.
- B) Yes, because it offers a relevant counterpoint to the argument that the use of digital recorders is on the rise.
- C) No, because it presents information that is not directly related to the paragraph's discussion of the role of court reporters.
- D) No, because it does not provide information about the pay scale for more experienced court reporters.

general jurisdiction sessions. [5] Proponents of going digital say that technology is the easiest way to get the most accurate record of the proceedings, as the machine records everything faithfully as it occurs and is not **26** subject to human errors such as mishearing or mistyping. [6] However, with the rise of high-quality recording technology, reliance on court reporters **27** as a record keeper is decreasing. **28**

26

- A) NO CHANGE
- B) subjected to
- C) subjected from
- D) subject for

27

- A) NO CHANGE
- B) each as record keepers
- C) as record keepers
- D) to be a record keeper

28

To make this paragraph most logical, sentence 6 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 3.
- D) after sentence 4.

Champions of court reporting, though, argue the **29** opposite. They argue that with the increased reliance on technology, errors actually increase. Because digital systems record **30** indiscriminately; they cannot discern important parts of the proceedings from other noises in the courtroom. **31** Despite this, a digital device does indeed record everything, but that includes loud noises, such as a book dropping, that can make the actual words spoken impossible to hear. A court reporter, however,

29

Which choice most effectively combines the sentences at the underlined portion?

- A) opposite, such
- B) opposite—
- C) opposite, which is
- D) opposite; their opinion is

30

- A) NO CHANGE
- B) indiscriminately, they
- C) indiscriminately. They
- D) indiscriminately, therefore they

31

- A) NO CHANGE
- B) In other words,
- C) Therefore,
- D) Consequently,

can distinguish between the words **32** and distinguish between the extrinsic noises that need not be recorded. Also, if a witness mumbles, a human court reporter can pause court proceedings to ask the witness to repeat what he or she said. In some cases, digital recording **33** makes it necessary for the judge to make additional announcements at the beginning of a trial. Increasing use of technology is “a transition from accurate records to adequate records,” says Bob Tate, president of the Certified Court Reporters Association of New Jersey.

Despite the apparent benefits of using digital recording systems in courtrooms, there is still a need for the human touch in legal proceedings. At least for the foreseeable future, machines simply cannot replicate the invaluable clarification skills and adaptability of human court reporters.

**32**

- A) NO CHANGE
- B) also between the
- C) and when there are
- D) and the

**33**

Which choice provides the best supporting example for the main idea of the paragraph?

- A) NO CHANGE
- B) requires a courtroom monitor to ensure the equipment is functioning properly.
- C) leads to changes in the roles and duties of several members of the courtroom staff.
- D) has led to the need for retrial because of indistinct testimony from key witnesses.



Questions 34-44 are based on the following passage.

### Fire in Space

On Earth, fire provides light, heat, and comfort. Its creation, by a process called combustion, requires a chemical reaction between a fuel source and oxygen. The shape that fire assumes on Earth is a result of gravitational influence and the movement of molecules. In the microgravity environment of space, **34** moreover, combustion and the resulting fire behave in fundamentally different ways than they do on Earth—differences that have important implications for researchers.

A group of engineering students from the University of California at San Diego (UCSD), for example, **35** tried to find a method to make their biofuel combustion study (fuels derived from once-living material) free of the drawbacks researchers face on Earth. The standard method involves burning droplets of fuel, but Earth's gravitational influence causes the droplets to lose

34

- A) NO CHANGE
- B) however,
- C) accordingly,
- D) subsequently,

35

- A) NO CHANGE
- B) strove for a method to make their study of biofuel combustion
- C) looked for a method to study biofuel combustion
- D) sought a method to study combustion of biofuels

spherical symmetry while burning. This **36** deformation results in subtle variations in density that both **37** causes uneven heat flow and limits the size of the droplets that can be tested. Specially designed “drop towers” **38** built for this purpose reduce these problems, but they provide no more than 10 seconds of microgravity, and droplet size is still too small to produce accurate models of combustion rates. **39** The UCSD students understood that these limitations had to be surmounted. As part of the program, researchers fly their experiments aboard aircraft that simulate the microgravity environment of space. The aircraft accomplish this feat by flying in parabolic paths instead of horizontal ones. On the plane’s ascent, passengers feel twice Earth’s gravitational pull, but for brief periods at the peak of the trajectory,

36

Which choice provides the most precise description of the phenomenon depicted in the previous sentence?

- A) NO CHANGE
- B) alteration
- C) transformation
- D) modification

37

- A) NO CHANGE
- B) cause uneven heat flow and limit
- C) cause uneven heat flow and limits
- D) has caused uneven heat flow and has limited

38

- A) NO CHANGE
- B) intended for this use
- C) constructed for this function
- D) DELETE the underlined portion.

39

Which choice provides the most effective transition between ideas in the paragraph?

- A) NO CHANGE
- B) The UCSD group sought to overcome these difficulties by participating in NASA’s Microgravity University program.
- C) The engineering group realized that aircraft might be the tools they were looking for.
- D) Thus, for the UCSD group, drop towers were not an adequate solution.

40 “weightlessness” or microgravity similar to what is experienced in space, is achieved.

These flights allowed the UCSD students to experience microgravity 41. Specifically, they 42 investigated the combustion of biofuel droplets in microgravity for twice as long as could be accomplished

40

- A) NO CHANGE
- B) “weightlessness” or microgravity, similar to what is experienced, in space
- C) “weightlessness” or, microgravity, similar to what is experienced in space
- D) “weightlessness,” or microgravity similar to what is experienced in space,

41

At this point, the writer is considering adding the following.

and perform their experiment without traveling into space

Should the writer make this addition here?

- A) Yes, because it elaborates on the advantage the students gained from the flights.
- B) Yes, because it reveals that the students did not actually go into space, a point that the previous paragraph does not address.
- C) No, because it shifts focus away from the students’ experiences while on the flights.
- D) No, because it restates what has already been said in the sentence.

42

- A) NO CHANGE
- B) could investigate
- C) were investigating
- D) were able to investigate

in drop towers and to perform tests with larger droplets. The larger, **43** spherically symmetric droplets burned longer and gave the students more reliable data on combustion rates of biofuels because the droplets' uniform shape reduced the variations in density that hinder tests performed in normal gravity. The students hope the new data will aid future research by improving theoretical models of biofuel combustion. Better combustion-rate models may even lead to the production of more fuel-efficient engines and improved **44** techniques, for fighting fires in space or at future outposts on the Moon and Mars.

43

Which choice most effectively establishes that the UCSD students' approach had solved a problem, mentioned earlier in the passage, relating to burning fuel on Earth?

- A) NO CHANGE
- B) combustible
- C) microgravity-influenced
- D) biofuel-derived

44

- A) NO CHANGE
- B) techniques for fighting fires, in space or at future outposts
- C) techniques for fighting fires in space or at future outposts
- D) techniques for fighting fires in space, or at future outposts,

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

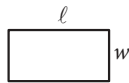
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

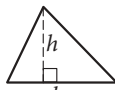


$$A = \pi r^2$$

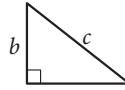
$$C = 2\pi r$$



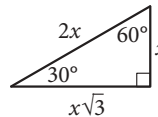
$$A = \ell w$$



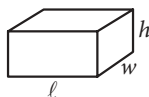
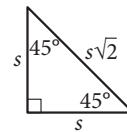
$$A = \frac{1}{2}bh$$



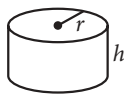
$$c^2 = a^2 + b^2$$



Special Right Triangles



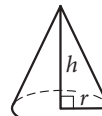
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



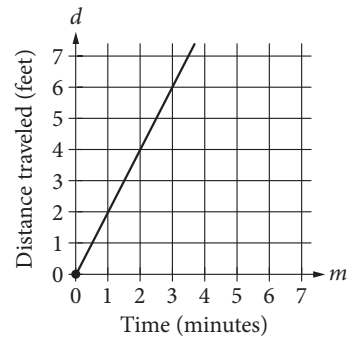
1

$$3x + x + x + x - 3 - 2 = 7 + x + x$$

In the equation above, what is the value of  $x$  ?

- A)  $-\frac{5}{7}$
- B) 1
- C)  $\frac{12}{7}$
- D) 3

2



The graph above shows the distance traveled  $d$ , in feet, by a product on a conveyor belt  $m$  minutes after the product is placed on the belt. Which of the following equations correctly relates  $d$  and  $m$  ?

- A)  $d = 2m$
- B)  $d = \frac{1}{2}m$
- C)  $d = m + 2$
- D)  $d = 2m + 2$



3

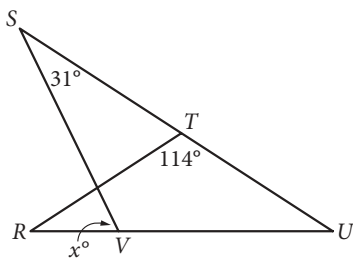
The formula below is often used by project managers to compute  $E$ , the estimated time to complete a job, where  $O$  is the shortest completion time,  $P$  is the longest completion time, and  $M$  is the most likely completion time.

$$E = \frac{O + 4M + P}{6}$$

Which of the following correctly gives  $P$  in terms of  $E$ ,  $O$ , and  $M$ ?

- A)  $P = 6E - O - 4M$
- B)  $P = -6E + O + 4M$
- C)  $P = \frac{O + 4M + E}{6}$
- D)  $P = \frac{O + 4M - E}{6}$

4



In the figure above,  $RT = TU$ . What is the value of  $x$ ?

- A) 72
- B) 66
- C) 64
- D) 58

5

The width of a rectangular dance floor is  $w$  feet. The length of the floor is 6 feet longer than its width. Which of the following expresses the perimeter, in feet, of the dance floor in terms of  $w$ ?

- A)  $2w + 6$
- B)  $4w + 12$
- C)  $w^2 + 6$
- D)  $w^2 + 6w$

6

$$y > 2x - 1$$

$$2x > 5$$

Which of the following consists of the  $y$ -coordinates of all the points that satisfy the system of inequalities above?

- A)  $y > 6$
- B)  $y > 4$
- C)  $y > \frac{5}{2}$
- D)  $y > \frac{3}{2}$



7

$$\sqrt{2x+6} + 4 = x + 3$$

What is the solution set of the equation above?

- A)  $\{-1\}$
- B)  $\{5\}$
- C)  $\{-1, 5\}$
- D)  $\{0, -1, 5\}$

8

$$f(x) = x^3 - 9x$$

$$g(x) = x^2 - 2x - 3$$

Which of the following expressions is equivalent to

$$\frac{f(x)}{g(x)}, \text{ for } x > 3 ?$$

- A)  $\frac{1}{x+1}$
- B)  $\frac{x+3}{x+1}$
- C)  $\frac{x(x-3)}{x+1}$
- D)  $\frac{x(x+3)}{x+1}$

9

$$(x-6)^2 + (y+5)^2 = 16$$

In the  $xy$ -plane, the graph of the equation above is a circle. Point  $P$  is on the circle and has coordinates  $(10, -5)$ . If  $\overline{PQ}$  is a diameter of the circle, what are the coordinates of point  $Q$  ?

- A)  $(2, -5)$
- B)  $(6, -1)$
- C)  $(6, -5)$
- D)  $(6, -9)$

10

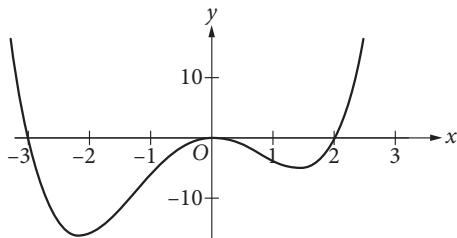
A group of 202 people went on an overnight camping trip, taking 60 tents with them. Some of the tents held 2 people each, and the rest held 4 people each. Assuming all the tents were filled to capacity and every person got to sleep in a tent, exactly how many of the tents were 2-person tents?

- A) 30
- B) 20
- C) 19
- D) 18





11



Which of the following could be the equation of the graph above?

- A)  $y = x(x-2)(x+3)$
- B)  $y = x^2(x-2)(x+3)$
- C)  $y = x(x+2)(x-3)$
- D)  $y = x^2(x+2)(x-3)$

12

If  $\frac{2a}{b} = \frac{1}{2}$ , what is the value of  $\frac{b}{a}$ ?

- A)  $\frac{1}{8}$
- B)  $\frac{1}{4}$
- C) 2
- D) 4

13

Oil and gas production in a certain area dropped from 4 million barrels in 2000 to 1.9 million barrels in 2013. Assuming that the oil and gas production decreased at a constant rate, which of the following linear functions  $f$  best models the production, in millions of barrels,  $t$  years after the year 2000?

- A)  $f(t) = \frac{21}{130}t + 4$
- B)  $f(t) = \frac{19}{130}t + 4$
- C)  $f(t) = -\frac{21}{130}t + 4$
- D)  $f(t) = -\frac{19}{130}t + 4$



14

$$y = x^2 + 3x - 7$$
$$y - 5x + 8 = 0$$

How many solutions are there to the system of equations above?

- A) There are exactly 4 solutions.
- B) There are exactly 2 solutions.
- C) There is exactly 1 solution.
- D) There are no solutions.

15

$$g(x) = 2x - 1$$
$$h(x) = 1 - g(x)$$

The functions  $g$  and  $h$  are defined above. What is the value of  $h(0)$  ?

- A)  $-2$
- B)  $0$
- C)  $1$
- D)  $2$

**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $7/2$ . (If  $\boxed{3\ 1\ / \ 2}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result. →

	7	/	1	2	
.					
	0	0	0		
1	1		1		
2	2		2		
3	3		3		
4	4		4		
5	5		5		
6	6		6		
7	7		7		
8	8		8		
9	9		9		

	2	.	5		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

.	6	6	6		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

.	6	6	7		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

Answer: 201 – either position is correct

	2	0	1		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

	2	0	1		
.					
	0	0	0		
1	1	1	1		
2	2	2	2		
3	3	3	3		
4	4	4	4		
5	5	5	5		
6	6	6	6		
7	7	7	7		
8	8	8	8		
9	9	9	9		

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

$$x^2 + x - 12 = 0$$

If  $a$  is a solution of the equation above and  $a > 0$ , what is the value of  $a$ ?

17

The sum of  $-2x^2 + x + 31$  and  $3x^2 + 7x - 8$  can be written in the form  $ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are constants. What is the value of  $a + b + c$ ?

18

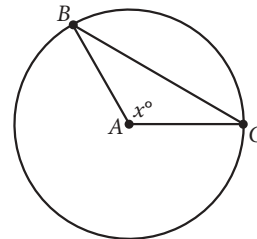
$$\begin{aligned} -x + y &= -3.5 \\ x + 3y &= 9.5 \end{aligned}$$

If  $(x, y)$  satisfies the system of equations above, what is the value of  $y$ ?

19

A start-up company opened with 8 employees. The company's growth plan assumes that 2 new employees will be hired each quarter (every 3 months) for the first 5 years. If an equation is written in the form  $y = ax + b$  to represent the number of employees,  $y$ , employed by the company  $x$  quarters after the company opened, what is the value of  $b$ ?

20



Note: Figure not drawn to scale.

In the circle above, point  $A$  is the center and the length of arc  $\widehat{BC}$  is  $\frac{2}{5}$  of the circumference of the circle. What is the value of  $x$ ?

## STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



## Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

### DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

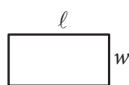
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE



$$A = \pi r^2$$

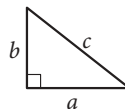
$$C = 2\pi r$$



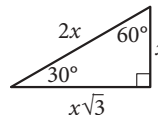
$$A = \ell w$$



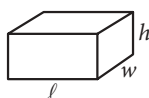
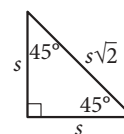
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



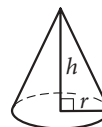
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



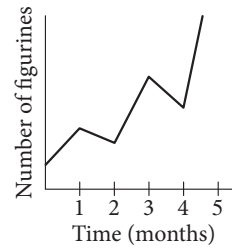
1

One pound of grapes costs \$2. At this rate, how many dollars will  $c$  pounds of grapes cost?

- A)  $2c$
- B)  $2 + c$
- C)  $\frac{2}{c}$
- D)  $\frac{c}{2}$

2

Tracy collects, sells, and trades figurines, and she tracks the number of figurines in her collection on the graph below.



On what interval did the number of figurines decrease the fastest?

- A) Between 1 and 2 months
- B) Between 2 and 3 months
- C) Between 3 and 4 months
- D) Between 4 and 5 months

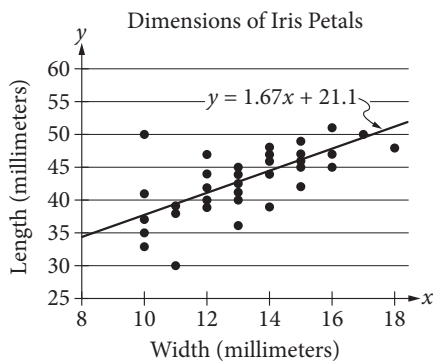


3

In a random sample of 200 cars of a particular model, 3 have a manufacturing defect. At this rate, how many of 10,000 cars of the same model will have a manufacturing defect?

- A) 150
- B) 200
- C) 250
- D) 300

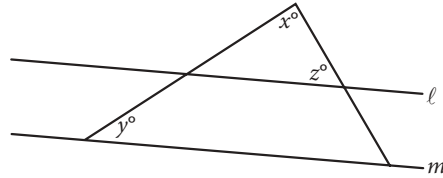
4



The scatterplot above shows data collected on the lengths and widths of *Iris setosa* petals. A line of best fit for the data is also shown. Based on the line of best fit, if the width of an *Iris setosa* petal is 19 millimeters, what is the predicted length, in millimeters, of the petal?

- A) 21.10
- B) 31.73
- C) 52.83
- D) 55.27

5



Note: Figure not drawn to scale.

In the figure above, lines  $\ell$  and  $m$  are parallel,  $y = 20$ , and  $z = 60$ . What is the value of  $x$ ?

- A) 120
- B) 100
- C) 90
- D) 80



6

Two types of tickets were sold for a concert held at an amphitheater. Tickets to sit on a bench during the concert cost \$75 each, and tickets to sit on the lawn during the concert cost \$40 each. Organizers of the concert announced that 350 tickets had been sold and that \$19,250 had been raised through ticket sales alone. Which of the following systems of equations could be used to find the number of tickets for bench seats,  $B$ , and the number of tickets for lawn seats,  $L$ , that were sold for the concert?

- A)  $(75B)(40L) = 1,950$   
 $B + L = 350$
- B)  $40B + 75L = 19,250$   
 $B + L = 350$
- C)  $75B + 40L = 350$   
 $B + L = 19,250$
- D)  $75B + 40L = 19,250$   
 $B + L = 350$

7

In the  $xy$ -plane, the graph of which of the following equations is a line with a slope of 3?

- A)  $y = \frac{1}{3}x$
- B)  $y = x - 3$
- C)  $y = 3x + 2$
- D)  $y = 6x + 3$

8

$$x + 1 = \frac{2}{x + 1}$$

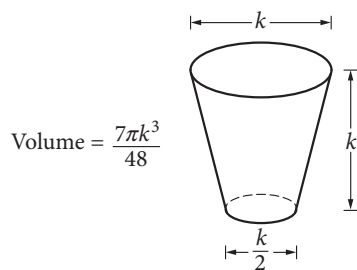
In the equation above, which of the following is a possible value of  $x + 1$ ?

- A)  $1 - \sqrt{2}$
- B)  $\sqrt{2}$
- C) 2
- D) 4





Questions 9-11 refer to the following information.



The glass pictured above can hold a maximum volume of 473 cubic centimeters, which is approximately 16 fluid ounces.

9

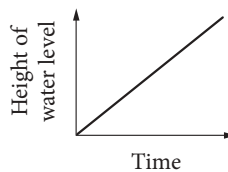
What is the value of  $k$ , in centimeters?

- A) 2.52
- B) 7.67
- C) 7.79
- D) 10.11

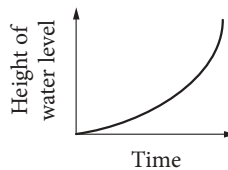
10

Water pours into the glass slowly and at a constant rate. Which of the following graphs best illustrates the height of the water level in the glass as it fills?

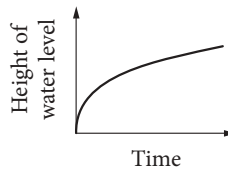
A)



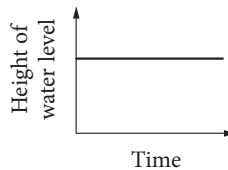
B)



C)



D)





11

Jenny has a pitcher that contains 1 gallon of water. How many times could Jenny completely fill the glass with 1 gallon of water? (1 gallon = 128 fluid ounces)

- A) 16
- B) 8
- C) 4
- D) 3

12

Roberto is an insurance agent who sells two types of policies: a \$50,000 policy and a \$100,000 policy. Last month, his goal was to sell at least 57 insurance policies. While he did not meet his goal, the total value of the policies he sold was over \$3,000,000. Which of the following systems of inequalities describes  $x$ , the possible number of \$50,000 policies, and  $y$ , the possible number of \$100,000 policies, that Roberto sold last month?

- A)  $x + y < 57$   
 $50,000x + 100,000y < 3,000,000$
- B)  $x + y > 57$   
 $50,000x + 100,000y > 3,000,000$
- C)  $x + y < 57$   
 $50,000x + 100,000y > 3,000,000$
- D)  $x + y > 57$   
 $50,000x + 100,000y < 3,000,000$

13

If  $a^{-\frac{1}{2}} = x$ , where  $a > 0$ , what is  $a$  in terms of  $x$ ?

- A)  $\sqrt{x}$
- B)  $-\sqrt{x}$
- C)  $\frac{1}{x^2}$
- D)  $-\frac{1}{x^2}$

14

Which of the following is a value of  $x$  for which the expression  $\frac{-3}{x^2 + 3x - 10}$  is undefined?

- A) -3
- B) -2
- C) 0
- D) 2



15

A granite block in the shape of a right rectangular prism has dimensions 30 centimeters by 40 centimeters by 50 centimeters. The block has a density of 2.8 grams per cubic centimeter. What is the mass of the block, in grams? (Density is mass per unit volume.)

- A) 336
- B) 3,360
- C) 16,800
- D) 168,000

16

Number of Adults Contracting Colds

	Cold	No cold	Total
Vitamin C	21	129	150
Sugar pill	33	117	150
Total	54	246	300

The table shows the results of a research study that investigated the therapeutic value of vitamin C in preventing colds. A random sample of 300 adults received either a vitamin C pill or a sugar pill each day during a 2-week period, and the adults reported whether they contracted a cold during that time period. What proportion of adults who received a sugar pill reported contracting a cold?

- A)  $\frac{11}{18}$
- B)  $\frac{11}{50}$
- C)  $\frac{9}{50}$
- D)  $\frac{11}{100}$

17

Ages of 20 Students Enrolled in a College Class

Age	Frequency
18	6
19	5
20	4
21	2
22	1
23	1
30	1

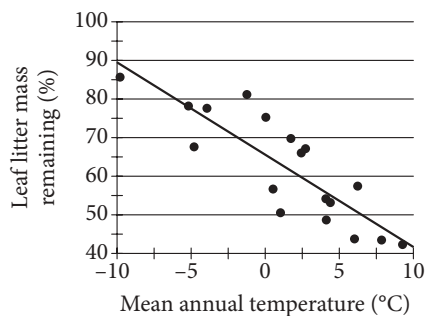
The table above shows the distribution of ages of the 20 students enrolled in a college class. Which of the following gives the correct order of the mean, median, and mode of the ages?

- A) mode < median < mean
- B) mode < mean < median
- C) median < mode < mean
- D) mean < mode < median



18

The figure below shows the relationship between the percent of leaf litter mass remaining after decomposing for 3 years and the mean annual temperature, in degrees Celsius ( $^{\circ}\text{C}$ ), in 18 forests in Canada. A line of best fit is also shown.

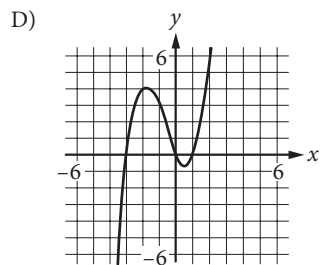
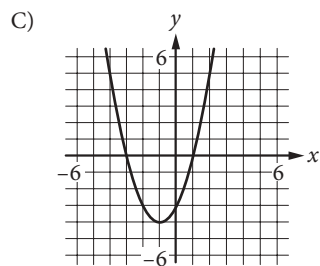
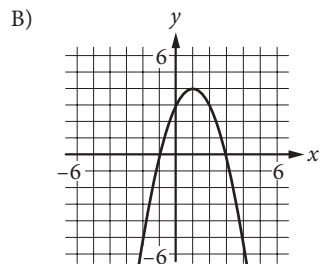
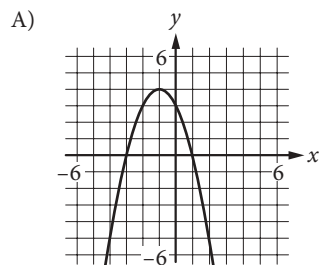


A particular forest in Canada, whose data is not included in the figure, had a mean annual temperature of  $-2^{\circ}\text{C}$ . Based on the line of best fit, which of the following is closest to the predicted percent of leaf litter mass remaining in this particular forest after decomposing for 3 years?

- A) 50%
- B) 63%
- C) 70%
- D) 82%

19

The range of the polynomial function  $f$  is the set of real numbers less than or equal to 4. If the zeros of  $f$  are  $-3$  and  $1$ , which of the following could be the graph of  $y = f(x)$  in the  $xy$ -plane?





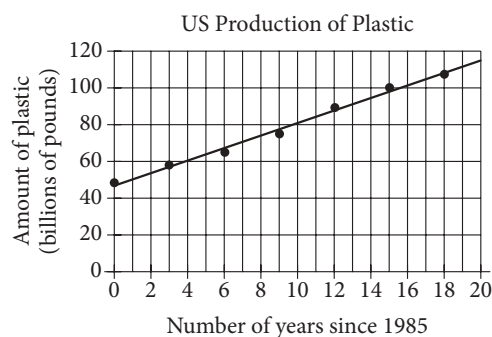
20

The average annual energy cost for a certain home is \$4,334. The homeowner plans to spend \$25,000 to install a geothermal heating system. The homeowner estimates that the average annual energy cost will then be \$2,712. Which of the following inequalities can be solved to find  $t$ , the number of years after installation at which the total amount of energy cost savings will exceed the installation cost?

- A)  $25,000 > (4,334 - 2,712)t$
- B)  $25,000 < (4,334 - 2,712)t$
- C)  $25,000 - 4,334 > 2,712t$
- D)  $25,000 > \frac{4,332}{2,712}t$

Questions 21 and 22 refer to the following information.

Between 1985 and 2003, data were collected every three years on the amount of plastic produced annually in the United States, in billions of pounds. The graph below shows the data and a line of best fit. The equation of the line of best fit is  $y = 3.39x + 46.89$ , where  $x$  is the number of years since 1985 and  $y$  is the amount of plastic produced annually, in billions of pounds.



21

Which of the following is the best interpretation of the number 3.39 in the context of the problem?

- A) The amount of plastic, in billions of pounds, produced in the United States during the year 1985
- B) The number of years it took the United States to produce 1 billion pounds of plastic
- C) The average annual plastic production, in billions of pounds, in the United States from 1985 to 2003
- D) The average annual increase, in billions of pounds, of plastic produced per year in the United States from 1985 to 2003



22

Which of the following is closest to the percent increase in the billions of pounds of plastic produced in the United States from 2000 to 2003?

- A) 10%
- B) 44%
- C) 77%
- D) 110%

23

$$M = 1,800(1.02)^t$$

The equation above models the number of members,  $M$ , of a gym  $t$  years after the gym opens. Of the following, which equation models the number of members of the gym  $q$  quarter years after the gym opens?

- A)  $M = 1,800(1.02)^{\frac{q}{4}}$
- B)  $M = 1,800(1.02)^{4q}$
- C)  $M = 1,800(1.005)^{4q}$
- D)  $M = 1,800(1.082)^q$

24

For the finale of a TV show, viewers could use either social media or a text message to vote for their favorite of two contestants. The contestant receiving more than 50% of the vote won. An estimated 10% of the viewers voted, and 30% of the votes were cast on social media. Contestant 2 earned 70% of the votes cast using social media and 40% of the votes cast using a text message. Based on this information, which of the following is an accurate conclusion?

- A) If all viewers had voted, Contestant 2 would have won.
- B) Viewers voting by social media were likely to be younger than viewers voting by text message.
- C) If all viewers who voted had voted by social media instead of by text message, Contestant 2 would have won.
- D) Viewers voting by social media were more likely to prefer Contestant 2 than were viewers voting by text message.



25

Population of Greenleaf, Idaho

Year	Population
2000	862
2010	846

The table above shows the population of Greenleaf, Idaho, for the years 2000 and 2010. If the relationship between population and year is linear, which of the following functions  $P$  models the population of Greenleaf  $t$  years after 2000?

- A)  $P(t) = 862 - 1.6t$
- B)  $P(t) = 862 - 16t$
- C)  $P(t) = 862 + 16(t - 2,000)$
- D)  $P(t) = 862 - 1.6(t - 2,000)$

26

To determine the mean number of children per household in a community, Tabitha surveyed 20 families at a playground. For the 20 families surveyed, the mean number of children per household was 2.4. Which of the following statements must be true?

- A) The mean number of children per household in the community is 2.4.
- B) A determination about the mean number of children per household in the community should not be made because the sample size is too small.
- C) The sampling method is flawed and may produce a biased estimate of the mean number of children per household in the community.
- D) The sampling method is not flawed and is likely to produce an unbiased estimate of the mean number of children per household in the community.



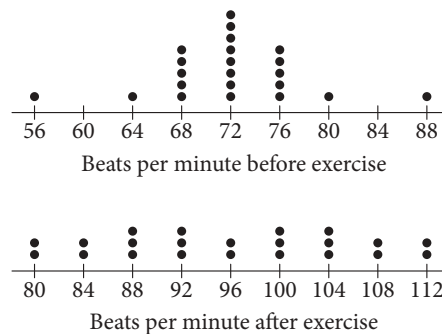
27

In the  $xy$ -plane, the point  $(p, r)$  lies on the line with equation  $y = x + b$ , where  $b$  is a constant. The point with coordinates  $(2p, 5r)$  lies on the line with equation  $y = 2x + b$ . If  $p \neq 0$ , what is the value of  $\frac{r}{p}$ ?

- A)  $\frac{2}{5}$   
 B)  $\frac{3}{4}$   
 C)  $\frac{4}{3}$   
 D)  $\frac{5}{2}$

28

The 22 students in a health class conducted an experiment in which they each recorded their pulse rates, in beats per minute, before and after completing a light exercise routine. The dot plots below display the results.



Let  $s_1$  and  $r_1$  be the standard deviation and range, respectively, of the data before exercise, and let  $s_2$  and  $r_2$  be the standard deviation and range, respectively, of the data after exercise. Which of the following is true?

- A)  $s_1 = s_2$  and  $r_1 = r_2$   
 B)  $s_1 < s_2$  and  $r_1 < r_2$   
 C)  $s_1 > s_2$  and  $r_1 > r_2$   
 D)  $s_1 \neq s_2$  and  $r_1 = r_2$



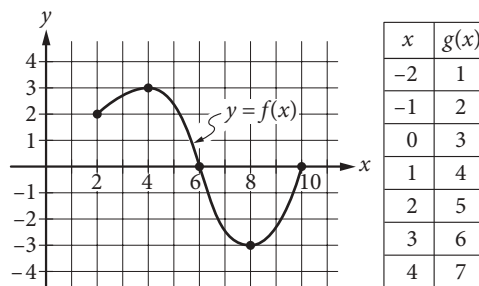


29

A photocopy machine is initially loaded with 5,000 sheets of paper. The machine starts a large job and copies at a constant rate. After 20 minutes, it has used 30% of the paper. Which of the following equations models the number of sheets of paper,  $p$ , remaining in the machine  $m$  minutes after the machine started printing?

- A)  $p = 5,000 - 20m$
- B)  $p = 5,000 - 75m$
- C)  $p = 5,000(0.3)^{\frac{m}{20}}$
- D)  $p = 5,000(0.7)^{\frac{m}{20}}$

30



The complete graph of the function  $f$  and a table of values for the function  $g$  are shown above. The maximum value of  $f$  is  $k$ . What is the value of  $g(k)$ ?

- A) 7
- B) 6
- C) 3
- D) 0

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \odot & \odot & \odot & \odot \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

← Fraction line

← Decimal point

Grid in result.

	7	/	1	2
⊙	⊙	⊙	⊙	⊙
	0	0	0	0
①	①	●	①	①
②	②	②	●	②
③	③	③	③	③
④	④	④	④	④
⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥
●	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨

	2	.	5	
⊙	⊙	⊙	⊙	⊙
	0	0	0	0
①	①	①	①	①
②	●	②	②	②
③	③	③	③	③
④	④	④	④	④
⑤	⑤	⑤	●	⑤
⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3	
⊙	⊙	⊙	⊙	⊙
	0	0	0	0
①	①	①	①	①
②	●	②	②	②
③	③	③	●	③
④	④	④	④	④
⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨

.	6	6	6	
⊙	⊙	⊙	⊙	⊙
	0	0	0	0
①	①	①	①	①
②	②	②	②	②
③	③	③	③	③
④	④	④	④	④
⑤	⑤	⑤	⑤	⑤
⑥	●	●	●	⑥
⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨

.	6	6	7	
⊙	⊙	⊙	⊙	⊙
	0	0	0	0
①	①	①	①	①
②	②	②	②	②
③	③	③	③	③
④	④	④	④	④
⑤	⑤	⑤	⑤	⑤
⑥	●	●	⑥	⑥
⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨

Answer: 201 – either position is correct

	2	0	1	
⊙	⊙	⊙	⊙	⊙
	0	●	0	0
①	①	①	●	①
②	●	②	②	②
③	③	③	③	③

	2	0	1	
⊙	⊙	⊙	⊙	⊙
	0	●	0	0
①	①	●	①	①
②	●	②	②	②
③	③	③	③	③

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

There are two atoms of hydrogen and one atom of oxygen in one molecule of water. How many atoms of hydrogen are there in 51 molecules of water?

32

$$x - \frac{1}{2}a = 0$$

If  $x = 1$  in the equation above, what is the value of  $a$ ?

33

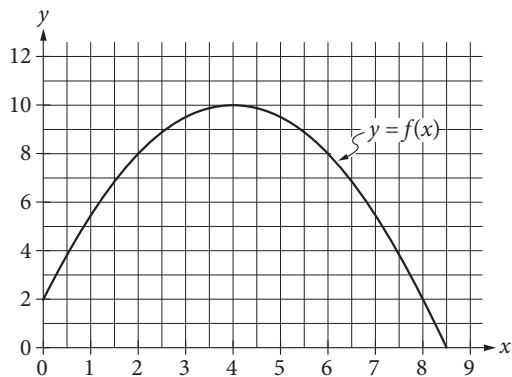
In the  $xy$ -plane, the equations  $x + 2y = 10$  and  $3x + 6y = c$  represent the same line for some constant  $c$ . What is the value of  $c$ ?

34

On April 18, 1775, Paul Revere set off on his midnight ride from Charlestown to Lexington. If he had ridden straight to Lexington without stopping, he would have traveled 11 miles in 26 minutes. In such a ride, what would the average speed of his horse have been, to the nearest tenth of a mile per hour?



35



The graph of the function  $f$ , defined by

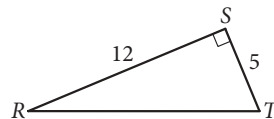
$$f(x) = -\frac{1}{2}(x-4)^2 + 10, \text{ is shown in the } xy\text{-plane}$$

above. If the function  $g$  (not shown) is defined by

$$g(x) = -x + 10, \text{ what is one possible value of } a \text{ such}$$

that  $f(a) = g(a)$  ?

36

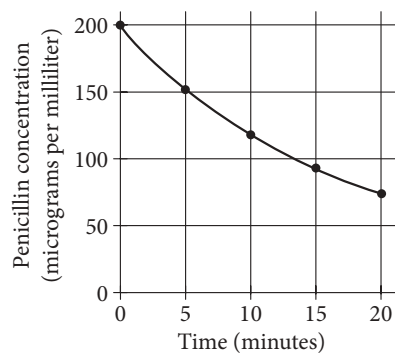


In triangle  $RST$  above, point  $W$  (not shown) lies on  $\overline{RT}$ . What is the value of  $\cos(\angle RSW) - \sin(\angle WST)$  ?



Questions 37 and 38 refer to the following information.

Minutes after injection	Penicillin concentration (micrograms per milliliter)
0	200
5	152
10	118
15	93
20	74



When a patient receives a penicillin injection, the kidneys begin removing the penicillin from the body. The table and graph above show the penicillin concentration in a patient's bloodstream at 5-minute intervals for the 20 minutes immediately following a one-time penicillin injection.



37

According to the table, how many more micrograms of penicillin are present in 10 milliliters of blood drawn from the patient 5 minutes after the injection than are present in 8 milliliters of blood drawn 10 minutes after the injection?

38

The penicillin concentration, in micrograms per milliliter, in the patient's bloodstream  $t$  minutes after the penicillin injection is modeled by the function  $P$  defined by  $P(t) = 200b^{\frac{t}{5}}$ . If  $P$  approximates the values in the table to within 10 micrograms per milliliter, what is the value of  $b$ , rounded to the nearest tenth?

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**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

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## Answer Explanations

# SAT Practice Test #8

## Section 1: Reading Test

### QUESTION 1

**Choice A is the best answer.** The first paragraph explains the narrator’s love of reading: “Even then my only friends were made of paper and ink. . . . Where my school friends saw notches of ink on incomprehensible pages, I saw light, streets, and people.” The fourth paragraph reiterates this love in its description of the bookshop as a “sanctuary” and “refuge.” The shift in focus occurs in the last six paragraphs, which recount the gift of a book that transforms the narrator’s love of reading into a desire to write: “I did not think there could be a better [book] in the whole world and I was beginning to suspect that Mr. Dickens had written it just for me. Soon I was convinced that I didn’t want to do anything else in life but learn to do what Mr. Dickens had done.” Thus the passage’s overall focus shifts from the narrator’s love of reading to a specific incident that influences his decision to become a writer.

Choice B is incorrect because the passage never focuses on the narrator’s father, who primarily serves to illustrate the narrator’s determination to read books despite all obstacles. Choice C is incorrect because the passage focuses on the narrator’s desire to write rather than on whatever skill he may have as a writer. Choice D is incorrect because the passage doesn’t make the narrator’s childhood hardships its central focus or analyze the effects of those hardships.

### QUESTION 2

**Choice C is the best answer.** In the first paragraph, the third sentence describes the narrator’s love of reading (“where my school friends saw notches of ink on incomprehensible pages, I saw light, streets, and people”), and the fourth sentence describes the role that reading played in the narrator’s life (“a safe haven from that home, those streets, and those troubled days in which even I could sense that only a limited fortune awaited me”). The remainder of the passage recounts incidents in which the narrator’s actions arise from his love of, and dependence on, reading. Thus the third and fourth sentences can be seen as describing a passion that accounts for those actions.



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Choice A is incorrect because although the narrator’s “school friends” are mentioned in passing in the third sentence, they aren’t introduced as proper characters and make no further appearance in the passage. Choice B is incorrect because the passage doesn’t list the difficult conditions of the narrator’s childhood until after these sentences. Choice D is incorrect because the narrator’s aspirations aren’t discussed until the last paragraph of the passage.

### QUESTION 3

**Choice C is the best answer.** The tenth paragraph shows that upon returning home, the narrator hides the gift (the “new friend”) that Sempere had given him: “That afternoon I took my new friend home, hidden under my clothes so that my father wouldn’t see it.” It can be inferred from this sentence that the narrator’s concern arises from an awareness that his father would disapprove of the gift.

Choice A is incorrect because although the passage discusses the father’s hostility toward the narrator’s love of reading, there is no indication that the father is not affectionate to the narrator more generally; indeed, the third paragraph depicts the father’s generosity toward the narrator. Choice B is incorrect because the father’s generosity toward the narrator, as depicted in the third paragraph, clearly shows that the father encourages unnecessary purchases of such things as candy. Choice D is incorrect because although the first paragraph shows that the father is hostile toward books in general, there is no indication in the passage that Dickens or any other author is a specific object of the father’s disdain.

### QUESTION 4

**Choice D is the best answer.** The previous question asks which statement about the narrator’s father would the narrator most likely agree with. The answer, that his father wouldn’t have approved of Sempere’s gift to the narrator, is best supported in the tenth paragraph: “That afternoon I took my new friend home, hidden under my clothes so that my father wouldn’t see it.” It can be inferred from this sentence that the narrator is aware of his father’s likely disapproval of the gift (the “new friend”).

Choices A, B, and C are incorrect because the cited lines don’t support the answer to the previous question. Instead, they show the father giving his own gift to the narrator (choice A) and illustrate how the narrator was treated when in Sempere’s bookshop (choices B and C).

### QUESTION 5

**Choice A is the best answer.** The last paragraph makes clear the narrator’s enthusiasm for Charles Dickens’s *Great Expectations*, and it can be inferred from the last sentence of this paragraph that this enthusiasm motivated the narrator to aspire to a career as a writer: “Soon I was convinced that I didn’t want to do anything else in life but learn to do what Mr. Dickens had done.”

Choice B is incorrect because the passage doesn't discuss gifts the narrator has received in the past; although the father sometimes gave the narrator money to buy sweets and snacks, these weren't gifts since the narrator made the purchases himself. Choice C is incorrect because although it is clear from the passage that Sempere was kind and even indulgent to the narrator, there is no suggestion that this treatment was inspired by respect for the narrator. Choice D is incorrect because there is no suggestion that the narrator took Sempere's figurative designation of Dickens as a "lifelong friend" in the ninth paragraph to be a literal statement.

## QUESTION 6

**Choice D is the best answer.** The previous question asks why the narrator considers *Great Expectations* to be the greatest gift he ever received. The answer, that the book convinced him to become a writer, is best supported by the last sentence of the last paragraph: "Soon I was convinced that I didn't want to do anything else in life but learn to do what Mr. Dickens had done."

Choices A, B, and C are incorrect because the cited lines don't support the answer to the previous question. Instead, they explain the narrator's interactions with the bookseller (choice A), describe the book's physical condition (choice B), and indicate the narrator's initial, erroneous assumption that Sempere knew Charles Dickens personally (choice C).

## QUESTION 7

**Choice D is the best answer.** In the fourth paragraph, the narrator explains that although Sempere normally didn't charge him for books, he still left Sempere a few coins as payment: "It was only small change—if I'd had to buy a book with that pittance, I would probably have been able to afford only a booklet of cigarette papers." These lines signal the narrator's awareness that he was paying less for the books than they were worth.

Choice A is incorrect because the passage states that Sempere didn't expect or want the narrator to pay: "He hardly ever allowed me to pay for the books." Choice B is incorrect because the fourth paragraph makes clear that even if Sempere didn't want the narrator's money, the narrator would still "leave the coins I'd managed to collect." Choice C is incorrect because the third paragraph states that the money with which the narrator paid Sempere was originally given to the narrator by his father.

## QUESTION 8

**Choice B is the best answer.** In the fourth paragraph, the narrator describes his reluctance to leave Sempere's bookshop: "When it was time for me to leave, I would do so dragging my feet, a weight on my soul." In this context, "weight" most nearly means burden.

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Choices A, C, and D are incorrect because in the context of the narrator having to do something he doesn't want to, a "weight" he had to carry most nearly means a burden, not a bulk (choice A), force (choice C), or clout (choice D).

### QUESTION 9

**Choice C is the best answer.** When, in the eighth paragraph, the narrator asks Sempere if the author Charles Dickens is a friend of his, Sempere replies, in the ninth paragraph, that Dickens is a "lifelong friend. And from now on, he's your friend too." Sempere designated Dickens a "friend" of both himself and the narrator, who had never heard of the author before. This signals that the use of "friend" in these lines is figurative and emphasizes Sempere's emotional connection to Dickens and, more generally, to reading. It also signals Sempere's hope that the narrator will come to have a similar connection to Dickens.

Choices A, B, and D are incorrect because the word "friend" is used in these lines to emphasize Sempere's connection to reading, rather than his connection to the narrator (choice A), the narrator's relationships or home life (choice B), or the narrator's emotional state or decision making (choice D).

### QUESTION 10

**Choice B is the best answer.** In the ninth paragraph, Sempere describes the author Charles Dickens to the narrator: "A lifelong friend. And from now on, he's your friend too." As the reader can reasonably assume that Sempere doesn't actually know Dickens, this description can be read as signaling Sempere as an avid admirer of Dickens's work.

Choice A is incorrect because the passage describes Sempere as a bookseller, not a writer. Choice C is incorrect because although the passage implies Sempere feels an emotional connection to Dickens, it doesn't suggest that this connection arises from any similarity between Sempere's life and that of Dickens. Choice D is incorrect because even if the passage implies that Sempere admires Dickens's work, Sempere's admiration isn't discussed in relation to that felt by other readers of Dickens, nor is Sempere shown to compare himself to other such readers.

### QUESTION 11

**Choice B is the best answer.** The first paragraph describes the widespread practice of not reporting null results, or results in which researchers fail to see an effect that should be detectable. The second through sixth paragraphs discuss a study that examined how scientists have dealt with null results. The seventh and eighth paragraphs discuss the negative consequences that null results pose for future research and the possible creation of a registry for all data produced by research studies, reported and unreported alike, as a remedy for those

consequences. Therefore, the purpose of the passage as a whole is to explain a common practice in the reporting of research studies and summarize a study that provides support for a change to that practice.

Choice A is incorrect because the passage doesn't dispute a widely held belief about the publication of social science research; rather, it suggests a solution to deal with a long-debated problem. Choice C is incorrect because while the passage hints at possible shortcomings in research trials, it doesn't describe them in detail; because it addresses other kinds of research besides medical trials; and because it doesn't call for a government database, specifically. Choice D is incorrect because the passage calls for changes to the reporting of research results, rather than to research methodology itself, and because it doesn't address the publishers of research at all.

### QUESTION 12

**Choice D is the best answer.** The second paragraph states that “TESS allows scientists to order up Internet-based surveys.” In the context of the service that the TESS program provides to scientists, “allows” most nearly means enables.

Choices A, B, and C are incorrect because in the context of the passage's discussion of TESS, “allows” most nearly means enables, not admits (choice A), tolerates (choice B), or grants (choice C).

### QUESTION 13

**Choice D is the best answer.** The fifth paragraph of the passage addresses the “statistical strength” of certain scientific findings. In this context, “strength” most nearly means significance, or importance.

Choices A, B, and C are incorrect because in the context of the statistical importance of scientific findings, “strength” most nearly means significance, not attribution (choice A), exertion (choice B), or toughness (choice C).

### QUESTION 14

**Choice A is the best answer.** The seventh paragraph discusses the negative consequences of not publishing null results, emphasizing that “worse, if researchers publish significant results from similar experiments in the future, they could look stronger than they should because the earlier null studies are ignored.” In other words, failing to document null results means that the results of later, related studies will not be as accurate as they appear.

Choices B, C, and D are incorrect because the passage does not indicate that failing to document null results can cause promising areas of research to be overlooked (choice B), cause errors in data collection practices that lead to null results being overlooked (choice C), or lessen bias against null results (choice D).

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## QUESTION 15

**Choice D is the best answer.** The previous question asks what the passage indicates could result from failing to document null results. The answer, that the results of future studies will be misleading, is best supported in the seventh paragraph: “Worse, if researchers publish significant results from similar experiments in the future, they could look stronger than they should because the earlier null studies are ignored.”

Choices A, B, and C are incorrect because the cited lines don’t support the answer to the previous question. Instead, choice A suggests how the findings of a study about null results may affect existing beliefs about such results; choice B explains how infrequently null results had been written up, according to Malhotra’s study; and choice C illustrates a problem resulting from the failure to document null results, but one that is unrelated to the fact that this documentation failure may make the results of future, related studies appear more valid than they are.

## QUESTION 16

**Choice B is the best answer.** The last two sentences of the seventh paragraph identify a particular research scenario that Malhotra uncovered in his study: “Even more troubling to Malhotra was the fact that two scientists whose initial studies ‘didn’t work out’ went on to publish results based on a smaller sample. ‘The non-TESS version of the same study, in which we used a student sample, did yield fruit,’ noted one investigator.” Since Malhotra especially objected to these researchers’ suppression of data that produced null results and their subsequent publication of related data that were statistically significant, it can be inferred that the hypothetical situation to which he would most strongly object is one in which researchers publish their study results in a journal but exclude the portion of data that produced null results.

Choices A and D are incorrect because the seventh paragraph, which identifies a research scenario that Malhotra disapproved of, provides no basis for an inference that he would especially object to a team’s insisting on publishing null results in a top journal only (choice A) or a team’s expanding the scope of a study that had produced null results (choice D). Choice C is incorrect because although the first sentence of the seventh paragraph indicates Malhotra’s concern that failing to publish null results can mean that other researchers unwittingly replicate strategies that produced null results in prior studies, the paragraph goes on to identify other scenarios as being “worse” and “even more troubling” from Malhotra’s perspective.

## QUESTION 17

**Choice C is the best answer.** The previous question asks about which hypothetical situation Malhotra would most strongly object to. The answer, that he would most strongly object to researchers' reporting their findings but failing to disclose the null results, is best supported at the end of the seventh paragraph: "Even more troubling to Malhotra was the fact that two scientists whose initial studies 'didn't work out' went on to publish results based on a smaller sample. 'The non-TESS version of the same study, in which we used a student sample, did yield fruit,' noted one investigator."

Choices A, B, and D are incorrect because the cited lines don't support the answer to the previous question about which situation Malhotra would most strongly object to. Instead, they cite another researcher's attitude toward null results from his or her own study (choice A), compare the publication rate for studies that produce null results with that for studies that produce statistically significant results (choice B), and describe the recommendation by Malhotra and his team for the creation of a database to remedy problems resulting from the nonpublication of null results (choice D).

## QUESTION 18

**Choice B is the best answer.** After describing problems that could arise from the failure to report null results, the passage shifts in the last paragraph to a potential solution to such problems: "A registry for data generated by all experiments would address these problems, the authors argue." The paragraph goes on to imply that a registry could solve such problems by deterring the suppression of null results.

Choice A is incorrect because the last paragraph proposes a "registry for data" rather than a future research project. Choice C is incorrect because the summary of the results of Malhotra's study occurs in the fifth paragraph, not in the last. Choice D is incorrect because the last paragraph of the passage does not mention reexamining results already obtained in social science trials.

## QUESTION 19

**Choice C is the best answer.** The far left bar of the graph pertains to social science studies that produced strong results. This bar shows that approximately 20 percent (or two full increments of 10 percent) of such studies were published in a top journal.

Choice A is incorrect because the graph shows that approximately 5 percent of social science studies that produced strong results were unwritten, rather than over 50 percent. Choice B is incorrect because the graph shows that about 30 percent of social science studies that produced strong results were unpublished but written, rather than 50 percent. Choice D is incorrect because the graph shows that slightly over 40 percent of social science studies that produced strong results were published in a non-top journal, rather than almost 80 percent.

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## QUESTION 20

**Choice A is the best answer.** The middle bar of the graph pertains to social science studies that produced mixed results. The top 50 percent of this bar represents studies that were published. The bottom 50 percent of this bar represents studies that were either unpublished or went unwritten. Since each of the two categories accounts for 50 percent of the total, it can be said that studies with mixed results were just as likely to be published as they were to be left either unpublished or unwritten.

Choice B is incorrect because the graph indicates that roughly 42 percent of social science studies produced strong results and roughly 22 percent produced null results; together, these two percentages far exceed the 36 percent accounted for by studies that produced mixed results. Choice C is incorrect because the graph shows that roughly 12 percent of studies that produced mixed results were published in top journals, well less than the percentage published in non-top journals (approximately 38 percent). Choice D is incorrect because the graph indicates that studies that produced strong results accounted for approximately 42 percent of all studies, while those that produced mixed results only accounted for around 36 percent of all studies.

## QUESTION 21

**Choice C is the best answer.** The first sentence of the fifth paragraph states, “Not unexpectedly, the statistical strength of the findings made a huge difference in whether they were ever published.” This statement is supported by the graph, which shows that more than 60 percent of social science studies that produced strong results were published, while only about 50 percent of studies with mixed results and about 20 percent of studies with null results were published.

Choices A, B, and D are incorrect because none of the cited lines contain information that is represented by the data in the graph. Instead, they recount scientists’ explanations for why they didn’t publish their null results (choices A and B) and highlight claims about the importance of Malhotra’s study (choice D).

## QUESTION 22

**Choice A is the best answer.** The first paragraph explains that in the nanoworld, salt can be seen “stretching like taffy.” The third paragraph notes that while this elasticity was expected in metals, it wasn’t imagined for salt: “But scientists don’t expect this superplasticity in a rigid, crystalline material like salt.” The rest of the passage explores this unexpected behavior of salt. Therefore it can be said that one of the central ideas of the passage is that materials don’t always behave as scientists might expect them to.

Choices B, C, and D are incorrect because the passage focuses on the unexpected way that salt reacts in the nanoworld, not on the role of inputs and outputs in systems (choice B), the relative strengths and weaknesses of models (choice C), or how the properties of systems differ from the properties of their parts (choice D).

### QUESTION 23

**Choice D is the best answer.** The first five paragraphs introduce salt's ability to stretch "like taffy to more than twice its length." In the fifth paragraph, the passage shifts into an explanation of how "Moore and his colleagues discovered salt's stretchiness." The last paragraph speculates about the possible application of this discovery: "The work also suggests new techniques for making nanowires, which are often created through nano-imprinting techniques." The passage's overall structure can therefore be seen as consisting of an introduction to an interesting salt property, followed by a description of how the property was discovered, followed by a speculation regarding applications of this property.

Choice A is incorrect because the passage discusses only one way in which salt differed from researchers' expectations. Choice B is incorrect because the passage begins not with a hypothesis about salt's behavior but with an explanation of its behaviors. Choice C is incorrect because the passage discusses complementary observations of salt crystals rather than two experiments involving salt that yield seemingly conflicting results.

### QUESTION 24

**Choice A is the best answer.** That Moore's group was surprised to observe salt stretching is most directly suggested by the last sentence of the third paragraph: "But scientists don't expect this superplasticity in a rigid, crystalline material like salt, Moore says."

Choices B, C, and D are incorrect because the cited lines don't support the idea that Moore's group was surprised to observe salt stretching. Instead, they explain how the group happened upon their observation (choice B), the measures the group took to investigate the stretching further (choice C), and how common salt is in nature (choice D).

### QUESTION 25

**Choice B is the best answer.** The first sentence of the fourth paragraph states, "This unusual behavior highlights that different forces rule the nanoworld." In this context, to "rule" most nearly means to control.

Choices A, C, and D are incorrect because in the context of a discussion of forces that operate on the nanoworld, to "rule" most nearly means to control, not to mark (choice A), declare (choice C), or restrain (choice D).



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## QUESTION 26

**Choice D is the best answer.** The first sentence of the sixth paragraph identifies “electrostatic forces, perhaps good old van der Waals interactions” as the potential cause of the initial attraction between the microscope tip and the salt.

Choices A, B, and C are incorrect because the first sentence of the sixth paragraph clearly identifies the potential cause of the initial attraction between the microscope tip and the salt as van der Waals interactions, not as gravity (choice A), nano-imprinting (choice B), or surface tension (choice C).

## QUESTION 27

**Choice B is the best answer.** The sixth paragraph says that “several mechanisms might lead to” salt’s elasticity. In this context, the phrase “lead to” most nearly means result in.

Choices A, C, and D are incorrect because in the context of something causing salt molecules to exhibit elasticity, the phrase “lead to” most nearly means result in, not guide to (choice A), point toward (choice C), or start with (choice D).

## QUESTION 28

**Choice A is the best answer.** The first paragraph of the passage makes clear that salt exhibits elasticity (“stretching like taffy”) in the nanoworld, and the eighth paragraph explains that salt possesses some degree of elasticity in the macroworld as well: “Huge underground deposits of salt can bend like plastic, but water is believed to play a role at these scales.” Thus flexibility describes the relationship between salt’s behavior in both the nanoworld and the macroworld.

Choice B is incorrect because the third paragraph explains that “scientists don’t expect” salt’s flexibility in the nanoworld, not that they do expect it; moreover, there is no indication that salt’s flexibility in the macroworld is surprising. Choice C is incorrect because the passage doesn’t make clear whether nanowires were first observed in the nanoworld or the macroworld. Choice D is incorrect because the passage does not examine the interaction of salt and water in the nanoworld or suggest that such interaction causes salt to have properties that are different from those it possesses in the macroworld.

## QUESTION 29

**Choice D is the best answer.** The previous question asks about which description of the relationship between salt behavior in the nanoworld and in the macroworld can be inferred from the passage. The answer, that salt is flexible or elastic in both worlds, is best supported in the eighth paragraph: “Huge underground deposits of salt can bend like plastic, but water is believed to play a role at these scales.” These lines suggest that in the macroworld, as in the nanoworld, salt possesses flexibility.

Choices A, B, and C are incorrect because the cited lines don't support the answer to the previous question. Instead, they highlight the prevalence of nanowires (choice A), identify which forces dominate the nanoworld (choice B), and offer a tentative explanation for an observation discussed in the passage (choice C).

### QUESTION 30

**Choice C is the best answer.** The lower graph, which shows the “tip moving away from salt surface,” indicates that when the microscope tip was 15 nanometers from the surface, the force on the tip was approximately 0.75 micronewtons.

Choices A, B, and D are incorrect because the graph shows that when the microscope tip was 15 nanometers from the salt surface, the force on the tip was approximately 0.75 micronewtons, not 0 micronewtons (choice A), 0.25 micronewtons (choice B), or 1.25 micronewtons (choice D).

### QUESTION 31

**Choice D is the best answer.** The bottom graph illustrates the process described in the first sentence of the seventh paragraph of the passage: “as the microscope pulls away from the salt, the salt stretches.” On the graph, the stretching of the salt is represented by the amount of force, in micronewtons, exerted on the microscope tip as the tip moves away from the salt surface. The graph shows that force was exerted on the tip until the tip reached point T at approximately 22 nanometers from the salt surface; from point T on, the force was 0 micronewtons. It can be inferred that since no force is being exerted after point T, point T is the point at which a salt nanowire breaks.

Choices A, B, and C are incorrect because the labels P, Q, and R all appear on the top graph, which represents data on the movement of the microscope tip toward the salt surface. As the fifth sentence of the fifth paragraph explains, when the microscope tip moved toward the salt, “the salt actually stretched out to glom on to the microscope tip.” Therefore, the first graph shows the salt attaching itself to the microscope tip and forming nanowires, not the breaking of a nanowire.

### QUESTION 32

**Choice B is the best answer.** In the first paragraph of Passage 1, Douglas argues that throughout the period in which the United States had both free and slave states, the nation as a whole “increased from four millions to thirty millions of people . . . extended our territory from the Mississippi to the Pacific Ocean . . . acquired the Floridas and Texas . . . [and had] risen from a weak and feeble power to become the terror and admiration of the civilized world.” It can reasonably be inferred that Douglas cites such growth in territory and population to make the point that the division into free and slave states was obviously not a threat to the country's health or survival.

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Choice A is incorrect because although it can be inferred that Douglas would argue for continued expansion of the United States, he cites the expansion it has already undergone as support for perpetuating the division into free and slave states. Choice C is incorrect because although Douglas implies that basic facts pertaining to the historical growth of the nation cast doubt on Lincoln's political agenda, he doesn't imply that Lincoln is unaware of those facts. Choice D is incorrect because although Douglas notes that the United States is globally perceived to be powerful, he doesn't imply that this perception can be accounted for by the nation's record of growth.

### QUESTION 33

**Choice C is the best answer.** In the second paragraph of Passage 1, Douglas uses a rhetorical question to stress that the division into slave and free states has existed since the beginning of the United States: "I now come back to the question, why cannot this Union exist forever, divided into Free and Slave States, as our fathers made it?" It can be inferred from this question that Douglas believes that since this division is long-standing, the provisions for it in the US Constitution have provided a good basic structure that doesn't need to be changed.

Choice A is incorrect because in Passage 1, Douglas doesn't observe that the US Constitution's provisions for slavery lack a means for reconciling differences between slave states and free states. Choice B is incorrect because although Douglas stresses that the provisions for slavery are long-standing, he doesn't characterize them as having somehow anticipated the Union's expansion to the west. Choice D is correct because although it can be inferred from Passage 1 that Douglas believes the provisions for slavery have had a positive economic impact, he nowhere implies that the founders based them on an assumption that slavery was economically necessary.

### QUESTION 34

**Choice B is the best answer.** The previous question asks about how Douglas, in Passage 1, characterizes the Constitution's provisions for slavery. The answer, that Douglas believes they provided a good basic structure and don't need to be changed, is best supported in the first sentence of the second paragraph of Passage 1: "I now come back to the question, why cannot this Union exist forever, divided into Free and Slave States, as our fathers made it?"

Choices A, C, and D are incorrect because the cited lines don't support the answer to the previous question. Instead, they describe the various ways in which the nation has expanded since its founding (choice A), stress the likelihood that the nation will only continue to expand (choice C), and assert the importance of the sovereignty of individual states to the future expansion of the nation (choice D).

### QUESTION 35

**Choice C is the best answer.** In the first sentence of the second paragraph of Passage 2, Lincoln raises a question about how the consequences of the division of the United States into slave states and free states compare with the consequences of the other ways in which states differ from each other: “But has it been so with this element of slavery?” In this context, the word “element” most nearly means factor.

Choices A, B, and D are incorrect because in the context of Lincoln’s discussion of the “element of slavery,” the word “element” most nearly means factor, not ingredient (choice A), environment (choice B), or quality (choice D).

### QUESTION 36

**Choice B is the best answer.** In the second paragraph of Passage 2, Lincoln asserts that the controversy surrounding slavery in the United States has died down whenever the institution of slavery has been restricted geographically: “Whenever it has been limited to its present bounds, and there has been no effort to spread it, there has been peace.” Since Lincoln associates peace on this issue with geographical limits on the institution of slavery itself, it can be inferred that he would agree that the controversy would abate if all attempts to establish slavery in new regions ceased.

Choice A is incorrect because Lincoln neither urges Northern states to attempt to abolish slavery unilaterally nor implies that such an attempt would extinguish the controversy over slavery. Choice C is incorrect because Lincoln neither suggests that the laws regulating slavery are ambiguous nor that such ambiguity exacerbates controversy over slavery. Choice D is incorrect because Lincoln never attributes the controversy over slavery to differences in religion or social values from one state to another.

### QUESTION 37

**Choice C is the best answer.** The previous question asks which claim about the controversy over slavery would Lincoln agree with. The answer, that the controversy would abate if attempts to spread slavery to regions where it isn’t practiced were abandoned, is best supported in the second paragraph of Passage 2: “Whenever [slavery] has been limited to its present bounds, and there has been no effort to spread it, there has been peace.”

Choices A, B, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they discuss state-to-state differences in laws regulating issues other than slavery (choice A), assert that the differences among the various states generally benefit the nation (choice B), and ask a philosophical question that doesn’t directly address the issue of slavery (choice D).

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### QUESTION 38

**Choice D is the best answer.** In the last sentence of Passage 2, Lincoln asks about the likelihood that people will fundamentally change: “Do you think that the nature of man will be changed?” In this context, the word “nature” most nearly means character.

Choices A, B, and C are incorrect because in the context of a discussion of the “nature of man,” the word “nature” most nearly means character, not force (choice A), simplicity (choice B), or world (choice C).

### QUESTION 39

**Choice C is the best answer.** In the first paragraph of Passage 1, Douglas claims that Lincoln considers the Constitution to be “a house divided against itself,” due to its provisions for the division of the nation into slave states and free states, and to be “in violation of the law of God.” In Passage 2, Lincoln objects to this characterization of his position and devotes the majority of the passage to clarifying that it isn’t the Constitution he finds fault with, or even its provisions for slavery, but rather with attempts to spread slavery to regions where it isn’t currently practiced. Therefore it can be said that a central tension between the two passages arises from, on the one hand, Douglas’s criticism of Lincoln for finding fault with the Constitution and, on the other, Lincoln’s insistence that Douglas has misrepresented his position.

Choice A is incorrect because Douglas (Passage 1) proposes no changes to federal policies on slavery and because Lincoln (Passage 2) doesn’t consider whether changes to such policies would enjoy popular support. Choice B is incorrect because Douglas (Passage 1) never expresses concern about the potential impact of abolition on the US economy and because Lincoln (Passage 2) neither discusses such an impact nor dismisses concerns about it. Choice D is incorrect because neither passage offers any interpretation of federal law.

### QUESTION 40

**Choice A is the best answer.** In the first paragraph of Passage 1, Douglas discusses the issue of slavery in the context of the division of free states and slave states throughout the period when the United States “extended our territory from the Mississippi to the Pacific Ocean” and “acquired the Floridas and Texas, and other territory sufficient to double our geographical extent.” In the second paragraph of Passage 2, Lincoln asserts that the controversy over slavery has historically been “excited by the effort to spread [slavery] into new territory,” as in the case of Missouri, Texas, and “the territory acquired by the Mexican War.” Therefore, it can be said that, notwithstanding their differences of opinion, both Douglas and Lincoln discuss the issue of slavery in relationship to the expansion of the Union.

Choices B, C, and D are incorrect because it is in relationship to the nation's expansion that both passages discuss the issue of slavery, not in relationship to questions of morality (choice B), religious toleration (choice C), or laws regulating commerce (choice D).

## QUESTION 41

**Choice D is the best answer.** In the second paragraph of Passage 1, Douglas asks the rhetorical question: "why cannot this Union exist forever, divided into Free and Slave States, as our fathers made it?" The remainder of the paragraph amounts to an answer to this rhetorical question and a refutation of Lincoln's viewpoint on slavery, as represented by Douglas. In the second paragraph of Passage 2, Lincoln asks a series of rhetorical questions: "But has it been so with this element of slavery? Have we not always had quarrels and difficulties over it? And when will we cease to have quarrels over it?" These questions imply that there are flaws in Douglas's equating the division into slave states and free states with other, more unambiguously beneficial differences from state to state. The remainder of the second paragraph expands on these flaws. Therefore, it can be said that in context, the rhetorical questions asked by each speaker serve to undermine the argument of the other speaker.

Choice A is incorrect because in asking rhetorical questions, neither Douglas nor Lincoln casts doubt on the sincerity of his opponent. Choices B and C are incorrect because although Douglas and Lincoln find fault with each other's ideas, they don't criticize each other's methods (choice B) or reproach each other's actions (choice C).

## QUESTION 42

**Choice A is the best answer.** The first two paragraphs of the passage describe the physical process by which the Venus flytrap closes its trap but also note certain long-standing questions about that process: "How does the plant encode and store the information from the unassuming bug's encounter with the first hair? How does it remember the first touch in order to react upon the second?" The passage then answers those questions by discussing, in the third and fourth paragraphs, a study conducted by Dieter Hodick and Andreas Sievers that identified the physiological means behind the closing of the Venus flytrap's trap and, in the last paragraph, a study conducted by Alexander Volkov that confirmed and built on Hodick and Sievers's findings. The primary purpose of the passage can therefore be seen as discussing scientific findings that explain how the Venus flytrap closes its trap.

Choice B is incorrect because the passage doesn't discuss the Venus flytrap's ability to close its trap in the context of the abilities of other plants. Choice C is incorrect because the passage discusses how the closing action operates but not how it has evolved. Choice D is incorrect because the passage doesn't provide an overview of the Venus flytrap and its predatory behavior; it merely notes in passing that the closing action has a predatory function.

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### QUESTION 43

**Choice C is the best answer.** The first paragraph discusses the challenge posed to the Venus flytrap by the opening and closing of its trap: “Closing its trap requires a huge expense of energy, and reopening the trap can take several hours, so *Dionaea* only wants to spring closed when it’s sure that the dawdling insect visiting its surface is large enough to be worth its time.” Since closing and reopening the trap requires the expense of precious energy, it can be inferred that by guarding against unnecessary closing, multiple triggers safeguard the plant’s energy supply.

Choice A is incorrect because the passage never indicates that multiple triggers allow the Venus flytrap to identify which species its prey belongs to, only that they allow it to gauge the prey’s size. Choice B is incorrect because although the passage implies that the plant needs to conserve energy and indicates that calcium is involved in the trap-closing mechanism, there is no indication that the plant’s calcium reserves themselves require conservation. Choice D is incorrect because it can be inferred from the passage that the advantage of multiple triggers is that they prevent the Venus flytrap from closing on the improper prey rather than from prematurely closing on the proper prey; the passage never implies that when touched by its proper prey, the Venus flytrap is at risk of closing too soon to capture it.

### QUESTION 44

**Choice A is the best answer.** The previous question asks what the Venus flytrap gains from requiring multiple triggers before closing. The answer, that multiple triggers allow the plant to conserve energy, is best supported near the beginning of the first paragraph: “Closing its trap requires a huge expense of energy, and reopening the trap can take several hours, so *Dionaea* only wants to spring closed when it’s sure that the dawdling insect visiting its surface is large enough to be worth its time.”

Choices B, C, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they describe how the hairs on the Venus flytrap function and how the system of multiple triggers works (choices B and C) and explain how the plant preserves a memory, as it were, that something has touched the trigger hairs (choice D).

### QUESTION 45

**Choice C is the best answer.** The phrases “dawdling insect,” “happily meanders,” and “unassuming bug’s encounter” are less typical of word choices made in formal, scientific writing than of those made in less formal writing modes. Therefore, the tone that these phrases establish is best described as informal.

Choices A, B, and D are incorrect because the phrases establish a tone that is informal, not academic (choice A), melodramatic (choice B), or mocking (choice D).

### QUESTION 46

**Choice A is the best answer.** The first paragraph describes the mechanism that prompts the Venus flytrap to close its trap. The second paragraph makes an analogy of each step of that mechanism to an aspect of short-term memory formation in humans and then poses questions about the precise physiological terms in which those steps are carried out. It can therefore be said that the discussion of short-term memory serves to clarify the first paragraph's explanation of what prompts the trap of the Venus flytrap to close.

Choice B is incorrect because it is the third paragraph, not the second, that discusses the function of electric charges in the Venus flytrap; moreover, the passage presents this function as a fact, not as a controversial hypothesis. Choice C is incorrect because rather than stressing the differences between Venus flytraps and humans, the analogy in the second paragraph stresses their superficial similarities. Choice D is incorrect because the second paragraph implies that the Venus flytrap's capacity for retaining information is far from detailed: "something (it doesn't know what) has touched one of its hairs."

### QUESTION 47

**Choice D is the best answer.** The third paragraph explains that touching a single trigger hair results in "a rapid increase in the concentration of calcium ions" in the plant. The fourth paragraph further explains that the calcium concentration produced by this initial touch isn't enough to cause the trap to close, but that a second hair touch will bring the total concentration to the level necessary to close the trap: "a second hair needs to be stimulated to push the calcium concentration over this threshold and spring the trap."

Choices A and B are incorrect because the fourth paragraph explains that the second trigger supplements the action of the first trigger, not that it reverses it (choice A) or stabilizes its effect (choice B). Choice C is incorrect because the third paragraph clearly states that the calcium channels open after the first trigger hair is touched, not the second.

### QUESTION 48

**Choice B is the best answer.** The fourth paragraph explains that the Venus flytrap will close only if a second hair is stimulated to "push the calcium concentration over this threshold and spring the trap." But the last sentence of the paragraph notes that the calcium concentrations "dissipate over time," and if enough time elapses after the first trigger, "the final concentration after the second trigger won't be high enough to close the trap." It can be inferred, then, that if a large insect didn't touch a second trigger hair until after the calcium ion concentrations had diminished appreciably, the Venus flytrap would fail to close.



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Choice A is incorrect because the fourth paragraph makes clear that if the calcium concentration goes above the trap's threshold, the plant will close, not remain open. Choice C is incorrect because as the third paragraph explains, the touching of the trigger hair and opening of the calcium ion channels don't act to keep the trap open but are instead a precondition for the closing of the trap (though closing will occur only if a second trigger hair is touched). Choice D is incorrect because the last sentence of the fifth paragraph explains that the threshold for the time that can elapse between the touching of the first and second trigger hairs is twenty seconds, meaning that a large insect touching two hairs within ten seconds would almost certainly make the plant close.

### QUESTION 49

**Choice B is the best answer.** The second sentence of the last paragraph says that Alexander Volkov and his colleagues "first demonstrated that it is indeed electricity that causes the Venus flytrap to close." In this context, the word "demonstrated" most nearly means established.

Choices A, C, and D are incorrect because in the context of scientists showing what causes the Venus flytrap to close, the word "demonstrated" most nearly means established, not protested (choice A), performed (choice C), or argued (choice D).

### QUESTION 50

**Choice B is the best answer.** As described in the third paragraph, Hodick and Sievers's model emphasizes that the Venus flytrap closes by means of an electrical charge triggered when the plant's hairs are touched. But as explained in the last paragraph, when Alexander Volkov tested this model, the design of his experiment involved the direct application of an electrical charge, which "made the trap close without any direct touch to its trigger hairs." Therefore, Volkov's work could be criticized because his design omitted, rather than corroborated, a central element of Hodick and Sievers's model—namely, the physical stimulation of the hairs.

Choice A is incorrect because although the last paragraph explains that Volkov omitted an element of Hodick and Sievers's model when designing his own experiment, there is no suggestion that he did so out of a faulty understanding of their model. Choice C is incorrect because it is impossible to know from the passage if Hodick and Sievers would have objected to Volkov's methods. Choice D is incorrect because the passage doesn't indicate whether the technology Volkov used had been available to Hodick and Sievers when they formulated their model.

## QUESTION 51

**Choice C is the best answer.** The previous question asks what potential criticism might be made of Volkov’s testing of Hodick and Sievers’s model. The answer, that a central element of that model wasn’t corroborated by Volkov’s measurements, is best supported in the last paragraph: “This made the trap close without any direct touch to its trigger hairs (while they didn’t measure calcium levels, the current likely led to increases).” Because the physical touch to the hairs figured in Hodick and Sievers’s model, it can be said that Volkov’s decision to apply an electrical current directly to the plant means that he failed to corroborate a central element of their model.

Choices A, B, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they summarize the basic agreement of Volkov’s work with Hodick and Sievers’s model (choice A) and describe steps in Volkov’s experimental design that are related to the application of an electrical current but don’t directly address the omission of the central element of the physical touch to the hairs (choices B and D).

## QUESTION 52

**Choice C is the best answer.** The second sentence of the last paragraph says that the focus of Volkov’s work was the role of electricity in the Venus flytrap’s closing mechanism. The paragraph goes on to explain that by applying electricity directly to the plant and “altering the amount of electrical current, Volkov could determine the exact electrical charge needed for the trap to close.” It is therefore accurate to say that Volkov and his colleagues made the most extensive use of information obtained from measuring the plant’s response to varying amounts of electrical current.

Choice A is incorrect because although the last paragraph explains that Volkov’s work was based on Hodick and Sievers’s mathematical model in which an electrical charge is required to close the Venus flytrap, that model isn’t described as predicting the precise amount of charge required; moreover, although Volkov made use of this earlier model, it served as a starting point, and his work made greater use of the findings generated by his experiment. Choice B is incorrect because the passage doesn’t describe Volkov’s work as having involved analysis of data from earlier studies on the plant’s response to electricity. Choice D is incorrect because although the last paragraph explains that Volkov based his work on Hodick and Sievers’s earlier model, this was the sole model that Volkov relied on, and there is no suggestion that he made use of multiple “published theories” or “earlier models”; moreover, he made more extensive use of data generated by his own experiment than of Hodick and Sievers’s model.

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## Section 2: Writing and Language Test

### QUESTION 1

**Choice D is the best answer.** The prepositional phrase “for example” logically connects the two sentences and correctly indicates that what follows in the second sentence will be examples of household waste products: paper, glass, aluminum, and garbage.

Choices A, B, and C are incorrect because they don’t indicate the true relationship between the two sentences. “Regardless” (choice A) means in spite of something, “however” (choice B) indicates a contrast, and “furthermore” (choice C) means in addition. None of these transitions indicates that an example will follow.

### QUESTION 2

**Choice B is the best answer.** The verb “eliminate” means to remove, and it makes the most sense in the sentence because the object of the verb is “need.” “Eliminating the need” is an idiomatic expression for “removing the need.”

Choices A, C, and D are incorrect. Although all the choices mean “to get rid of,” their connotations are different. “Annihilating” (choice A) is usually used to refer to the act of completely destroying, which is too intense in this context. “Ousting” (choice C) is generally used when referring to the act of forcibly removing a person from a position. “Closing the door on” (choice D) is a colloquial expression that usually means shutting out the possibility of something happening or not being willing to consider an idea. This expression doesn’t fit the tone of the passage and is not idiomatic when used with “need.”

### QUESTION 3

**Choice C is the best answer.** The singular present tense verb “increases” agrees in number with the singular noun “compost” and maintains the parallel structure of the other two compound verbs in the sentence, “minimizes” and “helps.”

Choices A and D are incorrect because the use of the pronoun “it” (choice A) and “also it” (choice D) to begin new independent clauses creates comma splices. Choice B is incorrect because “savings increase” doesn’t maintain the parallel structure of the verbs in the sentence: “minimizes water waste and storm runoff” and “helps reduce erosion.”

### QUESTION 4

**Choice B is the best answer.** When setting off nonessential information, a pair of parentheses needs to be used. This choice provides the initial parenthesis that the parenthesis after “municipality” requires.

Choice A is incorrect because the initial parenthesis is missing and no comma is needed between the noun “quantities” and the modifying information. Choice C is incorrect because the initial parenthesis is missing. Choice D is incorrect because no semicolon is needed before the parenthetical information.

## QUESTION 5

**Choice D is the best answer.** According to the information from the graph, 33 million tons of food waste were discarded in US landfills in 2009, which is consistent with the discussion of food waste in the passage.

Choices A, B, and C are incorrect because the passage thus far has focused on compost. Metal, rubber, leather, and textiles are not materials that are composted.

## QUESTION 6

**Choice C is the best answer.** According to the graph, this is the only choice that makes the sentence true. More food waste was discarded in landfills in 2009 “than any other substance, including plastics or paper.”

Choices A, B, and D are incorrect because they are not true, according to the graph. The graph indicates that less glass, metal, and yard waste were discarded in the landfills than plastics and paper.

## QUESTION 7

**Choice B is the best answer.** No comma is needed between the comparative adjective “worse” and the comparative conjunction “than.”

Choices A, C, and D are incorrect because the word “then” indicates “when” and is not used in comparisons (choices A and C), and no comma is needed after worse (choice D).

## QUESTION 8

**Choice C is the best answer.** The present tense singular verb “contributes” agrees in number with the singular noun “material,” and the present tense verb is consistent with the other present tense verbs in the passage.

Choices A and B are incorrect because “contribute” (choice A) and “are contributing” (choice B) are plural present tense verbs. Choice D is incorrect because “have contributed” is a plural past tense verb.

## QUESTION 9

**Choice A is the best answer.** “Potent” means strong or powerful, which makes sense in the context of discussing greenhouse gas.

Choice B is incorrect because “sturdy” is usually used to refer to the physical strength or solidity of something. Choice C is incorrect because “influential” refers to the power of a person to affect or sway others or events without any apparent effort. Choice D is incorrect because “commanding” indicates that the inanimate greenhouse gas is actually commanding something.

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## QUESTION 10

**Choice C is the best answer.** “Armed with these facts” is the most effective transition from the previous paragraph, which discusses the amounts of various substances that end up in landfills and the resulting methane gas that is released from the organic matter. The paragraph that this transition introduces goes on to discuss laws that some cities have instituted to control the handling of compost in landfills to reduce the release of methane gas.

Choices A, B, and D are incorrect because they do not offer transitions that indicate a connection between the problem identified in the previous paragraph—the release of dangerous methane gas from the compost in landfills—and the concluding paragraph that identifies what some cities have done to help alleviate the problem.

## QUESTION 11

**Choice A is the best answer.** No change is needed because the correlative conjunctions “either” and “or” are used together to indicate that one choice or another should be considered. In this sentence, residents are encouraged to choose the option to create their own compost piles or to dispose of compostable materials in bins for collection.

Choices B, C, and D are incorrect because they do not provide the correlating conjunction for “either” used earlier in the sentence.

## QUESTION 12

**Choice A is the best answer.** The sentences are effectively combined by placing a comma after “red” and making the second sentence an appositive that explains the significance of the color red.

Choices B, C, and D are incorrect because they all contain excessive words that add no meaning to the resulting sentence.

## QUESTION 13

**Choice D is the best answer.** Punctuation is not necessary in the underlined portion of the sentence.

Choice A is incorrect because no commas are needed after “festive” and “red” because the adjectives don’t equally modify “banners.” No comma is needed after “banners” because there is no reason to put one between “banners” and “and garlands,” the two objects of the preposition “with.” Choice B is incorrect because placing commas around the prepositional phrase “with festive red banners” wrongly indicates that the information is nonessential and could be eliminated without changing the meaning of the sentence. Choice C is incorrect because there should not be a dash or any other kind of punctuation between “banners” and “and garlands.”

**QUESTION 14**

**Choice C is the best answer.** This choice expands on the idea that the lion dance may have originated to ward off an evil spirit and that dressing in a lion costume was part of the effort to scare the spirit away.

Choice A is incorrect because it doesn't make a connection between the fierce quality of a lion and scaring away spirits. Choices B and D are incorrect because the name of the spirit (choice B) and the location of the village where the dance originated (choice D) are not as important as why a lion was incorporated into the dance.

**QUESTION 15**

**Choice C is the best answer.** It ties the information about the possible origins and historical purpose of the lion dance to its present purpose as a New Year's celebration of hope.

Choices A, B, and D are incorrect because they don't effectively bring the paragraph to a conclusion. Each of these options is vague and calls for elaboration: choice A lacks specific information, choice B lacks proof for the idea of irrelevance, and choice D lacks a connection to the subject of the paragraph.

**QUESTION 16**

**Choice A is the best answer.** The pronoun "both" and prepositional phrase "of whom" refer to "dancers" and are used correctly to introduce a clause that describes how the dancers are hidden by the lion costume. "Whom" is used correctly as the object of the preposition "of."

Choice B is incorrect because the word order doesn't make grammatical sense and the pronoun "which" can't be used to refer to people. Choices C and D are incorrect because they create comma splices.

**QUESTION 17**

**Choice D is the best answer.** The pronoun "those" correctly indicates that the moves in dance are being compared to the moves in martial arts. "Those" takes the place of the noun "moves" in the comparison.

Choices A, B, and C are incorrect because they do not compare similar things. "Moves" can't be compared to "martial arts," "acrobatics," "disciplines," "martial artists," or "acrobats."

**QUESTION 18**

**Choice B is the best answer.** This choice indicates that the phoenix represents new beginnings, which is consistent in content with the information explaining that the tortoise represents longevity. Additionally, this choice is presented as a parenthetical prepositional phrase beginning with the preposition "for," which is consistent in structure with the parenthetical prepositional phrase "for longevity."

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Choice A is incorrect because the parenthetical information indicates what a phoenix is, not what it represents. Furthermore, the information is not presented in a prepositional phrase. Choice C is incorrect because this choice indicates the source of the phoenix, not what it represents. Choice D is incorrect because it is vague and doesn't identify what the phoenix symbolizes.

### QUESTION 19

**Choice D is the best answer.** Sentence 5 most logically should follow sentence 7. The pronoun "their" in sentence 5 refers to the "black lions" (which are the youngest lions and dance quickly) in sentence 7. Sentence 5 indicates that the "older counterparts" to the young lions don't move as quickly.

Choices A, B, and C are incorrect because placing sentence 5 after any other sentence in the paragraph would not be logical and would interrupt the flow of the passage.

### QUESTION 20

**Choice B is the best answer.** The singular possessive pronoun "its" agrees in number with the singular antecedent "dance" and correctly indicates that the "climax" belongs to the dance.

Choice A is incorrect because "it's" is the contraction for "it is" and doesn't make sense in the sentence. Choice C is incorrect because "there" is not a possessive pronoun. Choice D is incorrect because "their" is a plural possessive pronoun that doesn't agree with the singular antecedent "dance."

### QUESTION 21

**Choice B is the best answer.** This choice correctly indicates that the lion is doing the approaching and the snaring, not the teeth.

Choices A and D are incorrect because the teeth don't do the approaching or the snaring; only an animate object can do either. Choice C is incorrect because it is written in the passive voice, which changes the subject of the sentence from "lion" to "envelope." Furthermore, an "envelope" cannot approach a doorway.

### QUESTION 22

**Choice D is the best answer.** The single word "envelope" is concise and clearly refers to the envelope that has been described earlier in the paragraph.

Choices A, B, and C are incorrect because they are wordy and contain information that has been given previously in the paragraph. Additionally, choice A contains inaccurate information because once the money has been chewed up, the envelope is no longer "money-filled."

**QUESTION 23**

**Choice A is the best answer.** No change is needed because “scrupulous” fits the formal tone of the passage. “Scrupulous” means exact and conscientious, and it is appropriate when discussing notes taken during a court proceeding.

Choices B and C are incorrect because they are too informal and therefore do not fit the tone of the passage. Choice D is incorrect because “intense” is an adjective that is used to describe something that is done to an extreme degree, such as putting forth effort or performing a physical act.

**QUESTION 24**

**Choice C is the best answer.** Commas after “hearings” and “depositions” are correct because they separate the first two items in a series of three.

Choices A, B, and D are incorrect because they all contain semicolons either after “hearings,” “depositions,” or both of the words. Semicolons can be used to separate items in a series that already contains commas, but not to separate individual items in a simple series of words or phrases.

**QUESTION 25**

**Choice C is the best answer.** The graph should not be added because it doesn’t support the information in the paragraph. The paragraph describes what a court reporter does. The graph provides information that compares the median salary of court reporters to that of other jobs.

Choices A and B are incorrect because the graph should not be added. It neither supports the claim that court reporting is an important part of a trial nor offers a relevant counterpoint to the argument that the use of digital recorders is on the rise. Choice D is incorrect because it doesn’t matter that there is no information provided in the graph about the pay scale for more experienced court reporters. The paragraph doesn’t deal with the subject of pay, so therefore the graph doesn’t support the paragraph.

**QUESTION 26**

**Choice A is the best answer.** No change needs to be made because the word “to” is the idiomatic preposition to connect “subject” with the phrase “human errors” to show that technology such as a digital recorder doesn’t make the same mistakes that people make, such as “mishearing or mistyping.”

Choices B and C are incorrect because the verb “subjected” is a transitive verb that requires a direct object, which is not present in the sentence. Furthermore, “subjected from” is not idiomatic. Choice D is incorrect because “subject for human errors” doesn’t make sense.



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## QUESTION 27

**Choice C is the best answer.** The preposition “as” means “functioning in the same way” or “in the capacity of.” The plural noun “record keepers” agrees in number with the plural noun “court reporters.” The sentence indicates that court reporters are functioning as record keepers.

Choices A and D are incorrect because the singular “record keeper” can’t be used to refer to plural “court reporters.” Additionally, in choice D the infinitive verb phrase “to be” can’t be used in place of a preposition. Choice B is incorrect because the word “each” is unnecessary and makes the sentence confusing.

## QUESTION 28

**Choice C is the best answer.** To make the paragraph most logical, sentence 6 should be placed after sentence 3. Sentence 3 explains that the words the recorder types are “instantaneously” available to a judge to view on a computer screen. Sentence 6 explains, by using the transition “however,” that even though words are available instantly, recording technology continues to improve and therefore the need for court reporters is decreasing.

Choices A, B, and D are incorrect because placing sentence 6 after any other sentence would not be logical and would interrupt the flow of the paragraph.

## QUESTION 29

**Choice B is the best answer.** The dash most effectively combines the two sentences. It correctly indicates that what follows is explanatory information. In this case, the information after the dash could be inferred from what has already been stated because the opposite of making fewer mistakes is making more mistakes. The information after the dash in this sentence makes the conclusion overt.

Choice A is incorrect because the word “such” indicates incorrectly that an example of something will follow it. Choices C and D are incorrect because they are wordy and not as succinct as using a dash.

## QUESTION 30

**Choice B is the best answer.** The comma is used correctly to separate the introductory dependent clause from the main independent clause that follows it.

Choice A is incorrect because a semicolon can’t be used to separate a dependent and an independent clause. Choice C is incorrect because a period can’t be used at the end of a dependent clause. Choice D is incorrect because the adverb “therefore” doesn’t make sense in this context; what follows does not result from something said earlier in the sentence.

**QUESTION 31**

**Choice B is the best answer.** “In other words” indicates correctly that what follows will be an elaboration of the idea that digital recorders can’t distinguish “important parts of the proceedings from other noises in the courtroom,” “such as a book dropping.”

Choices A, C, and D are incorrect because they don’t show the true relationship between the two sentences. “Despite this” means that in spite of something already said, what follows will be the case. “Therefore” and “consequently” indicate that what follows will be the result of something said earlier. None of these offers a further explanation of what was previously said.

**QUESTION 32**

**Choice D is the best answer.** The prepositional phrase “between the words and the extrinsic noises” clearly and concisely identifies what a court reporter is able to distinguish. It is also the only parallel option, using two noun phrases after “between,” which are joined by “and.”

Choice A is incorrect because it needlessly repeats “distinguish between.” Choice B is incorrect because it is not parallel or grammatical. Choice C is incorrect because it is wordy and wrongly suggests that court reporters distinguish between words and a time period (when).

**QUESTION 33**

**Choice D is the best answer.** The main idea of the paragraph is that court reporters can distinguish between words and extraneous noises in the courtroom, which digital recorders can’t always do. This choice offers an example of what can go wrong in a courtroom because digital recorders can’t always pick up “indistinct testimony”: the need for retrial because of indistinct testimony from witnesses.

Choices A, B, and C are incorrect because they don’t support the main idea of the paragraph. Making additional announcements at the beginning of a trial (choice A), monitoring to ensure equipment is functioning properly (choice B), and changing roles and duties of several members of the courtroom staff (choice C) are not examples of what can happen as a result of using digital recorders that can’t distinguish words from other courtroom noises.

**QUESTION 34**

**Choice B is the best answer.** The adverb “however” indicates that regardless of the conditions that affect “combustion and the resulting fire” on Earth, their behavior in space is different.

Choices A, C, and D are incorrect because they do not show the true relationship between the information that comes before and what follows the linking adverb. “Moreover” means that additional information will follow; “accordingly” means that what follows corresponds to

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what has already been said or that what follows is a consequence; and “subsequently” means that what follows happens after what was previously stated. None of these choices indicates the difference between the behaviors of combustion and fire on Earth and in space.

### QUESTION 35

**Choice D is the best answer.** The past tense verb “sought” clearly and concisely conveys the idea that the students were trying to find a method to study combustion of biofuels. Additionally, the word “biofuels” is correctly placed immediately in front of the parenthetical information that defines it to prevent confusion.

Choices A and B are incorrect because they are wordy and the word “biofuel” is not placed immediately in front of the parenthetical information that defines it. Choice C is incorrect because it uses the verb “looked,” which is not preferable to “sought” in this science context.

### QUESTION 36

**Choice A is the best answer.** No change needs to be made because the word “deformation” provides the most precise description of what results when fuel droplets lose their symmetrical form while burning. A droplet that is deformed loses some good attribute due to the influence of some external condition.

Choices B and D are incorrect because “alteration” and “modification” imply that something is changed on purpose. Choice C is incorrect because “transformation” means that one thing is changed into another. None of these choices is accurate when discussing the effect of “gravitational influence” and the “movement of molecules” on droplets of fuel.

### QUESTION 37

**Choice B is the best answer.** The plural verbs “cause” and “limit” agree in number with the plural pronoun “both,” which refers to the plural noun “variations.”

Choices A and C are incorrect because “causes” and “limits” are singular verbs that don’t agree in number with the plural pronoun “both.” Choice D is incorrect because “has caused” and “has limited” are also singular verbs. Additionally, they are present perfect tense verbs that are used to describe a past event that has an influence on the present, which is not the case in this context.

### QUESTION 38

**Choice D is the best answer.** The underlined portion should be deleted because “built for this purpose” repeats the idea of being “specially designed” used previously in the sentence.

Choices A, B, and C are incorrect because they are redundant. There is no reason to repeat the idea of “specially designed.”

**QUESTION 39**

**Choice B is the best answer.** This choice offers the most effective transition because it links the previously mentioned problems of conducting the biofuel experiment to the UCSD students' solution: participating in NASA's Microgravity University program.

Choices A, C, and D are incorrect because they don't link the previously identified problems with the specific solution: a program that could help the students overcome too little microgravity time and too small droplets.

**QUESTION 40**

**Choice D is the best answer.** The commas after "weightlessness" and "space" are used correctly to set off the nonessential information between them. The information between the commas could be removed and the sentence would still make sense.

Choice A is incorrect because it is missing the comma after "weightlessness." In this context, choices B and C are incorrect because the commas are misplaced. In each of these choices, if the information between the commas were removed, the sentence would not make sense.

**QUESTION 41**

**Choice A is the best answer.** The addition should be made because the information specifically identifies an advantage the students gained by working with NASA's Microgravity University program: not traveling to space.

Choice B is incorrect because it isn't accurate. The previous paragraph does suggest that the students didn't actually go into space by stating that researchers fly their experiments aboard aircraft that simulate the microgravity environment. Choices C and D are incorrect because the addition should be made. The addition neither shifts focus away from the students' experiences while on the flight nor restates what has already been said in the sentence.

**QUESTION 42**

**Choice D is the best answer.** This choice, "were able to investigate," focuses on what the flights enabled the UCSD students to do that they were not able to do previously using the drop towers. It is consistent with the previous sentence, which states what the flights allowed the students to do.

Choices A, B, and C are incorrect because their focus is on "investigating" and not on allowing or enabling the students to investigate combustion in an environment that provided larger droplets and microgravity similar to that experienced in space.

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### QUESTION 43

**Choice A is the best answer.** No change is needed because the larger “spherically symmetric” droplets indicate that the flights remedied the problem of smaller deformed droplets mentioned earlier in the passage.

Choices B, C, and D are incorrect because none of these choices refers to the size or shape of the biofuel droplets, which is what made the investigation of combustion and fire on Earth problematic.

### QUESTION 44

**Choice C is the best answer.** No comma is needed in the underlined phrase, which clearly and concisely expresses the improved techniques for fighting fires in space or at future outposts on the Moon and Mars that may result from better combustion-rate models.

Choices A and B are incorrect because the commas are incorrectly separating the prepositional phrases from the noun “techniques.” Choice D is incorrect because the pair of commas indicate that the information contained between them is nonessential, which isn’t accurate.

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice D is correct.** Combining like terms on each side of the given equation yields  $6x - 5 = 7 + 2x$ . Adding 5 to both sides of  $6x - 5 = 7 + 2x$  and subtracting  $2x$  from both sides yields  $4x = 12$ . Dividing both sides of  $4x = 12$  by 4 yields  $x = 3$ .

Choices A, B, and C are incorrect because substituting those values into the equation  $3x + x + x + x - 3 - 2 = 7 + x + x$  will result in a false statement. For example, in choice B, substituting 1 for  $x$  in the equation would give  $3(1) + 1 + 1 + 1 - 3 - 2 = 7 + 1 + 1$ , which yields the false statement  $1 = 9$ ; therefore,  $x$  cannot equal 1.

### QUESTION 2

**Choice A is correct.** The line passes through the origin. Therefore, this is a relationship of the form  $d = km$ , where  $k$  is a constant representing the slope of the graph. To find the value of  $k$ , choose a point  $(m, d)$  on the graph of the line other than the origin and substitute the values of  $m$  and  $d$  into the equation. For example, if the point  $(2, 4)$  is chosen, then  $4 = k(2)$ , and  $k = 2$ . Therefore, the equation of the line is  $d = 2m$ .

Choice B is incorrect and may result from calculating the slope of the line as the change in time over the change in distance traveled instead of the change in distance traveled over the change in time. Choices C and D are incorrect because each of these equations represents a line with a  $d$ -intercept of 2. However, the graph shows a line with a  $d$ -intercept of 0.

**QUESTION 3**

**Choice A is correct.** Multiplying both sides of the equation by 6 results in  $6E = O + 4M + P$ . Then, subtracting  $O + 4M$  from both sides of  $6E = O + 4M + P$  gives  $P = 6E - O - 4M$ .

Choice B is incorrect. This choice may result from solving for  $-P$  instead of for  $P$ . Choice C is incorrect and may result from transposing  $P$  with  $E$  in the given equation rather than solving for  $P$ . Choice D is incorrect and may result from transposing  $P$  with  $E$  and changing the sign of  $E$  rather than solving for  $P$ .

**QUESTION 4**

**Choice C is correct.** Since  $RT = TU$ , it follows that  $\triangle RTU$  is an isosceles triangle with base  $RU$ . Therefore,  $\angle TRU$  and  $\angle TUR$  are the base angles of an isosceles triangle and are congruent. Let the measures of both  $\angle TRU$  and  $\angle TUR$  be  $t^\circ$ . According to the triangle sum theorem, the sum of the measures of the three angles of a triangle is  $180^\circ$ . Therefore,  $114^\circ + 2t^\circ = 180^\circ$ , so  $t = 33$ .

Note that  $\angle TUR$  is the same angle as  $\angle SUV$ . Thus, the measure of  $\angle SUV$  is  $33^\circ$ . According to the triangle exterior angle theorem, an external angle of a triangle is equal to the sum of the opposite interior angles. Therefore,  $x^\circ$  is equal to the sum of the measures of  $\angle VSU$  and  $\angle SUV$ ; that is,  $31^\circ + 33^\circ = 64^\circ$ . Thus, the value of  $x$  is 64.

Choice B is incorrect. This is the measure of  $\angle STR$ , but  $\angle STR$  is not congruent to  $\angle SVR$ . Choices A and D are incorrect and may result from a calculation error.

**QUESTION 5**

**Choice B is correct.** It is given that the width of the dance floor is  $w$  feet. The length is 6 feet longer than the width; therefore, the length of the dance floor is  $w + 6$ . So the perimeter is  $w + w + (w + 6) + (w + 6) = 4w + 12$ .

Choice A is incorrect because it is the sum of one length and one width, which is only half the perimeter. Choice C is incorrect and may result from using the formula for the area instead of the formula for the perimeter and making a calculation error. Choice D is incorrect because this is the area, not the perimeter, of the dance floor.

**QUESTION 6**

**Choice B is correct.** Subtracting the same number from each side of an inequality gives an equivalent inequality. Hence, subtracting 1 from each side of the inequality  $2x > 5$  gives  $2x - 1 > 4$ . So the given system of inequalities is equivalent to the system of inequalities  $y > 2x - 1$  and  $2x - 1 > 4$ , which can be rewritten as  $y > 2x - 1 > 4$ . Using the transitive property of inequalities, it follows that  $y > 4$ .

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Choice A is incorrect because there are points with a  $y$ -coordinate less than 6 that satisfy the given system of inequalities. For example,  $(3, 5.5)$  satisfies both inequalities. Choice C is incorrect. This may result from solving the inequality  $2x > 5$  for  $x$ , then replacing  $x$  with  $y$ . Choice D is incorrect because this inequality allows  $y$ -values that are not the  $y$ -coordinate of any point that satisfies both inequalities. For example,  $y = 2$  is contained in the set  $y > \frac{3}{2}$ ; however, if 2 is substituted into the first inequality for  $y$ , the result is  $x < \frac{3}{2}$ . This cannot be true because the second inequality gives  $x > \frac{5}{2}$ .

### QUESTION 7

**Choice B is correct.** Subtracting 4 from both sides of  $\sqrt{2x+6} + 4 = x + 3$  isolates the radical expression on the left side of the equation as follows:  $\sqrt{2x+6} = x - 1$ . Squaring both sides of  $\sqrt{2x+6} = x - 1$  yields  $2x + 6 = x^2 - 2x + 1$ . This equation can be rewritten as a quadratic equation in standard form:  $x^2 - 4x - 5 = 0$ . One way to solve this quadratic equation is to factor the expression  $x^2 - 4x - 5$  by identifying two numbers with a sum of  $-4$  and a product of  $-5$ . These numbers are  $-5$  and  $1$ . So the quadratic equation can be factored as  $(x - 5)(x + 1) = 0$ . It follows that  $5$  and  $-1$  are the solutions to the quadratic equation. However, the solutions must be verified by checking whether  $5$  and  $-1$  satisfy the original equation,  $\sqrt{2x+6} + 4 = x + 3$ . When  $x = -1$ , the original equation gives  $\sqrt{2(-1)+6} + 4 = (-1) + 3$ , or  $6 = 2$ , which is false. Therefore,  $-1$  does not satisfy the original equation. When  $x = 5$ , the original equation gives  $\sqrt{2(5)+6} + 4 = 5 + 3$ , or  $8 = 8$ , which is true. Therefore,  $x = 5$  is the only solution to the original equation, and so the solution set is  $\{5\}$ .

Choices A, C, and D are incorrect because each of these sets contains at least one value that results in a false statement when substituted into the given equation. For instance, in choice D, when  $0$  is substituted for  $x$  into the given equation, the result is  $\sqrt{2(0)+6} + 4 = (0) + 3$ , or  $\sqrt{6} + 4 = 3$ . This is not a true statement, so  $0$  is not a solution to the given equation.

### QUESTION 8

**Choice D is correct.** Since  $x^3 - 9x = x(x+3)(x-3)$  and  $x^2 - 2x - 3 = (x+1)(x-3)$ , the fraction  $\frac{f(x)}{g(x)}$  can be written as  $\frac{x(x+3)(x-3)}{(x+1)(x-3)}$ . It is given that  $x > 3$ , so the common factor  $x - 3$  is not equal to  $0$ . Therefore, the fraction can be further simplified to  $\frac{x(x+3)}{x+1}$ .

Choice A is incorrect. The expression  $\frac{1}{x+1}$  is not equivalent to  $\frac{f(x)}{g(x)}$  because at  $x = 0$ ,  $\frac{1}{x+1}$  has a value of 1 and  $\frac{f(x)}{g(x)}$  has a value of 0.

Choice B is incorrect and results from omitting the factor  $x$  in the factorization of  $f(x)$ . Choice C is incorrect and may result from incorrectly factoring  $g(x)$  as  $(x+1)(x+3)$  instead of  $(x+1)(x-3)$ .

## QUESTION 9

**Choice A is correct.** The standard form for the equation of a circle is  $(x-h)^2 + (y-k)^2 = r^2$ , where  $(h, k)$  are the coordinates of the center and  $r$  is the length of the radius. According to the given equation, the center of the circle is  $(6, -5)$ . Let  $(x_1, y_1)$  represent the coordinates of point  $Q$ . Since point  $P(10, -5)$  and point  $Q(x_1, y_1)$  are the endpoints of a diameter of the circle, the center  $(6, -5)$  lies on the diameter, halfway between  $P$  and  $Q$ . Therefore, the following relationships hold:  $\frac{x_1 + 10}{2} = 6$  and  $\frac{y_1 + (-5)}{2} = -5$ . Solving the equations for  $x_1$  and  $y_1$ , respectively, yields  $x_1 = 2$  and  $y_1 = -5$ . Therefore, the coordinates of point  $Q$  are  $(2, -5)$ .

Alternate approach: Since point  $P(10, -5)$  on the circle and the center of the circle  $(6, -5)$  have the same  $y$ -coordinate, it follows that the radius of the circle is  $10 - 6 = 4$ . In addition, the opposite end of the diameter  $\overline{PQ}$  must have the same  $y$ -coordinate as  $P$  and be 4 units away from the center. Hence, the coordinates of point  $Q$  must be  $(2, -5)$ .

Choices B and D are incorrect because the points given in these choices lie on a diameter that is perpendicular to the diameter  $\overline{PQ}$ . If either of these points were point  $Q$ , then  $\overline{PQ}$  would not be the diameter of the circle. Choice C is incorrect because  $(6, -5)$  is the center of the circle and does not lie on the circle.

## QUESTION 10

**Choice C is correct.** Let  $x$  represent the number of 2-person tents and let  $y$  represent the number of 4-person tents. It is given that the total number of tents was 60 and the total number of people in the group was 202. This situation can be expressed as a system of two equations,  $x + y = 60$  and  $2x + 4y = 202$ . The first equation can be rewritten as  $y = -x + 60$ . Substituting  $-x + 60$  for  $y$  in the equation  $2x + 4y = 202$  yields  $2x + 4(-x + 60) = 202$ . Distributing and combining like terms gives  $-2x + 240 = 202$ . Subtracting 240 from both sides of  $-2x + 240 = 202$  and then dividing both sides by  $-2$  gives  $x = 19$ . Therefore, the number of 2-person tents is 19.

Alternate approach: If each of the 60 tents held 4 people, the total number of people that could be accommodated in tents would be 240. However, the actual number of people who slept in tents was 202. The difference of 38 accounts for the 2-person tents. Since each of these tents holds 2 people fewer than a 4-person tent,  $\frac{38}{2} = 19$  gives the number of 2-person tents.



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Choice A is incorrect. This choice may result from assuming exactly half of the tents hold 2 people. If that were true, then the total number of people who slept in tents would be  $2(30) + 4(30) = 180$ ; however, the total number of people who slept in tents was 202, not 180.

Choice B is incorrect. If 20 tents were 2-person tents, then the remaining 40 tents would be 4-person tents. Since all the tents were filled to capacity, the total number of people who slept in tents would be  $2(20) + 4(40) = 40 + 160 = 200$ ; however, the total number of people who slept in tents was 202, not 200. Choice D is incorrect. If 18 tents were 2-person tents, then the remaining 42 tents would be 4-person tents. Since all the tents were filled to capacity, the total number of people who slept in tents would be  $2(18) + 4(42) = 36 + 168 = 204$ ; however, the total number of people who slept in tents was 202, not 204.

### QUESTION 11

**Choice B is correct.** The  $x$ -coordinates of the  $x$ -intercepts of the graph are  $-3$ ,  $0$ , and  $2$ . This means that if  $y = f(x)$  is the equation of the graph, where  $f$  is a polynomial function, then  $(x + 3)$ ,  $x$ , and  $(x - 2)$  are factors of  $f$ . Of the choices given, A and B have the correct factors. However, in choice A,  $x$  is raised to the first power, and in choice B,  $x$  is raised to the second power. At  $x = 0$ , the graph touches the  $x$ -axis but doesn't cross it. This means that  $x$ , as a factor of  $f$ , is raised to an even power. If  $x$  were raised to an odd power, then the graph would cross the  $x$ -axis. Alternatively, in choice A,  $f$  is a third-degree polynomial, and in choice B,  $f$  is a fourth-degree polynomial. The  $y$ -coordinates of points on the graph become large and positive as  $x$  becomes large and negative; this is consistent with a fourth-degree polynomial, but not with a third-degree polynomial. Therefore, of the choices given, only choice B could be the equation of the graph.

Choice A is incorrect. The graph of the equation in this answer choice has the correct factors. However, at  $x = 0$  the graph of the equation in this choice crosses the  $x$ -axis; the graph shown touches the  $x$ -axis but doesn't cross it. Choices C and D are incorrect and are likely the result of misinterpreting the relationship between the  $x$ -intercepts of a graph of a polynomial function and the factors of the polynomial expression.

### QUESTION 12

**Choice D is correct.** Dividing both sides of equation  $\frac{2a}{b} = \frac{1}{2}$  by 2 gives  $\frac{a}{b} = \frac{1}{4}$ . Taking the reciprocal of both sides yields  $\frac{b}{a} = 4$ .

Choice A is incorrect. This is the value of  $\frac{a}{2b}$ , not  $\frac{b}{a}$ . Choice B is incorrect. This is the value of  $\frac{a}{b}$ , not  $\frac{b}{a}$ . Choice C is incorrect. This is the value of  $\frac{b}{2a}$ , not  $\frac{b}{a}$ .

### QUESTION 13

**Choice C is correct.** It is assumed that the oil and gas production decreased at a constant rate. Therefore, the function  $f$  that best models the production  $t$  years after the year 2000 can be written as a linear function,  $f(t) = mt + b$ , where  $m$  is the rate of change of the oil and gas production and  $b$  is the oil and gas production, in millions of barrels, in the year 2000. Since there were 4 million barrels of oil and gas produced in 2000,  $b = 4$ . The rate of change,  $m$ , can be calculated as  $\frac{4 - 1.9}{0 - 13} = -\frac{2.1}{13}$ , which is equivalent to  $-\frac{21}{130}$ , the rate of change in choice C.

Choices A and B are incorrect because each of these functions has a positive rate of change. Since the oil and gas production decreased over time, the rate of change must be negative. Choice D is incorrect. This model may result from misinterpreting 1.9 million barrels as the amount by which the production decreased.

### QUESTION 14

**Choice C is correct.** The second equation of the system can be rewritten as  $y = 5x - 8$ . Substituting  $5x - 8$  for  $y$  in the first equation gives  $5x - 8 = x^2 + 3x - 7$ . This equation can be solved as shown below:

$$x^2 + 3x - 7 - 5x + 8 = 0$$

$$x^2 - 2x + 1 = 0$$

$$(x - 1)^2 = 0$$

$$x = 1$$

Substituting 1 for  $x$  in the equation  $y = 5x - 8$  gives  $y = -3$ . Therefore,  $(1, -3)$  is the only solution to the system of equations.

Choice A is incorrect. In the  $xy$ -plane, a parabola and a line can intersect at no more than two points. Since the graph of the first equation is a parabola and the graph of the second equation is a line, the system cannot have more than 2 solutions. Choice B is incorrect. There is a single ordered pair  $(x, y)$  that satisfies both equations of the system. Choice D is incorrect because the ordered pair  $(1, -3)$  satisfies both equations of the system.

### QUESTION 15

**Choice D is correct.** Since  $h(x) = 1 - g(x)$ , substituting 0 for  $x$  yields  $h(0) = 1 - g(0)$ . Evaluating  $g(0)$  gives  $g(0) = 2(0) - 1 = -1$ . Therefore,  $h(0) = 1 - (-1) = 2$ .

Choice A is incorrect. This choice may result from an arithmetic error. Choice B is incorrect. This choice may result from incorrectly evaluating  $g(0)$  to be 1. Choice C is incorrect. This choice may result from evaluating  $1 - 0$  instead of  $1 - g(0)$ .

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### QUESTION 16

**The correct answer is 3.** The solution to the given equation can be found by factoring the quadratic expression. The factors can be determined by finding two numbers with a sum of 1 and a product of  $-12$ . The two numbers that meet these constraints are 4 and  $-3$ . Therefore, the given equation can be rewritten as  $(x + 4)(x - 3) = 0$ . It follows that the solutions to the equation are  $x = -4$  or  $x = 3$ . Since it is given that  $a > 0$ ,  $a$  must equal 3.

### QUESTION 17

**The correct answer is 32.** The sum of the given expressions is  $(-2x^2 + x + 31) + (3x^2 + 7x - 8)$ . Combining like terms yields  $x^2 + 8x + 23$ . Based on the form of the given equation,  $a = 1$ ,  $b = 8$ , and  $c = 23$ . Therefore,  $a + b + c = 32$ .

Alternate approach: Because  $a + b + c$  is the value of  $ax^2 + bx + c$  when  $x = 1$ , it is possible to first make that substitution into each polynomial before adding them. When  $x = 1$ , the first polynomial is equal to  $-2 + 1 + 31 = 30$  and the second polynomial is equal to  $3 + 7 - 8 = 2$ . The sum of 30 and 2 is 32.

### QUESTION 18

**The correct answer is  $\frac{3}{2}$ .** One method for solving the system of equations for  $y$  is to add corresponding sides of the two equations. Adding the left-hand sides gives  $(-x + y) + (x + 3y)$ , or  $4y$ . Adding the right-hand sides yields  $-3.5 + 9.5 = 6$ . It follows that  $4y = 6$ . Finally, dividing both sides of  $4y = 6$  by 4 yields  $y = \frac{6}{4}$  or  $\frac{3}{2}$ . Any of  $3/2$ ,  $6/4$ ,  $9/6$ ,  $12/8$  or the decimal equivalent 1.5 will be scored as correct.

### QUESTION 19

**The correct answer is 8.** The number of employees,  $y$ , expected to be employed by the company  $x$  quarters after the company opened can be modeled by the equation  $y = ax + b$ , where  $a$  represents the constant rate of change in the number of employees each quarter and  $b$  represents the number of employees with which the company opened. The company's growth plan assumes that 2 employees will be hired each quarter, so  $a = 2$ . The number of employees the company opened with was 8, so  $b = 8$ .

### QUESTION 20

**The correct answer is 144.** In a circle, the ratio of the length of a given arc to the circle's circumference is equal to the ratio of the measure of the arc, in degrees, to  $360^\circ$ . The ratio between the arc length and the circle's circumference is given as  $\frac{2}{5}$ . It follows that  $\frac{2}{5} = \frac{x}{360}$ . Solving this proportion for  $x$  gives  $x = 144$ .

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice A is correct.** If one pound of grapes costs \$2, two pounds of grapes will cost 2 times \$2, three pounds of grapes will cost 3 times \$2, and so on. Therefore,  $c$  pounds of grapes will cost  $c$  times \$2, which is  $2c$  dollars.

Choice B is incorrect and may result from incorrectly adding instead of multiplying. Choice C is incorrect and may result from assuming that  $c$  pounds cost \$2, and then finding the cost per pound. Choice D is incorrect and could result from incorrectly assuming that 2 pounds cost \$ $c$ , and then finding the cost per pound.

### QUESTION 2

**Choice C is correct.** According to the graph, the number of figurines decreased between 1 and 2 months and between 3 and 4 months. Because the line segment between 3 and 4 months is steeper than the line segment between 1 and 2 months, it follows that the number of figurines decreased the fastest between 3 and 4 months.

Choice A is incorrect. Between 1 and 2 months, the number of figurines decreased. However, the number of figurines decreased faster during the interval between 3 and 4 months. Choices B and D are incorrect. The number of figurines during these intervals was increasing, not decreasing.

### QUESTION 3

**Choice A is correct.** The fraction of the cars in the random sample that have a manufacturing defect is  $\frac{3}{200} = 0.015$ . At this rate, out of 10,000 cars there would be  $0.015 \times 10,000 = 150$  cars that have a manufacturing defect.

Choices B, C, and D are incorrect because the fractions of cars in the population that have a defect,  $\frac{200}{10,000} = 0.02$  in choice B,  $\frac{250}{10,000} = 0.025$  in choice C, and  $\frac{300}{10,000} = 0.03$  in choice D, are all different from the fraction of cars in the sample with a manufacturing defect, which is 0.015.

### QUESTION 4

**Choice C is correct.** The given line of best fit can be used to predict the length when the width is known. The equation of the line of best fit is given as  $y = 1.67x + 21.1$ , where  $x$  is the width in millimeters and  $y$  is the predicted length in millimeters. If the width of the petal is 19 millimeters, then  $x = 19$  and  $y = 1.67(19) + 21.1 = 52.83$ .

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Choice A is incorrect and may result from incorrectly using  $x = 0$  in the equation. Choice B is incorrect and may result from neglecting to add 21.1 in the computation. Choice D is incorrect and may result from an arithmetic error.

### QUESTION 5

**Choice B is correct.** Let the measure of the third angle in the smaller triangle be  $a^\circ$ . Since lines  $\ell$  and  $m$  are parallel and cut by transversals, it follows that the corresponding angles formed are congruent.

So  $a^\circ = y^\circ = 20^\circ$ . The sum of the measures of the interior angles of a triangle is  $180^\circ$ , which for the interior angles in the smaller triangle yields  $a + x + z = 180$ . Given that  $z = 60$  and  $a = 20$ , it follows that  $20 + x + 60 = 180$ . Solving for  $x$  gives  $x = 180 - 60 - 20$ , or  $x = 100$ .

Choice A is incorrect and may result from incorrectly assuming that angles  $x + z = 180$ . Choice C is incorrect and may result from incorrectly assuming that the smaller triangle is a right triangle, with  $x$  as the right angle. Choice D is incorrect and may result from a misunderstanding of the exterior angle theorem and incorrectly assuming that  $x = y + z$ .

### QUESTION 6

**Choice D is correct.** Since only two types of tickets were sold and a total of 350 tickets were sold, the sum of the numbers of both types of ticket sold must be 350. Therefore,  $B + L = 350$ . Since the bench tickets were \$75 each, the income from  $B$  bench tickets was  $75B$ . Similarly, since the lawn tickets were \$40 each, the income from  $L$  lawn tickets sold was  $40L$ . The total income from all tickets was \$19,250. So the sum of the income from bench tickets and lawn tickets sold must equal 19,250. Therefore,  $75B + 40L = 19,250$ . Only choice D has both correct equations.

Choice A is incorrect and may result from incorrectly multiplying the income from each type of ticket instead of adding them. It also incorrectly uses 1,950 instead of 19,250. Choice B is incorrect and may result from confusing the cost of bench tickets with the cost of lawn tickets. Choice C is incorrect and may result from confusing the total number of tickets sold with the total amount raised.

### QUESTION 7

**Choice C is correct.** The graph of an equation given in the form  $y = mx + b$  has slope  $m$ . The equation in choice C is  $y = 3x + 2$ , so the slope of its graph is 3.

Choices A, B, and D are incorrect. They are all given in the form  $y = mx + b$ , where  $m$  is the slope. Therefore, choice A has a graph with a slope of  $\frac{1}{3}$ , choice B has a graph with a slope of 1 (because  $x = 1 \cdot x$ ), and choice D has a graph with a slope of 6.

**QUESTION 8**

**Choice B is correct.** Multiplying both sides of the equation by  $x + 1$  gives  $(x + 1)^2 = 2$ . This means  $x + 1$  is a number whose square is 2, so  $(x + 1)$  is either  $\sqrt{2}$  or  $-\sqrt{2}$ . Therefore,  $\sqrt{2}$  is a possible value for  $x + 1$ .

Choice A is incorrect and may result from trying to find the value of  $x$  instead of  $x + 1$  and making a sign error. Choice C is incorrect and may result from solving for  $(x + 1)^2$  instead of  $x + 1$ . Choice D is incorrect and may result from squaring instead of taking the square root to find the value of  $x + 1$ .

**QUESTION 9**

**Choice D is correct.** Using the volume formula  $V = \frac{7\pi k^3}{48}$  and the given information that the volume of the glass is 473 cubic centimeters, the value of  $k$  can be found as follows:

$$473 = \frac{7\pi k^3}{48}$$

$$k^3 = \frac{473(48)}{7\pi}$$

$$k = \sqrt[3]{\frac{473(48)}{7\pi}} \approx 10.10690$$

Therefore, the value of  $k$  is approximately 10.11 centimeters.

Choices A, B, and C are incorrect. Substituting the values of  $k$  from these choices in the formula results in volumes of approximately 7 cubic centimeters, 207 cubic centimeters, and 217 cubic centimeters, respectively, all of which contradict the given information that the volume of the glass is 473 cubic centimeters.

**QUESTION 10**

**Choice C is correct.** Due to the shape of the glass, if the water is poured at a constant rate, the height of the water level will increase faster initially, where the diameter of the glass is smaller, and increase more slowly later, as the diameter of the glass increases. Choice C is the only graph that shows this behavior: it is steeper initially and then gets less steep.

Choice A is incorrect since it shows the height of the water level increasing at a constant rate over time. Choice B is incorrect since it shows the height of the water level increasing slowly at first and faster later. Choice D is incorrect since it shows the height of the water level staying constant even as water is being poured into the glass.

**QUESTION 11**

**Choice B is correct.** It is given that the volume of the glass is approximately 16 fluid ounces. If Jenny has 1 gallon of water, which is 128 fluid ounces, she could fill the glass  $\frac{128}{16} = 8$  times.

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Choice A is incorrect because Jenny would need  $16 \times 16$  fluid ounces = 256 fluid ounces, or 2 gallons, of water to fill the glass 16 times. Choice C is incorrect because Jenny would need only  $4 \times 16$  fluid ounces = 64 fluid ounces of water to fill the glass 4 times. Choice D is incorrect because Jenny would need only  $3 \times 16$  fluid ounces = 48 fluid ounces to fill the glass 3 times.

## QUESTION 12

**Choice C is correct.** Since Roberto sells only two types of policies and he didn't meet his goal of selling at least 57 policies, the sum of  $x$ , the number of \$50,000 policies, and  $y$ , the number of \$100,000 policies, must be less than 57. Symbolically, that is  $x + y < 57$ . The total value, in dollars, from selling  $x$  number of \$50,000 policies is  $50,000x$ . The total value, in dollars, from selling  $y$  number of \$100,000 policies is  $100,000y$ . Since the total value of the policies he sold was over \$3,000,000, it follows that  $50,000x + 100,000y > 3,000,000$ . Only choice C has both correct inequalities.

Choice A is incorrect because the total value, in dollars, of the policies Roberto sold was greater than, not less than, 3,000,000. Choice B is incorrect because Roberto didn't meet his goal, so  $x + y$  should be less than, not greater than, 57. Choice D is incorrect because both inequalities misrepresent the situation.

## QUESTION 13

**Choice C is correct.** Since  $a$  has the exponent  $-\frac{1}{2}$ ,  $a$  can be isolated by raising both sides of the equation to the  $-2$  power.

$$a^{(-\frac{1}{2})(-2)} = x^{-2}$$

$$a = x^{-2}$$

$$a = \frac{1}{x^2}$$

Alternate method:

$$a^{-\frac{1}{2}} = \frac{1}{a^{\frac{1}{2}}} = \frac{1}{\sqrt{a}}$$

So,

$$\frac{1}{\sqrt{a}} = x$$

Square both sides of the equation:

$$\frac{1}{a} = x^2$$

Then take the reciprocal of both sides:

$$a = \frac{1}{x^2}$$

Choice A is incorrect and may result from incorrectly taking the square root of both sides to eliminate the exponent of  $a$ . Choice B is incorrect and may result from incorrectly taking the square root of both sides to eliminate the exponent of  $a$ , and incorrectly multiplying by  $-1$  to make the exponent positive. Choice D is incorrect and may result from incorrectly multiplying by  $-1$  to make the exponent positive.

**QUESTION 14**

**Choice D is correct.** A rational expression is undefined when the denominator is 0. To determine the values of  $x$  that result in a denominator of 0, set the denominator equal to 0 and solve for  $x$ :

$$x^2 + 3x - 10 = 0$$

$$(x + 5)(x - 2) = 0$$

$$x + 5 = 0 \text{ or } x - 2 = 0$$

$$x = -5 \text{ or } x = 2$$

Among the answer choices, only the value  $x = 2$  is listed, so choice D is correct.

Choice A is incorrect. When  $x = -3$ , the denominator is  $(-3)^2 + 3(-3) - 10 = -10$ , so the given expression is not undefined. Choice B is incorrect and may result from incorrectly factoring the denominator or incorrectly assuming that if  $(x - 2)$  is a factor, then  $x = -2$  is a solution. Choice C is incorrect and may result from giving the value of the denominator that makes the given expression undefined rather than the value of  $x$  that makes the denominator equal to 0.

**QUESTION 15**

**Choice D is correct.** Since density is mass per unit volume, the mass is the density times volume. The volume of a right rectangular prism is the product of the lengths of the sides. Therefore:

$$\begin{aligned} \text{mass} &= (2.8 \text{ grams per cubic centimeter}) \times \\ & (30 \text{ centimeters} \times 40 \text{ centimeters} \times 50 \text{ centimeters}) \end{aligned}$$

$$\text{mass} = (2.8 \text{ grams per cubic centimeter}) \times (60,000 \text{ cubic centimeters})$$

$$\text{mass} = 168,000 \text{ grams}$$

Choice A is incorrect and may result from adding, instead of multiplying, the lengths of the sides to find the volume. Choice B is incorrect and may result from the same error as in choice A, as well as a place value error. Choice C is incorrect and may result from a place value error when finding the volume.

**QUESTION 16**

**Choice B is correct.** A total of 150 adults received the sugar pill. Of those, 33 reported contracting a cold. Therefore,  $\frac{33}{150}$ , or the equivalent  $\frac{11}{50}$ , is the proportion of adults receiving a sugar pill who reported contracting a cold.



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Choice A is incorrect. This is the proportion of adults receiving a sugar pill and contracting a cold to all adults contracting a cold  $\left(\frac{33}{54}\right)$ .  
Choice C is incorrect. This is the proportion of adults who reported contracting a cold to all the participants in the study  $\left(\frac{54}{300} = \frac{9}{50}\right)$ .  
Choice D is incorrect. This is the proportion of adults who received a sugar pill and reported contracting a cold to all the participants in the study  $\left(\frac{33}{300} = \frac{11}{100}\right)$ .

### QUESTION 17

**Choice A is correct.** The mode is the data value with the highest frequency. So for the data shown, the mode is 18. The median is the middle data value when the data values are sorted from least to greatest. Since there are 20 ages ordered, the median is the average of the two middle values, the 10th and 11th, which for these data are both 19. Therefore, the median is 19. The mean is the sum of the data values divided by the number of the data values. So for these data, the mean is  $\frac{(18 \times 6) + (19 \times 5) + (20 \times 4) + (21 \times 2) + (22 \times 1) + (23 \times 1) + (30 \times 1)}{20} = 20$ .

Since the mode is 18, the median is 19, and the mean is 20,  
mode < median < mean.

Choice B and D are incorrect because the mean is greater than the median. Choice C is incorrect because the median is greater than the mode.

Alternate approach: After determining the mode, 18, and the median, 19, it remains to determine whether the mean is less than 19 or more than 19. Because the mean is a balancing point, there is as much deviation below the mean as above the mean. It is possible to compare the data to 19 to determine the balance of deviation above and below the mean. There is a total deviation of only 6 below 19 (the 6 values of 18); however, the data value 30 alone deviates by 11 above 19. Thus the mean must be greater than 19.

### QUESTION 18

**Choice C is correct.** Based on the line of best fit shown, the predicted percent of leaf litter mass remaining for a forest with a mean annual temperature of  $-2^{\circ}\text{C}$  is about 70%.

Choice A is incorrect; it is the predicted percent of leaf litter mass remaining at about  $6.5^{\circ}\text{C}$ . Choice B is incorrect; it is the predicted percent of leaf litter mass remaining at  $2^{\circ}\text{C}$  instead of at  $-2^{\circ}\text{C}$ .

Choice D is incorrect; it is the predicted percent of leaf litter mass remaining at about  $-7^{\circ}\text{C}$ .

**QUESTION 19**

**Choice A is correct.** Since zeros of  $f$  correspond to the  $x$ -intercepts of the graph of  $f$ , and the range of  $f$  gives all the possible  $y$ -values on the graph of the function, the correct graph of the function has only points with  $y$ -values less than or equal to 4, and crosses the  $x$ -axis at only  $(-3, 0)$  and  $(1, 0)$ . The graph in choice A satisfies both of these conditions.

Choice B is incorrect. The graph of the function matches the range given, but the zeros are at  $-1$  and  $3$ , not  $-3$  and  $1$ . Choice C is incorrect. The graph has  $y$ -values greater than 4. Choice D is incorrect. Even though the graph has zeros at  $-3$  and  $1$ , it has an additional zero at  $0$ , and the range of the graph is the set of all real numbers.

**QUESTION 20**

**Choice B is correct.** The savings each year from installing the geothermal heating system will be the average annual energy cost for the home before the geothermal heating system installation minus the average annual energy cost after the geothermal heating system installation, which is  $(4,334 - 2,712)$  dollars. In  $t$  years, the savings will be  $(4,334 - 2,712)t$  dollars. Therefore, the inequality that can be solved to find the number of years after installation at which the total amount of energy cost savings will exceed (be greater than) the installation cost, \$25,000, is  $25,000 < (4,334 - 2,712)t$ .

Choice A is incorrect. It gives the number of years after installation at which the total amount of energy cost savings will be less than the installation cost. Choice C is incorrect and may result from subtracting the average annual energy cost for the home from the onetime cost of the geothermal heating system installation. To find the predicted total savings, the predicted average cost should be subtracted from the average annual energy cost before the installation, and the result should be multiplied by the number of years,  $t$ . Choice D is incorrect and may result from misunderstanding the context. The ratio  $\frac{4,332}{2,712}$  compares the average energy cost before installation and the average energy cost after installation; it does not represent the savings.

**QUESTION 21**

**Choice D is correct.** The number 3.39 in the equation  $y = 3.39x + 46.89$  is the slope, which is the change in  $y$  per unit change in  $x$ . Because  $y$  represents the amount of plastic produced annually, in billions of pounds, and  $x$  represents the number of years since 1985, the number 3.39 represents the rate of change of the amount of plastic produced with respect to time, in units of billions of pounds per year. The change is an increase since 3.39 is positive, and it is described as an average change because the data show increases that are sometimes more and sometimes less than 3.39.

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Choice A is incorrect. It is the interpretation of the number 46.89 in the line of best fit equation,  $y = 3.39x + 46.89$ . Choices B and C are incorrect because they are expressed in the wrong units. The number 3.39 has units of billions of pounds per year, but choice B has units of years and choice C has units of billions of pounds.

## QUESTION 22

**Choice A is correct.** Since  $x$  is the number of years since 1985, the year 2000 corresponds to  $x = 15$  and the year 2003 corresponds to  $x = 18$ . The corresponding points on the line of best fit are approximately (15, 98) and (18, 107). This means that approximately 98 billion pounds of plastic were produced in 2000 and approximately 107 billion pounds of plastic were produced in 2003. To calculate the percent increase, subtract the amount of plastic produced in 2000 from the amount of plastic produced in 2003 and then divide the result by the amount of plastic produced in 2000 and multiply by 100. This yields  $\left(\frac{107 - 98}{98}\right) \cdot 100 = 9.2$ , or approximately 10%.

Choices B and C are incorrect and may be the result of misreading the graph or making an arithmetic error. Choice D is incorrect and may be the result of approximating the amount of plastic produced, in billions of pounds, in the year 2003 ( $x = 18$ ).

## QUESTION 23

**Choice A is correct.** In 1 year, there are 4 quarter years, so the number of quarter years,  $q$ , is 4 times the number of years,  $t$ ; that is,  $q = 4t$ . This is equivalent to  $t = \frac{q}{4}$ , and substituting this into the expression for  $M$  in terms of  $t$  gives  $M = 1,800(1.02)^{\frac{q}{4}}$ .

Choices B and D are incorrect and may be the result of incorrectly using  $t = 4q$ . In choice D,  $1.02^{4q} = 1.02^{4(q)}$ , which is approximately  $1.082^q$ . Choice C is incorrect and may be the result of incorrectly using  $t = 4q$  and unnecessarily dividing 0.02 by 4.

## QUESTION 24

**Choice D is correct.** It is given that Contestant 2 earned 70% of the votes cast using social media and 40% of the votes cast using a text message. Based on this information, viewers voting by social media were more likely to prefer Contestant 2 than were viewers voting by text message.

Choices A, B, and C are incorrect. There is not enough information about the viewers to reach these conclusions.

### QUESTION 25

**Choice A is correct.** It is given that the relationship between population and year is linear; therefore, the function that models the population  $t$  years after 2000 is of the form  $P(t) = mt + b$ , where  $m$  is the slope and  $b$  is the population when  $t = 0$ .

In the year 2000,  $t = 0$ . Therefore,  $b = 862$ . The slope is given by

$$m = \frac{P(10) - P(0)}{10 - 0} = \frac{846 - 862}{10 - 0} = \frac{-16}{10} = -1.6. \text{ Therefore, } P(t) = -1.6t + 862,$$

which is equivalent to the equation in choice A.

Choice B is incorrect and may be the result of incorrectly calculating the slope as just the change in the value of  $P$ . Choice C is incorrect and may be the result of the same error as in choice B, in addition to incorrectly using  $t$  to represent the year, instead of the number of years after 2000. Choice D is incorrect and may be the result of incorrectly using  $t$  to represent the year instead of the number of years after 2000.

### QUESTION 26

**Choice C is correct.** In order to use a sample mean to estimate the mean for a population, the sample must be representative of the population (for example, a simple random sample). In this case, Tabitha surveyed 20 families in a playground. Families in the playground are more likely to have children than other households in the community. Therefore, the sample isn't representative of the population. Hence, the sampling method is flawed and may produce a biased estimate.

Choices A and D are incorrect because they incorrectly assume the sampling method is unbiased. Choice B is incorrect because a sample of size 20 could be large enough to make an estimate if the sample had been representative of all the families in the community.

### QUESTION 27

**Choice B is correct.** Since the point  $(p, r)$  lies on the line with equation  $y = x + b$ , the point must satisfy the equation. Substituting  $p$  for  $x$  and  $r$  for  $y$  in the equation  $y = x + b$  gives  $r = p + b$ . Similarly, since the point  $(2p, 5r)$  lies on the line with the equation  $y = 2x + b$ , the point must satisfy the equation. Substituting  $2p$  for  $x$  and  $5r$  for  $y$  in the equation  $y = 2x + b$  gives  $5r = 2(2p) + b$ , or  $5r = 4p + b$ . Solving each equation for  $b$  gives  $b = r - p$  and  $b = 5r - 4p$ , respectively. Substituting  $r - p$  for  $b$  in the equation  $b = 5r - 4p$  gives  $r - p = 5r - 4p$ . Subtracting  $r$  from each side of the equation and adding  $4p$  to each side of the equation gives  $3p = 4r$ . Dividing each side of the equation by  $p$  and dividing each side of the equation by 4 gives  $\frac{3}{4} = \frac{r}{p}$ .

Choices A, C, and D are incorrect. Choices A and D may be the result of incorrectly forming the answer out of the coefficients in the point  $(2p, 5r)$ . Choice C may be the result of confusing  $r$  and  $p$ .

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### QUESTION 28

**Choice D is correct.** The two data sets have the same range. The first data set has a range of  $88 - 56 = 32$ , and the second data set has a range of  $112 - 80 = 32$ . Alternatively, it can be seen visually that the ranges are the same because the two dot plots are aligned, the scales of the graphs are the same, and the graphs have the same width. The two data sets have different standard deviations. Both dot plots show distributions that have a mean near the center value of the dot plot. The first dot plot shows most values clustered near the mean, while the second dot plot shows most values farther from the mean. Therefore, the standard deviations of the two data sets are not equal—the data represented by the second dot plot has a greater standard deviation.

Choices A, B, and C are incorrect because they incorrectly assert either that the standard deviations are the same or that the ranges are different.

### QUESTION 29

**Choice B is correct.** Since the machine copies at a constant rate, the relationship between  $p$ , the number of sheets of paper remaining, and  $m$ , the time in minutes since the machine started printing, is modeled by a linear equation. The initial number of sheets of paper is given as 5,000. It is also given that the machine used 30% of those 5,000 sheets in 20 minutes, so it used  $0.30 \times 5,000 = 1,500$  sheets in 20 minutes. Therefore, the number of sheets used per minute is  $\frac{1,500}{20} = 75$ . To determine the number of sheets of paper used  $m$  minutes after the machine started printing, multiply 75 by  $m$ , which gives  $75m$ . Therefore, a linear equation modeling this relationship is the number of sheets remaining equals the initial number of sheets of paper minus the number of sheets of paper used  $m$  minutes after the machine started printing, which is  $p = 5,000 - 75m$ .

Choice A is incorrect and may be the result of using the given number of minutes, 20, as the rate at which the copy machine uses paper. However, the rate is 75, not 20, sheets per minute. Choices C and D are incorrect because they aren't linear equations; they assume that the copy machine prints at a nonconstant rate.

### QUESTION 30

**Choice B is correct.** The maximum value of the function  $f$  occurs at the highest point on the graph of  $y = f(x)$ ; the highest point on the graph is  $(4, 3)$ . For any point on the graph of  $f$ , the  $y$ -coordinate gives the value of the function at the  $x$ -coordinate; therefore, the maximum value of the function  $f$  is 3. It is stated that  $k$  is the maximum value of  $f$ , so  $k = 3$ . Thus,  $g(k) = g(3)$ . From the table of values for  $g$ , it can be seen that when  $x = 3$ ,  $g(3) = 6$ .

Choice A is incorrect and may result from using the  $x$ -coordinate of the maximum point as the value of  $k$ . Choice C is incorrect; it is the value of  $k$ , not of  $g(k)$ . Choice D is incorrect and may be the result of giving the value of  $x$  that makes  $g(x) = 3$  instead of finding the value of  $g(x)$  when  $x = 3$ .

### QUESTION 31

**The correct answer is 102.** Since each molecule of water has 2 atoms of hydrogen, 51 molecules of water have a total of  $(51)(2) = 102$  atoms of hydrogen.

### QUESTION 32

**The correct answer is 2.** Substituting  $x = 1$  in the equation  $x - \frac{1}{2}a = 0$  gives  $1 - \frac{1}{2}a = 0$ . Adding  $\frac{1}{2}a$  to both sides of this equation gives  $1 = \frac{1}{2}a$ . Multiplying both sides of this last equation by 2 gives  $2 = a$ .

### QUESTION 33

**The correct answer is 30.** Since the equations  $x + 2y = 10$  and  $3x + 6y = c$  represent the same line in the  $xy$ -plane, they must be equivalent equations. The expression  $3x + 6y$  on the left-hand side of the second equation is equivalent to  $3(x + 2y)$ , which is 3 times the left-hand side of the first equation. Thus, to be equivalent, the right-hand side of the second equation,  $c$ , must be 3 times the right-hand side of the first equation, 10. Therefore,  $c = 30$ .

### QUESTION 34

**The correct answer is 25.4.** The average speed is the total distance divided by the total time. The total distance is 11 miles and the total time is 26 minutes. Thus, the average speed is  $\frac{11}{26}$  miles per minute. The question asks for the average speed in miles per hour, and there are 60 minutes in an hour; converting miles per minute to miles per hour gives the following:

$$\begin{aligned} \text{Average speed} &= \frac{11 \text{ miles}}{26 \text{ minutes}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} \\ &= \frac{660}{26} \text{ miles per hour} \\ &\approx 25.38 \text{ miles per hour} \end{aligned}$$

Therefore, to the nearest tenth of a mile per hour, the average speed of Paul Revere's ride would have been 25.4 miles per hour.

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### QUESTION 35

**The correct answers are 2 and 8.** Substituting  $x = a$  in the definitions for  $f$  and  $g$  gives  $f(a) = -\frac{1}{2}(a - 4)^2 + 10$  and  $g(a) = -a + 10$ , respectively. If  $f(a) = g(a)$ , then  $-\frac{1}{2}(a - 4)^2 + 10 = -a + 10$ . Subtracting 10 from both sides of this equation gives  $-\frac{1}{2}(a - 4)^2 = -a$ . Multiplying both sides by  $-2$  gives  $(a - 4)^2 = 2a$ . Expanding  $(a - 4)^2$  gives  $a^2 - 8a + 16 = 2a$ . Combining the like terms on one side of the equation gives  $a^2 - 10a + 16 = 0$ . One way to solve this equation is to factor  $a^2 - 10a + 16$  by identifying two numbers with a sum of  $-10$  and a product of  $16$ . These numbers are  $-2$  and  $-8$ , so the quadratic equation can be factored as  $(a - 2)(a - 8) = 0$ . Therefore, the possible values of  $a$  are either 2 or 8. Either 2 or 8 will be scored as a correct answer.

Alternate approach: Graphically, the condition  $f(a) = g(a)$  implies the graphs of the functions  $y = f(x)$  and  $y = g(x)$  intersect at  $x = a$ . The graph  $y = f(x)$  is given, and the graph of  $y = g(x)$  may be sketched as a line with  $y$ -intercept 10 and a slope of  $-1$  (taking care to note the different scales on each axis). These two graphs intersect at  $x = 2$  and  $x = 8$ .

### QUESTION 36

**The correct answer is 0.** Note that no matter where point  $W$  is on  $\overline{RT}$ , the sum of the measures of  $\angle RSW$  and  $\angle WST$  is equal to the measure of  $\angle RST$ , which is  $90^\circ$ . Thus,  $\angle RSW$  and  $\angle WST$  are complementary angles. Since the cosine of an angle is equal to the sine of its complementary angle,  $\cos(\angle RSW) = \sin(\angle WST)$ . Therefore,  $\cos(\angle RSW) - \sin(\angle WST) = 0$ .

### QUESTION 37

**The correct answer is 576.** According to the table, 5 minutes after the injection, the penicillin in the patient's bloodstream is 152 micrograms per milliliter. Thus, there are  $10 \times 152 = 1520$  micrograms of penicillin in 10 milliliters of blood drawn 5 minutes after the injection. Similarly, 10 minutes after the injection, the penicillin concentration is 118 micrograms per milliliter. Thus, there are  $8 \times 118 = 944$  micrograms of penicillin in 8 milliliters of blood drawn 10 minutes after the injection. Therefore, there are  $1520 - 944 = 576$  more micrograms of penicillin in 10 milliliters of blood drawn 5 minutes after the injection than in 8 milliliters of blood drawn 10 minutes after the injection.

**QUESTION 38**

**The correct answer is 0.8.** The value of  $b$  in the equation  $P(t) = 200b^{\frac{t}{5}}$  can be estimated using any row of the table other than the first one. Substituting  $t = 5$  and  $P(5) = 152$  from the second row of the table into the definition of  $P$  yields  $152 = 200b^{\frac{5}{5}}$ , or  $152 = 200b$ . Dividing both sides of this equation by 200 yields  $b = \frac{152}{200}$ . The fraction can be rewritten as  $\frac{76}{100}$ , or its decimal equivalent .76. Rounded to the nearest tenth, this value is .8. Other rows of the table also give a value of  $b$  that rounds to .8. Therefore, the value of  $b$ , rounded to the nearest tenth, is .8. Either .8, or its fractional equivalents,  $\frac{4}{5}$  or  $\frac{8}{10}$ , can be gridded as the correct answer.



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# Practice Test #9

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from Amy Tan, *The Bonesetter's Daughter*. ©2001 by Amy Tan.

At last, Old Widow Lau was done haggling with the driver and we stepped inside Father's shop. It was north-facing, quite dim inside, and perhaps this was why Father did not see us at first. He was busy with a customer, a man who was distinguished-looking, like the scholars of two decades before. The two men were bent over a glass case, discussing the different qualities of inksticks. Big Uncle welcomed us and invited us to be seated. From his formal tone, I knew he did not recognize who we were. So I called his name in a shy voice. And he squinted at me, then laughed and announced our arrival to Little Uncle, who apologized many times for not rushing over sooner to greet us. They rushed us to be seated at one of two tea tables for customers. Old Widow Lau refused their invitation three times, exclaiming that my father and uncles must be too busy for visitors. She made weak efforts to leave. On the fourth insistence, we finally sat. Then Little Uncle brought us hot tea and sweet oranges, as well as bamboo latticework fans with which to cool ourselves.

I tried to notice everything so I could later tell GaoLing what I had seen, and tease out her envy. The floors of the shop were of dark wood, polished and clean, no dirty footprints, even though this was during the dustiest part of the summer. And along the walls were display cases made of wood and glass.

The glass was very shiny and not one pane was broken. Within those glass cases were our silk-wrapped boxes, all our hard work. They looked so much nicer than they had in the ink-making studio at Immortal Heart village.

I saw that Father had opened several of the boxes. He set sticks and cakes and other shapes on a silk cloth covering a glass case that served as a table on which he and the customer leaned. First he pointed to a stick with a top shaped like a fairy boat and said with graceful importance, "Your writing will flow as smoothly as a keel cutting through a glassy lake." He picked up a bird shape: "Your mind will soar into the clouds of higher thought." He waved toward a row of ink cakes embellished with designs of peonies and bamboo: "Your ledgers will blossom into abundance while bamboo surrounds your quiet mind."

As he said this, Precious Auntie came back into mind. I was remembering how she taught me that everything, even ink, had a purpose and a meaning: Good ink cannot be the quick kind, ready to pour out of a bottle. You can never be an artist if your work comes without effort. That is the problem of modern ink from a bottle. You do not have to think. You simply write what is swimming on the top of your brain. And the top is nothing but pond scum, dead leaves, and mosquito spawn. But when you push an inkstick along an inkstone, you take the first step to cleansing your mind and your heart. You push and you ask yourself, What are my intentions? What is in my heart that matches my mind?

60 I remembered this, and yet that day in the ink shop, I listened to what Father was saying, and his words became far more important than anything Precious Auntie had thought. “Look here,” Father said to his customer, and I looked. He held up an inkstick and rotated it in the light. “See? It’s the right hue, purple-black, not brown or gray like the cheap brands you might find down the street. And listen to this.” And I heard a sound as clean and pure as a small silver bell. “The high-pitched tone tells you that the soot is very fine, as smooth as the sliding banks of old rivers. And the scent—can you smell the balance of strength and delicacy, the musical notes of the ink’s perfume? Expensive, and everyone who sees you using it will know that it was well worth the high price.”

I was very proud to hear Father speak of our family’s ink this way.

1

Which choice best summarizes the passage?

- A) A character’s arrival at her family’s ink shop sparks fond memories of her favorite aunt.
- B) A character’s surprise visit leads to a happy reunion at her family’s ink shop.
- C) A character comes to understand her father’s ambitions while visiting her family’s ink shop.
- D) A character’s visit to her family’s ink shop deepens her appreciation of her family’s work.

2

A main theme of the passage is that

- A) family relationships should be nurtured.
- B) quality is achieved through deliberate effort.
- C) hard work results in material compensation.
- D) creativity needs to be expressed concretely.

3

Throughout the passage, the narrator is portrayed as someone who is

- A) reserved around unfamiliar people.
- B) attuned to her immediate surroundings.
- C) sympathetic to the needs of others.
- D) anxious about her responsibilities.

4

It can be most reasonably inferred from the passage that Old Widow Lau’s reluctance to stay for tea is

- A) feigned, because she is not genuinely firm in her resolve.
- B) inconsiderate, because the family has been planning her visit.
- C) appropriate, because the shop is unusually busy.
- D) ill-advised, because she is exhausted from the journey.

5

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-4 (“At last . . . first”)
- B) Lines 11-15 (“And he . . . customers”)
- C) Lines 15-18 (“Old . . . leave”)
- D) Lines 19-21 (“Then . . . ourselves”)

6

The narrator indicates that the contrast between the ink-making studio at Immortal Heart village and her family’s ink shop is that the ink shop

- A) displays the family’s ink more impressively.
- B) is more conveniently located for the public.
- C) provides greater individual attention to customers.
- D) offers a larger space for presenting products.

7

Based on the artistic philosophy expressed in the fourth paragraph (lines 46-59), it is reasonable to infer that Precious Auntie would consider a hastily written first draft of a story to be

- A) emotionally raw and powerful.
- B) creatively satisfying for the author.
- C) essentially worthless in and of itself.
- D) inappropriately analytical for a piece of art.

8

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 46-48 (“As he . . . meaning”)
- B) Lines 49-50 (“Good . . . bottle”)
- C) Lines 52-55 (“You simply . . . spawn”)
- D) Lines 57-59 (“You push . . . mind”)

9

As used in line 59, “matches” most nearly means

- A) competes against.
- B) corresponds with.
- C) runs counter to.
- D) treats equally.

10

As used in line 68, “clean” most nearly means

- A) complete.
- B) skillful.
- C) distinct.
- D) upright.

**Questions 11-20 are based on the following passage and supplementary material.**

This passage is adapted from “How the Web Affects Memory.” ©2011 by Harvard Magazine Inc.

Search engines have changed the way we use the Internet, putting vast sources of information just a few clicks away. But Harvard professor of psychology

Line Daniel Wegner’s recent research proves that  
5 websites—and the Internet—are changing much more than technology itself. They are changing the way our memories function.

Wegner’s latest study, “Google Effects on Memory: Cognitive Consequences of Having  
10 Information at Our Fingertips,” shows that when people have access to search engines, they remember fewer facts and less information because they know they can rely on “search” as a readily available shortcut.

15 Wegner, the senior author of the study, believes the new findings show that the Internet has become part of a transactive memory source, a method by which our brains compartmentalize information. First hypothesized by Wegner in 1985, transactive  
20 memory exists in many forms, as when a husband relies on his wife to remember a relative’s birthday. “[It is] this whole network of memory where you don’t have to remember everything in the world yourself,” he says. “You just have to remember who  
25 knows it.” Now computers and technology as well are becoming virtual extensions of our memory.

The idea validates habits already forming in our daily lives. Cell phones have become the primary location for phone numbers. GPS devices in cars  
30 remove the need to memorize directions.

Wegner points out that we never have to stretch our memories too far to remember the name of an obscure movie actor or the capital of Kyrgyzstan—we just type our questions into Google. “We become  
35 part of the Internet in a way,” he says. “We become part of the system and we end up trusting it.”

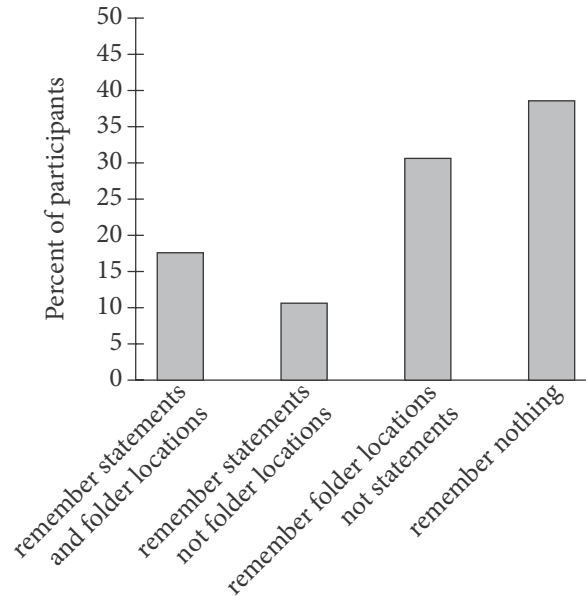
Working with researchers Betsy Sparrow of Columbia University and Jenny Liu of the University of Wisconsin–Madison, Wegner conducted four

40 experiments to demonstrate the phenomenon, using various forms of memory recall to test reliance on computers. In the first experiment, participants demonstrated that they were more likely to think of computer terms like “Yahoo” or “Google” after being  
45 asked a set of difficult trivia questions. In two other experiments, participants were asked to type a collection of readily memorable statements, such as “An ostrich’s eye is bigger than its brain.” Half the subjects were told that their work would be saved to a  
50 computer; the other half were informed that the statements would be erased. In subsequent memory testing, participants who were told their work would not be saved were best at recalling the statements. In a fourth experiment, participants typed into a  
55 computer statements they were told would be saved in specific folders. Next, they were asked to recall the statements. Finally, they were given cues to the wording and asked to name the folders where the statements were stored. The participants proved  
60 better able to recall the folder locations than the statements themselves.

Wegner concedes that questions remain about whether dependence on computers will affect memories negatively: “Nobody knows now what the  
65 effects are of these tools on logical thinking.” Students who have trouble remembering distinct facts, for example, may struggle to employ those facts in critical thinking. But he believes that the situation overall is beneficial, likening dependence on  
70 computers to dependence on a mechanical hand or other prosthetic device.

And even though we may not be taxing our memories to recall distinct facts, we are still using them to consider where the facts are located and how  
75 to access them. “We still have to remember things,” Wegner explains. “We’re just remembering a different range of things.” He believes his study will lead to further research into understanding computer dependence, and looks forward to tracing the extent  
80 of human *interdependence* with the computer world—pinpointing the “movable dividing line between us and our computers in cyber networks.”

Results of Experiment 4: Memory of Statements and Folder Locations



Adapted from Betsy Sparrow et al., "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips." ©2011 by American Association for the Advancement of Science.

11

The main purpose of the passage is to

- A) describe a series of experiments on the way technology interferes with critical thinking.
- B) assert that people have become overly dependent on computers for storing information.
- C) discuss the idea that humans' capacity for memory is much weaker than it once was.
- D) share the findings of a study examining the effect of computer use on memory recall.

12

Which choice best supports the idea that reliance on computers does not necessarily diminish human memory?

- A) Lines 3-6 ("But Harvard . . . itself")
- B) Lines 31-33 ("Wegner . . . Kyrgyzstan")
- C) Lines 66-68 ("Students . . . thinking")
- D) Lines 72-75 ("And even . . . them")



13

In context, the reference to remembering a relative's birthday mainly serves to

- A) show that people who are closely related tend to have shared memories.
- B) demonstrate how people initially developed external sources of memory.
- C) emphasize the effectiveness and accuracy of transactive memory sources.
- D) illustrate the concept of a transactive memory source using a familiar situation.

14

Based on the information in the passage, which of the following would be considered a transactive memory source?

- A) A souvenir brought home from a memorable trip
- B) A written list of a user's passwords for different websites
- C) A library database that helps users locate specific books
- D) A website that helps users plan and make travel arrangements

15

As used in line 26, "extensions of" most nearly means

- A) delays in.
- B) additions to.
- C) lengths of.
- D) developments of.

16

The discussion of the experiments suggests that people are inclined to think of specific information sources in response to being

- A) required to memorize details that will then be made inaccessible.
- B) directed to develop a system for organizing and saving content.
- C) asked to provide facts that are not already familiar to them.
- D) prompted to identify terms related to dependence on computers.

17

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 42-45 ("In the . . . questions")
- B) Lines 48-51 ("Half . . . erased")
- C) Lines 51-53 ("In subsequent . . . statements")
- D) Lines 59-61 ("The participants . . . themselves")

18

As used in line 67, "employ" most nearly means

- A) utilize.
- B) enroll.
- C) exert.
- D) assign.

19

According to the graph, approximately what percentage of participants remembered both parts of the information given to them during the fourth experiment?

- A) 7%
- B) 10%
- C) 17%
- D) 30%

20

Based on the description of Wegner’s fourth experiment, what is the most likely explanation for the findings for the largest single group of participants represented in the graph?

- A) Those participants focused on remembering the folder locations.
- B) Those participants attempted to remember the statements and the folder locations.
- C) Those participants did not attempt to remember any specific pieces of information.
- D) There is not enough information to determine the cause of the results for those participants.

**Questions 21-31 are based on the following passage and supplementary material.**

This passage is adapted from Marlene Zuk, *Paleofantasy: What Evolution Really Tells Us about Sex, Diet, and How We Live*. ©2013 by Marlene Zuk.

A female guppy can be sexually mature at two months of age and have her first babies just a month later. This unstinting rate of reproduction makes guppies ideally suited for studying the rate of evolution, and David Reznick, a biologist at UC Riverside, has been doing exactly that for the last few decades.

People usually think of guppies as colorful aquarium fish, but they also have a life in the real world, inhabiting streams and rivers in tropical places like Trinidad, where Reznick has done his fieldwork. Guppies can experience different kinds of conditions depending on the luck of the draw.

A lucky guppy is born above a waterfall or a set of rapids, which keep out the predatory fish called pike cichlids found in calmer downstream waters. As you might expect, the guppy mortality rate—that is, the proportion of individuals that die—is much higher in the sites with the rapacious cichlids than in those without them.

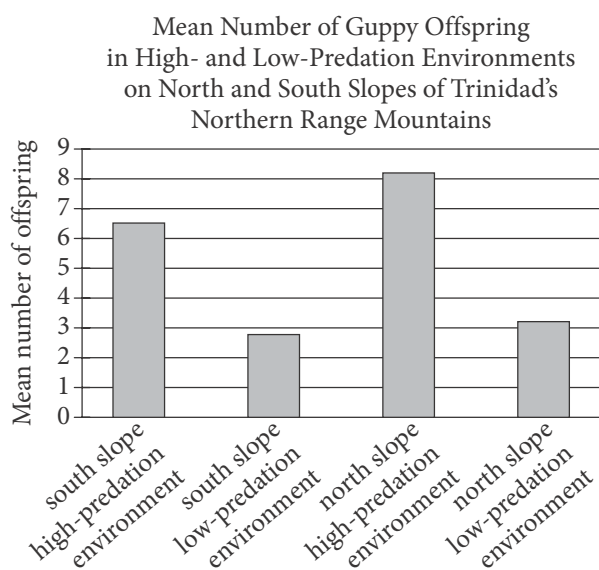
Reznick has shown that if you bring the fish into the lab and let them breed there, the guppies from the sites with many predators become sexually mature when they are younger and smaller than do the guppies from the predator-free sites. In addition, the litters of baby guppies produced by mothers from the high-risk streams are larger, but each individual baby is smaller than those produced by their counterparts. The disparity makes sense because if you are at risk of being eaten, being able to have babies sooner, and spreading your energy reserves over a lot of them, makes it more likely that you will manage to pass on some of your genes before you meet your fate. Reznick and other scientists also demonstrated that these traits are controlled by the guppies’ genes, not by the environment in which they grow up.

How quickly, though, could these differences in how the two kinds of guppies lived their lives have evolved? Because there are numerous tributaries of the streams in Trinidad, with guppies living in some but not all of them, Reznick realized that he could, as he put it in a 2008 paper, “treat streams like giant test tubes by introducing guppies or predators” to places they had not originally occurred, and then watch as

natural selection acted on the guppies. This kind of real-world manipulation of nature is called “experimental evolution,” and it is growing increasingly popular among scientists working with organisms that reproduce quickly enough for humans to be able to see the outcome within our lifetimes.

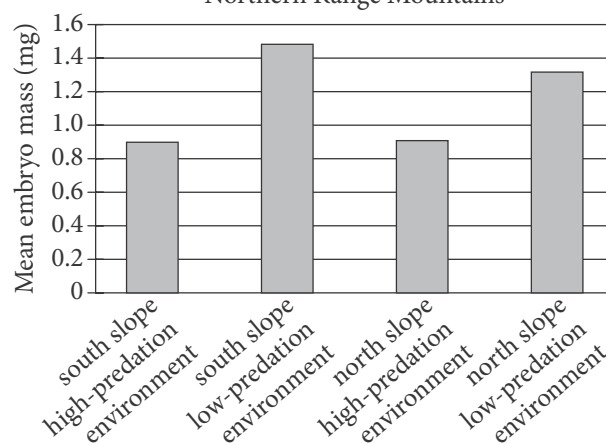
Along with his students and colleagues, Reznick removed groups of guppies from their predator-ridden lives below the waterfall and released them into previously guppy-free streams above the falls. Although small predatory killifish occurred in these new sites, these fish do not pose anything close to the danger of the cichlids. Then the scientists waited for nature to do its work, and they brought the descendants of the transplanted fish back to the lab to examine their reproduction. After just eleven years, the guppies released in the new streams had evolved to mature later, and have fewer, bigger offspring in each litter, just like the guppies that naturally occurred in the cichlid-free streams. Other studies of guppies in Trinidad have shown evolutionary change in as few as two and a half years, or a little over four generations, with more time required for genetic shifts in traits such as the ability to form schools and less time for changes in the colorful spots and stripes on a male’s body.

**Figure 1**



**Figure 2**

Mean Embryo Mass of Guppy Offspring in High- and Low-Predation Environments on North and South Slopes of Trinidad’s Northern Range Mountains



Figures adapted from David N. Reznick, Cameron K. Ghalambor, and Kevin Crooks, “Experimental Studies of Evolution in Guppies: A Model for Understanding the Evolutionary Consequences of Predator Removal in Natural Communities.” ©2007 by Blackwell Publishing Ltd.

21

The first paragraph mainly serves to

- A) establish the reason why a certain species was selected for scientific observation.
- B) illustrate the value of studying the offspring of a particular animal shortly after birth.
- C) introduce a theory at the center of an ongoing scientific debate.
- D) offer a rationale for the prevalence of a new field of scientific inquiry.

22

In describing the living conditions of guppies, the author indicates that a “lucky guppy” (line 14) is one that

- A) is born in a major river having an established guppy population.
- B) inhabits an environment that provides natural protection from predators.
- C) manages to navigate the risks associated with living near a waterfall.
- D) avoids predatory fish by living in calmer downstream waters.

23

Which choice provides the best evidence for the conclusion that the streams used by Reznick’s team in their real-world study were not entirely free of predators?

- A) Lines 14-16 (“A lucky . . . waters”)
- B) Lines 16-20 (“As you . . . them”)
- C) Lines 46-52 (“This . . . lifetimes”)
- D) Lines 57-59 (“Although . . . cichlids”)

24

In lines 43-44, Reznick uses the phrase “giant test tubes” to suggest that certain streams can

- A) provide suitable experimental conditions.
- B) promote cooperative behaviors in specimens.
- C) expedite the rate of genetic changes.
- D) solve widespread environmental problems.

25

As used in line 49, “popular” most nearly means

- A) accessible.
- B) suitable.
- C) widespread.
- D) likable.

26

Which finding, if accurate, would undermine Reznick’s findings?

- A) Guppies examined in other parts of the globe exhibit genetic shifts in traits at a different rate from that exhibited by the guppies Reznick examined.
- B) The new site into which Reznick released the guppies is inhabited by fish that are found to be as predatory as the cichlids in the original sites.
- C) Experimental evolution is shown to be harmful to the environments where studies like Reznick’s are conducted.
- D) The descendants of Reznick’s transplanted fish are proven to mature later than the guppies living below the waterfall.

27

It can most reasonably be inferred from the passage that the experiments in Trinidad have shown which of the following about guppies?

- A) Some genetic traits will evolve more readily than others.
- B) Some predatory fish are more dangerous to guppies than cichlids are.
- C) Some guppies thrive better in areas below waterfalls than they do in areas above waterfalls.
- D) Some genetic shifts are easier to prevent in a natural environment than in a lab.

28

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 38-40 (“How quickly . . . evolved”)
- B) Lines 40-46 (“Because . . . the guppies”)
- C) Lines 53-56 (“Along . . . falls”)
- D) Lines 67-72 (“Other . . . body”)

29

According to figure 1, guppies living in the south slope high-predation environment produced a mean number of offspring between

- A) 2 and 3.
- B) 3 and 4.
- C) 5 and 6.
- D) 6 and 7.

30

Which conclusion about the mean mass of guppy embryos is best supported by figure 2?

- A) The slope location was a better indicator of mean embryo mass than was the predation level observed in each environment.
- B) The mean embryo mass of guppies born in the north slope environments exceeded the mean embryo mass of guppies born in the south slope environments.
- C) The predation level observed in each environment had more of an effect on mean embryo mass than did slope location.
- D) The guppies born in the low-predation environments had a mean embryo mass less than that of guppies born in the high-predation environments.

31

The data presented in figures 1 and 2 best support the conclusion that compared with guppies from high-predation environments, guppies from low-predation environments were more likely to

- A) have fewer offspring and reach full maturity sooner.
- B) be part of a smaller litter and have a greater mean embryo mass.
- C) have a higher rate of survival and have less mean embryo mass.
- D) produce a greater number of offspring and have a greater mean embryo mass.

**Questions 32-42 are based on the following passage.**

This passage is adapted from a speech delivered in 1838 by Sara T. Smith at the Second Anti-Slavery Convention of American Women.

We are told that it is not within the “province of woman,” to discuss the subject of slavery; that it is a “political question,” and we are “stepping out of our sphere,” when we take part in its discussion. It is not  
 5 true that it is *merely* a political question, it is likewise a question of justice, of humanity, of morality, of religion; a question which, while it involves considerations of immense importance to the welfare and prosperity of our country, enters deeply into the  
 10 home-concerns, the every-day feelings of millions of our fellow beings. Whether the laborer shall receive the reward of his labor, or be driven daily to *unrequited* toil—whether he shall walk erect in the dignity of conscious manhood, or be reckoned  
 15 among the beasts which perish—whether his bones and sinews shall be his own, or another’s—whether his child shall receive the protection of its natural guardian, or be ranked among the live-stock of the estate, to be disposed of as the caprice or interest of  
 20 the master may dictate—. . . these considerations are all involved in the question of liberty or slavery.

And is a subject comprehending interests of such magnitude, merely a “political question,” and one in which woman “can take no part without losing  
 25 something of the modesty and gentleness which are her most appropriate ornaments”? May not the “ornament of a meek and quiet spirit” exist with an upright mind and enlightened intellect, and must woman necessarily be less gentle because her heart is  
 30 open to the claims of humanity, or less modest because she feels for the degradation of her enslaved sisters, and would stretch forth her hand for their rescue?

By the Constitution of the United States, the  
 35 whole physical power of the North is pledged for the suppression of domestic insurrections, and should the slaves, maddened by oppression, endeavor to shake off the yoke of the taskmaster, the men of the North are bound to make common cause with the  
 40 tyrant, and put down, at the point of the bayonet, every effort on the part of the slave, for the attainment of his freedom. And when the father, husband, son, and brother shall have left their homes to mingle in the unholy warfare, “to become the  
 45 executioners of their brethren, or to fall themselves

by their hands,”<sup>1</sup> will the mother, wife, daughter, and sister feel that they have no interest in this subject? Will it be easy to convince them that it is no concern of theirs, that their homes are rendered desolate, and  
 50 their habitations the abodes of wretchedness? Surely this consideration is of itself sufficient to arouse the slumbering energies of woman, for the overthrow of a system which thus threatens to lay in ruins the fabric of her domestic happiness; and she  
 55 will not be deterred from the performance of her duty to herself, her family, and her country, by the cry of political question.

But admitting it to be a political question, have we no interest in the welfare of our country? May we not permit a thought to stray beyond the narrow limits of our own family circle, and of the present hour? May we not breathe a sigh over the miseries of our countrymen, nor utter a word of remonstrance against the unjust laws that are crushing them to the  
 65 earth? Must we witness “the headlong rage or heedless folly,” with which our nation is rushing onward to destruction, and not seek to arrest its downward course? Shall we silently behold the land which we love with all the heart-warm affection of  
 70 children, rendered a hissing and a reproach throughout the world, by this system which is already tolling the death-bell of her decease among the nations? No: the events of the last two years have cast their dark shadows before, overclouding the bright  
 75 prospects of the future, and shrouding the destinies of our country in more than midnight gloom, and we cannot remain inactive. Our country is as dear to us as to the proudest statesman, and the more closely our hearts cling to “our altars and our homes,” the  
 80 more fervent are our aspirations that every inhabitant of our land may be protected in his fireside enjoyments by just and equal laws; that the foot of the tyrant may no longer invade the domestic sanctuary, nor his hand tear asunder those whom  
 85 God himself has united by the most holy ties. Let our course, then, still be *onward!*

<sup>1</sup> A quotation from the Declaration of Independence

32

Smith's main purpose in the passage is to

- A) accuse fellow abolitionists of overlooking the contributions that women have made to the movement.
- B) argue that the causes of abolition and women's rights are continuations of the spirit of the American Revolution.
- C) make the case that women's rights are meaningless while slavery exists.
- D) encourage women to see their participation in the abolitionist cause as just and important.

33

Which statement provides the best description of a technique that Smith uses throughout the passage to advance her main point?

- A) She presents claims in the form of rhetorical questions that mostly have implicit negative answers.
- B) She criticizes her opponents by quoting self-contradictory remarks they have made.
- C) She illustrates each of her central ideas with an emotionally powerful anecdote.
- D) She emphasizes the reasonableness of her views by presenting them as though they are universally held.

34

How does Smith develop her argument about slavery as a "political question" (line 3) over the course of the passage?

- A) She claims the designation is an outdated one and then offers alternative definitions.
- B) She dismisses the designation as too narrow but then demonstrates its relevance to her audience.
- C) She contends that the designation has become trite and then invites her audience to revitalize it.
- D) She describes the meaning the designation has for men and then challenges women to embrace it.

35

Which choice best summarizes the first paragraph?

- A) Smith explains a conventional viewpoint and presents evidence supporting it.
- B) Smith rejects a claim and elaborates on her reasons for doing so.
- C) Smith introduces her subject and provides historical background for understanding it.
- D) Smith identifies a problem and proposes steps to remedy it.

36

In the passage, Smith argues that it is possible for women to engage in which activity?

- A) Acting according to humanitarian principles while preserving their femininity
- B) Adhering to personal morality while being politically neutral
- C) Contributing to their family's financial security while meeting social expectations
- D) Resisting calls for war while still opposing slavery

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 26-33 ("May . . . rescue")
- B) Lines 42-47 ("And when . . . subject")
- C) Lines 51-54 ("Surely . . . happiness")
- D) Lines 77-82 ("Our . . . laws")

38

According to Smith, the US Constitution requires which action on the part of the Northern free states if slaves were to revolt?

- A) The Northern states would have to sever ties with the slave states.
- B) The Northern states would have to give shelter to refugees from the slave states.
- C) The Northern states would have to help the slave states fight the slaves' rebellion.
- D) The Northern states would have to provide financial assistance to the rebelling slaves.

39

In context, what is the main effect of Smith's use of the word "tyrant" in lines 40 and 83?

- A) It identifies a specific individual as oppressive.
- B) It highlights the threat of aggression from abroad.
- C) It critiques the limited roles for women in antislavery movements.
- D) It emphasizes the unjustness of slavery.

40

As used in line 52, "slumbering" most nearly means

- A) lethargic.
- B) drowsy.
- C) dormant.
- D) unconscious.

41

In the passage, Smith most strongly suggests that slavery affects the United States by

- A) lowering the country's reputation in the international community.
- B) leading many women to disavow their allegiance to the country.
- C) causing violent conflicts in many areas of the country.
- D) weakening the authority of the country's government.

42

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 48-50 ("Will it . . . wretchedness")
- B) Lines 59-61 ("May . . . hour")
- C) Lines 68-73 ("Shall . . . nations")
- D) Lines 73-77 ("No: the . . . inactive")



**Questions 43-52 are based on the following passages.**

Passage 1 is adapted from Brian Handwerk, “A New Antibiotic Found in Dirt Can Kill Drug-Resistant Bacteria.” ©2015 by Smithsonian Institution. Passage 2 is adapted from David Livermore, “This New Antibiotic Is Cause for Celebration—and Caution.” ©2015 by Telegraph Media Group Limited.

**Passage 1**

“Pathogens are acquiring resistance faster than we can introduce new antibiotics, and this is causing a human health crisis,” says biochemist Kim Lewis of

Line Northeastern University.

5 Lewis is part of a team that recently unveiled a promising antibiotic, born from a new way to tap the powers of soil microorganisms. In animal tests, teixobactin proved effective at killing off a wide variety of disease-causing bacteria—even those that  
10 have developed immunity to other drugs. The scientists’ best efforts to create mutant bacteria with resistance to the drug failed, meaning teixobactin could function effectively for decades before pathogens naturally evolve resistance to it.

15 Natural microbial substances from soil bacteria and fungi have been at the root of most antibiotic drug development during the past century. But only about one percent of these organisms can be grown in a lab. The rest, in staggering numbers, have  
20 remained uncultured and of limited use to medical science, until now. “Instead of trying to figure out the ideal conditions for each and every one of the millions of organisms out there in the environment, to allow them to grow in the lab, we simply grow  
25 them in their natural environment where they already have the conditions they need for growth,” Lewis says.

To do this, the team designed a gadget that sandwiches a soil sample between two membranes,  
30 each perforated with pores that allow molecules like nutrients to diffuse through but don’t allow the passage of cells. “We just use it to trick the bacteria into thinking that they are in their natural environment,” Lewis says.

35 The team isolated 10,000 strains of uncultured soil bacteria and prepared extracts from them that could be tested against nasty pathogenic bacteria. Teixobactin emerged as the most promising drug. Mice infected with bacteria that cause upper

40 respiratory tract infections (including *Staphylococcus aureus* and *Streptococcus pneumoniae*) were treated with teixobactin, and the drug knocked out the infections with no noticeable toxic effects.

It’s likely that teixobactin is effective because of  
45 the way it targets disease: The drug breaks down bacterial cell walls by attacking the lipid molecules that the cell creates organically. Many other antibiotics target the bacteria’s proteins, and the genes that encode those proteins can mutate to  
50 produce different structures.

**Passage 2**

Many good antibiotic families—penicillin, streptomycin, tetracycline—come from soil fungi and bacteria and it has long been suspected that, if we could grow more types of bacteria from soil—or  
55 from exotic environments, such as deep oceans—then we might find new natural antibiotics. In a recent study, researchers [Kim Lewis and others] found that they could isolate and grow individual soil bacteria—including types that can’t normally be  
60 grown in the laboratory—in soil itself, which supplied critical nutrients and minerals. Once the bacteria reached a critical mass they could be transferred to the lab and their cultivation continued. This simple and elegant methodology is their most  
65 important finding to my mind, for it opens a gateway to cultivating a wealth of potentially antibiotic-producing bacteria that have never been grown before.

The first new antibiotic that they’ve found by this  
70 approach, teixobactin, from a bacterium called *Eleftheria terrae*, is less exciting to my mind, though it doesn’t look bad. Teixobactin killed Gram-positive bacteria, such as *S. aureus*, in the laboratory, and cured experimental infection in mice. It also killed  
75 the tuberculosis bacterium, which is important because there is a real problem with resistant tuberculosis in the developing world. It was also difficult to select teixobactin resistance.

So, what are my caveats? Well, I see three. First,  
80 teixobactin isn’t a potential panacea. It doesn’t kill the Gram-negative opportunists as it is too big to cross their complex cell wall. Secondly, scaling to commercial manufacture will be challenging, since the bacteria making the antibiotic are so difficult to  
85 grow. And, thirdly, it’s early days yet. As with any antibiotic, teixobactin now faces the long haul of clinical trials: Phase I to see what dose you can safely give the patient, Phase II to see if it cures infections,

and Phase III to compare its efficacy to that of “standard of care treatment.” That’s going to take five years and £500 million and these are numbers we must find ways to reduce (while not compromising safety) if we’re to keep ahead of bacteria, which can evolve far more swiftly and cheaply.

43

The first paragraph of Passage 1 primarily serves to

- A) present a claim that is supported and developed over the course of the passage.
- B) introduce a controversy that the study described in the passage is intended to resolve.
- C) identify a problem that the research discussed in the passage may help to address.
- D) offer a theory that is challenged by the findings presented in the passage.

44

The author of Passage 1 suggests that an advantage of the method Lewis’s team used to grow microorganisms is that it

- A) identifies the requirements for soil bacteria to thrive and replicates those features in artificial soil.
- B) enables soil bacteria to take in more nutrients than they typically consume in natural settings.
- C) directly affects the cell walls of bacteria rather than the proteins those bacteria produce.
- D) allows researchers to make use of soil bacteria that they had previously been unable to exploit.

45

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 17-21 (“But only . . . now”)
- B) Lines 28-32 (“To do . . . cells”)
- C) Lines 32-34 (“We just . . . says”)
- D) Lines 44-47 (“It’s likely . . . organically”)

46

The author of Passage 2 would most likely agree with which statement about the development of teixobactin?

- A) It reveals that some antibiotics are effective against gram-negative bacteria.
- B) It shows that conventional methods can still yield new types of antibiotics.
- C) It casts doubt on the practicality of searching for new antibiotics in exotic environments.
- D) It confirms a long-held belief about a potential source of new antibiotics.

47

As used in line 79, “caveats” most nearly means

- A) exceptions.
- B) restrictions.
- C) misgivings.
- D) explanations.

48

In the last sentence of Passage 2, the author uses the phrase “five years and £500 million” primarily to

- A) emphasize the scale of the effort needed to make teixobactin available for consumer use.
- B) criticize the level of funding that the government has committed to teixobactin development.
- C) underscore the amount of time and money that has already been spent researching teixobactin.
- D) compare the amount of money spent developing teixobactin with the amount spent developing other antibiotics.

49

Which choice best describes the relationship between Passage 1 and Passage 2?

- A) Passage 2 offers an evaluation of the significance of the research discussed in Passage 1.
- B) Passage 2 suggests a modification to the methodology described in Passage 1.
- C) Passage 2 uses concrete examples to illustrate concepts considered in Passage 1.
- D) Passage 2 takes a dismissive stance regarding the findings mentioned in Passage 1.

50

Both passages make the point that teixobactin could be useful in

- A) standardizing the future development of antibiotics produced in laboratory environments.
- B) combating infections that are no longer responding to treatment with other antibiotics.
- C) controlling the spread of pathogenic soil fungi.
- D) shaping a new method of studying the effectiveness of antibiotics.

51

Information in Passage 2 best supports which conclusion about the mice in the experiment described in Passage 1?

- A) Exposure to teixobactin made them less susceptible to subsequent upper respiratory tract infections.
- B) Gram-positive bacteria enhanced the effectiveness of teixobactin against their upper respiratory tract infections.
- C) Their upper respiratory tract infections were likely not caused by gram-negative bacteria.
- D) Teixobactin attacked the proteins of the bacteria that caused their upper respiratory tract infections.

52

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 51-56 (“Many . . . antibiotics”)
- B) Lines 64-68 (“This . . . before”)
- C) Lines 69-72 (“The first . . . bad”)
- D) Lines 80-82 (“It doesn’t . . . wall”)

## STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Survival in the Hostile Environment of NW Rota-1

[1] Sixty miles north of Guam and more than 1,700 feet under the ocean’s surface is the summit of NW Rota-1, an undersea volcano discovered in 2003.

[2] Surprisingly, the volcano appears to have been continuously active; it even grew 130 feet in height between 2006 and 2009. [3] Yet despite the hostile environment created by the constant volcanic activity, life is thriving there. [4] Special adaptations are the key to survival. [5] At that depth, water pressure suppresses the explosive force of the volcano’s eruptions, allowing scientists to **1** watch and observe them up close via

1

- A) NO CHANGE
- B) watch
- C) observe to see
- D) visually watch

remotely operated vehicles. **2**

NW Rota-1 is far below the ocean's photic zone where sunlight drives photosynthesis; **3** nevertheless, bacteria supporting a unique food web have adapted to this perpetually dark environment. The bacteria have evolved to use hydrogen sulfide instead of sunlight for the energy that drives their metabolic processes, and hydrothermal venting is the source of the chemical soup necessary to support **4** him or her. Seawater seeping into fissures in the ocean floor is heated by underlying magma, and the heat drives chemical reactions that remove oxygen, sulfates, **5** and remove other chemicals from the water. Once the superheated water (up to 750°F) rises through vents in the ocean floor, additional reactions cause minerals and compounds to precipitate onto the seafloor, where bacteria feed on them.

**2**

To make the paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 3.

**3**

- A) NO CHANGE
- B) afterward,
- C) furthermore,
- D) similarly,

**4**

- A) NO CHANGE
- B) one.
- C) them.
- D) it.

**5**

- A) NO CHANGE
- B) it also removes
- C) also removing
- D) and

Loihi shrimp—originally thought to exist only around an undersea volcano near **6** Hawaii, survive by using tiny, shear-like claws to harvest rapidly growing bacterial filaments covering rocks near NW Rota-1’s hydrothermal vents. The Loihi shrimp spend most of their time grazing on the bacteria and evading another, previously unknown, species of shrimp. Shrimp of that species also graze on bacterial filaments as juveniles, **7** resulting from their ability to cope with the noxious environment around the volcano. They feed on the Loihi shrimp and other organisms that are overcome by the toxic plumes of volcanic gas and ash.

6

- A) NO CHANGE
- B) Hawaii;
- C) Hawaii—
- D) Hawaii

7

Which choice most effectively sets up the information in the next sentence?

- A) NO CHANGE
- B) but their adaptations are not yet fully understood by the scientific community.
- C) thriving in an unusual ecosystem that also includes crabs, limpets, and barnacles.
- D) but as adults, their claws are large enough for the shrimp to be predators.

During an underwater eruption, steam quickly **8** condenses. The steam leaves only carbon dioxide bubbles and droplets of molten sulfur. This means that the water near NW Rota-1 is more acidic than **9** that of stomach acid, presenting yet another challenge to life-forms living nearby. As the carbon dioxide level in Earth's atmosphere rises, the **10** worlds' ocean's absorb more carbon **11** dioxide. Organisms flourishing near the volcano may help biologists understand how life adjusts to very acidic conditions. In addition, NW Rota-1 is a natural laboratory where scientists can study conditions that may be similar to those that gave rise to life on Earth and perhaps even other worlds.

8

Which choice most effectively combines the sentences at the underlined portion?

- A) condenses and leaves
- B) condenses, having to leave
- C) condenses, thereafter leaving
- D) condenses, and then, after this, it leaves

9

- A) NO CHANGE
- B) those of stomach
- C) the acid from stomach
- D) stomach

10

- A) NO CHANGE
- B) world's oceans'
- C) world's oceans
- D) worlds oceans

11

The writer is considering revising the underlined portion to the following.

dioxide, which increases their acidity.

Should the writer make this revision here?

- A) Yes, because it explains the relevance of this sentence to the point made in the paragraph.
- B) Yes, because it helps the reader understand why organisms near NW Rota-1 evolved the way they did.
- C) No, because it merely repeats information provided earlier in the passage without contributing to the paragraph's main idea.
- D) No, because it interrupts discussion of oceanic life-forms with an irrelevant detail.

Questions 12-22 are based on the following passage and supplementary material.

### Free Public Transportation

City planners, concerned about vehicle traffic clogging their cities' roadways, are trying to find ways to get people out of their cars and onto buses and trains. One radical proposal some planners have considered is to make public transportation free to passengers. While fare-free policies do increase **12** ridership, but they have not been found to be an effective way to address traffic problems. Moreover, these policies may result in serious budget shortfalls.

Not surprisingly, **13** public transportation is used by more people when people do not have to pay a fare. According to a report by the Center for Urban Transportation Research, public transit systems that abolish fares typically see a short-term increase in ridership of about 50 percent. However, this increase does not necessarily correlate with a decrease in car traffic. Evidence suggests that when buses and subways are free, people often take bus and train trips they would not have taken otherwise while still using their cars nearly as much as they did before. In 2013 Tallinn, Estonia, instituted fare-free rides for city residents (becoming the largest city in the world to do so), but car use in Tallinn has only slightly **14** declined; as a 2014 study by the KTH Royal Institute of Technology in Sweden found that car traffic in Tallinn was down less than 3 percent since **15** it was enacted.

12

- A) NO CHANGE
- B) ridership, and while
- C) ridership,
- D) ridership;

13

Which choice is the most effective version of the underlined portion?

- A) NO CHANGE
- B) more people use public transportation if they do not have to pay a fare.
- C) if people do not have to pay a fare, more of those people use public transportation.
- D) using public transportation is done by more people when they do not have to pay a fare.

14

- A) NO CHANGE
- B) declined:
- C) declined,
- D) declined. As

15

- A) NO CHANGE
- B) that
- C) one
- D) the policy



Instituting a fare-free system **16** can also have a devastating effect on a city’s transportation budget. All public transportation systems are subsidized by the government to some extent, but large systems gain a substantial portion of their operating revenue from fares. Since systems that go fare-free see increases in ridership, they often must operate more buses and trains and hire more drivers and other personnel at the same time that they are losing a key source of funding. Advocates of fare-free policies claim that the costs of these policies are largely offset by various **17** savings, however, a recent study comparing projected results of fare-free policies in different cities found this outlook to be **18** way too sunny. For example, in San Francisco, CA, fare-free

16

Which choice best introduces the paragraph?

- A) NO CHANGE
- B) also requires planners to make careful considerations about changes in service.
- C) might also have a negative impact on the environment as more service is added.
- D) also has the drawback of increasing crowding on public transportation.

17

- A) NO CHANGE
- B) savings,
- C) savings, but
- D) savings; and

18

- A) NO CHANGE
- B) looking too much on the bright side.
- C) pretty upbeat.
- D) overly optimistic.

public transit was projected to save \$8.4 million per year in fare collection costs **19** but create a deficit of \$72 million per year in lost fares, on top of capital investments in new equipment and infrastructure. **20**

Projected Yearly Savings and Costs of Implementing a Fare-Free Policy

Transit agency	Savings from eliminating fare collection	Cost in lost fares	Cost of adding service	Total additional operating costs
Lane Transit, Eugene, OR	\$100,000 to \$500,000	\$5 million	not provided	\$5 million
Muni, San Francisco, CA	\$8.4 million	\$112 million	\$72 million*	\$184 million
Public Transit, Hamilton, Canada	not provided	\$900,000	\$30 million	\$30.9 million

\*plus \$512 million in capital investments

Adapted from Transportation Research Board, "Implementation and Outcomes of Fare-Free Transit Systems." ©2012 by Transportation Research Board.

19

Which choice provides an accurate interpretation of the chart?

- A) NO CHANGE
- B) and save an additional \$112 million from lost fares,
- C) but result in a total increase of \$184 million per year in operating costs,
- D) and save \$72 million per year in costs related to adding service,

20

The writer is considering adding the following sentence based on information from the chart.

By contrast, Lane Transit in Eugene, OR, would lose only \$5 million in fares if it instituted a fare-free system.

Should the writer make this addition here?

- A) Yes, because it proves how little money Eugene would lose under a fare-free system compared with San Francisco.
- B) Yes, because it reinforces the claim made by advocates of fare-free policies mentioned earlier in the paragraph.
- C) No, because it does not support the argument that fare-free systems cause a substantial loss for governments.
- D) No, because it contradicts a point about fare collection made earlier in the paragraph.

This is not to say that fare-free public transportation is always a bad idea. Some college towns and resort communities embrace the model because buses can go faster when drivers **21** would not have had to collect fares. For large cities looking to reduce automobile traffic, though, **22** research about Tallinn, Estonia, could be instructive.

21

- A) NO CHANGE
- B) do not have
- C) did not have
- D) will not have

22

Which choice provides the best conclusion to the passage?

- A) NO CHANGE
- B) subways will prove to be more important than buses.
- C) public transportation should be cheaper but not free.
- D) fare-free public transportation is not the answer.

Questions 23-33 are based on the following passage.

**Wet Plate Photography: An Old Technique Makes a New Splash**

[1] Upon the arrival of the digital camera, professional photographers harrumphed that **23** they produced ugly, low-resolution images. [2] Yet eventually the vast majority of them traded film for megapixels. [3] The latest digital cameras take pictures so crisp that the images in them appear to be die-cut. [4] Even today's humblest smartphones snap bright, sharp photos. [5] A few contemporary photographers, however, have embraced an anachronistic method that was state-of-the-art technology when it was invented in 1851: wet plate photography. **24**

**23**

- A) NO CHANGE
- B) it
- C) one
- D) he or she

**24**

The writer plans to add the following sentence to this paragraph.

Why wouldn't they?

To make the paragraph most logical, the sentence should be placed

- A) after sentence 1.
- B) after sentence 2.
- C) after sentence 4.
- D) after sentence 5.

Wet plate photographers essentially create their own film. The process can be dangerous, given that it requires the use of several volatile chemicals. **25** To take a wet plate photograph, photographers usually first arrange or pose **26** it's subjects before mixing collodion (a viscous, light-sensitive chemical solution) with bromide, iodide, or chloride and applying the mixture to a clean, polished glass plate. Dried collodion is unusable, **27** so once the photo is snapped with a massive, tripod-mounted

25

At this point, the writer is considering adding the following sentence.

It's also labor-intensive, involving several intricate steps.

Should the writer make this addition here?

- A) Yes, because it serves as an effective transition by reiterating the main idea of the previous paragraph.
- B) Yes, because it sets up the paragraph's outline of the process of wet plate photography.
- C) No, because it blurs the paragraph's focus on the dangers involved in wet plate photography.
- D) No, because it provides an opinion in a paragraph that is focused on facts.

26

- A) NO CHANGE
- B) its
- C) there
- D) their

27

- A) NO CHANGE
- B) but
- C) and
- D) for

camera, the photographer has **28** nominal minutes to develop it, using more chemicals. When the image appears in the negative, water is used to stop the process. A chemical “fix bath” turns the negative image into a positive one. The photo is then immersed in water and warmed. **29** In conclusion, it is coated with lavender **30** oil to give it (a protective finish).

28

The writer wants to emphasize how quickly wet plate photographers have to work. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) a few
- C) a matter of
- D) mere

29

- A) NO CHANGE
- B) Finally,
- C) Thus,
- D) Nevertheless,

30

- A) NO CHANGE
- B) oil—to give it a protective finish.
- C) oil, to give it, a protective finish.
- D) oil to give it a protective finish.

Wet plate photos are marvelously fine-grained and detailed, and they seem to glow with an ethereal silvery light. One misstep or a speck of dust on the glass plate, though, and flaws appear. Smudges resembling oyster shells **31** swirl around the photos' edges. Sunbursts or streaks emerge where collodion pools unevenly. Since the film requires long exposures, moving subjects blur. **32** A shifting arm or leg might even disappear because of the lengthy exposure time required. The exposure time required explains why people in wet plate photographs often look dour: it's hard to hold a smile for that long.

Prominent among contemporary wet plate photographers is Joni Sternbach, whose work centers, appropriately, on water and people's relationship to it. Sternbach's photo series *Ocean Details*, *Sea/Sky*, and *SurfLand* depict surging surfs, roiling waves, and the surfers who ride them. **33** Her subjects could be nineteenth-century wave riders, if not for the modern board shorts and bikinis they wear. Sternbach characterizes wet plate photography as "one part photography, one part performance art, and one part three-ring circus," a worthwhile endeavor because it produces the unique, haunting images she seeks. "When I look at a digital print," she says, "it might be gorgeous and smooth, but it's on a piece of paper and it's one of many."

31

- A) NO CHANGE
- B) will have swirled
- C) have swirled
- D) swirled

32

- A) NO CHANGE
- B) An arm or a leg, shifting during the long exposure time required by wet plate photography, might even disappear.
- C) A wet plate photographer's subject's arm or leg might even disappear during this long exposure time.
- D) A shifting arm or leg might even disappear.

33

The writer wants to highlight the contrast between Sternbach's techniques and the people Sternbach photographs. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) The subjects of her photos could be ordinary people,
- C) It would be hard to tell her subjects are surfers,
- D) They would appear to come from all walks of life,

Questions 34-44 are based on the following passage.

### Digging Up Cities

In 2010, as a construction crew began to tear up sidewalks in New York City’s South Street Seaport to replace a water pipe, Alyssa Loorya and her team watched eagerly, picks and brushes in hand. Loorya, an urban archaeologist, studies the history of **34** cities. Any New York City construction project using municipal funds **35** are required to consider whether historical artifacts will be affected during construction, and if that possibility **36** exists or is possible, an urban archaeologist must be consulted. Since the South Street Seaport area was a bustling commercial center for early colonists, Loorya anticipated that a rich history lay beneath the pavement. “It’s our job to document and recover that history before it’s lost,” she said.

**34**

The writer is considering revising the underlined portion to the following.

cities by excavating artifacts that have accumulated over centuries of land development.

Should the writer make this revision here?

- A) Yes, because it helps set up the rest of the passage by explaining what urban archaeologists do.
- B) Yes, because it identifies the characteristics that make particular cities worthy of archaeological study.
- C) No, because it does not give enough detail about the kinds of artifacts that urban archaeologists typically find.
- D) No, because it does not explain how excavation benefits the study of a city’s history.

**35**

- A) NO CHANGE
- B) have been
- C) is
- D) were

**36**

- A) NO CHANGE
- B) exists potentially,
- C) exists, it is necessary that
- D) exists,



As the work continued, **37** therefore, the team faced obstacles. Fieldwork in a city has to be done intermittently: the construction crew had to proceed one block at a time to avoid interrupting traffic, and the archaeology team's work was periodically **38** halted—by stormy weather and the discovery of toxic materials underground. Moreover, as archaeologists underground attempted to relay information to those at the surface, they had to contend with the noise of construction vehicles, car horns, and **39** pedestrians' noise on the busy New York City streets.

37

- A) NO CHANGE
- B) though,
- C) meanwhile,
- D) similarly,

38

- A) NO CHANGE
- B) halted;
- C) halted,
- D) halted

39

- A) NO CHANGE
- B) the noise of pedestrians
- C) pedestrians
- D) that of pedestrians

Despite these setbacks, Loorya and her team eventually began to uncover some interesting artifacts. In 2012, the team discovered a foundation wall, a network of wooden pipes, and several well bases dating to the eighteenth century. In August 2013, the archaeologists discovered thousands of objects in a single fifteen-foot stretch that was likely a garbage disposal **40** site. Including buttons from Revolutionary War uniforms, clay pipes, and an imported mineral water bottle from Germany.

As they cleaned and catalogued the artifacts, the archaeologists took stock of their findings. The team's discoveries provided a snapshot of **41** the various kinds of construction materials that were used in the eighteenth century. Colonial-era New Yorkers went to great lengths to secure fresh drinking water, Loorya noted, given the **42** effort involved in laying wooden pipes to bring in fresh water from surrounding areas, digging very deep wells, brewing alcohol to mask the water's salty taste, and even importing bottled water.

40

- A) NO CHANGE
- B) site, among these were
- C) site, including
- D) site; including

41

Which choice most effectively sets up the example discussed in the following sentence?

- A) NO CHANGE
- B) the numerous rituals associated with hospitality
- C) public utility planning and infrastructure development
- D) how major construction projects were financed

42

Which choice best maintains the style and tone of the passage?

- A) NO CHANGE
- B) blood, sweat, and tears
- C) hassle
- D) feats of strength and fortitude

Through such discoveries, **43** they tell the story of a city's history in a new way. **44** "One of my favorite things is putting together someone's life," Loorya said.

43

- A) NO CHANGE
- B) we
- C) colonial-era New Yorkers
- D) urban archaeologists

44

The writer wants to conclude the passage with a quotation from Loorya that illustrates the broad impact of her team's work. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) "New York City construction has a lot of stops and starts,"
- C) "Finding the bits and pieces that were actually used by the people in the past makes New York City's history real,"
- D) "We call our archaeological technique 'monitoring,' and we work hand-in-hand with the contractors and are a part of their team,"

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



# Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

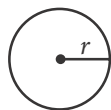
## DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

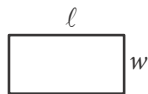
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

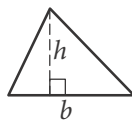


$$A = \pi r^2$$

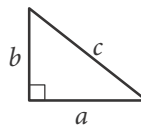
$$C = 2\pi r$$



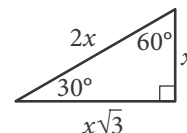
$$A = \ell w$$



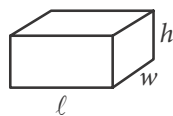
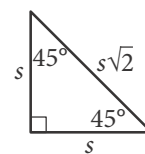
$$A = \frac{1}{2}bh$$



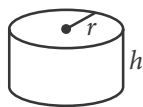
$$c^2 = a^2 + b^2$$



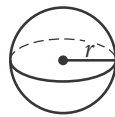
Special Right Triangles



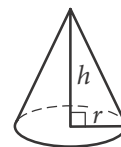
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

$$2x - y = 8$$

$$x + 2y = 4$$

For the system of equations above, what is the value of  $x + y$  ?

- A) -1
- B) 4
- C) 5
- D) 20

2

Which of the following is equivalent to

$$2(x^2 - x) + 3(x^2 - x) ?$$

- A)  $5x^2 - 5x$
- B)  $5x^2 + 5x$
- C)  $5x$
- D)  $5x^2$

3

Which of the following statements is true about the graph of the equation  $2y - 3x = -4$  in the  $xy$ -plane?

- A) It has a negative slope and a positive  $y$ -intercept.
- B) It has a negative slope and a negative  $y$ -intercept.
- C) It has a positive slope and a positive  $y$ -intercept.
- D) It has a positive slope and a negative  $y$ -intercept.

4

The front of a roller-coaster car is at the bottom of a hill and is 15 feet above the ground. If the front of the roller-coaster car rises at a constant rate of 8 feet per second, which of the following equations gives the height  $h$ , in feet, of the front of the roller-coaster car  $s$  seconds after it starts up the hill?

- A)  $h = 8s + 15$
- B)  $h = 15s + \frac{335}{8}$
- C)  $h = 8s + \frac{335}{15}$
- D)  $h = 15s + 8$



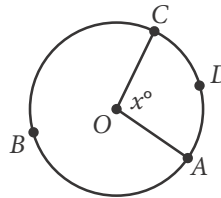
5

$$C = 75h + 125$$

The equation above gives the amount  $C$ , in dollars, an electrician charges for a job that takes  $h$  hours. Ms. Sanchez and Mr. Roland each hired this electrician. The electrician worked 2 hours longer on Ms. Sanchez's job than on Mr. Roland's job. How much more did the electrician charge Ms. Sanchez than Mr. Roland?

- A) \$75
- B) \$125
- C) \$150
- D) \$275

6



The circle above has center  $O$ , the length of arc  $\widehat{ADC}$  is  $5\pi$ , and  $x = 100$ . What is the length of arc  $\widehat{ABC}$ ?

- A)  $9\pi$
- B)  $13\pi$
- C)  $18\pi$
- D)  $\frac{13}{2}\pi$

7

If  $\frac{8}{x} = 160$ , what is the value of  $x$ ?

- A) 1,280
- B) 80
- C) 20
- D) 0.05



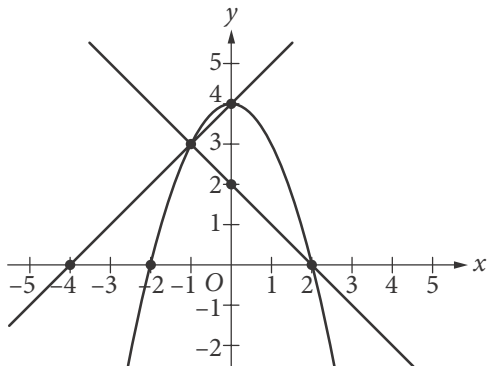
8

$$2ax - 15 = 3(x + 5) + 5(x - 1)$$

In the equation above,  $a$  is a constant. If no value of  $x$  satisfies the equation, what is the value of  $a$ ?

- A) 1
- B) 2
- C) 4
- D) 8

9



A system of three equations is graphed in the  $xy$ -plane above. How many solutions does the system have?

- A) None
- B) One
- C) Two
- D) Three

10

$$(ax + 3)(5x^2 - bx + 4) = 20x^3 - 9x^2 - 2x + 12$$

The equation above is true for all  $x$ , where  $a$  and  $b$  are constants. What is the value of  $ab$ ?

- A) 18
- B) 20
- C) 24
- D) 40

11

$$\frac{x}{x-3} = \frac{2x}{2}$$

Which of the following represents all the possible values of  $x$  that satisfy the equation above?

- A) 0 and 2
- B) 0 and 4
- C) -4 and 4
- D) 4



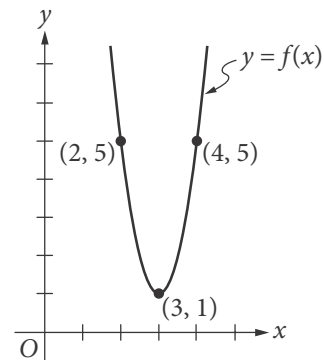
12

$$\frac{1}{2x+1} + 5$$

Which of the following is equivalent to the expression above for  $x > 0$ ?

- A)  $\frac{2x+5}{2x+1}$   
 B)  $\frac{2x+6}{2x+1}$   
 C)  $\frac{10x+5}{2x+1}$   
 D)  $\frac{10x+6}{2x+1}$

13



The graph of the function  $f$  in the  $xy$ -plane above is a parabola. Which of the following defines  $f$ ?

- A)  $f(x) = 4(x-3)^2 + 1$   
 B)  $f(x) = 4(x+3)^2 + 1$   
 C)  $f(x) = (x-3)^2 + 1$   
 D)  $f(x) = 3(x+3)^2 + 1$





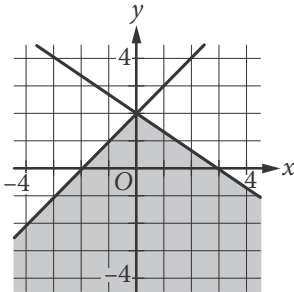
14

$$y \geq x + 2$$

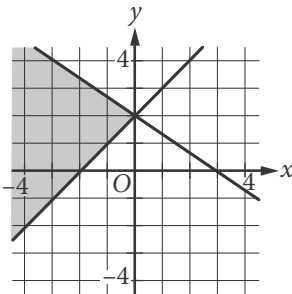
$$2x + 3y \leq 6$$

In which of the following does the shaded region represent the solution set in the  $xy$ -plane to the system of inequalities above?

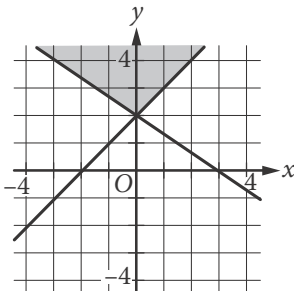
A)



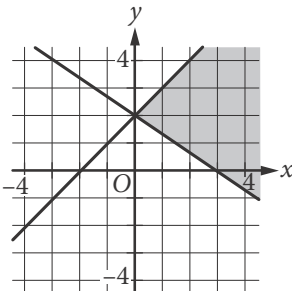
B)



C)



D)



15

What is the set of all solutions to the equation

$$\sqrt{x+2} = -x?$$

- A)  $\{-1, 2\}$
- B)  $\{-1\}$
- C)  $\{2\}$
- D) There are no solutions to the given equation.

**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \circ & \circ & \circ & \circ \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Grid in result. →

← Fraction line

← Decimal point

Answer:  $\frac{7}{12}$

	7	/	1	2	
·	·	·	·	·	
	0	0	0	0	
1	1	1	1	1	
2	2	2	2	2	
3	3	3	3	3	
4	4	4	4	4	
5	5	5	5	5	
6	6	6	6	6	
7	7	7	7	7	
8	8	8	8	8	
9	9	9	9	9	

Answer: 2.5

	2	.	5	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

.	6	6	6	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

.	6	6	7	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

Answer: 201 – either position is correct

	2	0	1	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

	2	0	1	
·	·	·	·	
	0	0	0	
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	5	
6	6	6	6	
7	7	7	7	
8	8	8	8	
9	9	9	9	

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

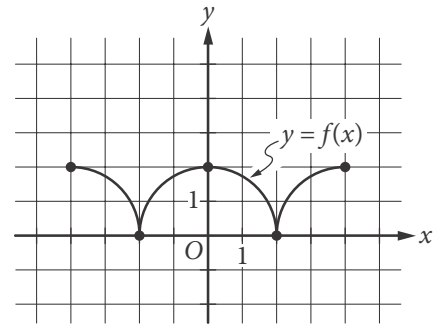
What is the volume, in cubic centimeters, of a right rectangular prism that has a length of 4 centimeters, a width of 9 centimeters, and a height of 10 centimeters?

17

$$4x + 2 = 4$$

If  $x$  satisfies the equation above, what is the value of  $2x + 1$ ?

18



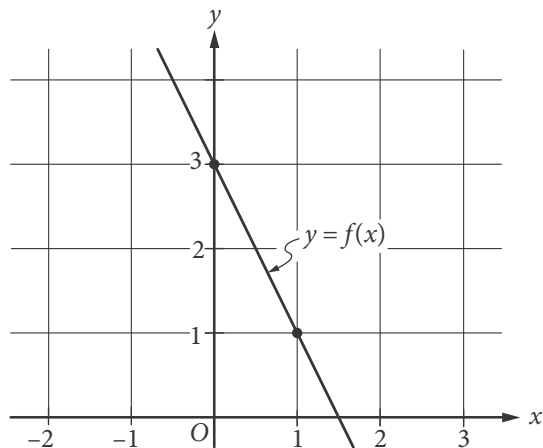
The figure above shows the complete graph of the function  $f$  in the  $xy$ -plane. The function  $g$  (not shown) is defined by  $g(x) = f(x) + 6$ . What is the maximum value of the function  $g$ ?



19

Triangle  $PQR$  has right angle  $Q$ . If  $\sin R = \frac{4}{5}$ , what is the value of  $\tan P$  ?

20



The graph of the linear function  $f$  is shown in the  $xy$ -plane above. The graph of the linear function  $g$  (not shown) is perpendicular to the graph of  $f$  and passes through the point  $(1, 3)$ . What is the value of  $g(0)$  ?

# STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

**No Test Material On This Page**



# Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

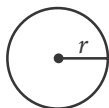
## DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

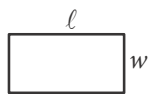
- The use of a calculator **is permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

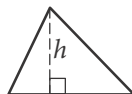


$$A = \pi r^2$$

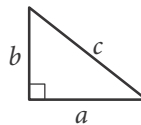
$$C = 2\pi r$$



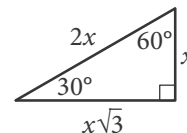
$$A = \ell w$$



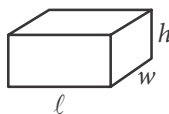
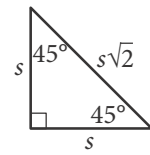
$$A = \frac{1}{2}bh$$



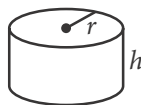
$$c^2 = a^2 + b^2$$



Special Right Triangles



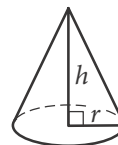
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

What value of  $x$  satisfies the equation  $3x + 3 = 27$  ?

- A) 3
- B) 8
- C) 10
- D) 27

2

Two units of length used in ancient Egypt were cubits and palms, where 1 cubit is equivalent to 7 palms. The Great Sphinx statue in Giza is approximately 140 cubits long. Which of the following best approximates the length, in palms, of the Great Sphinx statue?

- A) 0.05
- B) 20
- C) 140
- D) 980

3

If  $\frac{2n}{5} = 10$ , what is the value of  $2n - 1$  ?

- A) 24
- B) 49
- C) 50
- D) 99

4

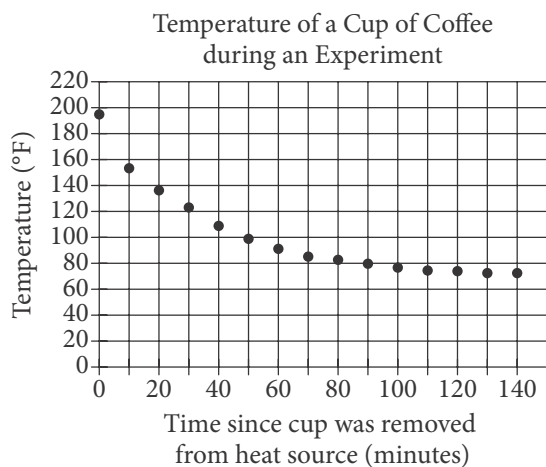
$$\sqrt{x^2} = x$$

Which of the following values of  $x$  is NOT a solution to the equation above?

- A) -4
- B) 0
- C) 1
- D) 3



Questions 5 and 6 refer to the following information.



In an experiment, a heated cup of coffee is removed from a heat source, and the cup of coffee is then left in a room that is kept at a constant temperature. The graph above shows the temperature, in degrees Fahrenheit ( $^{\circ}\text{F}$ ), of the coffee immediately after being removed from the heat source and at 10-minute intervals thereafter.

5

Of the following, which best approximates the temperature, in degrees Fahrenheit, of the coffee when it is first removed from the heat source?

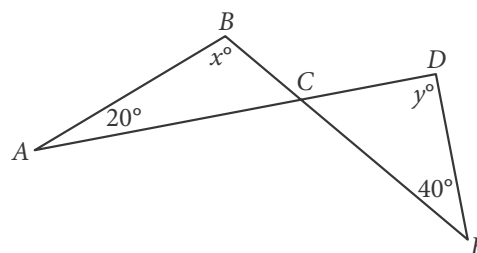
- A) 75
- B) 100
- C) 155
- D) 195

6

During which of the following 10-minute intervals does the temperature of the coffee decrease at the greatest average rate?

- A) Between 0 and 10 minutes
- B) Between 30 and 40 minutes
- C) Between 50 and 60 minutes
- D) Between 90 and 100 minutes

7



Note: Figure not drawn to scale.

In the figure above,  $\overline{AD}$  intersects  $\overline{BE}$  at  $C$ . If  $x = 100$ , what is the value of  $y$ ?

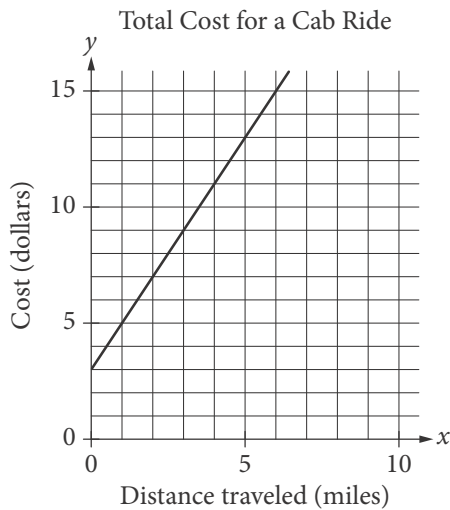
- A) 100
- B) 90
- C) 80
- D) 60





8

The line graphed in the  $xy$ -plane below models the total cost, in dollars, for a cab ride,  $y$ , in a certain city during nonpeak hours based on the number of miles traveled,  $x$ .



According to the graph, what is the cost for each additional mile traveled, in dollars, of a cab ride?

- A) \$2.00
- B) \$2.60
- C) \$3.00
- D) \$5.00

9

Customer Purchases at a Gas Station

	Beverage purchased	Beverage not purchased	Total
Gasoline purchased	60	25	85
Gasoline not purchased	35	15	50
Total	95	40	135

On Tuesday, a local gas station had 135 customers. The table above summarizes whether or not the customers on Tuesday purchased gasoline, a beverage, both, or neither. Based on the data in the table, what is the probability that a gas station customer selected at random on that day did not purchase gasoline?

- A)  $\frac{15}{50}$
- B)  $\frac{15}{40}$
- C)  $\frac{35}{50}$
- D)  $\frac{50}{135}$



10

Washington High School randomly selected freshman, sophomore, junior, and senior students for a survey about potential changes to next year's schedule. Of students selected for the survey,  $\frac{1}{4}$  were freshmen and  $\frac{1}{3}$  were sophomores. Half of the remaining selected students were juniors. If 336 students were selected for the survey, how many were seniors?

- A) 240
- B) 140
- C) 120
- D) 70

11

Plant A is currently 20 centimeters tall, and Plant B is currently 12 centimeters tall. The ratio of the heights of Plant A to Plant B is equal to the ratio of the heights of Plant C to Plant D. If Plant C is 54 centimeters tall, what is the height of Plant D, in centimeters?

- A) 32.4
- B) 44.0
- C) 62.0
- D) 90.0

12

Biologists found a new species of pale shrimp at the world's deepest undersea vent, the Beebe Vent Field. The vent is 3.1 miles below the sea's surface. Approximately how many kilometers below the sea's surface is the vent? (1 kilometer  $\approx$  0.6214 miles)

- A) 2
- B) 3
- C) 4
- D) 5

13

A cargo helicopter delivers only 100-pound packages and 120-pound packages. For each delivery trip, the helicopter must carry at least 10 packages, and the total weight of the packages can be at most 1,100 pounds. What is the maximum number of 120-pound packages that the helicopter can carry per trip?

- A) 2
- B) 4
- C) 5
- D) 6



14

A company purchased a machine valued at \$120,000. The value of the machine depreciates by the same amount each year so that after 10 years the value will be \$30,000. Which of the following equations gives the value,  $v$ , of the machine, in dollars,  $t$  years after it was purchased for  $0 \leq t \leq 10$  ?

- A)  $v = 30,000 - 9,000t$
- B)  $v = 120,000 - 9,000t$
- C)  $v = 120,000 + 9,000t$
- D)  $v = 120,000 - 30,000t$

15

Line  $m$  in the  $xy$ -plane contains the points  $(2, 4)$  and  $(0, 1)$ . Which of the following is an equation of line  $m$  ?

- A)  $y = 2x + 3$
- B)  $y = 2x + 4$
- C)  $y = \frac{3}{2}x + 3$
- D)  $y = \frac{3}{2}x + 1$

16

$$(4x + 4)(ax - 1) - x^2 + 4$$

In the expression above,  $a$  is a constant. If the expression is equivalent to  $bx$ , where  $b$  is a constant, what is the value of  $b$  ?

- A)  $-5$
- B)  $-3$
- C)  $0$
- D)  $12$

17

If  $2w + 4t = 14$  and  $4w + 5t = 25$ , what is the value of  $2w + 3t$  ?

- A)  $6$
- B)  $10$
- C)  $13$
- D)  $17$



Questions 18-20 refer to the following information.

Jennifer bought a box of Crunchy Grain cereal. The nutrition facts on the box state that a serving size of the cereal is  $\frac{3}{4}$  cup and provides 210 calories, 50 of which are calories from fat. In addition, each serving of the cereal provides 180 milligrams of potassium, which is 5% of the daily allowance for adults.

18

If  $p$  percent of an adult's daily allowance of potassium is provided by  $x$  servings of Crunchy Grain cereal per day, which of the following expresses  $p$  in terms of  $x$ ?

- A)  $p = 0.5x$
- B)  $p = 5x$
- C)  $p = (0.05)^x$
- D)  $p = (1.05)^x$

19

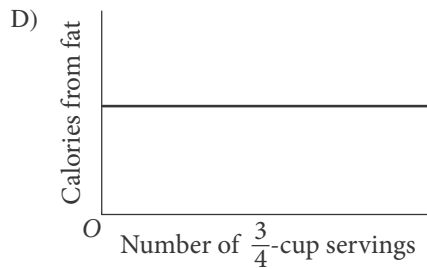
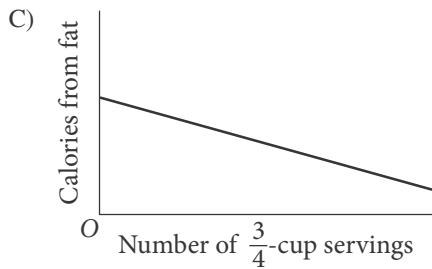
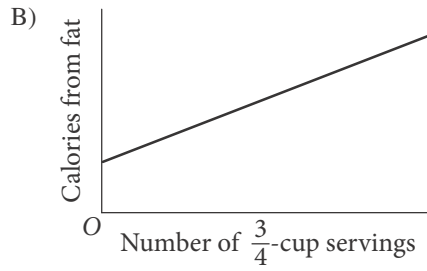
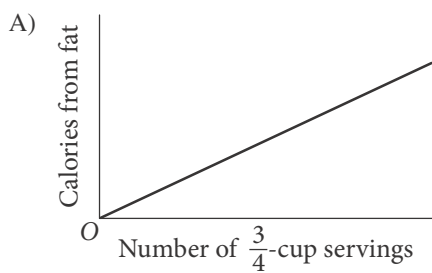
On Tuesday, Jennifer will mix Crunchy Grain cereal with Super Grain cereal for her breakfast. Super Grain cereal provides 240 calories per cup. If the total number of calories in one cup of Jennifer's mixture is 270, how much Super Grain cereal is in one cup of the mixture?

- A)  $\frac{1}{8}$  cup
- B)  $\frac{1}{4}$  cup
- C)  $\frac{1}{3}$  cup
- D)  $\frac{1}{2}$  cup



20

Which of the following could be the graph of the number of calories from fat in Crunchy Grain cereal as a function of the number of  $\frac{3}{4}$ -cup servings of the cereal?





21

The graph of the exponential function  $h$  in the  $xy$ -plane, where  $y = h(x)$ , has a  $y$ -intercept of  $d$ , where  $d$  is a positive constant. Which of the following could define the function  $h$ ?

- A)  $h(x) = -3(d)^x$
- B)  $h(x) = 3(x)d$
- C)  $h(x) = d(-x)^3$
- D)  $h(x) = d(3)^x$

22

The weights, in pounds, for 15 horses in a stable were reported, and the mean, median, range, and standard deviation for the data were found. The horse with the lowest reported weight was found to actually weigh 10 pounds less than its reported weight. What value remains unchanged if the four values are reported using the corrected weight?

- A) Mean
- B) Median
- C) Range
- D) Standard deviation

23

Near the end of a US cable news show, the host invited viewers to respond to a poll on the show's website that asked, "Do you support the new federal policy discussed during the show?" At the end of the show, the host reported that 28% responded "Yes," and 70% responded "No." Which of the following best explains why the results are unlikely to represent the sentiments of the population of the United States?

- A) The percentages do not add up to 100%, so any possible conclusions from the poll are invalid.
- B) Those who responded to the poll were not a random sample of the population of the United States.
- C) There were not 50% "Yes" responses and 50% "No" responses.
- D) The show did not allow viewers enough time to respond to the poll.

24

If  $f(x) = 5x^2 - 3$  and  $f(x + a) = 5x^2 + 30x + 42$ , what is the value of  $a$ ?

- A)  $-30$
- B)  $-3$
- C)  $3$
- D)  $30$



25

If  $\sin x^\circ = a$ , which of the following must be true for all values of  $x$ ?

- A)  $\cos x^\circ = a$
- B)  $\sin(90^\circ - x^\circ) = a$
- C)  $\cos(90^\circ - x^\circ) = a$
- D)  $\sin(x^2)^\circ = a^2$

26

$$h(x) = -16x^2 + 100x + 10$$

The quadratic function above models the height above the ground  $h$ , in feet, of a projectile  $x$  seconds after it had been launched vertically. If  $y = h(x)$  is graphed in the  $xy$ -plane, which of the following represents the real-life meaning of the positive  $x$ -intercept of the graph?

- A) The initial height of the projectile
- B) The maximum height of the projectile
- C) The time at which the projectile reaches its maximum height
- D) The time at which the projectile hits the ground

27

In the  $xy$ -plane, the graph of the polynomial function  $f$  crosses the  $x$ -axis at exactly two points,  $(a, 0)$  and  $(b, 0)$ , where  $a$  and  $b$  are both positive. Which of the following could define  $f$ ?

- A)  $f(x) = (x - a)(x - b)$
- B)  $f(x) = (x + a)(x + b)$
- C)  $f(x) = (x - a)(x + b)$
- D)  $f(x) = x(x - a)(x - b)$

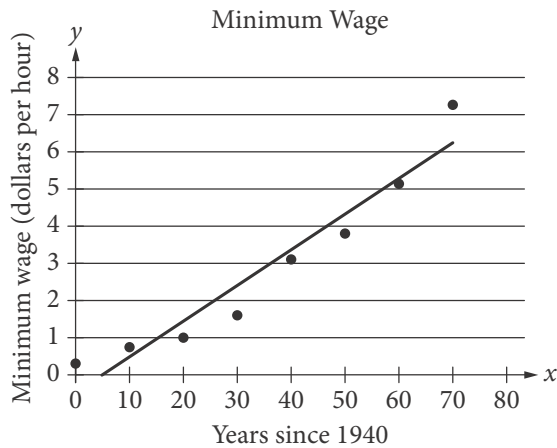
28

If  $y = 3x^2 + 6x + 2$  is graphed in the  $xy$ -plane, which of the following characteristics of the graph is displayed as a constant or coefficient in the equation?

- A)  $y$ -coordinate of the vertex
- B)  $x$ -intercept(s)
- C)  $y$ -intercept
- D)  $x$ -intercept of the line of symmetry



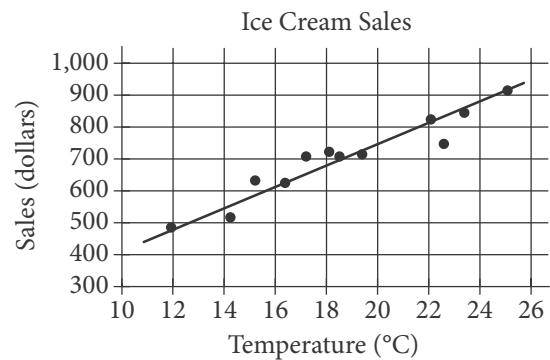
29



The scatterplot above shows the federal-mandated minimum wage every 10 years between 1940 and 2010. A line of best fit is shown, and its equation is  $y = 0.096x - 0.488$ . What does the line of best fit predict about the increase in the minimum wage over the 70-year period?

- A) Each year between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.
- B) Each year between 1940 and 2010, the average increase in minimum wage was 0.49 dollars.
- C) Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.
- D) Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.488 dollars.

30



The scatterplot above shows a company's ice cream sales  $d$ , in dollars, and the high temperature  $t$ , in degrees Celsius ( $^{\circ}\text{C}$ ), on 12 different days. A line of best fit for the data is also shown. Which of the following could be an equation of the line of best fit?

- A)  $d = 0.03t + 402$
- B)  $d = 10t + 402$
- C)  $d = 33t + 300$
- D)  $d = 33t + 84$



**DIRECTIONS**

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If 

3	1	/	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

 is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Answer:  $\frac{7}{12}$

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Answer: 2.5

2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal point

Grid in result. →

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

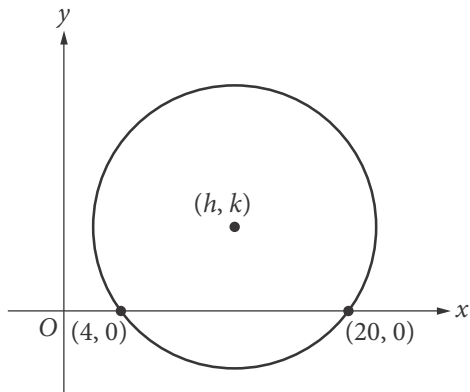
2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31



In the  $xy$ -plane above, the circle has center  $(h, k)$  and radius 10. What is the value of  $k$ ?

32

In the  $xy$ -plane, line  $\ell$  has a  $y$ -intercept of  $-13$  and is perpendicular to the line with equation  $y = -\frac{2}{3}x$ . If the point  $(10, b)$  is on line  $\ell$ , what is the value of  $b$ ?

33

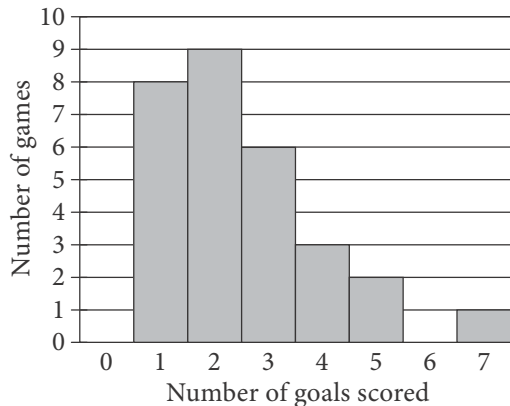
Rhesus factor	Blood type			
	A	B	AB	O
+	33	9	3	37
-	7	2	1	$x$

Human blood can be classified into four common blood types—A, B, AB, and O. It is also characterized by the presence (+) or absence (–) of the rhesus factor. The table above shows the distribution of blood type and rhesus factor for a group of people. If one of these people who is rhesus negative (–) is chosen at random, the probability that the person has blood type B is  $\frac{1}{9}$ . What is the value of  $x$ ?



34

Number of Goals Scored by  
a Soccer Team in 29 Games



Based on the graph above, in how many of the games played did the soccer team score goals equal to the median number of goals for the 29 games?

35

Gisela would owe \$15,500 in taxes each year if she were not eligible for any tax deductions. This year, Gisela is eligible for tax deductions that reduce the amount of taxes she owes by \$2,325.00. If these tax deductions reduce the taxes Gisela owes this year by  $d\%$ , what is the value of  $d$ ?

36

$$\begin{aligned}\frac{3}{4}x - \frac{1}{2}y &= 12 \\ ax - by &= 9\end{aligned}$$

The system of equations above has no solutions. If  $a$  and  $b$  are constants, what is the value of  $\frac{a}{b}$ ?



Questions 37 and 38 refer to the following information.

International Tourist Arrivals, in millions

Country	2012	2013
France	83.0	84.7
United States	66.7	69.8
Spain	57.5	60.7
China	57.7	55.7
Italy	46.4	47.7
Turkey	35.7	37.8
Germany	30.4	31.5
United Kingdom	26.3	32.2
Russia	24.7	28.4

The table above shows the number of international tourist arrivals, rounded to the nearest tenth of a million, to the top nine tourist destinations in both 2012 and 2013.

37

Based on the information given in the table, how much greater, in millions, was the median number of international tourist arrivals to the top nine tourist destinations in 2013 than the median number in 2012, to the nearest tenth of a million?

38

The number of international tourist arrivals in Russia in 2012 was 13.5% greater than in 2011. The number of international tourist arrivals in Russia was  $k$  million more in 2012 than in 2011. What is the value of  $k$  to the nearest integer?

# STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

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**This page represents the back cover of the Practice Test.**



## Answer Explanations

# SAT Practice Test #9

## Section 1: Reading Test

### QUESTION 1

**Choice D is the best answer.** Throughout the passage, the narrator describes a visit to her family’s ink shop. The narrator’s father and uncles are employed at the shop, and in the third and fifth paragraphs the narrator describes her father’s interactions with a customer. Her father praises the color, sound, and smell of an ink sample as indicators of the ink’s quality. This interaction leads the narrator to conclude in the last paragraph, “I was very proud to hear Father speak of our family’s ink this way.” Therefore, the passage is best summarized as a character’s visit to her family’s ink shop that deepens her appreciation of her family’s work.

Choice A is incorrect. Although the narrator’s arrival at her family’s ink shop does spark memories of her Precious Auntie, these memories center on Precious Auntie’s beliefs about creativity, including the conviction that inferior ink produces inferior thought. The narrator’s thoughts on Precious Auntie occur in the fourth paragraph, so choice A isn’t the best summary of the overall passage. Choice B is incorrect. Although the passage describes the narrator’s surprise visit to the ink shop and a reunion with her uncles, these events occur in the first paragraph. Therefore, choice B doesn’t provide the best summary of the passage as a whole. Choice C is incorrect because the narrator doesn’t make any reference to her father’s ambitions.

### QUESTION 2

**Choice B is the best answer.** In the fourth paragraph, the narrator recounts her Precious Auntie’s belief that “you can never be an artist if your work comes without effort.” Her Precious Auntie states that when the physical act of writing is done with an “inkstick along an inkstone,” this process requires an artist to “take the first step to cleansing your mind and your heart. You push and you ask yourself, What are my intentions? What is in my heart that matches my mind?” In the following paragraphs, the narrator recalls the pride she felt while listening to her father describe the high quality of the ink that her family had worked hard to produce. Therefore, a main theme of the passage is that quality is achieved through deliberate effort.

Choice A is incorrect. Although family relationships form a backdrop to the passage, the nurturing of these relationships isn't a main theme. Choice C is incorrect. Although the passage does emphasize that hard work produces higher quality writing than that which is produced through minimal work, the passage doesn't mention that hard work results in material compensation. Choice D is incorrect. Although the passage discusses the role of concentrated effort in creative expression, a main theme of the passage isn't that creativity needs to be expressed concretely.

### QUESTION 3

**Choice B is the best answer.** In the first sentence of the second paragraph, the narrator states: "I tried to notice everything so I could later tell GaoLing what I had seen." She then proceeds to describe the floors of the family's ink shop, the walls and display cases, and the various items for sale. According to the third paragraph, these include an inkstick "with a top shaped like a fairy boat," another inkstick with "a bird shape," and a collection of ink cakes "embellished with designs of peonies and bamboo." Therefore, throughout the passage, the narrator is portrayed as someone who is attuned to her immediate surroundings.

Choice A is incorrect. Although the narrator describes herself as shy, the people she interacts with aren't unfamiliar to her because they are members of her family whom she has met before. Choices C and D are incorrect because the narrator isn't portrayed as sympathetic to the needs of others (choice C) or anxious about her responsibilities (choice D).

### QUESTION 4

**Choice A is the best answer.** Big Uncle and Little Uncle offer Old Widow Lau and the narrator a seat at a table reserved for customers upon their arrival at the narrator's family's ink shop. According to the tenth sentence of the first paragraph, "Old Widow Lau refused their invitation three times, exclaiming that my father and uncles must be too busy for visitors." Old Widow Lau's rejection of the uncles' offer is characterized as insincere, as the next sentence of that paragraph shows that she doesn't actually want to leave the shop: "She made weak efforts to leave." Instead, her gestures are intended to inspire exaggerated insistence from the uncles, such that it isn't until the uncles' "fourth insistence, [that Old Widow Lau and the narrator] finally sat." Therefore, it can be most reasonably inferred from the passage that Old Widow Lau's reluctance to stay for tea is feigned because she isn't genuinely firm in her resolve.

Choice B is incorrect because the passage doesn't imply that Old Widow Lau's reluctance is inconsiderate or that the family has been planning her visit. Choice C is incorrect because the shop isn't unusually busy. Instead, only one customer is mentioned in the passage. Choice D is incorrect because the passage doesn't state or imply that Old Widow Lau is exhausted from her journey.

## QUESTION 5

**Choice C is the best answer.** The previous question asks what can be most reasonably inferred from the passage about Old Widow Lau's reluctance to stay for tea. The answer, that her reluctance is feigned because she isn't genuinely firm in her resolve, is best supported by the tenth and eleventh sentences of the first paragraph: "Old Widow Lau refused their invitation three times, exclaiming that my father and uncles must be too busy for visitors. She made weak efforts to leave."

Choices A, B, and D are incorrect because the cited lines don't support the answer to the previous question. Instead, they describe the narrator and Old Widow Lau's arrival at the shop (choice A), their initial reception by the uncles (choice B), and the hospitality the uncles lavish on them once they are seated (choice D).

## QUESTION 6

**Choice A is the best answer.** In the second paragraph, the narrator describes the "shiny" glass display cases at her family's ink shop and how the silk-wrapped boxes of ink inside these cases "looked so much nicer [in the shop] than they had in the ink-making studio at Immortal Heart village." Therefore, the narrator indicates that the contrast between the ink-making studio at Immortal Heart village and her family's ink shop is that the ink shop displays the family's ink more impressively.

Choices B, C, and D are incorrect because the narrator doesn't state or imply that her family's ink shop, in comparison to the ink-making studio at Immortal Heart village, is more conveniently located for the public (choice B), provides greater individual attention to customers (choice C), or offers a larger space for presenting products (choice D).

## QUESTION 7

**Choice C is the best answer.** In the fourth paragraph, the narrator summarizes Precious Auntie's artistic philosophy: when you write without effort, "you do not have to think. You simply write what is swimming on the top of your brain. And the top is nothing but pond scum, dead leaves, and mosquito spawn." In other words, anything written too quickly, and therefore without concerted effort and thought, would be synonymous with the debris floating on top of a pool of water. Therefore, it is reasonable to infer that Precious Auntie would consider a hastily written first draft of a story to be essentially worthless in and of itself.

Choice A is incorrect because Precious Auntie's description of work made without effort is exclusively negative; therefore, it isn't reasonable to infer that she would praise a hastily written story draft as emotionally raw and powerful. Choice B is incorrect because Precious Auntie's artistic philosophy is concerned solely with the quality of the artist's output rather than with the satisfaction the artist experiences. Choice D is incorrect because whether a hastily produced work would be inappropriately analytical isn't discussed in the passage.

## QUESTION 8

**Choice C is the best answer.** The previous question asks what can be reasonably inferred about Precious Auntie’s view of a hastily written first draft of a story, based on the artistic philosophy expressed in the fourth paragraph. The answer, that she would consider such a story to be essentially worthless in and of itself, is best supported by the sixth and seventh sentences of the fourth paragraph, which describe Precious Auntie’s view of writing produced without effort: “You simply write what is swimming on the top of your brain. And the top is nothing but pond scum, dead leaves, and mosquito spawn.”

Choices A, B, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they transition between the scene in the ink shop and the narrator’s memories of Precious Auntie (choice A), summarize Precious Auntie’s assessment of ink quality (choice B), and describe the process of creating good writing through concerted effort (choice D).

## QUESTION 9

**Choice B is the best answer.** In the last sentences of the fourth paragraph, the narrator describes Precious Auntie’s artistic philosophy, or, more specifically, the questions that an artist is forced to ask when working with concerted effort: “You push and you ask yourself, What are my intentions? What is in my heart that matches my mind?” With the second question, Precious Auntie highlights how an artist must strive to create work that resembles, or corresponds with, what is in both the artist’s heart and mind. Therefore, the word “matches,” as used in this sentence, most nearly means corresponds with.

Choices A, C, and D are incorrect because in the context of the passage, “matches” means corresponds with, not competes against (choice A), runs counter to (choice C), or treats equally (choice D).

## QUESTION 10

**Choice C is the best answer.** In the fifth paragraph, the narrator’s father demonstrates the quality of an inkstick to a customer. He strikes the inkstick, and the narrator describes “a sound as clean and pure as a small silver bell.” Therefore, the word “clean,” as used in this paragraph to describe a sound that the inkstick produced, most nearly means distinct, or clear.

Choices A, B, and D are incorrect because in the context of the passage, “clean” means distinct, not complete (choice A), skillful (choice B), or upright (choice D).

## QUESTION 11

**Choice D is the best answer.** The first paragraph of the passage introduces research by Harvard psychology professor Daniel Wegner demonstrating that the Internet is changing “the way our

memories function.” One finding of Wegner’s study, as stated in the second paragraph, is that “when people have access to search engines, they remember fewer facts and less information because they know they can rely on ‘search’ as a readily available shortcut.” In the third paragraph, Wegner claims that his study shows how “the Internet has become part of a transactive memory source, a method by which [humans’] brains compartmentalize information,” such that “computers and technology as well are becoming virtual extensions of [human] memory.” The remainder of the passage details Wegner’s experiments and findings. Thus, the main purpose of the passage is to share the findings of a study examining the effect of computer use on memory recall.

Choice A is incorrect. Although the author suggests in the sixth paragraph that technology may interfere with critical thinking, this isn’t the focus of Wegner’s experiments, nor is illustrating this position the main purpose of the passage. Choices B and C are incorrect because the passage doesn’t support the assertion that people have become overly dependent on computers for storing information (choice B) or that humans’ capacity for memory is much weaker than it once was (choice C).

## QUESTION 12

**Choice D is the best answer.** The fifth paragraph details the results of the fourth experiment of Wegner’s study, where participants were more likely to recall digital folder locations where statements they typed were saved than the actual statements themselves. The first sentence of the last paragraph summarizes why this result may not be alarming: “And even though we may not be taxing our memories to recall distinct facts, we are still using them to consider where the facts are located and how to access them.” In this sentence, the author paraphrases Wegner’s view that although human memory is changing as a result of technology, this doesn’t indicate that human memory is declining, as people are relying on their memory to access specific types of information. Therefore, this sentence best supports the idea that reliance on computers doesn’t necessarily diminish human memory.

Choices A, B, and C are incorrect because the cited lines don’t support the idea that reliance on computers doesn’t necessarily diminish human memory. Instead, they introduce the topic of Wegner’s research (choice A), provide examples of the types of information that people may now rely on the Internet to provide (choice B), and concede that the Internet may diminish critical thinking skills (choice C).

## QUESTION 13

**Choice D is the best answer.** In the third paragraph, the author outlines Wegner’s theory of a “transactive memory source.” According to Wegner, transactive memory is a “network of memory,” where an individual can access information that he or she can’t personally

recall from a particular source. The author illustrates this idea in the second sentence of this paragraph, with the example of “a husband [who] relies on his wife to remember a relative’s birthday.” Thus, the reference to remembering a relative’s birthday mainly serves to illustrate the concept of a transactive memory source using a familiar situation.

Choice A is incorrect. Although the situation of a husband relying on his wife’s memory does suggest that closely related people tend to have shared memories, this isn’t the main purpose of this reference in the context of the passage. Choice B is incorrect because the example doesn’t demonstrate how people initially developed external sources of memory. Choice C is incorrect because the function of the example isn’t to emphasize the effectiveness and accuracy of transactive memory sources. Instead, its function is to make the abstract concept of transactive memory more easily understandable.

### QUESTION 14

**Choice B is the best answer.** In the third paragraph, Wegner describes transactive memory as a “network of memory where you don’t have to remember everything in the world yourself.” Instead, the burden of storing information is shifted to transactive memory sources that can function as “extensions of [human] memory.” Examples of sources provided in the fourth paragraph of the passage include cell phones, GPS devices, and search engines. What these examples have in common is that they store information, such as phone numbers, directions, and general knowledge, so that a person doesn’t have to commit this information to memory. A written list of a user’s passwords for different websites serves the same function as these examples. Although remembering a list of passwords for different websites is conceivable without a list, keeping such a list shifts the burden of storing readily memorable information away from the user because the list preserves the information in place of the user’s memory. Therefore, based on the passage, a written list of a user’s passwords for different websites would be considered a transactive memory source.

Choices A, C, and D are incorrect because they don’t accurately exemplify transactive memory sources. A souvenir brought home from a memorable trip (choice A) may evoke memories of that place for the owner. However, it doesn’t preserve actual information in the way the examples provided in the passage do. A library database that helps users locate specific books (choice C) may seem similar to a search engine. However, it doesn’t store information that would otherwise be readily memorable in the way that a search engine can help a user remember an actor’s name or a detail of geography, according to the fourth paragraph of the passage. Instead, it helps a library patron navigate a system that is typically far too vast to be committed to memory. A website that helps users plan and make travel arrangements

(choice D) may help facilitate transactions in the form of ticket purchases or hotel reservations. However, it doesn't store information that the user would otherwise memorize.

## QUESTION 15

**Choice B is the best answer.** In the last sentence of the third paragraph, the author states that “computers and technology . . . are becoming virtual extensions of our memory.” In other words, computers and technology are becoming memory sources that serve as additions to human memory. Thus, “extensions of,” as used in the passage, most nearly means additions to.

Choices A, C, and D are incorrect because in the context of the passage, “extensions of” means additions to, not delays in (choice A), lengths of (choice C), or developments of (choice D).

## QUESTION 16

**Choice C is the best answer.** The fifth paragraph of the passage describes four experiments that Wegner conducted to demonstrate his theory of a transactional memory source. The first experiment, described in the second sentence of this paragraph, found that participants “were more likely to think of computer terms like ‘Yahoo’ or ‘Google’ after being asked a set of difficult trivia questions.” The second, third, and fourth experiments explored participants’ tendency to remember the location of information rather than the information itself. Therefore, the discussion of the experiments, most specifically the first experiment, suggests that people are inclined to think of specific information sources in response to being asked to provide facts that aren’t already familiar to them.

Choice A is incorrect. Although some of the subjects in the second experiment did memorize information that later became inaccessible, this act of memorization didn’t cause the subjects to think of specific information sources. Choice B is incorrect. Although participants in the fourth experiment were told their work would be saved in specific folders, they weren’t directed to develop a system for organizing and saving content. Choice D is incorrect because none of the experiments involved participants being prompted to identify terms related to dependence on computers.

## QUESTION 17

**Choice A is the best answer.** The previous question asks, based on Wegner’s experiments, when people would be inclined to think of specific information sources. The answer, that being asked to provide facts that aren’t already familiar to them provokes this response, is best supported by the second sentence of the fifth paragraph: “In the first experiment, participants demonstrated that they were more likely to think of computer terms like ‘Yahoo’ or ‘Google’ after being asked a set of difficult trivia questions.”

Choices B, C, and D are incorrect because the cited lines don't support the answer to the previous question. Instead, they describe the different parameters for the participants in the second and third experiments (choice B), summarize the results of the second and third experiments (choice C), and summarize the results of the fourth experiment (choice D).

### QUESTION 18

**Choice A is the best answer.** The second sentence of the sixth paragraph states: "Students who have trouble remembering distinct facts, for example, may struggle to employ those facts in critical thinking." In other words, students who find it difficult to remember information may find it challenging to utilize that information to develop logical arguments. Therefore, the word "employ," as used in the context of this sentence, most nearly means utilize.

Choices B, C, and D are incorrect because in the context of the passage, "employ" means utilize, not enroll (choice B), exert (choice C), or assign (choice D).

### QUESTION 19

**Choice C is the best answer.** The passage explains that in the fourth experiment participants were given statements and folder locations where they were told those statements would be saved. On the graph, the bar farthest to the left represents those who remembered both elements of the information given to them during the experiment. This bar rises to a point midway between 15% and 20%. Therefore, according to the graph, approximately 17% of participants remembered both parts of the information given to them during the fourth experiment.

Choice A is incorrect because none of the groups represented on the graph comprised 7% of participants. Choices B and D are incorrect because neither 10% (choice B) nor 30% (choice D) of participants remembered both elements of the information given to them during the fourth experiment. Instead, 10% remembered statements but not folder locations (according to the second bar from the left), while 30% remembered folder locations but not statements (according to the third bar from the left).

### QUESTION 20

**Choice D is the best answer.** The largest single group of participants represented on the graph is composed of those who remembered nothing, as indicated by the bar that is farthest to the right. Why approximately 40% of participants could not remember the statements or the folder locations isn't explained by the description of the fourth experiment in the fifth paragraph of the passage. Therefore, the



most likely explanation for the findings regarding the largest single group of participants represented on the graph is that there isn't enough information to determine the cause of the results for those participants.

Choices A, B, and C are incorrect because these speculations aren't supported by the passage. There isn't enough information provided about the fourth experiment to know whether the participants who could remember nothing focused on remembering the folder locations (choice A), attempted to remember the statements and the folder locations (choice B), or didn't attempt to remember any specific pieces of information (choice C).

## QUESTION 21

**Choice A is the best answer.** Throughout the passage, the author describes experiments conducted on guppies to determine the guppies' rate of and types of evolutionary change. The first paragraph outlines the reason why these fish were an optimal choice for this research: their "unstinting rate of reproduction makes guppies ideally suited for studying the rate of evolution." Therefore, the first paragraph mainly serves to establish the reason why a certain species was selected for scientific observation.

Choice B is incorrect because the purpose of the first paragraph isn't to illustrate the value of studying the offspring of a particular animal shortly after birth. Instead, guppies were selected because of their rapid rate of reproduction and weren't only studied shortly after being born, according to the passage. Choices C and D are incorrect. Although the fourth paragraph does introduce a new method of scientific inquiry (experimental evolution), the first paragraph doesn't mainly serve to introduce a theory at the center of an ongoing scientific debate (choice C) or offer a rationale for the prevalence of a new field of scientific inquiry (choice D).

## QUESTION 22

**Choice B is the best answer.** The third sentence of the second paragraph states, "A lucky guppy is born above a waterfall or a set of rapids, which keep out the predatory fish called pike cichlids found in calmer downstream waters." In other words, pike cichlids normally eat guppies, but waterfalls and rapids can create natural barriers that prevent these predators from entering certain areas where guppies live. Thus, in describing the living conditions of guppies, the author indicates that a "lucky guppy" is one that inhabits an environment that provides natural protection from predators.

Choices A and C are incorrect because the author doesn't indicate that being born in a major river with an established guppy population is an advantage for a guppy (choice A) or that there are risks associated with living near a waterfall or that guppies benefit by avoiding such risks (choice C). Choice D is incorrect because the author doesn't indicate that there is an advantage for guppies living in calmer

downstream waters. Instead, the author notes that calmer downstream waters are where guppies' predators live, making these zones more dangerous for guppies than the areas above waterfalls or rapids.

### QUESTION 23

**Choice D is the best answer.** In the last paragraph, the author describes an experiment in which Reznick's team removed groups of guppies from areas with large populations of pike cichlid predators and relocated them into areas above waterfalls and rapids. According to the second sentence of this paragraph, "Although small predatory killifish occurred in these new sites, these fish do not pose anything close to the danger of the cichlids." This sentence provides the best evidence for the conclusion that the streams used by Reznick's team were not entirely free of predators, as they contained populations of killifish.

Choices A, B, and C are incorrect because the cited lines don't provide the best evidence for the conclusion that the streams used by Reznick's team were not entirely free of predators. Instead, they explain the advantage for guppies living above waterfalls or rapids (choice A), outline the correlation between numbers of pike cichlids and guppy mortality rates (choice B), and explain the growing popularity of "experimental evolution" among scientists (choice C).

### QUESTION 24

**Choice A is the best answer.** According to the fourth paragraph, the existence of streams in Trinidad with populations of guppies and those without guppies led Reznick to the conclusion that he could conduct experiments by altering the guppy populations in various streams. According to the second sentence of the fourth paragraph, Reznick realized he could "treat streams like giant test tubes by introducing guppies or predators' to places they had not originally occurred, and then watch as natural selection acted on the guppies." Reznick uses the phrase "giant test tubes" in this sentence to suggest that certain streams can provide suitable experimental conditions for his guppy research.

Choices B, C, and D are incorrect because the phrase "giant test tubes" serves to characterize certain streams as suitable for experimental research, not to suggest that those streams promote cooperative behaviors among guppies used as subjects in experimental studies (choice B), increase the rate of genetic change among guppies (choice C), or assist scientists in solving environmental problems in the natural habitat of guppies (choice D).

### QUESTION 25

**Choice C is the best answer.** The fourth paragraph describes Reznick's rationale for moving populations of guppies from one body of water to another. The last sentence of the paragraph states, "This kind of real-world manipulation of nature is called 'experimental evolution,'

and it is growing increasingly popular among scientists working with organisms that reproduce quickly enough for humans to be able to see the outcome within our lifetimes.” In other words, the fact that this type of research is “growing increasingly popular” means that it is becoming more widespread. Thus, the word “popular” as used in the passage most nearly means widespread.

Choices A, B, and D are incorrect because in the context of the passage, “popular” means widespread, not accessible (choice A), suitable (choice B), or likable (choice D).

## QUESTION 26

**Choice B is the best answer.** Reznick’s team found that guppies, when moved from predator-ridden environments to a site where there was not the same level of predation, “evolved to mature later, and have fewer, bigger offspring in each litter, just like the guppies that naturally occurred in the cichlid-free streams,” according to the fourth sentence of the last paragraph. If it were discovered that the new site into which Reznick released the guppies were inhabited by fish found to be as predatory as the cichlids in the original sites, this discovery would undermine Reznick’s findings. Such a finding would mean that the pressure of predation on the guppies remained constant from one site to the next. As a consequence, some other factor or factors would be responsible for the developmental changes in the guppies that Reznick’s team recorded.

Choice A is incorrect. If guppies examined in other parts of the globe were found to exhibit genetic shifts in traits at a different rate from the guppies Reznick examined, these findings would not undermine his research because they would have occurred outside the confines of his experimental conditions. Choice C is incorrect. If experimental evolution were shown to be harmful to the environment, this finding, though important, would not undermine Reznick’s findings. Choice D is incorrect. If the descendants of Reznick’s transplanted fish were proven to mature later than the guppies living below the waterfall, this finding would support, rather than undermine, Reznick’s findings.

## QUESTION 27

**Choice A is the best answer.** The last sentence of the passage states, “Other studies of guppies in Trinidad have shown evolutionary change in as few as two and a half years, or a little over four generations, with more time required for genetic shifts in traits such as the ability to form schools and less time for changes in the colorful spots and stripes on a male’s body.” That is, certain traits, such as physical markings, seem to change more quickly than other traits, such as aspects of group behavior. Thus, it can most reasonably be inferred from the passage that the experiments in Trinidad have shown that some genetic traits will evolve more readily than others.

Choices B, C, and D are incorrect because the experiments in Trinidad led to conclusions about guppies' rate of evolutionary changes. These experiments did not lead to an identification of other dangerous predators (choice B), an analysis of how certain guppies thrive better in predator-ridden environments (choice C), or an examination as to how evolutionary changes can be prevented in a natural environment (choice D).

### QUESTION 28

**Choice D is the best answer.** The previous question asks what can most reasonably be inferred about guppies based on the experiments in Trinidad described in the passage. The answer, that some guppy genetic traits will evolve more readily than others, is best supported by the last sentence of the passage: "Other studies of guppies in Trinidad have shown evolutionary change in as few as two and a half years, or a little over four generations, with more time required for genetic shifts in traits such as the ability to form schools and less time for changes in the colorful spots and stripes on a male's body."

Choices A, B, and C are incorrect because the cited lines don't support the answer to the previous question. Instead, they pose a question central to Reznick's research (choice A), describe the conditions that led Reznick to consider conducting experimental evolution tests in Trinidad (choice B), and describe how Reznick's team removed guppies from one area and reintroduced them in another (choice C).

### QUESTION 29

**Choice D is the best answer.** The number of offspring produced by guppies living in the south slope high-predation environment is indicated by the first bar from the left in figure 1. This bar rises to a point midway between 6 and 7 on the graph. Therefore, according to figure 1, guppies living in the south slope high-predation environment produced a mean number of offspring between 6 and 7.

Choice A is incorrect because 2 to 3 offspring were produced by guppies living in the south slope low-predation environment, rather than those living in the high-predation environment, as indicated by the second bar from the left in figure 1. Choice B is incorrect because 3 to 4 offspring were produced by guppies living in the north slope low-predation environment, rather than guppies living in the south slope high-predation environment, as indicated by the bar that is farthest to the right in figure 1. Choice C is incorrect because none of the groups represented in figure 1 produced 5 to 6 offspring.

### QUESTION 30

**Choice C is the best answer.** The graph shows that the mean embryo mass in a low-predation environment for south slope guppies (second bar from the left) is higher than mean embryo mass in a

high-predation environment for south slope guppies (bar farthest to the left). A similar relationship exists for north slope guppies, as the mean embryo mass in a low-predation environment (bar farthest to the right) is higher than the mean embryo mass in a high-predation environment (third bar from the left). Meanwhile, a comparison of south slope high-predation environments (bar farthest to the left) to north slope high-predation environments shows no difference in mean embryo mass. The graph shows that while there is a slightly lower mean embryo mass in north slope low-predation environments (bar farthest to the right) than in south slope low-predation environments (second bar from the left), this difference is only 0.2 mg, which is considerably less than the difference that results from comparing the low- and high-predation environments in each of the two locations. Therefore, the conclusion about the mean mass of guppy embryos that is best supported by figure 2 is that the predation level observed in each environment had more of an effect on mean embryo mass than did slope location.

Choice A is incorrect because slope location wasn't a better indicator of mean embryo mass than was the predation level observed in each environment. Instead, the mean masses of embryos in the two locations were roughly equivalent. Choice B is incorrect because the mean embryo mass of guppies born in the north slope environments didn't exceed the mean embryo mass of guppies born in the south slope environments. Guppies living in high-predation environments in both north and south slope locations had embryos with the same mass, while those living on the north slope in low-predation environments had embryos with a slightly lower mass than that of south slope guppies in low-predation environments. Therefore, the mean embryo mass of guppies born in the south slope environment exceeded the mean embryo mass of guppies born in the north slope environment. Choice D is incorrect because guppies born in low-predation environments didn't have a mean embryo mass less than that of guppies born in high-predation environments. Instead, these guppies had a greater mass.

### QUESTION 31

**Choice B is the best answer.** Figure 1 shows that guppies from low-predation environments (represented on the graph by second and fourth bars from the left) had smaller litters, or fewer guppy offspring, than did guppies from high-predation environments (represented by the first and third bars from the left). Similarly, figure 2 shows that guppies from low-predation environments (the second and fourth bars from the left) also had embryos with a greater mean mass than did guppies from high-predation environments (the first and third bars from the left).

Choice A is incorrect. Although figure 1 does support the conclusion that guppies from low-predation environments have fewer offspring than those from high-predation environments, neither figure indicates the time required for guppies to reach full maturity. Choice C is incorrect because neither figure indicates the survival rate of guppies,

and figure 2 directly contradicts the conclusion that guppies from low-predation environments have less mean embryo mass than those from high-predation environments. Choice D is incorrect. Although figure 2 supports the conclusion that guppies from low-predation environments have a greater mean embryo mass than those from high-predation environments, figure 1 directly contradicts the conclusion that guppies from low-predation environments produce a greater number of offspring than those from high-predation environments.

### QUESTION 32

**Choice D is the best answer.** In the passage, Sara T. Smith addresses the Second Anti-Slavery Convention of American Women. In the second sentence of the first paragraph, Smith states that confronting slavery is “a question of justice” and that it involves “considerations of immense importance to the welfare and prosperity of our country.” In the third paragraph, Smith argues that women shouldn’t be deterred from participating in the abolitionist cause. In the last paragraph, she argues that women “cannot remain inactive” in confronting slavery as “our country is as dear to us as to the proudest statesman. . . . Let our course, then, still be *onward!*” Therefore, Smith’s main purpose in the passage is to encourage women to see their participation in the abolitionist cause as just and important.

Choices A and C are incorrect because Smith doesn’t accuse fellow abolitionists of overlooking the contributions that women have made to the movement (choice A) or make the case that women’s rights are meaningless while slavery exists (choice C). Choice B is incorrect. Although Smith quotes the Declaration of Independence in the third paragraph, the main purpose of the passage isn’t to argue that the causes of abolition and women’s rights are continuations of the spirit of the American Revolution.

### QUESTION 33

**Choice A is the best answer.** Throughout the passage, Smith poses questions that aren’t answered explicitly until the last paragraph, but the leading tone of the speech makes it clear that the implied answer to these questions is “no.” In the second paragraph, Smith questions her critics’ claim that upholding humanitarian values undermines conventional feminine virtues. In the third paragraph, she wonders how women can “have no interest” in the subject of slavery when it could lead to the destruction of their families through war. In the last paragraph, she asks women numerous questions and then answers them with a “no.” Thus, a technique that Smith uses throughout the passage to advance her main point is to present her claims in the form of rhetorical questions that mostly have implicit negative answers.

Choice B is incorrect. Although Smith questions the assertions that her opponents made, she doesn’t criticize her opponents themselves by quoting self-contradictory remarks they have made. Choice C

is incorrect. Although Smith makes use of vivid language and imagery throughout the passage, she doesn't illustrate each of her central ideas with an emotionally powerful anecdote. Choice D is incorrect. Although it is implied that Smith considers her views to be reasonable, she doesn't present them as universally held.

### QUESTION 34

**Choice B is the best answer.** In the first sentence of the passage, Smith introduces the argument that slavery is a “political question” and therefore not “within the ‘province of woman.’” In the second sentence, Smith voices her opposition to this argument: “It is not true that [slavery] is *merely* a political question, it is likewise a question of justice, of humanity, of morality, of religion.” In other words, slavery is too broad a problem to be classified solely as “political,” in Smith's view. However, in the fourth paragraph, Smith returns to the political aspect of the argument at hand by addressing how women must engage in the subject of slavery on a political scale. She argues that “admitting [slavery] to be a political question” doesn't mean that women have “no interest in the welfare of our country,” as women must criticize slavery and its “unjust laws” and seek to stop the nation's “downward course” by choosing to not “remain inactive.” Therefore, Smith develops her argument about slavery as a “political question” over the course of the passage by dismissing the designation as too narrow but then demonstrates its relevance to her audience.

Choice A is incorrect. Although Smith does offer alternative ways of defining the problem of slavery, she doesn't claim that the designation of slavery as a “political question” is outdated, but rather that it is insufficient. Choice C is incorrect because Smith doesn't contend that the designation of slavery as a “political question” has become trite, nor does she invite her audience to revitalize it. Choice D is incorrect. Although Smith's argument is intertwined with questions of gender roles, she doesn't describe the meaning the designation of a “political question” has for men and then challenge women to embrace it.

### QUESTION 35

**Choice B is the best answer.** In the first sentence of the passage, Smith relays a claim: “We are told that it is not within the ‘province of woman,’ to discuss the subject of slavery; that it is a ‘political question,’ and we are ‘stepping out of our sphere,’ when we take part in its discussion.” In the next sentence, Smith rejects this claim: “It is not true that it is *merely* a political question, it is likewise a question of justice, of humanity, of morality, of religion.” She then argues that the subject of slavery “involves considerations of immense importance to the welfare and prosperity of our country, enters deeply into the home-concerns, the every-day feelings of millions of our fellow beings” and expands upon this point by providing an example of the difference, under slavery, between laborers who are enslaved and those

who are within the “dignity of conscious manhood.” Therefore, the best summary of the first paragraph is that Smith rejects a claim and elaborates on her reasons for doing so.

Choice A is incorrect. Although Smith may outline a conventional viewpoint in the first paragraph, she doesn’t present evidence to support it. Choice C is incorrect. Although Smith introduces her subject in the first paragraph, she doesn’t provide historical background for understanding it. Choice D is incorrect. Although Smith does identify a problem in the first paragraph, she doesn’t propose steps to remedy it.

### QUESTION 36

**Choice A is the best answer.** In the first sentence of the second paragraph, Smith relays the sentiment, presumably voiced by those opposed to women abolitionists, that “woman ‘can take no part [in the debate over slavery] without losing something of the modesty and gentleness which are her most appropriate ornaments.’” Smith opposes this view in the following sentence: “must woman necessarily be less gentle because her heart is open to the claims of humanity, or less modest because she feels for the degradation of her enslaved sisters, and would stretch forth her hand for their rescue?” The leading tone of this rhetorical question makes it clear that Smith would answer it with a “no.” Thus, Smith argues that it is possible for women to act according to humanitarian principles while preserving their femininity.

Choices B, C, and D are incorrect because Smith doesn’t argue that it is possible for women to adhere to personal morality while being politically neutral (choice B), contribute to their family’s financial security while meeting social expectations (choice C), or resist calls for war while still opposing slavery (choice D).

### QUESTION 37

**Choice A is the best answer.** The previous question asks which activity Smith argues it is possible for women to engage in. The answer, that she argues that women can act according to humanitarian principles while preserving their femininity, is best supported in the last sentence of the second paragraph: “must woman necessarily be less gentle because her heart is open to the claims of humanity, or less modest because she feels for the degradation of her enslaved sisters, and would stretch forth her hand for their rescue?” The leading tone of this rhetorical question makes it clear that Smith would answer it with a “no.” In other words, Smith believes that women can uphold humanitarian principles while maintaining conventional feminine virtues.

Choices B, C, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they link women’s conventional domestic concerns with the losses that would be incurred by a war over slavery (choice B), affirm that the potential horrors of



war are enough to stir women out of a state of political inactivity (choice C), and equate women's patriotism with that of male political leaders (choice D).

### QUESTION 38

**Choice C is the best answer.** In the first sentence of the third paragraph, Smith states “by the Constitution of the United States, the whole physical power of the North is pledged for the suppression of domestic insurrections, and should the slaves, maddened by oppression, endeavor to shake off the yoke of the taskmaster, the men of the North are bound to make common cause with the tyrant, and put down, at the point of the bayonet, every effort on the part of the slave, for the attainment of his freedom.” In other words, according to Smith, if slaves were to revolt, the US Constitution would require that Northern states help the slave states fight the slaves' rebellion.

Choices A, B, and D are incorrect because Smith doesn't argue that if the slaves were to revolt the US Constitution would require the Northern states to sever ties with the slave states (choice A), give shelter to refugees from the slave states (choice B), or provide financial assistance to the rebelling slaves (choice D).

### QUESTION 39

**Choice D is the best answer.** The word “tyrant” describes a cruel and unfair ruler. It is first used in the first sentence of the third paragraph, when Smith argues that in the event of a slave rebellion in the slave states, “the men of the North are bound to make common cause with the tyrant, and put down, at the point of the bayonet, every effort on the part of the slave, for the attainment of his freedom.” The word occurs again in the seventh sentence of the last paragraph, when Smith asserts the strength of women's “aspirations that every inhabitant of our land may be protected . . . by just and equal laws” so that “the foot of the tyrant may no longer invade the domestic sanctuary.” In both instances, the word “tyrant” is used to represent slaveholders and their allies. Thus, Smith's use of “tyrant” emphasizes the unjustness of slavery.

Choice A is incorrect because Smith's use of the word “tyrant” doesn't identify a specific individual as oppressive. Instead, it refers to all those individuals who profit from and abet the unjust institution of slavery. Choice B is incorrect because Smith's use of the word “tyrant” doesn't highlight the threat of aggression from abroad. Instead, it highlights national injustice. Choice C is incorrect because Smith's use of the word “tyrant” doesn't critique the limited roles for women in antislavery movements. Smith's use of the word “tyrant” refers to slaveholders and their allies, not those who would discourage women's participation in the antislavery movement.

### QUESTION 40

**Choice C is the best answer.** In the last sentence of the third paragraph, Smith argues that the threat of a war precipitated by slavery “is of itself sufficient to arouse the slumbering energies of woman” to speak out against slavery’s injustice. In other words, women have the potential to protest slavery, but they have been relatively inactive, or dormant, up until now. Therefore, the word “slumbering,” as used in this sentence, most nearly means dormant.

Choices A, B, and D are incorrect because in the context of the passage, “slumbering” means dormant, not lethargic (choice A), drowsy (choice B), or unconscious (choice D).

### QUESTION 41

**Choice A is the best answer.** The fifth sentence of the last paragraph poses the following question: “Shall we silently behold the land which we love with all the heart-warm affection of children, rendered a hissing and a reproach throughout the world, by this system which is already tolling the death-bell of her decease among the nations?” In other words, the continuation of slavery in the United States is being criticized “throughout the world,” such that the existence of slavery affects the United States by lowering the country’s reputation in the international community.

Choice B is incorrect because Smith doesn’t suggest that slavery affects the United States by leading many women to disavow their allegiance to the country. Instead, she suggests that it is partly women’s patriotism that should stir them to protest slavery because it is lowering the reputation of the United States in the international community. Choice C is incorrect. Although Smith speaks ominously in the last paragraph of “the events of the last two years” that are “overclouding the bright prospects of the future,” she doesn’t cite any current violent conflicts in the country. Choice D is incorrect because Smith doesn’t suggest that slavery weakens the authority of the country’s government. Instead, she argues that it damages the country’s reputation abroad.

### QUESTION 42

**Choice C is the best answer.** The previous question asks how Smith most strongly suggests that slavery affects the United States. The answer, that slavery affects the United States by lowering the country’s reputation in the international community, is best supported by the fifth sentence of the last paragraph: “Shall we silently behold the land which we love with all the heart-warm affection of children, rendered a hissing and a reproach throughout the world, by this system which is already tolling the death-bell of her decease among the nations?”

Choices A, B, and D are incorrect because the cited lines don’t support the answer to the previous question. Instead, they suggest that because war affects home life, women are right to concern themselves

with the possibility of war (choice A), imply that women have a right to consider issues that fall outside the domestic sphere (choice B), and issue a call to action for women to voice condemnation of slavery (choice D).

### QUESTION 43

**Choice C is the best answer.** The first paragraph of Passage 1 presents a quote by biochemist Kim Lewis of Northeastern University: “Pathogens are acquiring resistance faster than we can introduce new antibiotics, and this is causing a human health crisis.” The rest of the passage describes Lewis’s research and the experimental antibiotic called teixobactin that her research has produced. According to the second paragraph of the passage, teixobactin has “proved effective at killing off a wide variety of disease-causing bacteria—even those that have developed immunity to other drugs.” Therefore, the first paragraph of Passage 1 primarily serves to identify a problem that the research discussed in the passage may help to address.

Choice A is incorrect because although the first paragraph quotes a claim by Lewis regarding antibiotic resistance, this claim isn’t developed over the course of Passage 1. Choice B is incorrect because the claim made in the first paragraph regarding antibiotic resistance isn’t presented as controversial, nor does Passage 1 attempt to resolve any scientific controversies. Choice D is incorrect because the claim made in Paragraph 1 isn’t presented as a theory; moreover, the findings in Passage 1 support this claim rather than challenge it.

### QUESTION 44

**Choice D is the best answer.** The third paragraph of Passage 1 describes how, historically, the development of antibiotics requires “natural microbial substances,” but this reliance has severe limitations as only about one percent of these microbial substances can be grown in a laboratory. The author goes on to explain how “the rest, in staggering numbers, have remained uncultured and of limited use to medical science, until now.” The paragraph then describes the method Lewis’s team used to grow teixobactin microorganisms “in their natural environment where they already have the conditions they need for growth.” Therefore, the author of Passage 1 suggests that an advantage of the method Lewis’s team used to grow microorganisms is that it allows researchers to make use of soil bacteria that they had previously been unable to exploit.

Choice A is incorrect because although the author of Passage 1 suggests that Lewis’s team identified the requirements for soil bacteria to thrive, the team didn’t replicate those features in artificial soil. Instead, the author suggests in the third and fourth paragraphs of Passage 1 that they used real soil samples. Choice B is incorrect because the author of Passage 1 doesn’t suggest that the method Lewis’s team used to grow microorganisms enabled soil bacteria to

take in more nutrients than they typically consume in natural settings. Instead, it can be inferred from the fourth paragraph of the passage that the bacteria were provided with the same nutrients they consume in natural settings. Choice C is incorrect because the last paragraph of Passage 1 explains that it isn't the method Lewis's team used to grow bacteria but the antibiotic the team created that affects the cell walls of bacteria.

### QUESTION 45

**Choice A is the best answer.** The previous question asks what advantage of the method Lewis's team used to grow microorganisms is suggested by the author of Passage 1. The answer, that this method allows researchers to make use of soil bacteria that they had previously been unable to exploit, is best supported by the first through third sentences of the third paragraph of Passage 1: "Natural microbial substances from soil bacteria and fungi have been at the root of most antibiotic drug development during the past century. But only about one percent of these organisms can be grown in a lab. The rest, in staggering numbers, have remained uncultured and of limited use to medical science, until now."

Choices B, C, and D are incorrect because the cited lines don't support the answer to the previous question. Instead, they describe the gadget that Lewis's team developed to grow microorganisms (choice B), explain how the team's technique affects the bacteria (choice C), and outline how teixobactin attacks harmful bacteria (choice D).

### QUESTION 46

**Choice D is the best answer.** In the first sentence of Passage 2, the author outlines the "long . . . suspected" belief that if researchers could "grow more types of bacteria from soil . . . then we might find new natural antibiotics." The author then explains how Lewis's team's technique that led to the development of teixobactin employed growing bacteria from soil. The author concludes in the last sentence of the first paragraph that Lewis's team's "simple and elegant methodology . . . opens a gateway to cultivating a wealth of potentially antibiotic-producing bacteria." Therefore, the author of Passage 2 would most likely agree with the statement that the development of teixobactin confirms a long-held belief about a potential source of new antibiotics.

Choice A is incorrect because the author of Passage 2 wouldn't likely agree with the statement that the development of teixobactin reveals that some antibiotics are effective against gram-negative bacteria. The author mentions gram-negative bacteria in the third paragraph to highlight teixobactin's ineffectiveness in combating it, not to discuss other antibiotics that are effective against gram-negative bacteria. Choice B is incorrect because the author wouldn't likely agree with the statement that the development of teixobactin shows that conventional methods can still yield new types of antibiotics. Instead, the author

contends that the unconventional method used to produce teixobactin may yield new types of antibiotics. Choice C is incorrect because the author wouldn't likely agree with the statement that the development of teixobactin casts doubt on the practicality of searching for new antibiotics in exotic environments. Rather, in the first paragraph of Passage 2, the author states that exotic environments might yield new antibiotics.

### QUESTION 47

**Choice C is the best answer.** In the first sentence of the last paragraph of Passage 2, the author expresses reservations about the immediate usefulness of teixobactin: "So, what are my caveats? Well, I see three. First, teixobactin isn't a potential panacea. . . . Secondly, scaling to commercial manufacture will be challenging. . . . And, thirdly . . . teixobactin now faces the long haul of clinical trials." The author uses the word "caveats" to introduce skeptical comments about teixobactin's value. Thus, the word "caveats," as used in the first sentence of the last paragraph of Passage 2, most nearly means misgivings.

Choices A, B, and D are incorrect because in the context of the passage, "caveats" means misgivings, not exceptions (choice A), restrictions (choice B), or explanations (choice D).

### QUESTION 48

**Choice A is the best answer.** In the last paragraph of Passage 2, the author expresses reservations regarding teixobactin. One of these reservations is that the drug "now faces the long haul of clinical trials" before teixobactin can be made available for consumers. These clinical trials will be used to discover "what dose you can safely give the patient . . . if it cures infections, and . . . to compare its efficacy to that of 'standard of care treatment,'" and are "going to take five years and £500 million." Thus, the author uses the phrase "five years and £500 million" primarily to emphasize the scale of the effort needed to make teixobactin available for consumer use.

Choices B, C, and D are incorrect because the author of Passage 2 uses the phrase "five years and £500 million" as a reference to the time and financial commitment that will be required to make teixobactin available to the public. That being the case, the phrase doesn't imply criticism of the level of funding that the government has committed to teixobactin development (choice B), address the amount of time and money that has already been spent researching teixobactin (choice C), or compare the amount of money spent developing teixobactin with the amount spent developing other antibiotics (choice D).

### QUESTION 49

**Choice A is the best answer.** Passage 1 discusses research conducted by biochemist Kim Lewis. As described in the second paragraph of the passage, this research explored "a new way to tap the powers of

soil microorganisms” in the laboratory and led to the development of teixobactin, a promising new drug that could “function effectively for decades,” thereby addressing the problem of pathogens’ resistance to antibiotics. The author of Passage 2 critiques the research described in Passage 1. In the first paragraph of Passage 2, the author declares that the methodology Lewis and others developed “is their most important finding . . . for it opens a gateway to cultivating a wealth of potentially antibiotic-producing bacteria.” However, teixobactin “is less exciting” to the author of Passage 2 because it has proved ineffective at combating certain types of bacteria and large investments of time and money will be needed before it can be made available to the public at large, according to the second and third paragraphs of Passage 2. Therefore, the best description of the relationship between Passage 1 and Passage 2 is that Passage 2 offers an evaluation of the significance of the research discussed in Passage 1.

Choice B is incorrect because Passage 2 doesn’t suggest a modification to the methodology described in Passage 1. Instead, the author of Passage 2 embraces the “simple and elegant” methodology described in Passage 1. Choice C is incorrect because Passage 2 doesn’t use concrete examples to illustrate concepts considered in Passage 1. Instead, it evaluates the significance of the research. Choice D is incorrect because Passage 2 doesn’t take a dismissive stance regarding the findings mentioned in Passage 1. The author of Passage 2 endorses the methodology described in Passage 1, and concedes that teixobactin “doesn’t look bad,” while outlining some reservations about the drug’s value.

## QUESTION 50

**Choice B is the best answer.** The first paragraph of Passage 1 quotes biochemist Kim Lewis of Northeastern University: “Pathogens are acquiring resistance faster than we can introduce new antibiotics, and this is causing a human health crisis.” However, research conducted by Lewis has produced a drug called teixobactin, which has “proved effective at killing off a wide variety of disease-causing bacteria—even those that have developed immunity to other drugs,” according to the second sentence of the second paragraph of Passage 1. Similarly, in the third sentence of the second paragraph of Passage 2, the author of the passage states that teixobactin “killed the tuberculosis bacterium, which is important because there is a real problem with resistant tuberculosis in the developing world.” Therefore, both passages make the point that teixobactin could be useful in combating infections that are no longer responding to treatment with other antibiotics.

Choice A is incorrect because Passage 1 outlines the methodology used to produce teixobactin but doesn’t offer it as a model for future development of antibiotics produced in laboratory environments. Passage 2 suggests that future development of antibiotics may draw on the methodology that Lewis and others developed, but the passage doesn’t go so far as to suggest that teixobactin could be used to

standardize this development. Choices C and D are incorrect because neither passage makes the point that teixobactin could be useful in controlling the spread of pathogenic soil fungi (choice C) or in shaping a new method of studying the effectiveness of antibiotics (choice D).

## QUESTION 51

**Choice C is the best answer.** According to the last sentence of the fifth paragraph of Passage 1, “Mice infected with bacteria that cause upper respiratory tract infections . . . were treated with teixobactin, and the drug knocked out the infections with no noticeable toxic effects.” The second paragraph of Passage 2 explains that teixobactin was tested in a laboratory and killed gram-positive bacteria, but, according to the fourth sentence of the third paragraph, it “doesn’t kill the Gram-negative opportunists as it is too big to cross their complex cell wall.” Therefore, since teixobactin was not successful in eradicating gram-negative bacteria as stated in Passage 2, this information best supports the conclusion that the mice described in the experiment in Passage 1 had upper respiratory tract infections that were likely not caused by gram-negative bacteria since these infections were successfully treated by teixobactin.

Choices A, B, and D are incorrect because no information in Passage 2 supports the conclusion that the mice in the experiment described in Passage 1 were less susceptible to subsequent upper respiratory tract infections due to exposure to teixobactin (choice A), the gram-positive bacteria enhanced the effectiveness of teixobactin against the upper respiratory tract infections in the mice (choice B), or the teixobactin attacked the proteins of the bacteria that caused the upper respiratory tract infections in the mice.

## QUESTION 52

**Choice D is the best answer.** The previous question asks which conclusion about the mice in the experiment described in Passage 1 is best supported by information in Passage 2. The answer, that their upper respiratory tract infections were likely not caused by gram-negative bacteria, is best supported by the fourth sentence of the third paragraph of Passage 2: “[Teixobactin] doesn’t kill the Gram-negative opportunists as it is too big to cross their complex cell wall.”

Choices A, B, and C are incorrect because the cited lines don’t support the answer to the previous question. Instead, they provide a historical background to Lewis’s cultivation of soil bacteria (choice A), praise the methodology used by Lewis’s team and others (choice B), and introduce an evaluation of teixobactin (choice C).

## Section 2: Writing and Language Test

### QUESTION 1

**Choice B is the best answer.** The verb “watch” clearly and concisely indicates that scientists can view underwater volcanic eruptions “via remotely operated vehicles.”

Choices A, C, and D are incorrect because they’re repetitive. “Observe,” “see,” and “visually” unnecessarily reiterate the idea that scientists can view underwater volcanic eruptions.

### QUESTION 2

**Choice B is the best answer.** Sentence 5 should be placed after sentence 1. The phrase “at that depth” at the beginning of sentence 5 refers to the statement in sentence 1 that NW Rota-1’s summit is located “more than 1,700 feet under the ocean’s surface.” Furthermore, sentence 5 leads into sentence 2, which explains what scientists were able to determine about the volcano’s growth from remotely operated vehicles.

Choices A, C, and D are incorrect because placing sentence 5 anywhere in the paragraph other than after sentence 1 would create an illogical, confusing paragraph.

### QUESTION 3

**Choice A is the best answer.** The adverb “nevertheless” correctly indicates that despite the fact that sunlight doesn’t reach NW Rota-1, the bacteria there have adapted to the “perpetually dark environment” and “use hydrogen sulfide instead of sunlight” for energy.

Choices B, C, and D are incorrect because they don’t indicate the true relationship between the two independent clauses. “Afterward” indicates that one event happens after another. “Furthermore” suggests that additional information about what has been said earlier in the sentence will follow. “Similarly” indicates that a comparison is being made.

### QUESTION 4

**Choice C is the best answer.** The plural pronoun “them” agrees in number with the plural antecedent “bacteria.”

Choices A, B, and D are incorrect because they’re singular pronouns that don’t agree in number with the plural antecedent “bacteria.”

### QUESTION 5

**Choice D is the best answer.** The conjunction “and” followed by “other chemicals” results in a sentence with a parallel series of nouns.

Choices A, B, and C are incorrect because they don’t maintain the sentence’s parallel structure, and they unnecessarily repeat a form of the verb “remove.”



## QUESTION 6

**Choice C is the best answer.** The dashes after “shrimp” and “Hawaii” are used correctly to set off the nonessential information between them.

Choices A and B are incorrect because neither a comma nor a semicolon can be used with a dash to set off nonessential information. Choice D is incorrect because punctuation, in this case a dash, is needed after “Hawaii” to finish setting off the nonessential information.

## QUESTION 7

**Choice D is the best answer.** This choice’s reference to “predators” most effectively sets up the sentence that follows, which explains that, as adults, the previously unknown species of shrimp feeds on the Loihi shrimp.

Choices A, B, and C are incorrect because they don’t effectively set up the information in the sentence that follows. The following sentence doesn’t discuss the idea that the other species of shrimp is able to adapt to its noxious environment. Additionally, it doesn’t address the idea that scientists don’t yet understand the adaptations of the shrimp or that their unusual ecosystem also includes crabs, limpets, and barnacles.

## QUESTION 8

**Choice A is the best answer.** This choice most effectively combines the sentences at the underlined portion by creating a compound predicate using two parallel, singular, present tense verbs (“condenses” and “leaves”) to show that as the steam condenses only “carbon dioxide bubbles and droplets of molten sulfur” are left.

Choices B, C, and D are incorrect because they don’t effectively combine the sentences. The resulting sentences aren’t concise, and the verbs aren’t parallel.

## QUESTION 9

**Choice D is the best answer.** This choice results in a logical comparison between the water near NW Rota-1 and stomach acid.

Choices A and B are incorrect because the demonstrative pronouns “that” and “those” don’t have clear antecedents, leaving unclear what the water near NW Rota-1 is being compared to. Choice C is incorrect because it unnecessarily repeats the word “acid,” resulting in a nonsensical expression (“the acid from stomach acid”).

## QUESTION 10

**Choice C is the best answer.** The singular possessive noun “world’s” is used correctly to indicate that the plural noun “oceans” belongs to one world.

Choice A is incorrect because “worlds” is a plural possessive noun, and there is only one world being referred to. Furthermore, the possessive noun “ocean’s” is incorrect because nothing belongs to the ocean in this sentence. Choice B is incorrect because “oceans” is a possessive noun, and nothing belongs to “oceans” in this sentence. Choice D is incorrect because “worlds” is a plural noun, and this noun needs to be the singular possessive noun “world’s” to show that the oceans belong to one world.

### QUESTION 11

**Choice A is the best answer.** The writer should make the revision because it shows the relevance of the sentence about rising carbon dioxide levels in Earth’s atmosphere to the paragraph’s point about the increasing acidity of the world’s oceans.

Choice B is incorrect because the revision doesn’t help readers to understand why organisms near NW Rota-1 evolved the way they did. Choices C and D are incorrect because the revision should be made. The revision doesn’t repeat information, and it does contribute to the paragraph’s main idea. Furthermore, it doesn’t add an irrelevant detail that interrupts the discussion of oceanic life-forms.

### QUESTION 12

**Choice C is the best answer.** The comma after “ridership” is used correctly to separate the dependent clause that begins with the word “while” from the independent clause that follows “ridership.”

Choice A is incorrect because the conjunction “but” can’t join a dependent clause to an independent clause. Choice B is incorrect because the conjunctions “and while” create a second dependent clause, but an independent clause is needed to make the sentence complete. Choice D is incorrect because a semicolon can’t be used in this way to separate an introductory dependent clause from an independent clause.

### QUESTION 13

**Choice B is the best answer.** This choice is the most effective because it doesn’t repeat the word “people.” Furthermore, this choice’s use of the active voice, which indicates that “more people” (the subject of the sentence) use public transportation, eliminates unnecessary wording.

Choices A and C are incorrect because they unnecessarily repeat the noun “people.” Choice D is incorrect because the use of the passive voice, which changes the subject of the sentence from “more people” to “using public transportation,” creates a wordy sentence.

## QUESTION 14

**Choice B is the best answer.** The colon correctly introduces information that illustrates what has come before it. The independent clause that follows the colon indicates that “car traffic in Tallinn was down less than 3 percent,” which supports the statement before the colon that “car use in Tallinn has only slightly declined.”

Choice A is incorrect because the semicolon awkwardly joins an independent clause with the dependent clause that follows. Choice C is incorrect because it creates a comma splice. Choice D is incorrect because it creates a sentence fragment after the period.

## QUESTION 15

**Choice D is the best answer.** “The policy” clearly indicates what was enacted. The passage indicates that “car traffic in Tallinn was down less than 3 percent” since the policy of fare-free rides was enacted.

Choices A, B, and C are incorrect because the pronouns in these choices don’t have clear antecedents.

## QUESTION 16

**Choice A is the best answer.** This choice best introduces the paragraph; the phrase “devastating effect” sets up the paragraph’s discussion of how fare-free systems can negatively impact a city’s transportation budget.

Choices B, C, and D are incorrect because they don’t introduce the paragraph’s topic, which is the devastating effects of a fare-free system on a city’s budget. The paragraph doesn’t focus on changes in service, negative environmental impact, or increased crowding on public transportation.

## QUESTION 17

**Choice C is the best answer.** The comma after “savings” and the conjunction “but” are used correctly to connect the two independent clauses.

Choices A and B are incorrect because they each create a comma splice. Choice D is incorrect because the conjunction “and” signals additional information rather than the needed contrast.

## QUESTION 18

**Choice D is the best answer.** The expression “overly optimistic” is consistent with the formal tone of the passage.

Choices A, B, and C are incorrect. While “way too sunny,” “looking too much on the bright side,” and “pretty upbeat” all convey optimism, they’re colloquial expressions that don’t fit the formal tone of the passage.

### QUESTION 19

**Choice C is the best answer.** This choice provides an accurate interpretation because the chart indicates that the projected total additional operating costs for implementing a fare-free policy in San Francisco, CA, would be \$184 million per year.

Choices A, B, and D are incorrect because they don't accurately interpret the information provided in the chart for San Francisco, CA. The chart projects a cost of \$112 million in lost fares, not a deficit of \$72 million per year in lost fares (choice A) or a savings of \$112 million from lost fares (choice B). The chart projects a cost of \$72 million per year to add fare-free service, not a savings of \$72 million (choice D).

### QUESTION 20

**Choice C is the best answer.** The sentence shouldn't be added because the fact that Eugene, OR, "would lose only \$5 million" doesn't support the writer's argument that fare-free systems cause large financial losses to governments.

Choices A and B are incorrect. The sentence shouldn't be added because the fact that Eugene, OR, would lose only \$5 million in fares doesn't support the writer's argument against fare-free systems. Furthermore, it doesn't reinforce any claim made earlier in the paragraph by advocates of fare-free policies. Choice D is incorrect because the sentence doesn't contradict any point made earlier in the paragraph about fare collection.

### QUESTION 21

**Choice B is the best answer.** The present indicative verb "do [not] have" is consistent in tense and mood with the present indicative verb "can go" earlier in the sentence.

Choice A is incorrect because "would [not] have had" is a perfect conditional verb. Choice C is incorrect because "did [not] have" is a past indicative verb. Choice D is incorrect because "will [not] have" is a future indicative verb.

### QUESTION 22

**Choice D is the best answer.** This choice provides the best conclusion to the passage, which argues that fare-free transportation policies "have not been found to be an effective way to address traffic problems" and "may result in serious budget shortfalls."

Choices A, B, and C are incorrect because they don't provide the best conclusion to the passage. Choice A is too narrowly focused, and choices B and C make claims that aren't supported by information in the passage.

## QUESTION 23

**Choice B is the best answer.** The singular third person pronoun “it” correctly refers to the singular antecedent “digital camera.”

Choice A is incorrect because the plural pronoun “they” doesn’t agree in number with the singular antecedent “digital camera.” (It wouldn’t make sense here to assume that “they” refers to “professional photographers,” as there’s no clear indication that the photographers referred to used the earliest digital cameras.) Choice C is incorrect because the indefinite pronoun “one” doesn’t refer to a specific noun. Choice D is incorrect because the personal pronouns “he or she” refer to people, not things.

## QUESTION 24

**Choice B is the best answer.** To make the paragraph most logical, the new sentence “Why wouldn’t they?” should be placed after sentence 2. The pronoun “they” in the new sentence refers to the “vast majority” of professional photographers mentioned in sentence 2. Furthermore, the two sentences that follow the new sentence answer the question of why photographers would trade film for digital cameras by stating that the latest digital cameras take pictures that are “crisp,” “bright,” and “sharp.”

Choices A, C, and D are incorrect because placing the new sentence anywhere in the paragraph other than after sentence 2 would create an illogical and confusing paragraph.

## QUESTION 25

**Choice B is the best answer.** The new sentence should be added because its reference to “several intricate steps” sets up the process of wet plate photography discussed in the rest of the paragraph.

Choice A is incorrect. The sentence should be added, but it doesn’t reiterate the previous paragraph’s main idea. Choices C and D are incorrect because the sentence should be added. The new sentence doesn’t blur the paragraph’s focus on the dangers of developing wet plate photographs. It also doesn’t offer an opinion: while “labor-intensive” can be interpreted as an opinion, the description of the steps is factual.

## QUESTION 26

**Choice D is the best answer.** The plural possessive pronoun “their” agrees in number with the plural antecedent “photographers” and correctly indicates that the subjects belong to the photographers.

Choice A is incorrect because “it’s” is a contraction for “it is” and doesn’t make sense in the sentence. Choice B is incorrect because “its” is a singular possessive pronoun and doesn’t agree in number with the plural antecedent “photographers.” Choice C is incorrect because “there” isn’t a possessive pronoun.

### QUESTION 27

**Choice A is the best answer.** The coordinating conjunction “so” is used correctly to indicate that because dried collodion is unusable, a photographer has to work quickly to develop the film once the photo is taken.

Choices B, C, and D are incorrect because they don’t convey the intended cause-and-effect relationship between the two independent clauses. “But” (choice B) indicates that an exception or contrast to what was said previously will follow. “And” (choice C) suggests that the two clauses indicate separate ideas instead of a cause-and-effect relationship. “For” (choice D), used as a conjunction, means “because.” If used in this sentence, “for” would indicate that dried collodion is unusable because the photographer must quickly develop the photograph.

### QUESTION 28

**Choice D is the best answer.** The word “mere” most effectively suggests that the photographer has only a very brief time to develop wet plate photographs.

Choices A, B, and C are incorrect because they don’t accomplish the writer’s goal of emphasizing how quickly wet plate photographers must work. “Nominal” isn’t idiomatic when referring to a short amount of time. “A few” and “a matter of” can be used to describe time, but neither choice emphasizes how quickly wet plate photographers have to work.

### QUESTION 29

**Choice B is the best answer.** The adverb “finally” correctly indicates that the last step in the process of wet plate photography is to coat the photo with a protective finish.

Choices A, C, and D are incorrect because they don’t indicate that the final step in a process will follow. “In conclusion” is used to introduce a summary of what has previously been said. “Thus” indicates that a result of what has been previously stated will follow. “Nevertheless” is used to introduce a contrast to what has been stated earlier.

### QUESTION 30

**Choice D is the best answer.** No punctuation is needed in the sentence except for a period.

Choice A is incorrect because the parentheses indicate that the information between them could be deleted without changing the meaning of the sentence. In this sentence, the information in the parentheses contains the direct object of the verb “give” and is essential. Choice B is incorrect because the dash wrongly indicates that the information following is being emphasized. Choice C is incorrect because the commas indicate that the information between them is nonessential and could be deleted.

### QUESTION 31

**Choice A is the best answer.** The present tense verb “swirl” is consistent with the other present tense verbs in the paragraph’s description of wet plate photographs.

Choices B, C, and D are incorrect because the tenses of these choices are inconsistent with the present tense verbs in the paragraph’s description of wet plate photographs. “Will have swirled” (choice B) is a future perfect tense verb. “Have swirled” (choice C) is a present perfect tense verb. “Swirled” (choice D) is a simple past tense verb.

### QUESTION 32

**Choice D is the best answer.** This choice is clear and concise and doesn’t unnecessarily repeat the idea that long exposure time can cause parts of a subject to disappear in a photo.

Choices A, B, and C are incorrect because they’re repetitive. The previous sentence already mentions the “long exposures,” and this noun phrase doesn’t need to be repeated.

### QUESTION 33

**Choice A is the best answer.** The reference to “nineteenth-century wave riders” accomplishes the writer’s goal of highlighting the contrast between present-day photographer Joni Sternbach’s nineteenth-century techniques and her contemporary subjects.

Choices B, C, and D are incorrect because they don’t highlight a contrast between Sternbach’s techniques and her subjects. The descriptions “ordinary people,” “surfers,” and people “from all walks of life” don’t clearly allude to the old style of her photographic techniques and, therefore, don’t offer a contrast to her subjects who wear “modern board shorts and bikinis.”

### QUESTION 34

**Choice A is the best answer.** The revision should be made because the passage is about how a team of urban archaeologists uncovered the history of New York City’s South Street Seaport, and this revision helps explain the job of urban archaeologists.

Choice B is incorrect because, although the revision should be made, it doesn’t identify the characteristics that make “cities worthy of archaeological study.” Choices C and D are incorrect because the revision should be made. Neither the kinds of artifacts that urban archaeologists find nor how excavation benefits historical study explains what urban archaeologists do.

### QUESTION 35

**Choice C is the best answer.** The singular verb “is required” agrees in number with the singular subject “project.”

Choices A, B, and D are incorrect because the plural verbs “are required,” “have been required,” and “were required” don’t agree in number with the singular subject “project.”

### QUESTION 36

**Choice D is the best answer.** This choice is clear and concise and doesn’t repeat the idea of “possibility” already mentioned in the sentence.

Choices A and B are incorrect because the words “possible” and “potentially” repeat the idea of “possibility” mentioned earlier in the sentence. Choice C is incorrect because “it is necessary that” repeats the idea mentioned later in the sentence that “an urban archaeologist must be consulted.”

### QUESTION 37

**Choice B is the best answer.** The adverb “though” correctly conveys a contrast between the facts that the work continued and the team faced obstacles.

Choices A, C, and D are incorrect because they don’t indicate the true relationship between the progression of the team’s work and the obstacles. “Therefore” suggests that because the work continued, the team faced obstacles. “Meanwhile” is redundant: the dependent clause “as the work continued” already implies that the work was happening when obstacles emerged. “Similarly” suggests that a comparison is being made.

### QUESTION 38

**Choice D is the best answer.** No punctuation is needed between the verb “halted” and the prepositional phrase “by stormy weather and the discovery of toxic materials underground” that follows it.

Choices A, B, and C are incorrect because each introduces unnecessary punctuation between the verb and the prepositional phrase.

### QUESTION 39

**Choice C is the best answer.** The noun “pedestrians” is parallel in form to the nouns “vehicles” and “car horns.”

Choices A, B, and D are incorrect because the repetition of “noise” in choices A and B and the inclusion of the pronoun “that” (which stands in for “noise”) in choice D violate the parallel structure of the series of nouns (“construction vehicles,” “car horns,” “pedestrians”) serving as the objects of the preposition “of.”

### QUESTION 40

**Choice C is the best answer.** The comma is used correctly to separate the independent clause from the participial phrase that begins with “including.”



Choice A is incorrect because the period after “site” results in a rhetorically poor fragment. Choice B is incorrect because the comma after “site” creates a comma splice. Choice D is incorrect because a semicolon can’t be used in this way to connect an independent clause to a participial phrase.

### QUESTION 41

**Choice C is the best answer.** This idea of “public utility planning and infrastructure development” best sets up the example that follows about how colonial-era New Yorkers secured fresh drinking water.

Choices A, B, and D are incorrect because they don’t set up the discussion of colonial-era New Yorkers’ public utility planning and infrastructure development. The example that follows doesn’t deal with construction materials, hospitality rituals, or the financing of construction projects.

### QUESTION 42

**Choice A is the best answer.** The word “effort” is consistent with the formal style and tone of the passage.

Choices B, C, and D are incorrect because they don’t maintain the formal style and tone of the passage. Choices B and C are colloquial, and choices B and D are exaggerations that are inconsistent with the passage’s informative style.

### QUESTION 43

**Choice D is the best answer.** The subject of the sentence, “urban archaeologists,” clearly identifies who makes discoveries and tells the story of a city’s history.

Choices A and B are incorrect because the pronouns “they” and “we” don’t have clear antecedents. Choice C is incorrect because it isn’t true. “Colonial-era New Yorkers” don’t make the discoveries or tell the stories to which the sentence refers.

### QUESTION 44

**Choice C is the best answer.** This choice accomplishes the goal of identifying the broad impact of the urban archaeological team’s work by mentioning that excavation “makes New York City’s history real.”

Choices A, B, and D are incorrect because they don’t illustrate the broad impact of the team’s work. Loorya’s references to one of her favorite things about her work (choice A), New York City construction (choice B), and the archaeological technique of monitoring (choice D) don’t provide an effective concluding statement about her team’s impact.

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice B is correct.** Multiplying both sides of the first equation in the system by 2 yields  $4x - 2y = 16$ . Adding  $4x - 2y = 16$  to the second equation in the system yields  $5x = 20$ . Dividing both sides of  $5x = 20$  by 5 yields  $x = 4$ . Substituting 4 for  $x$  in  $x + 2y = 4$  yields  $4 + 2y = 4$ . Subtracting 4 from both sides of  $4 + 2y = 4$  yields  $2y = 0$ . Dividing both sides of this equation by 2 yields  $y = 0$ . Substituting 4 for  $x$  and 0 for  $y$  in the expression  $x + y$  yields  $4 + 0 = 4$ .

Choices A, C, and D are incorrect and may result from various computation errors.

### QUESTION 2

**Choice A is correct.** Since  $(x^2 - x)$  is a common term in the original expression, like terms can be added:  $2(x^2 - x) + 3(x^2 - x) = 5(x^2 - x)$ . Distributing the constant term 5 yields  $5x^2 - 5x$ .

Choice B is incorrect and may result from not distributing the negative signs in the expressions within the parentheses. Choice C is incorrect and may result from not distributing the negative signs in the expressions within the parentheses and from incorrectly eliminating the  $x^2$ -term. Choice D is incorrect and may result from incorrectly eliminating the  $x$ -term.

### QUESTION 3

**Choice D is correct.** To find the slope and  $y$ -intercept, the given equation can be rewritten in slope-intercept form  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. The given equation  $2y - 3x = -4$  can be rewritten in slope-intercept form by first adding  $3x$  to both sides of the equation, which yields  $2y = 3x - 4$ . Then, dividing both sides of the equation by 2 results in the equation  $y = \frac{3}{2}x - 2$ . The coefficient of  $x$ ,  $\frac{3}{2}$ , is the slope of the graph and is positive, and the constant term,  $-2$ , is the  $y$ -intercept of the graph and is negative. Thus, the graph of the equation  $2y - 3x = -4$  has a positive slope and a negative  $y$ -intercept.

Choice A is incorrect and may result from reversing the values of the slope and the  $y$ -intercept. Choices B and C are incorrect and may result from errors in calculation when determining the slope and  $y$ -intercept values.

### QUESTION 4

**Choice A is correct.** It's given that the front of the roller-coaster car starts rising when it's 15 feet above the ground. This initial height of 15 feet can be represented by a constant term, 15, in an equation. Each second, the front of the roller-coaster car rises 8 feet, which can

be represented by  $8s$ . Thus, the equation  $h = 8s + 15$  gives the height, in feet, of the front of the roller-coaster car  $s$  seconds after it starts up the hill.

Choices B and C are incorrect and may result from conceptual errors in creating a linear equation. Choice D is incorrect and may result from switching the rate at which the roller-coaster car rises with its initial height.

## QUESTION 5

**Choice C is correct.** Since the variable  $h$  represents the number of hours a job took, the coefficient of  $h$ , 75, represents the electrician's charge per hour, in dollars, after an initial fixed charge of \$125. It's given that the electrician worked 2 hours longer on Ms. Sanchez's job than on Mr. Roland's job; therefore, the additional charge for Ms. Sanchez's job is  $\$75 \times 2 = \$150$ .

Alternate approach: The amounts the electrician charged for Mr. Roland's job and Ms. Sanchez's job can be expressed in terms of  $t$ . If Mr. Roland's job took  $t$  hours, then it cost  $75t + 125$  dollars. Ms. Sanchez's job must then have taken  $t + 2$  hours, so it cost  $75(t + 2) + 125 = 75t + 275$  dollars. The difference between the two costs is  $(75t + 275) - (75t + 125) = \$150$ .

Choice A is incorrect. This is the electrician's charge per hour, not the difference between what Ms. Sanchez was charged and what Mr. Roland was charged. Choice B is incorrect. This is the fixed charge for each job, not the difference between the two. Choice D is incorrect and may result from finding the total charge for a 2-hour job.

## QUESTION 6

**Choice B is correct.** The ratio of the lengths of two arcs of a circle is equal to the ratio of the measures of the central angles that subtend the arcs. It's given that arc  $\widehat{ADC}$  is subtended by a central angle with measure  $100^\circ$ . Since the sum of the measures of the angles about a point is  $360^\circ$ , it follows that arc  $\widehat{ABC}$  is subtended by a central angle with measure  $360^\circ - 100^\circ = 260^\circ$ . If  $s$  is the length of arc  $\widehat{ABC}$ , then  $s$  must satisfy the ratio  $\frac{s}{5\pi} = \frac{260}{100}$ . Reducing the fraction  $\frac{260}{100}$  to its simplest form gives  $\frac{13}{5}$ . Therefore,  $\frac{s}{5\pi} = \frac{13}{5}$ . Multiplying both sides of  $\frac{s}{5\pi} = \frac{13}{5}$  by  $5\pi$  yields  $s = 13\pi$ .

Choice A is incorrect. This is the length of an arc consisting of exactly half of the circle, but arc  $\widehat{ABC}$  is greater than half of the circle. Choice C is incorrect. This is the total circumference of the circle. Choice D is incorrect. This is half the length of arc  $\widehat{ABC}$ , not its full length.

### QUESTION 7

**Choice D is correct.** Multiplying both sides of the given equation by  $x$  yields  $160x = 8$ . Dividing both sides of the equation  $160x = 8$  by 160 results in  $x = \frac{8}{160}$ . Reducing  $\frac{8}{160}$  to its simplest form gives  $x = \frac{1}{20}$ , or its decimal equivalent 0.05.

Choice A is incorrect and may result from multiplying, instead of dividing, the left-hand side of the given equation by 160. Choice B is incorrect and may result from a computational error. Choice C is incorrect. This is the value of  $\frac{1}{x}$ .

### QUESTION 8

**Choice C is correct.** Applying the distributive property of multiplication to the right-hand side of the given equation gives  $(3x + 15) + (5x - 5)$ , or  $8x + 10$ . An equation in the form  $cx + d = rx + s$  will have no solutions if  $c = r$  and  $d \neq s$ . Therefore, it follows that the equation  $2ax - 15 = 8x + 10$  will have no solutions if  $2a = 8$ , or  $a = 4$ .

Choice A is incorrect. If  $a = 1$ , then the given equation could be written as  $2x - 15 = 8x + 10$ . Since  $2 \neq 8$ , this equation has exactly one solution. Choice B is incorrect. If  $a = 2$ , then the given equation could be written as  $4x - 15 = 8x + 10$ . Since  $4 \neq 8$ , this equation has exactly one solution. Choice D is incorrect. If  $a = 8$ , then the given equation could be written as  $16x - 15 = 8x + 10$ . Since  $16 \neq 8$ , this equation has exactly one solution.

### QUESTION 9

**Choice B is correct.** A solution to the system of three equations is any ordered pair  $(x, y)$  that is a solution to each of the three equations. Such an ordered pair  $(x, y)$  must lie on the graph of each equation in the  $xy$ -plane; in other words, it must be a point where all three graphs intersect. The graphs of all three equations intersect at exactly one point,  $(-1, 3)$ . Therefore, the system of equations has one solution.

Choice A is incorrect. A system of equations has no solutions when there is no point at which all the graphs intersect. Because the graphs of all three equations intersect at the point  $(-1, 3)$ , there is a solution. Choice C is incorrect. The graphs of all three equations intersect at only one point,  $(-1, 3)$ . Since there is no other such point, there cannot be two solutions. Choice D is incorrect and may result from counting the number of points of intersection of the graphs of any two equations, including the point of intersection of all three equations.

### QUESTION 10

**Choice C is correct.** If the equation is true for all  $x$ , then the expressions on both sides of the equation will be equivalent. Multiplying the polynomials on the left-hand side of the equation gives  $5ax^3 - abx^2 + 4ax + 15x^2 - 3bx + 12$ . On the right-hand side of the equation, the only  $x^2$ -term is  $-9x^2$ . Since the expressions on both

sides of the equation are equivalent, it follows that  $-abx^2 + 15x^2 = -9x^2$ , which can be rewritten as  $(-ab + 15)x^2 = -9x^2$ . Therefore,  $-ab + 15 = -9$ , which gives  $ab = 24$ .

Choice A is incorrect. If  $ab = 18$ , then the coefficient of  $x^2$  on the left-hand side of the equation would be  $-18 + 15 = -3$ , which doesn't equal the coefficient of  $x^2$ ,  $-9$ , on the right-hand side. Choice B is incorrect. If  $ab = 20$ , then the coefficient of  $x^2$  on the left-hand side of the equation would be  $-20 + 15 = -5$ , which doesn't equal the coefficient of  $x^2$ ,  $-9$ , on the right-hand side. Choice D is incorrect. If  $ab = 40$ , then the coefficient of  $x^2$  on the left-hand side of the equation would be  $-40 + 15 = -25$ , which doesn't equal the coefficient of  $x^2$ ,  $-9$ , on the right-hand side.

## QUESTION 11

**Choice B is correct.** The right-hand side of the given equation,  $\frac{2x}{2}$ , can be rewritten as  $x$ . Multiplying both sides of the equation  $\frac{x}{x-3} = x$  by  $x - 3$  yields  $x = x(x - 3)$ . Applying the distributive property of multiplication to the right-hand side of the equation  $x = x(x - 3)$  yields  $x = x^2 - 3x$ . Subtracting  $x$  from both sides of this equation yields  $0 = x^2 - 4x$ . Factoring  $x$  from both terms of  $x^2 - 4x$  yields  $0 = x(x - 4)$ . By the zero product property, the solutions to the equation  $0 = x(x - 4)$  are  $x = 0$  and  $x - 4 = 0$ , or  $x = 4$ . Substituting 0 and 4 for  $x$  in the given equation yields  $0 = 0$  and  $4 = 4$ , respectively. Since both are true statements, both 0 and 4 are solutions to the given equation.

Choice A is incorrect and may result from a sign error. Choice C is incorrect and may result from an error in factoring. Choice D is incorrect and may result from not considering 0 as a possible solution.

## QUESTION 12

**Choice D is correct.** The original expression can be combined into one rational expression by multiplying the numerator and denominator of the second term by the denominator of the first term:  $\frac{1}{2x+1} + 5\left(\frac{2x+1}{2x+1}\right)$ , which can be rewritten as  $\frac{1}{2x+1} + \frac{10x+5}{2x+1}$ . This expression is now the sum of two rational expressions with a common denominator, and it can be rewritten as  $\frac{1}{2x+1} + \frac{10x+5}{2x+1} = \frac{10x+6}{2x+1}$ .

Choice A is incorrect and may result from a calculation error. Choice B is incorrect and may be the result of adding the denominator of the first term to the second term rather than multiplying the first term by the numerator and denominator of the second term. Choice C is incorrect and may result from not adding the numerator of  $\frac{1}{2x+1}$  to the numerator of  $\frac{10x+5}{2x+1}$ .

## QUESTION 13

**Choice A is correct.** The equation of a parabola in vertex form is  $f(x) = a(x - h)^2 + k$ , where the point  $(h, k)$  is the vertex of the parabola and  $a$  is a constant. The graph shows that the coordinates of the vertex

are (3, 1), so  $h = 3$  and  $k = 1$ . Therefore, an equation that defines  $f$  can be written as  $f(x) = a(x - 3)^2 + 1$ . To find  $a$ , substitute a value for  $x$  and its corresponding value for  $y$ , or  $f(x)$ . For example, (4, 5) is a point on the graph of  $f$ . So  $a$  must satisfy the equation  $5 = a(4 - 3)^2 + 1$ , which can be rewritten as  $4 = a(1)^2$ , or  $a = 4$ . An equation that defines  $f$  is therefore  $f(x) = 4(x - 3)^2 + 1$ .

Choice B is incorrect and may result from a sign error when writing the equation of the parabola in vertex form. Choice C is incorrect and may result from omitting the constant  $a$  from the vertex form of the equation of the parabola. Choice D is incorrect and may result from a sign error when writing the equation of the parabola in vertex form as well as by miscalculating the value of  $a$ .

### QUESTION 14

**Choice B is correct.** The solutions of the first inequality,  $y \geq x + 2$ , lie on or above the line  $y = x + 2$ , which is the line that passes through (-2, 0) and (0, 2). The second inequality can be rewritten in slope-intercept form by dividing the second inequality,  $2x + 3y \leq 6$ , by 3 on both sides, which yields  $\frac{2}{3}x + y \leq 2$ , and then subtracting  $\frac{2}{3}x$  from both sides, which yields  $y \leq -\frac{2}{3}x + 2$ . The solutions to this inequality lie on or below the line  $y = -\frac{2}{3}x + 2$ , which is the line that passes through (0, 2) and (3, 0). The only graph in which the shaded region meets these criteria is choice B.

Choice A is incorrect and may result from reversing the inequality sign in the first inequality. Choice C is incorrect and may result from reversing the inequality sign in the second inequality. Choice D is incorrect and may result from reversing the inequality signs in both inequalities.

### QUESTION 15

**Choice B is correct.** Squaring both sides of the given equation yields  $x + 2 = x^2$ . Subtracting  $x$  and 2 from both sides of  $x + 2 = x^2$  yields  $x^2 - x - 2 = 0$ . Factoring the left-hand side of this equation yields  $(x - 2)(x + 1) = 0$ . Applying the zero product property, the solutions to  $(x - 2)(x + 1) = 0$  are  $x - 2 = 0$ , or  $x = 2$  and  $x + 1 = 0$ , or  $x = -1$ . Substituting  $x = 2$  in the given equation gives  $\sqrt{4} = -2$ , which is false because  $\sqrt{4} = 2$  by the definition of a principal square root. So,  $x = 2$  isn't a solution. Substituting  $x = -1$  into the given equation gives  $\sqrt{1} = -(-1)$ , which is true because  $-(-1) = 1$ . So  $x = -1$  is the only solution.

Choices A and C are incorrect. The square root symbol represents the principal, or nonnegative, square root. Therefore, in the equation  $\sqrt{x + 2} = -x$ , the value of  $-x$  must be zero or positive. If  $x = 2$ , then  $-x = -2$ , which is negative, so 2 can't be in the set of solutions. Choice D is incorrect and may result from incorrectly reasoning that  $-x$  always has a negative value and therefore can't be equal to a value of a principal square root, which cannot be negative.

**QUESTION 16**

**The correct answer is 360.** The volume of a right rectangular prism is calculated by multiplying its dimensions: length, width, and height. Multiplying the values given for these dimensions yields a volume of  $(4)(9)(10) = 360$  cubic centimeters.

**QUESTION 17**

**The correct answer is 2.** The left-hand side of the given equation contains a common factor of 2 and can be rewritten as  $2(2x + 1)$ . Dividing both sides of this equation by 2 yields  $2x + 1 = 2$ . Therefore, the value of  $2x + 1$  is 2.

Alternate approach: Subtracting 2 from both sides of the given equation yields  $4x = 2$ . Dividing both sides of this equation by 4 yields  $x = \frac{1}{2}$ .

Substituting  $\frac{1}{2}$  for  $x$  in the expression  $2x + 1$  yields  $2\left(\frac{1}{2}\right) + 1 = 2$ .

**QUESTION 18**

**The correct answer is 8.** The graph shows that the maximum value of  $f(x)$  is 2. Since  $g(x) = f(x) + 6$ , the graph of  $g$  is the graph of  $f$  shifted up by 6 units. Therefore, the maximum value of  $g(x)$  is  $2 + 6 = 8$ .

**QUESTION 19**

**The correct answer is  $\frac{3}{4}$ , or .75.** By definition of the sine ratio, since  $\sin R = \frac{4}{5}$ ,  $\frac{PQ}{PR} = \frac{4}{5}$ . Therefore, if  $PQ = 4n$ , then  $PR = 5n$ , where  $n$  is a positive constant. Then  $QR = kn$ , where  $k$  is another positive constant. Applying the Pythagorean theorem, the following relationship holds:  $(kn)^2 + (4n)^2 = (5n)^2$ , or  $k^2n^2 + 16n^2 = 25n^2$ . Subtracting  $16n^2$  from both sides of this equation yields  $k^2n^2 = 9n^2$ . Taking the square root of both sides of  $k^2n^2 = 9n^2$  yields  $kn = 3n$ . It follows that  $k = 3$ . Therefore, if  $PQ = 4n$  and  $PR = 5n$ , then  $QR = 3n$ , and by definition of the tangent ratio,  $\tan P = \frac{3n}{4n}$ , or  $\frac{3}{4}$ . Either  $3/4$  or .75 may be entered as the correct answer.

**QUESTION 20**

**The correct answer is 2.5.** The graph of the linear function  $f$  passes through the points  $(0, 3)$  and  $(1, 1)$ . The slope of the graph of the function  $f$  is therefore  $\frac{1-3}{1-0} = -2$ . It's given that the graph of the linear function  $g$  is perpendicular to the graph of the function  $f$ . Therefore, the slope of the graph of the function  $g$  is the negative reciprocal of  $-2$ , which is  $-\frac{1}{-2} = \frac{1}{2}$ , and an equation that defines the function  $g$  is  $g(x) = \frac{1}{2}x + b$ , where  $b$  is a constant. Since it's given that the graph of the function  $g$  passes through the point  $(1, 3)$ , the value of  $b$  can be found using the equation  $3 = \frac{1}{2}(1) + b$ . Solving this equation for  $b$  yields  $b = \frac{5}{2}$ , so an equation that defines the function  $g$  is  $g(x) = \frac{1}{2}x + \frac{5}{2}$ . Finding the value of  $g(0)$  by substituting 0 for  $x$  into this equation yields  $g(0) = \frac{1}{2}(0) + \frac{5}{2}$ , or  $\frac{5}{2}$ . Either 2.5 or  $5/2$  may be entered as the correct answer.

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice B is correct.** Subtracting 3 from both sides of the equation yields  $3x = 24$ . Dividing both sides of this equation by 3 yields  $x = 8$ .

Choice A is incorrect and may result from finding a common factor among the three given terms instead of finding  $x$ . Choice C is incorrect and may result from incorrectly adding 3 to, instead of subtracting 3 from, the right-hand side of the equation. Choice D is incorrect. This is the value of  $3x + 3$ , not the value of  $x$ .

### QUESTION 2

**Choice D is correct.** Since 1 cubit is equivalent to 7 palms, 140 cubits are equivalent to  $140(7)$  palms, or 980 palms.

Choice A is incorrect and may result from dividing 7 by 140. Choice B is incorrect and may result from dividing 140 by 7. Choice C is incorrect. This is the length of the Great Sphinx statue in cubits, not palms.

### QUESTION 3

**Choice B is correct.** Multiplying both sides of the given equation by 5 yields  $2n = 50$ . Substituting 50 for  $2n$  in the expression  $2n - 1$  yields  $50 - 1 = 49$ .

Alternate approach: Dividing both sides of  $2n = 50$  by 2 yields  $n = 25$ . Evaluating the expression  $2n - 1$  for  $n = 25$  yields  $2(25) - 1 = 49$ .

Choice A is incorrect and may result from finding the value of  $n - 1$  instead of  $2n - 1$ . Choice C is incorrect and may result from finding the value of  $2n$  instead of  $2n - 1$ . Choice D is incorrect and may result from finding the value of  $4n - 1$  instead of  $2n - 1$ .

### QUESTION 4

**Choice A is correct.** The square root symbol represents the principal, or nonnegative, square root. Therefore, the equation  $\sqrt{x^2} = x$  is only true for values of  $x$  greater than or equal to 0. Thus,  $-4$  isn't a solution to the given equation.

Choices B, C, and D are incorrect because these values of  $x$  are solutions to the equation  $\sqrt{x^2} = x$ . Choosing one of these as a value of  $x$  that isn't a solution may result from incorrectly using the rules of exponents or incorrectly evaluating these values in the given equation.



## QUESTION 5

**Choice D is correct.** The  $x$ -axis of the graph represents the time, in minutes, after the coffee was removed from the heat source, and the  $y$ -axis of the graph represents the temperature, in degrees Fahrenheit, of the coffee. The coffee was first removed from the heat source when  $x = 0$ . The graph shows that when  $x = 0$ , the  $y$ -value was a little less than  $200^\circ\text{F}$ . Of the answer choices given, 195 is the best approximation.

Choice A is incorrect and may result from finding the temperature after 140 minutes. Choice B is incorrect and may result from finding the temperature after 50 minutes. Choice C is incorrect and may result from finding the temperature after 10 minutes.

## QUESTION 6

**Choice A is correct.** The average rate of change in temperature of the coffee in degrees Fahrenheit per minute is calculated by dividing the difference between two recorded temperatures by the number of minutes in the corresponding interval of time. Since the time intervals given are all 10 minutes, the average rate of change is greatest for the points with the greatest difference in temperature. Of the choices, the greatest difference in temperature occurs between 0 and 10 minutes.

Choices B, C, and D are incorrect and may result from misinterpreting the average rate of change from the graph.

## QUESTION 7

**Choice C is correct.** It's given that  $x = 100$ ; therefore, substituting 100 for  $x$  in triangle  $ABC$  gives two known angle measures for this triangle. The sum of the measures of the interior angles of any triangle equals  $180^\circ$ . Subtracting the two known angle measures of triangle  $ABC$  from  $180^\circ$  gives the third angle measure:  $180^\circ - 100^\circ - 20^\circ = 60^\circ$ . This is the measure of angle  $BCA$ . Since vertical angles are congruent, the measure of angle  $DCE$  is also  $60^\circ$ . Subtracting the two known angle measures of triangle  $CDE$  from  $180^\circ$  gives the third angle measure:  $180^\circ - 60^\circ - 40^\circ = 80^\circ$ . Therefore, the value of  $y$  is 80.

Choice A is incorrect and may result from a calculation error. Choice B is incorrect and may result from classifying angle  $CDE$  as a right angle. Choice D is incorrect and may result from finding the measure of angle  $BCA$  or  $DCE$  instead of the measure of angle  $CDE$ .

## QUESTION 8

**Choice A is correct.** The cost of each additional mile traveled is represented by the slope of the given line. The slope of the line can be calculated by identifying two points on the line and then calculating the ratio of the change in  $y$  to the change in  $x$  between the two points. Using the points  $(1, 5)$  and  $(2, 7)$ , the slope is equal to  $\frac{7-5}{2-1}$ , or 2. Therefore, the cost for each additional mile traveled of the cab ride is \$2.00.

Choice B is incorrect and may result from calculating the slope of the line that passes through the points (5, 13) and (0, 0). However, (0, 0) does not lie on the line shown. Choice C is incorrect. This is the y-coordinate of the y-intercept of the graph and represents the flat fee for a cab ride before the charge for any miles traveled is added. Choice D is incorrect. This value represents the total cost of a 1-mile cab ride.

### QUESTION 9

**Choice D is correct.** The total number of gas station customers on Tuesday was 135. The table shows that the number of customers who did not purchase gasoline was 50. Finding the ratio of the number of customers who did not purchase gasoline to the total number of customers gives the probability that a customer selected at random on that day did not purchase gasoline, which is  $\frac{50}{135}$ .

Choice A is incorrect and may result from finding the probability that a customer did not purchase a beverage, given that the customer did not purchase gasoline. Choice B is incorrect and may result from finding the probability that a customer did not purchase gasoline, given that the customer did not purchase a beverage. Choice C is incorrect and may result from finding the probability that a customer did purchase a beverage, given that the customer did not purchase gasoline.

### QUESTION 10

**Choice D is correct.** It is given that the number of students surveyed was 336. Finding  $\frac{1}{4}$  of 336 yields  $(\frac{1}{4})(336) = 84$ , the number of freshmen, and finding  $\frac{1}{3}$  of 336 yields  $(\frac{1}{3})(336) = 112$ , the number of sophomores. Subtracting these numbers from the total number of selected students results in  $336 - 84 - 112 = 140$ , the number of juniors and seniors combined. Finding half of this total yields  $(\frac{1}{2})(140) = 70$ , the number of juniors. Subtracting this number from the number of juniors and seniors combined yields  $140 - 70 = 70$ , the number of seniors.

Choices A and C are incorrect and may result from calculation errors. Choice B is incorrect. This is the total number of juniors and seniors.

### QUESTION 11

**Choice A is correct.** It's given that the ratio of the heights of Plant A to Plant B is 20 to 12 and that the height of Plant C is 54 centimeters. Let  $x$  be the height of Plant D. The proportion  $\frac{20}{12} = \frac{54}{x}$  can be used to solve for the value of  $x$ . Multiplying both sides of this equation by  $x$  yields  $\frac{20x}{12} = 54$  and then multiplying both sides of this equation by 12 yields  $20x = 648$ . Dividing both sides of this equation by 20 yields  $x = 32.4$  centimeters.

Choice B is incorrect and may result from a calculation error. Choice C is incorrect and may result from finding the difference in heights between Plant A and Plant B and then adding that to the height of Plant C. Choice D is incorrect and may result from using the ratio 12 to 20 rather than 20 to 12.

## QUESTION 12

**Choice D is correct.** It's given that 1 kilometer is approximately equivalent to 0.6214 miles. Let  $x$  be the number of kilometers equivalent to 3.1 miles. The proportion  $\frac{1 \text{ kilometer}}{0.6214 \text{ miles}} = \frac{x \text{ kilometers}}{3.1 \text{ miles}}$  can be used to solve for the value of  $x$ . Multiplying both sides of this equation by 3.1 yields  $\frac{3.1}{0.6214} = x$ , or  $x \approx 4.99$ . This is approximately 5 kilometers.

Choice A is incorrect and may result from misidentifying the ratio of kilometers to miles as miles to kilometers. Choice B is incorrect and may result from calculation errors. Choice C is incorrect and may result from calculation and rounding errors.

## QUESTION 13

**Choice C is correct.** Let  $a$  equal the number of 120-pound packages, and let  $b$  equal the number of 100-pound packages. It's given that the total weight of the packages can be at most 1,100 pounds: the inequality  $120a + 100b \leq 1,100$  represents this situation. It's also given that the helicopter must carry at least 10 packages: the inequality  $a + b \geq 10$  represents this situation. Values of  $a$  and  $b$  that satisfy these two inequalities represent the allowable numbers of 120-pound packages and 100-pound packages the helicopter can transport. To maximize the number of 120-pound packages,  $a$ , in the helicopter, the number of 100-pound packages,  $b$ , in the helicopter needs to be minimized. Expressing  $b$  in terms of  $a$  in the second inequality yields  $b \geq 10 - a$ , so the minimum value of  $b$  is equal to  $10 - a$ . Substituting  $10 - a$  for  $b$  in the first inequality results in  $120a + 100(10 - a) \leq 1,100$ . Using the distributive property to rewrite this inequality yields  $120a + 1,000 - 100a \leq 1,100$ , or  $20a + 1,000 \leq 1,100$ . Subtracting 1,000 from both sides of this inequality yields  $20a \leq 100$ . Dividing both sides of this inequality by 20 results in  $a \leq 5$ . This means that the maximum number of 120-pound packages that the helicopter can carry per trip is 5.

Choices A, B, and D are incorrect and may result from incorrectly creating or solving the system of inequalities.

## QUESTION 14

**Choice B is correct.** The difference between the machine's starting value and its value after 10 years can be found by subtracting \$30,000 from \$120,000:  $120,000 - 30,000 = 90,000$ . It's given that the value of the machine depreciates by the same amount each year for 10 years. Dividing \$90,000 by 10 gives \$9,000, which is the amount by which the value depreciates each year. Therefore, over a period of  $t$  years,

the value of the machine depreciates by a total of  $9,000t$  dollars. The value  $v$  of the machine, in dollars,  $t$  years after it was purchased is the starting value minus the amount of depreciation after  $t$  years, or  $v = 120,000 - 9,000t$ .

Choice A is incorrect and may result from using the value of the machine after 10 years as the machine's starting value. Choice C is incorrect. This equation shows the amount the machine's value changes each year being added to, rather than subtracted from, the starting value. Choice D is incorrect and may result from multiplying the machine's value after 10 years by  $t$  instead of multiplying the amount the machine depreciates each year by  $t$ .

### QUESTION 15

**Choice D is correct.** The slope-intercept form of a linear equation is  $y = ax + b$ , where  $a$  is the slope of the graph of the equation and  $b$  is the  $y$ -coordinate of the  $y$ -intercept of the graph. Two ordered pairs  $(x_1, y_1)$  and  $(x_2, y_2)$  can be used to compute the slope of the line with the formula  $a = \frac{y_2 - y_1}{x_2 - x_1}$ . Substituting the two ordered pairs  $(2, 4)$  and  $(0, 1)$  into this formula gives  $a = \frac{4 - 1}{2 - 0}$ , which simplifies to  $\frac{3}{2}$ . Substituting this value for  $a$  in the slope-intercept form of the equation yields  $y = \frac{3}{2}x + b$ . Substituting values from the ordered pair  $(0, 1)$  into this equation yields  $1 = \frac{3}{2}(0) + b$ , so  $b = 1$ . Substituting this value for  $b$  in the slope-intercept equation yields  $y = \frac{3}{2}x + 1$ .

Choice A is incorrect. This may result from misinterpreting the change in  $x$ -values as the slope and misinterpreting the change in  $y$ -values as the  $y$ -coordinate of the  $y$ -intercept of the graph. Choice B is incorrect and may result from using the  $x$ - and  $y$ -values of one of the given points as the slope and  $y$ -coordinate of the  $y$ -intercept, respectively. Choice C is incorrect. This equation has the correct slope but the incorrect  $y$ -coordinate of the  $y$ -intercept.

### QUESTION 16

**Choice B is correct.** Multiplying the binomials in the given expression results in  $4ax^2 + 4ax - 4x - 4 - x^2 + 4$ . Combining like terms yields  $4ax^2 + 4ax - 4x - x^2 + 4$ . Grouping by powers of  $x$  and factoring out their greatest common factors yields  $(4a - 1)x^2 + (4a - 4)x$ . It's given that this expression is equivalent to  $bx$ , so  $(4a - 1)x^2 + (4a - 4)x = bx$ . Since the right-hand side of the equation has no  $x^2$  term, the coefficient of the  $x^2$  term on the left-hand side must be 0. This gives  $4a - 1 = 0$  and  $4a - 4 = b$ . Since  $4a - 1 = 0$ ,  $4a = 1$ . Substituting the value of  $4a$  into the second equation gives  $1 - 4 = b$ , so  $b = -3$ .

Choices A, C, and D are incorrect and may result from a calculation error.

### QUESTION 17

**Choice C is correct.** Multiplying both sides of  $2w + 4t = 14$  by 2 yields  $4w + 8t = 28$ . Subtracting the second given equation from  $4w + 8t = 28$  yields  $(4w - 4w) + (8t - 5t) = (28 - 25)$  or  $3t = 3$ . Dividing both sides of this equation by 3 yields  $t = 1$ . Substituting 1 for  $t$  in the equation  $2w + 4t = 14$  yields  $2w + 4(1) = 14$ , or  $2w + 4 = 14$ . Subtracting 4 from both sides of this equation yields  $2w = 10$ , and dividing both sides of this equation by 2 yields  $w = 5$ . Substituting 5 for  $w$  and 1 for  $t$  in the expression  $2w + 3t$  yields  $2(5) + 3(1) = 13$ .

Choices A, B, and D are incorrect and may result from incorrectly calculating the values of  $w$  and  $t$ , or from correctly calculating the values of  $w$  and  $t$  but finding the value of an expression other than  $2w + 3t$ . For instance, choice A is the value of  $w + t$ , choice B is the value of  $2w$ , and choice D is the value of  $2t + 3w$ .

### QUESTION 18

**Choice B is correct.** It's given that each serving of Crunchy Grain cereal provides 5% of an adult's daily allowance of potassium, so  $x$  servings would provide  $x$  times 5%. The percentage of an adult's daily allowance of potassium,  $p$ , is 5 times the number of servings,  $x$ . Therefore, the percentage of an adult's daily allowance of potassium can be expressed as  $p = 5x$ .

Choices A, C, and D are incorrect and may result from incorrectly converting 5% to its decimal equivalent, which isn't necessary since  $p$  is expressed as a percentage. Additionally, choices C and D are incorrect because the context should be represented by a linear relationship, not by an exponential relationship.

### QUESTION 19

**Choice B is correct.** It's given that a  $\frac{3}{4}$ -cup serving of Crunchy Grain cereal provides 210 calories. The total number of calories per cup can be found by dividing 210 by  $\frac{3}{4}$ , which gives  $210 \div \frac{3}{4} = 280$  calories per cup. Let  $c$  be the number of cups of Crunchy Grain cereal and  $s$  be the number of cups of Super Grain cereal. The expression  $280c$  represents the number of calories in  $c$  cups of Crunchy Grain cereal, and  $240s$  represents the number of calories in  $s$  cups of Super Grain cereal. The equation  $280c + 240s = 270$  gives the total number of calories in one cup of the mixture. Since  $c + s = 1$  cup,  $c = 1 - s$ . Substituting  $1 - s$  for  $c$  in the equation  $280c + 240s = 270$  yields  $280(1 - s) + 240s = 270$ , or  $280 - 280s + 240s = 270$ . Simplifying this equation yields  $280 - 40s = 270$ . Subtracting 280 from both sides results in  $-40s = -10$ . Dividing both sides of the equation by  $-40$  results in  $s = \frac{1}{4}$ , so there is  $\frac{1}{4}$  cup of Super Grain cereal in one cup of the mixture.

Choices A, C, and D are incorrect and may result from incorrectly creating or solving the system of equations.

### QUESTION 20

**Choice A is correct.** There are 0 calories in 0 servings of Crunchy Grain cereal so the line must begin at the point (0, 0). Point (0, 0) is the origin, labeled *O*. Additionally, each serving increases the calories by 250. Therefore, the number of calories increases as the number of servings increases, so the line must have a positive slope. Of the choices, only choice A shows a graph with a line that begins at the origin and has a positive slope.

Choices B, C, and D are incorrect. These graphs don't show a line that passes through the origin. Additionally, choices C and D may result from misidentifying the slope of the graph.

### QUESTION 21

**Choice D is correct.** Since the function  $h$  is exponential, it can be written as  $h(x) = ab^x$ , where  $a$  is the  $y$ -coordinate of the  $y$ -intercept and  $b$  is the growth rate. Since it's given that the  $y$ -coordinate of the  $y$ -intercept is  $d$ , the exponential function can be written as  $h(x) = db^x$ . These conditions are only met by the equation in choice D.

Choice A is incorrect. For this function, the value of  $h(x)$  when  $x = 0$  is  $-3$ , not  $d$ . Choice B is incorrect. This function is a linear function, not an exponential function. Choice C is incorrect. This function is a polynomial function, not an exponential function.

### QUESTION 22

**Choice B is correct.** The median weight is found by ordering the horses' weights from least to greatest and then determining the middle value from this list of weights. Decreasing the value for the horse with the lowest weight doesn't affect the median since it's still the lowest value.

Choice A is incorrect. The mean is calculated by finding the sum of all the weights of the horses and then dividing by the number of horses. Decreasing one of the weights would decrease the sum and therefore decrease the mean. Choice C is incorrect. Range is the difference between the highest and lowest weights, so decreasing the lowest weight would increase the range. Choice D is incorrect. Standard deviation is calculated based on the mean weight of the horses. Decreasing one of the weights decreases the mean and therefore would affect the standard deviation.

### QUESTION 23

**Choice B is correct.** In order for the poll results from a sample of a population to represent the entire population, the sample must be representative of the population. A sample that is randomly selected from a population is more likely than a sample of the type described to represent the population. In this case, the people who responded were people with access to cable television and websites,

which aren't accessible to the entire population. Moreover, the people who responded also chose to watch the show and respond to the poll. The people who made these choices aren't representative of the entire population of the United States because they were not a random sample of the population of the United States.

Choices A, C, and D are incorrect because they present reasons unrelated to whether the sample is representative of the population of the United States.

## QUESTION 24

**Choice C is correct.** Substituting  $x + a$  for  $x$  in  $f(x) = 5x^2 - 3$  yields  $f(x + a) = 5(x + a)^2 - 3$ . Expanding the expression  $5(x + a)^2$  by multiplication yields  $5x^2 + 10ax + 5a^2$ , and thus  $f(x + a) = 5x^2 + 10ax + 5a^2 - 3$ . Setting the expression on the right-hand side of this equation equal to the given expression for  $f(x + a)$  yields  $5x^2 + 30x + 42 = 5x^2 + 10ax + 5a^2 - 3$ . Because this equality must be true for all values of  $x$ , the coefficients of each power of  $x$  are equal. Setting the coefficients of  $x$  equal to each other gives  $10a = 30$ . Dividing each side of this equation by 10 yields  $a = 3$ .

Choices A, B, and D are incorrect and may result from a calculation error.

## QUESTION 25

**Choice C is correct.** The sine of an angle is equal to the cosine of the angle's complement. This relationship can be expressed by the equation  $\sin x^\circ = \cos(90^\circ - x^\circ)$ . Therefore, if  $\sin x^\circ = a$ , then  $\cos(90^\circ - x^\circ)$  must also be equal to  $a$ .

Choices A and B are incorrect and may result from misunderstanding the relationship between the sine and cosine of complementary angles. Choice D is incorrect and may result from misinterpreting  $\sin(x^2)^\circ$  as  $\sin^2(x)^\circ$ .

## QUESTION 26

**Choice D is correct.** The positive  $x$ -intercept of the graph of  $y = h(x)$  is a point  $(x, y)$  for which  $y = 0$ . Since  $y = h(x)$  models the height above the ground, in feet, of the projectile, a  $y$ -value of 0 must correspond to the height of the projectile when it is 0 feet above ground or, in other words, when the projectile is on the ground. Since  $x$  represents the time since the projectile was launched, it follows that the positive  $x$ -intercept,  $(x, 0)$ , represents the time at which the projectile hits the ground.

Choice A is incorrect and may result from misidentifying the  $y$ -intercept as a positive  $x$ -intercept. Choice B is incorrect and may result from misidentifying the  $y$ -value of the vertex of the graph of the function as an  $x$ -intercept. Choice C is incorrect and may result from misidentifying the  $x$ -value of the vertex of the graph of the function as an  $x$ -intercept.

### QUESTION 27

**Choice A is correct.** Since  $(a, 0)$  and  $(b, 0)$  are the only two points where the graph of  $f$  crosses the  $x$ -axis, it must be true that  $f(a) = 0$  and  $f(b) = 0$  and that  $f(x)$  is not equal to 0 for any other value of  $x$ . Of the given choices, choice A is the only function for which this is true. If  $f(x) = (x - a)(x - b)$ , then  $f(a) = (a - a)(a - b)$ , which can be rewritten as  $f(a) = 0(a - b)$ , or  $f(a) = 0$ . Also,  $f(b) = (b - a)(b - b)$ , which can be rewritten as  $f(b) = (b - a)(0)$ , or  $f(b) = 0$ . Furthermore, if  $f(x) = (x - a)(x - b)$  is equal to 0, then it follows that either  $x - a = 0$  or  $x - b = 0$ . Solving each of these equations by adding  $a$  to both sides of the first equation and adding  $b$  to both sides of the second equation yields  $x = a$  or  $x = b$ . Therefore, the graph of  $f(x) = (x - a)(x - b)$  crosses the  $x$ -axis at exactly two points,  $(a, 0)$  and  $(b, 0)$ .

Choice B is incorrect because  $f(a) = (2a)(a + b)$ , which can't be 0 because it's given that  $a$  and  $b$  are positive. Choice C is incorrect because  $f(b) = (b - a)(2b)$ ; its graph could only be 0 if  $b = a$ , but it would cross the  $x$ -axis at only one point, since  $(a, 0)$  and  $(b, 0)$  would be the same point. Choice D is incorrect because its graph crosses the  $x$ -axis at  $(0, 0)$  as well as at  $(a, 0)$  and  $(b, 0)$ .

### QUESTION 28

**Choice C is correct.** Substituting 0 for  $x$  in the given equation yields  $3(0)^2 + 6(0) + 2 = 2$ . Therefore, the graph of the given equation passes through the point  $(0, 2)$ , which is the  $y$ -intercept of the graph. The right-hand side of the given equation,  $y = 3x^2 + 6x + 2$ , displays the constant 2, which directly corresponds to the  $y$ -coordinate of the  $y$ -intercept of the graph of this equation in the  $xy$ -plane.

Choice A is incorrect. The  $y$ -coordinate of the vertex of the graph is  $-1$ , not 3, 6, or 2. Choice B is incorrect. The  $x$ -coordinates of the  $x$ -intercepts of the graph are at approximately  $-1.577$  and  $-0.423$ , not 3, 6, or 2. Choice D is incorrect. The  $x$ -coordinate of the  $x$ -intercept of the line of symmetry is at  $-1$ , not 3, 6, or 2.

### QUESTION 29

**Choice A is correct.** The given equation is in slope-intercept form, or  $y = mx + b$ , where  $m$  is the value of the slope of the line of best fit. Therefore, the slope of the line of best fit is 0.096. From the definition of slope, it follows that an increase of 1 in the  $x$ -value corresponds to an increase of 0.096 in the  $y$ -value. Therefore, the line of best fit predicts that for each year between 1940 and 2010, the minimum wage will increase by 0.096 dollar per hour.

Choice B is incorrect and may result from using the  $y$ -coordinate of the  $y$ -intercept as the average increase, instead of the slope. Choice C is incorrect and may result from using the 10-year increments given on the  $x$ -axis to incorrectly interpret the slope of the line of best fit. Choice D is incorrect and may result from using the  $y$ -coordinate



of the  $y$ -intercept as the average increase, instead of the slope, and from using the 10-year increments given on the  $x$ -axis to incorrectly interpret the slope of the line of best fit.

### QUESTION 30

**Choice D is correct.** On the line of best fit,  $d$  increases from approximately 480 to 880 between  $t = 12$  and  $t = 24$ . The slope of the line of best fit is the difference in  $d$ -values divided by the difference in  $t$ -values, which gives  $\frac{880 - 480}{24 - 12} = \frac{400}{12}$ , or approximately 33. Writing the equation of the line of best fit in slope-intercept form gives  $d = 33t + b$ , where  $b$  is the  $y$ -coordinate of the  $y$ -intercept. This equation is satisfied by all points on the line, so  $d = 480$  when  $t = 12$ . Thus,  $480 = 33(12) + b$ , which is equivalent to  $480 = 396 + b$ . Subtracting 396 from both sides of this equation gives  $b = 84$ . Therefore, an equation for the line of best fit could be  $d = 33t + 84$ .

Choice A is incorrect and may result from an error in calculating the slope and misidentifying the  $y$ -coordinate of the  $y$ -intercept of the graph as the value of  $d$  at  $t = 10$  rather than the value of  $d$  at  $t = 0$ . Choice B is incorrect and may result from using the smallest value of  $t$  on the graph as the slope and misidentifying the  $y$ -coordinate of the  $y$ -intercept of the graph as the value of  $d$  at  $t = 10$  rather than the value of  $d$  at  $t = 0$ . Choice C is incorrect and may result from misidentifying the  $y$ -coordinate of the  $y$ -intercept as the smallest value of  $d$  on the graph.

### QUESTION 31

**The correct answer is 6.** Circles are symmetric with respect to any given diameter through the center  $(h, k)$ . One diameter of the circle is perpendicular to the  $x$ -axis. Therefore, the value of  $h$  is the mean of the  $x$ -coordinates of the circle's two  $x$ -intercepts:  $h = \frac{20 + 4}{2} = 12$ .

The radius of the circle is given as 10, so the point  $(h, k)$  must be a distance of 10 units from any point on the circle. The equation of any circle can be written as  $(x - h)^2 + (y - k)^2 = r^2$ , where  $(h, k)$  is the center of the circle and  $r$  is the length of the radius of the circle. Substituting 12 for  $h$  and 10 for  $r$  into this equation gives  $(x - 12)^2 + (y - k)^2 = 10^2$ . Substituting the  $x$ -coordinate and  $y$ -coordinate of a point on the circle,  $(4, 0)$ , gives  $(4 - 12)^2 + (0 - k)^2 = 10^2$ , or  $64 + k^2 = 100$ . Subtracting 64 from both sides of this equation yields  $k^2 = 36$ . Therefore,  $k = \pm\sqrt{36}$ . Since the graph shows the point  $(h, k)$  in the first quadrant,  $k$  must be the positive square root of 36, so  $k = 6$ .

### QUESTION 32

**The correct answer is 2.** It's given that line  $\ell$  is perpendicular to the line with equation  $y = -\frac{2}{3}x$ . Since the equation  $y = -\frac{2}{3}x$  is written in slope-intercept form, the slope of the line is  $-\frac{2}{3}$ . The slope of line  $\ell$  must be the negative reciprocal of  $-\frac{2}{3}$ , which is  $\frac{3}{2}$ . It's also given that

the  $y$ -coordinate of the  $y$ -intercept of line  $\ell$  is  $-13$ , so the equation of line  $\ell$  in slope-intercept form is  $y = \frac{3}{2}x - 13$ . If  $y = b$  when  $x = 10$ ,  $b = \frac{3}{2}(10) - 13$ , which is equivalent to  $b = 15 - 13$ , or  $b = 2$ .

### QUESTION 33

**The correct answer is 8.** In this group,  $\frac{1}{9}$ th of the people who are rhesus negative have blood type B. The total number of people who are rhesus negative in the group is  $7 + 2 + 1 + x$ , and there are 2 people who are rhesus negative with blood type B. Therefore,  $\frac{2}{(7 + 2 + 1 + x)} = \frac{1}{9}$ . Combining like terms on the left-hand side of the equation yields  $\frac{2}{(10 + x)} = \frac{1}{9}$ . Multiplying both sides of this equation by 9 yields  $\frac{18}{(10 + x)} = 1$ , and multiplying both sides of this equation by  $(10 + x)$  yields  $18 = 10 + x$ . Subtracting 10 from both sides of this equation yields  $8 = x$ .

### QUESTION 34

**The correct answer is 9.** The median number of goals scored is found by ordering the number of goals scored from least to greatest and then determining the middle value in the list. If the number of goals scored in each of the 29 games were listed in order from least to greatest, the median would be the fifteenth number of goals. The graph shows there were 8 games with 1 goal scored and 9 games with 2 goals scored. Therefore, the fifteenth number, or the median number, of goals scored must be 2. According to the graph, the soccer team scored 2 goals in 9 of the games played.

### QUESTION 35

**The correct answer is 15.** It's given that the deductions reduce the original amount of taxes owed by \$2,325.00. Since the deductions reduce the original amount of taxes owed by  $d\%$ , the equation  $\frac{2,325}{15,500} = \frac{d}{100}$  can be used to find this percent decrease,  $d$ . Multiplying both sides of this equation by 100 yields  $\frac{232,500}{15,500} = d$ , or  $15 = d$ . Thus, the tax deductions reduce the original amount of taxes owed by 15%.

### QUESTION 36

**The correct answer is 1.5.** It's given that the system of linear equations has no solutions. Therefore, the lines represented by the two equations are parallel. Each of the equations can be written in slope-intercept form, or  $y = mx + b$ , where  $m$  is the slope of the line and  $b$  is the  $y$ -coordinate of the line's  $y$ -intercept. Subtracting  $\frac{3}{4}x$  from both sides of  $\frac{3}{4}x - \frac{1}{2}y = 12$  yields  $-\frac{1}{2}y = -\frac{3}{4}x + 12$ . Dividing both sides of

this equation by  $-\frac{1}{2}$  yields  $y = \frac{-\frac{3}{4}}{-\frac{1}{2}}x + \frac{12}{-\frac{1}{2}}$ , or  $y = \frac{3}{2}x - 24$ . Therefore, the

slope of the line represented by the first equation in the system is  $\frac{3}{2}$ . The second equation in the system can be put into slope-intercept form by first subtracting  $ax$  from both sides of  $ax - by = 9$ , then dividing both sides of the equation by  $-b$ , which yields  $y = \frac{a}{b}x - \frac{9}{b}$ . Therefore, the slope of the line represented by the second equation in the system is  $\frac{a}{b}$ . Parallel lines have equal slopes. Therefore,  $\frac{a}{b} = \frac{3}{2}$ . Either  $3/2$  or  $1.5$  may be entered as the correct answer.

### QUESTION 37

**The correct answer is 1.3.** The median number of tourists is found by ordering the number of tourists from least to greatest and determining the middle value from this list. When the number of tourists in 2012 is ordered from least to greatest, the middle value, or the fifth number, is 46.4 million. When the number of tourists in 2013 is ordered from least to greatest, the middle value, or the fifth number, is 47.7 million. The difference between these two medians is  $47.7 \text{ million} - 46.4 \text{ million} = 1.3 \text{ million}$ .

### QUESTION 38

**The correct answer is 3.** Let  $y$  be the number of international tourist arrivals in Russia in 2012, and let  $x$  be the number of these arrivals in 2011. It's given that  $y$  is 13.5% greater than  $x$ , or  $y = 1.135x$ . The table gives that  $y = 24.7$ , so  $24.7 = 1.135x$ . Dividing both sides of this equation by 1.135 yields  $\frac{24.7}{1.135} = x$ , or  $x \approx 21.8$  million arrivals. The difference in the number of tourist arrivals between these two years is  $24.7 \text{ million} - 21.8 \text{ million} = 2.9 \text{ million}$ . Therefore, the value of  $k$  is 3 when rounded to the nearest integer.

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# Practice Test #10

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**Test begins on the next page.**

# Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

### Questions 1-10 are based on the following passage.

This passage is adapted from Mary Helen Stefaniak, *The Cailiffs of Baghdad, Georgia: A Novel*. ©2010 by Mary Helen Stefaniak.

Miss Grace Spivey arrived in Threestep, Georgia, in August 1938. She stepped off the train wearing a pair of thick-soled boots suitable for hiking, a navy blue dress, and a little white tam that rode the waves  
 5 of her red hair at a gravity-defying angle. August was a hellish month to step off the train in Georgia, although it was nothing, she said, compared to the 119 degrees that greeted her when she arrived one time in Timbuktu, which, she assured us, was a real  
 10 place in Africa. I believe her remark irritated some of the people gathered to welcome her on the burned grass alongside the tracks. When folks are sweating through their shorts, they don't like to hear that this is *nothing* compared to someplace else. Irritated or  
 15 not, the majority of those present were inclined to see the arrival of the new schoolteacher in a positive light. Hard times were still upon us in 1938, but, like my momma said, "We weren't no poorer than we'd ever been," and the citizens of Threestep were in the  
 20 mood for a little excitement.

Miss Spivey looked like just the right person to give it to them. She was, by almost anyone's standards, a woman of the world. She'd gone to boarding schools since she was six years old; she'd  
 25 studied French in Paris and drama in London; and during what she called a "fruitful intermission" in her formal education, she had traveled extensively in the

Near East and Africa with a friend of her grandmother's, one Janet Miller, who was a medical  
 30 doctor from Nashville, Tennessee. After her travels with Dr. Miller, Miss Spivey continued her education by attending Barnard College in New York City. She told us all that at school the first day. When my little brother Ralphord asked what did she study at  
 35 Barnard College, Miss Spivey explained that *Barnard*, which she wrote on the blackboard, was the sister school of Columbia University, of which, she expected, we all had heard.

It was there, she told us, in the midst of trying to  
 40 find her true mission in life, that she wandered one afternoon into a lecture by the famous John Dewey, who was talking about his famous book, *Democracy and Education*. Professor Dewey was in his seventies by then, Miss Spivey said, but he still liked to chat  
 45 with students after a lecture—especially female students, she added—sometimes over coffee, and see in their eyes the fire his words could kindle. It was after this lecture and subsequent coffee that Miss Spivey had marched to the Teacher's College and  
 50 signed up, all aflame. Two years later, she told a cheery blue-suited woman from the WPA<sup>1</sup> that she wanted to bring democracy and education to the poorest, darkest, most remote and forgotten corner of America.

55 They sent her to Threestep, Georgia. Miss Spivey paused there for questions, avoiding my brother Ralphord's eye.

What we really wanted to know about—all twenty-six of us across seven grade levels in the one  
 60 room—was the pearly white button hanging on a



string in front of the blackboard behind the teacher's desk up front. That button on a string was something new. When Mavis Davis (the only bona fide seventh grader, at age thirteen) asked what it was for, Miss Spivey gave the string a tug, and to our astonishment, the whole world—or at least a wrinkled map of it—unfolded before our eyes. Her predecessor, Miss Chandler, had never once made use of that map, which was older than our fathers, and until that moment, not a one of us knew it was there.

Miss Spivey showed us on the map how she and Dr. Janet Miller had sailed across the Atlantic Ocean and past the Rock of Gibraltar into the Mediterranean Sea. Using the end of a ruler, she gently tapped such places as Morocco and Tunis and Algiers to mark their route along the top of Africa. They spent twenty hours on the train to Baghdad, she said, swathed in veils against the sand that crept in every crack and crevice.

“And can you guess what we saw from the train?” Miss Spivey asked. We could not. “Camels!” she said. “We saw a whole caravan of *camels*.” She looked around the room, waiting for us to be amazed and delighted at the thought.

We all hung there for a minute, thinking hard, until Mavis Davis spoke up.

“She means like the three kings rode to Bethlehem,” Mavis said, and she folded her hands smugly on her seventh-grade desk in the back of the room.

Miss Spivey made a mistake right then. Instead of beaming upon Mavis the kind of congratulatory smile that old Miss Chandler would have bestowed on her for having enlightened the rest of us, Miss Spivey simply said, “That’s right.”

<sup>1</sup> The Works Progress Administration (WPA) was a government agency that hired people for public and cultural development projects and services.

1

The narrator of the passage can best be described as

- A) one of Miss Spivey’s former students.
- B) Miss Spivey’s predecessor.
- C) an anonymous member of the community.
- D) Miss Spivey herself.

2

In the passage, Threestep is mainly presented as a

- A) summer retreat for vacationers.
- B) small rural town.
- C) town that is home to a prominent university.
- D) comfortable suburb.

3

It can reasonably be inferred from the passage that some of the people at the train station regard Miss Spivey’s comment about the Georgia heat with

- A) sympathy, because they assume that she is experiencing intense heat for the first time.
- B) disappointment, because they doubt that she will stay in Threestep for very long.
- C) embarrassment, because they imagine that she is superior to them.
- D) resentment, because they feel that she is minimizing their discomfort.

4

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 2-5 (“She stepped . . . angle”)
- B) Lines 10-14 (“I believe . . . else”)
- C) Lines 14-20 (“Irritated . . . excitement”)
- D) Lines 23-25 (“She’d gone . . . London”)

5

Miss Spivey most likely uses the phrase “fruitful intermission” (line 26) to indicate that

- A) she benefited from taking time off from her studies in order to travel.
- B) her travels with Janet Miller encouraged her to start medical school.
- C) her early years at boarding school resulted in unanticipated rewards.
- D) what she thought would be a short break from school lasted several years.

6

The interaction between Miss Spivey and Ralphord serves mainly to

- A) suggest that Miss Spivey has an exaggerated view of what information should be considered common knowledge.
- B) establish a friendly dynamic between the charming schoolchildren and their indulgent and doting new instructor.
- C) introduce Ralphord as a precocious young student and Miss Spivey as a dismissive and disinterested teacher.
- D) demonstrate that the children want to amuse Miss Spivey with their questions.

7

In the third paragraph, what is the narrator most likely suggesting by describing Miss Spivey as having “wandered” (line 40) in one situation and “marched” (line 49) in another situation?

- A) Dewey, knowing Miss Spivey wasn’t very confident in her ability to teach, instilled in her a sense of determination.
- B) Talking with Dewey over coffee made Miss Spivey realize how excited she was to teach in the poorest, most remote corner of America.
- C) After two years spent studying, Miss Spivey was anxious to start teaching and be in charge of her own classroom.
- D) Miss Spivey’s initial encounter with Dewey’s ideas was somewhat accidental but ultimately motivated her to decisive action.

8

According to the passage, Miss Spivey ended up in Threestep as a direct result of

- A) her friendship with Janet Miller.
- B) attending college in New York City.
- C) talking with a woman at the WPA.
- D) Miss Chandler’s retirement from teaching.

9

In the passage, when Miss Spivey announces that she had seen camels, the students’ reaction suggests that they are

- A) delighted.
- B) fascinated.
- C) baffled.
- D) worried.

10

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 82-84 (“She looked . . . thought”)
- B) Lines 85-86 (“We all . . . up”)
- C) Lines 87-90 (“She means . . . room”)
- D) Lines 91-95 (“Instead . . . right”)

**Questions 11-21 are based on the following passage and supplementary material.**

This passage is adapted from David Owen, *The Conundrum: How Scientific Innovation, Increased Efficiency, and Good Intentions Can Make Our Energy and Climate Problems Worse*. ©2011 by David Owen.

Building good transit isn't a bad idea, but it can actually backfire if the new trains and buses merely clear space on highway lanes for those who would  
 Line prefer to drive—a group that, historically, has  
 5 included almost everyone with access to a car. To have environmental value, new transit has to replace and eliminate driving on a scale sufficient to cut energy consumption overall. That means that a new transit system has to be backed up by something that  
 10 impels complementary reductions in car use—say, the physical elimination of traffic lanes or the conversion of existing roadways into bike or bus lanes, ideally in combination with higher fuel taxes, parking fees, and tolls. Needless to say, those ideas  
 15 are not popular. But they're necessary, because you can't make people drive less, in the long run, by taking steps that make driving more pleasant, economical, and productive.

One of the few forces with a proven ability to slow  
 20 the growth of suburban sprawl has been the ultimately finite tolerance of commuters for long, annoying commutes. That tolerance has grown in recent decades, and not just in the United States, but it isn't unlimited, and even people who don't seem to  
 25 mind spending half their day in a car eventually reach a point where, finally, enough is enough. That means that traffic congestion can have environmental value, since it lengthens commuting times and, by doing so, discourages the proliferation  
 30 of still more energy-hungry subdivisions—unless we made the congestion go away. If, in a misguided effort to do something of environmental value, municipalities take steps that make long-distance car commuting faster or more convenient—by adding  
 35 lanes, building bypasses, employing traffic-control

measures that make it possible for existing roads to accommodate more cars with fewer delays, replacing tollbooths with radio-based systems that don't require drivers even to slow down—we actually make  
 40 the sprawl problem worse, by indirectly encouraging people to live still farther from their jobs, stores, schools, and doctors' offices, and by forcing municipalities to further extend road networks, power grids, water lines, and other civic  
 45 infrastructure. If you cut commuting time by 10 percent, people who now drive fifty miles each way to work can justify moving five miles farther out, because their travel time won't change. This is how metropolitan areas metastasize. It's the history of  
 50 suburban expansion.

Traffic congestion isn't an environmental problem; traffic is. Relieving congestion without doing anything to reduce the total volume of cars can only make the real problem worse. Highway  
 55 engineers have known for a long time that building new car lanes reduces congestion only temporarily, because the new lanes foster additional driving—a phenomenon called induced traffic. Widening roads makes traffic move faster in the short term, but the  
 60 improved conditions eventually attract additional drivers and entice current drivers to drive more, and congestion reappears, but with more cars—and that gets people thinking about widening roads again. Moving drivers out of cars and into other forms of  
 65 transportation can have the same effect, if existing traffic lanes are kept in service: road space begets road use.

One of the arguments that cities inevitably make in promoting transit plans is that the new system, by  
 70 relieving automobile congestion, will improve the lives of those who continue to drive. No one ever promotes a transit scheme by arguing that it would make traveling less convenient—even though, from an environmental perspective, inconvenient travel is  
 75 a worthy goal.

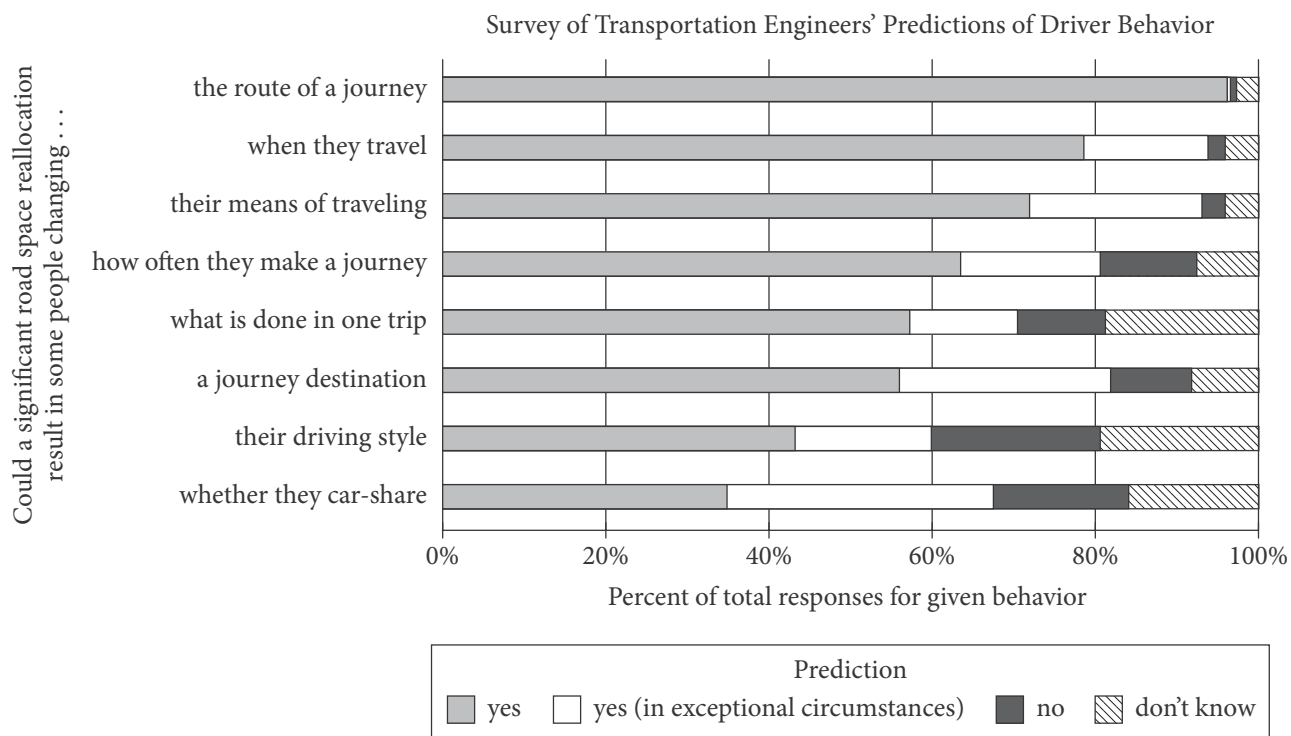
Figure 1

## Effect of Route Capacity Reduction in Selected Regions

Region	Vehicles per day on altered road		Vehicles per day on surrounding roads		Change in traffic*
	Before alteration	After alteration	Before alteration	After alteration	
Rathausplatz, Nürnberg	24,584	0	67,284	55,824	-146.6%
Southampton city center	5,316	3,081	26,522	24,101	-87.5%
Tower Bridge, London	44,242	0	103,262	111,999	-80.3%
New York highway	110,000	50,000	540,000	560,000	-36.4%
Kinnaird Bridge, Edmonton	1,300	0	2,130	2,885	-41.9%

\*Change in regional traffic in proportion to traffic previously using the altered road

Figure 2



Figures adapted from S. Cairns et al., "Disappearing Traffic? The Story So Far." ©2002 by UCL.

11

The main purpose of the passage is to

- A) provide support for the claim that efforts to reduce traffic actually increase traffic.
- B) dispute the widely held belief that building and improving mass transit systems is good for the environment.
- C) discuss the negative environmental consequences of car-focused development and suburban sprawl.
- D) argue that one way to reduce the negative environmental effects of traffic is to make driving less agreeable.

12

Which choice best supports the idea that the author assumes that, all things being equal, people would rather drive than take mass transit?

- A) Lines 1-5 ("Building . . . car")
- B) Lines 5-8 ("To have . . . overall")
- C) Lines 15-18 ("But they're . . . productive")
- D) Lines 19-22 ("One . . . commutes")

13

As used in line 9, “backed up” most nearly means

- A) supported.
- B) copied.
- C) substituted.
- D) jammed.

14

In the first paragraph, the author concedes that his recommendations are

- A) costly to implement.
- B) not widely supported.
- C) strongly opposed by experts.
- D) environmentally harmful in the short term.

15

Based on the passage, how would the author most likely characterize many attempts to improve traffic?

- A) They are doomed to fail because most people like driving too much to change their habits.
- B) They overestimate how tolerant people are of long commutes.
- C) They are well intentioned but ultimately lead to environmental harm.
- D) They will only work if they make driving more economical and productive.

16

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 8-14 (“That . . . tolls”)
- B) Lines 22-26 (“That . . . enough”)
- C) Lines 31-40 (“If, in . . . worse”)
- D) Lines 64-67 (“Moving . . . use”)

17

According to the passage, reducing commuting time for drivers can have which of the following effects?

- A) Drivers become more productive employees than they previously were.
- B) Mass transit gets extended farther into suburban areas than it previously was.
- C) Mass transit carries fewer passengers and receives less government funding than it previously did.
- D) Drivers become more willing to live farther from their places of employment than they previously were.

18

As used in line 72, “promotes” most nearly means

- A) upgrades.
- B) serves.
- C) advocates.
- D) develops.

19

According to figure 1, how many vehicles traveled on the altered road through the Southampton city center per day before the route was altered?

- A) 3,081
- B) 5,316
- C) 24,101
- D) 26,522

20

Do the data in figure 1 support or weaken the argument of the author of the passage, and why?

- A) Support, because the data show that merely moving drivers out of cars can induce traffic.
- B) Support, because the data show that reducing road capacity can lead to a net reduction in traffic.
- C) Weaken, because the data show that in some cases road alterations lead to greater traffic on surrounding roads.
- D) Weaken, because the data show that traffic reductions due to road alterations tend to be brief.

21

Based on figure 2, the engineers surveyed were most skeptical of the idea that in the event of a reallocation of road space, drivers would change

- A) when they travel.
- B) their means of traveling.
- C) how often they make a journey.
- D) their driving style.

**Questions 22-32 are based on the following passage.**

This passage is adapted from Sabrina Richards, “Pleasant to the Touch.” ©2012 by The Scientist.

In the early 1990s, textbooks acknowledged that humans had slow-conducting nerves, but asserted that those nerves only responded to two types of stimuli: pain and temperature. Sensations of pressure and vibration were believed to travel only along myelinated, fast-signaling nerve fibers, which also give information about location. Experiments blocking nerve fibers supported this notion.

Preventing fast fibers from firing (either by clamping the relevant nerve or by injecting the local anesthetic lidocaine) seemed to eliminate the sensation of pressure altogether, but blocking slow fibers only seemed to reduce sensitivity to warmth or a small painful shock.

Håkan Olausson and his Gothenburg University colleagues Åke Vallbo and Johan Wessberg wondered if slow fibers responsive to gentle pressure might be active in humans as well as in other mammals. In 1993, they corralled 28 young volunteers and recorded nerve signals while gently brushing the subjects’ arms with their fingertips. Using a technique called microneurography, in which a fine filament is inserted into a single nerve to capture its electrical impulses, the scientists were able to measure how quickly—or slowly—the nerves fired. They showed that soft stroking prompted two different signals, one immediate and one delayed. The delay, Olausson explains, means that the signal from a gentle touch on the forearm will reach the brain about a half second later. This delay identified nerve impulses traveling at speeds characteristic of slow, unmyelinated fibers—about 1 meter/second—confirming the presence of these fibers in human hairy skin. (In contrast, fast-conducting fibers, already known to respond to touch, signal at a rate between 35 and 75 m/s.)

Then, in 1999, the group looked more closely at the characteristics of the slow fibers. They named these “low-threshold” nerves “C-tactile,” or CT, fibers, said Olausson, because of their “exquisite sensitivity” to slow, gentle tactile stimulation, but unresponsiveness to noxious stimuli like pinpricks.

But why exactly humans might have such fibers, which respond only to a narrow range of rather subtle stimuli, was initially mystifying. Unlike other types of sensory nerves, CT fibers could be found

only in hairy human skin—such as the forearm and thigh. No amount of gentle stroking of hairless skin, such as the palms and soles of the feet, prompted similar activity signatures. Olausson and his colleagues decided that these fibers must be conveying a different dimension of sensory information than fast-conducting fibers.

Although microneurography can give information about how a single nerve responds to gentle brushing and pressure, it cannot tease out what aspect of sensation that fiber relays, says Olausson. He wanted to know if that same slow nerve can distinguish *where* the brush touches the arm, and whether it can discern the difference between a goat-hair brush and a feather. Most importantly, could that same fiber convey a pleasant sensation?

To address the question, Olausson’s group sought out a patient known as G.L. who had an unusual nerve defect. More than 2 decades earlier, she had developed numbness across many parts of her body after taking penicillin to treat a cough and fever. Testing showed that she had lost responsiveness to pressure, and a nerve biopsy confirmed that G.L.’s quick-conducting fibers were gone, resulting in an inability to sense any pokes, prods, or pinpricks below her nose. But she could still sense warmth, suggesting that her slow-conducting unmyelinated fibers were intact.

Upon recruiting G.L., Olausson tested her by brushing her arm gently at the speed of between 2–10 centimeters per second. She had more trouble distinguishing the direction or pressure of the brush strokes than most subjects, but reported feeling a pleasant sensation. When the researchers tried brushing her palm, where CT fibers are not found, she felt nothing.

Olausson used functional MRI studies to examine which areas of the brain lit up when G.L.’s arm was gently brushed to activate CT fibers. In normal subjects, both the somatosensory and insular cortices were activated, but only the insular cortex [which processes emotion] was active when researchers brushed G.L.’s arm. This solidified the notion that CT fibers convey a more emotional quality of touch, rather than the conscious aspect that helps us describe what we are sensing. CT fibers, it seemed, specifically provide pleasurable sensations.



22

Based on the passage, textbook authors in the early 1990s would most likely have expected which condition to result from the blocking of fast fibers?

- A) The rate at which other nerve fibers fired would increase.
- B) The test subject would perceive gentle stimuli as painful.
- C) The body would compensate by using slow fibers to sense pressure.
- D) The ability to perceive vibrations would be impaired.

23

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-4 (“In the . . . temperature”)
- B) Lines 4-7 (“Sensations . . . location”)
- C) Lines 12-14 (“blocking . . . shock”)
- D) Lines 34-36 (“In contrast . . . 75 m/s”)

24

As used in line 18, “active” most nearly means

- A) present.
- B) attentive.
- C) movable.
- D) restless.

25

As used in line 24, “capture” most nearly means

- A) occupy.
- B) seize.
- C) record.
- D) influence.

26

Which conclusion is best supported by the findings of Olausson’s 1993 experiment?

- A) Stimulation at bodily extremities can be sensed as rapidly as stimulation closer to the brain.
- B) The presence of hairs in human skin lessens the speed with which nerves conduct signals.
- C) Gentle pressure is sensed not only by fast fibers but also by slow fibers.
- D) The speed at which a nerve fires is dependent on the strength of pressure applied to the nerve.

27

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 22-26 (“Using . . . fired”)
- B) Lines 26-28 (“They . . . delayed”)
- C) Lines 28-30 (“The delay . . . later”)
- D) Lines 37-38 (“Then . . . fibers”)

28

The sentence in lines 43-45 (“But . . . mystifying”) serves mainly to

- A) identify factors that Olausson had previously failed to consider.
- B) propose a solution to a dilemma encountered by Olausson.
- C) anticipate a potential criticism of Olausson by the reader.
- D) show a problem from the perspective of Olausson’s team.

29

It can reasonably be inferred that one of the intended goals of the 1999 experiment was to determine the

- A) precise nature of sensations that CT fibers can convey.
- B) relationship between body hair and CT fiber function.
- C) role played by CT fibers in the perception of pain.
- D) effect of microneurography on CT fiber signaling.

30

The main purpose of the sixth paragraph (lines 64-75) is to

- A) identify those of G.L.'s neurological conditions that might be relieved by the experiment.
- B) contextualize the nerve function of G.L. by comparing it with that of other adults.
- C) detail procedures that G.L. had experienced during previous experiments.
- D) indicate why G.L.'s medical condition was of value to Olausson's experiment.

31

According to the passage, G.L. differed from Olausson's other test subjects in terms of the

- A) number of cortices activated in the brain during gentle brushing.
- B) physical dimensions of the somatosensory cortex.
- C) intensity of nerve signals required to activate the insular cortex.
- D) effect of MRI scanning on the basic function of brain cortices.

32

According to the passage, humans experience an emotional aspect of touch when

- A) brain cortices are shielded from nerve signals.
- B) CT fibers are exposed to a stimulus.
- C) nerve fibers that sense pain are suppressed.
- D) conscious aspects of sensation are ignored.

**Questions 33-42 are based on the following passages.**

Passage 1 is adapted from a speech delivered in 1898 by Albert J. Beveridge, "March of the Flag." Passage 2 is adapted from a speech delivered in 1900 by William Jennings Bryan, "Imperialism."

**Passage 1**

Fellow-Citizens: It is a noble land that God has given us; a land that can feed and clothe the world; a land whose coast lines would enclose half the countries of Europe; a land set like a sentinel between  
 5 the two imperial oceans of the globe; a greater England with a nobler destiny. It is a mighty people that He has planted on this soil; a people sprung from the most masterful blood of history; a people perpetually revitalized by the virile . . . working-folk  
 10 of all the earth; a people imperial by virtue of their power, by right of their institutions, by authority of their heaven-directed purposes—the propagandists and not the misers of liberty. It is a glorious history our God has bestowed upon His chosen people; a  
 15 history whose keynote was struck by Liberty Bell; a history heroic with faith in our mission and our future; a history of statesmen, who flung the boundaries of the Republic out into unexplored lands . . . a history of soldiers, who carried the flag  
 20 across blazing deserts and through the ranks of hostile mountains, even to the gates of sunset; a history of a multiplying people, who overran a continent in half a century . . . a history divinely logical, in the process of whose tremendous  
 25 reasoning we find ourselves to-day. . . .

Think of the thousands of Americans who will pour into Hawaii and Porto Rico when the Republic's laws cover those islands with justice and safety! Think of the tens of thousands of Americans  
 30 who will invade . . . the Philippines when a liberal government . . . shall establish order and equity there! Think of the hundreds of thousands of Americans who will build a . . . civilization of energy and industry in Cuba, when a government of law  
 35 replaces the double reign of anarchy and tyranny!—think of the prosperous millions that Empress of Islands will support when, obedient to the law of political gravitation, her people ask for the highest honor liberty can bestow, the sacred Order of the  
 40 Stars and Stripes, the citizenship of the Great Republic!

**Passage 2**

If it is right for the United States to hold the Philippine Islands permanently and imitate European empires in the government of colonies, the  
 45 Republican party ought to state its position and defend it, but it must expect the subject races to protest against such a policy and to resist to the extent of their ability.

The Filipinos do not need any encouragement  
 50 from Americans now living. Our whole history has been an encouragement not only to the Filipinos, but to all who are denied a voice in their own government. If the Republicans are prepared to censure all who have used language calculated to  
 55 make the Filipinos hate foreign domination, let them condemn the speech of Patrick Henry. When he uttered that passionate appeal, "Give me liberty or give me death," he expressed a sentiment which still echoes in the hearts of men.

60 Let them censure Jefferson; of all the statesmen of history none have used words so offensive to those who would hold their fellows in political bondage. Let them censure Washington, who declared that the colonists must choose between liberty and slavery.  
 65 Or, if the statute of limitations has run against the sins of Henry and Jefferson and Washington, let them censure Lincoln, whose Gettysburg speech will be quoted in defense of popular government when the present advocates of force and conquest are  
 70 forgotten.

Some one has said that a truth once spoken can never be recalled. It goes on and on, and no one can set a limit to its ever-widening influence. But if it were possible to obliterate every word written or  
 75 spoken in defense of the principles set forth in the Declaration of Independence, a war of conquest would still leave its legacy of perpetual hatred, for it was God himself who placed in every human heart the love of liberty. He never made a race of people so  
 80 low in the scale of civilization or intelligence that it would welcome a foreign master.

Those who would have this Nation enter upon a career of empire must consider, not only the effect of imperialism on the Filipinos, but they must also  
 85 calculate its effects upon our own nation. We cannot repudiate the principle of self-government in the Philippines without weakening that principle here.

33

In Passage 1, Beveridge asserts that the resources and immensity of the United States constitute a

- A) safeguard against foreign invasion.
- B) replication of conditions in Europe.
- C) divine gift to the American people.
- D) source of envy for people in other countries.

34

In the second paragraph of Passage 1 (lines 26-41), the commands given by Beveridge mainly serve to

- A) remind the audience of its civic responsibilities.
- B) anticipate the benefits of a proposed policy.
- C) emphasize the urgency of a national problem.
- D) refute arguments that opponents have advanced.

35

As used in line 72, “recalled” most nearly means

- A) repeated.
- B) retracted.
- C) rejected.
- D) remembered.

36

It can reasonably be inferred from Passage 2 that Bryan considers the preference for national sovereignty over foreign rule to be a

- A) reaction to the excesses of imperial governments in the modern era.
- B) sign that the belief in human equality is widespread.
- C) testament to the effects of the foreign policy of the United States.
- D) manifestation of an innate drive in humans toward self-rule.

37

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 53-56 (“If the . . . Henry”)
- B) Lines 72-73 (“It goes . . . influence”)
- C) Lines 79-81 (“He never . . . master”)
- D) Lines 82-85 (“Those . . . nation”)

38

As used in line 85, “calculate” most nearly means

- A) evaluate.
- B) design.
- C) assume.
- D) multiply.

39

In developing their respective arguments, Beveridge (Passage 1) and Bryan (Passage 2) both express admiration for the

- A) founding and history of the United States.
- B) vibrancy and diversity of American culture.
- C) worldwide history of struggles for independence.
- D) idealism that permeates many aspects of American society.

40

Which choice best describes a central difference between how Beveridge (Passage 1) and Bryan (Passage 2) view the concept of liberty as it is realized in the United States?

- A) Beveridge presents it as the direct inheritance of European colonization, whereas Bryan presents it as a sharp break from earlier governments in Europe.
- B) Beveridge considers it so exemplary as to justify conquest of other regions, whereas Bryan warns that its exemplary quality would be undermined by imperial expansion.
- C) Beveridge argues that it arose organically as the United States matured, whereas Bryan argues that it was present from the country's beginnings.
- D) Beveridge regards it as a model that should be shared with other countries, whereas Bryan believes that it is unique to the United States and could not work elsewhere.

41

It can most reasonably be inferred from Passage 2 that Bryan would criticize the vision of American governance of island territories that Beveridge presents in Passage 1 for being

- A) unrealistic, since most Americans would be unwilling to relocate to distant islands.
- B) deceptive, since economic domination would be the true goal of the American government.
- C) impractical, since the islanders would insist upon an equal distribution of resources.
- D) naive, since the islanders would object to being governed by Americans.

42

Which choice from Passage 2 provides the best evidence for the answer to the previous question?

- A) Lines 42-48 (“If it . . . ability”)
- B) Lines 49-50 (“The Filipinos . . . living”)
- C) Lines 50-53 (“Our . . . government”)
- D) Lines 56-59 (“When . . . men”)

**Questions 43-52 are based on the following passage and supplementary material.**

This passage is adapted from Peter A. Ensminger, *Life Under the Sun*. ©2001 by Peter A. Ensminger.

Many millennia before the invention of herbicides, farmers simply plowed their fields to control weeds. Even today, plowing can constitute a valuable part of an integrated weed-management program. Although plowing kills standing weeds, farmers have long known that it often leads to the emergence of new weed seedlings in a few weeks.

Ecologists have shown that a farmer's field can have 50,000 or more weed seeds per square meter buried beneath the soil surface. Plant physiologists have shown that seeds buried more than about one centimeter below the soil surface do not receive enough light to germinate. Do the blades of a plow, which can reach more than a foot beneath the soil surface, bring some of these buried seeds to the surface where their germination is induced by exposure to sunlight?

Two ecologists, Jonathan Sauer and Gwendolyn Struik, began to study this question in the 1960s. In a relatively simple experiment, they went to ten different habitats in Wisconsin during the night and collected pairs of soil samples. They stirred up the soil in one sample of each pair in the light and stirred up the other sample of each pair in the dark. They then exposed all ten pairs to natural sunlight in a greenhouse. For nine of the ten pairs of soil samples, weed growth was greater in the samples stirred up in light. They concluded that soil disturbance gives weed seeds a "light break," and this stimulates their germination.

More recently, Karl Hartmann of Erlangen University in Germany reasoned that when farmers plowed their fields during the day, the buried weed seeds are briefly exposed to sunlight as the soil is turned over, and that this stimulates their germination. Although the light exposures from plowing may be less than one millisecond, that can be enough to induce seed germination. Thus the germination of weed seeds would be minimized if farmers simply plowed their fields during the night, when the photon fluence rate [the rate at which photons hit the surface] is below  $10^{15}$  photons per square meter per second. Although even under these

conditions hundreds of millions of photons strike each square millimeter of ground each second, this illumination is below the threshold needed to stimulate the germination of most seeds.

Hartmann says that he was very skeptical when he first came up with this idea because he assumed that such a simple method of weed control as plowing at nighttime must be ineffective or it would have been discovered long ago. But the subsequent experiments, first presented at a 1989 scientific meeting in Freiburg, Germany, clearly demonstrated that the method can be effective.

Hartmann tested his idea by plowing two agricultural strips near Altershausen, Germany. The farmer Karl Seydel cultivated one strip, repeated threefold, at around midday and the other strip at night. No crops were planted in these pilot experiments, to avoid possible competition with the emerging weeds. The results were dramatic. More than 80 percent of the surface of the field plowed in daylight was covered by weeds, whereas only about 2 percent of the field plowed at night was covered by weeds.

This method of weed control is currently being used by several farmers in Germany. Because many of the same weed species that invade farmers' fields in Germany also invade fields elsewhere in the world, this method should be successful elsewhere. In fact, recent studies at universities in Nebraska, Oregon, Minnesota, Denmark, Sweden, and Argentina support this idea.

Number of Emerged Seedlings in Soil Samples  
One Month after Soil Was Disturbed

Sample	Source of soil	Number of emerged seedlings in soil disturbed in	
		light	darkness
A	deciduous woods	4	0
B	deciduous woods	2	1
C	deciduous woods	6	2
D	conifer plantation	8	3
E	conifer plantation	2	1
F	tall-grass prairie	5	1
G	old pasture	0	2
H	old pasture	2	1
I	muck field	14	2
J	muck field	5	3

Adapted from Jonathan Sauer and Gwendolyn Struik, "A Possible Ecological Relation between Soil Disturbance, Light-Flash, and Seed Germination." ©1964 by Jonathan Sauer and Gwendolyn Struik.

43

According to the passage, exposure to light allows seeds to

- A) begin to develop.
- B) absorb necessary nutrients.
- C) withstand extreme temperatures.
- D) achieve maximum growth.

44

The question in the second paragraph (lines 13-17) primarily serves to

- A) emphasize the provisional nature of the findings discussed in the passage.
- B) introduce the specific research topic addressed in the passage.
- C) suggest the hypothetical impact of the studies analyzed in the passage.
- D) indicate the level of disagreement about the methods explored in the passage.

45

As used in line 16, "induced" most nearly means

- A) lured.
- B) established.
- C) convinced.
- D) stimulated.

46

Which choice best supports the idea that seeds present in fields plowed at night are exposed to some amount of light?

- A) Lines 31-36 ("More . . . germination")
- B) Lines 36-38 ("Although . . . germination")
- C) Lines 43-47 ("Although . . . seeds")
- D) Lines 48-52 ("Hartmann . . . ago")

47

The passage suggests that if Seydel had planted wheat or corn on the two agricultural strips in Hartmann's experiment, the percentage of the surface of each strip covered with weeds would likely have been

- A) lower than the percentage that Hartmann found.
- B) higher than the percentage that Hartmann had predicted.
- C) nearly impossible for Hartmann to determine.
- D) comparable to Hartmann's original projection.

48

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 56-60 ("Hartmann . . . night")
- B) Lines 60-62 ("No crops . . . weeds")
- C) Line 62 ("The results . . . dramatic")
- D) Lines 63-66 ("More . . . weeds")

49

As used in line 62, “dramatic” most nearly means

- A) theatrical.
- B) sudden.
- C) impressive.
- D) emotional.

50

According to the table, in which soil sample disturbed in darkness did the fewest number of seedlings emerge?

- A) Sample A
- B) Sample B
- C) Sample C
- D) Sample D

51

As presented in the table, which sample produced the most seedlings when the soil was disturbed in light?

- A) Sample G
- B) Sample H
- C) Sample I
- D) Sample J

52

The data presented in the table most directly support which claim from the passage?

- A) Lines 1-3 (“Many . . . weeds”)
- B) Lines 8-10 (“Ecologists . . . surface”)
- C) Lines 10-13 (“Plant . . . germinate”)
- D) Lines 38-43 (“Thus . . . second”)

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



**No Test Material On This Page**

## Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### How a Cat in a Hat Changed Children’s Education

In a 1954 *Life* magazine article, author John Hersey expressed concern that children in the United States were disengaged from learning how to read. Among other problems, Hersey noted, the reading material available to grade-schoolers had a hard time competing with television, radio, **1** and other media for children’s attention. One solution he proposed was to make

1

- A) NO CHANGE
- B) and with
- C) and also
- D) and competing with

children’s books more **2** interesting, since “an individual’s sense of wholeness . . . follows, and cannot precede, a sense of accomplishment.”

The story of *The Cat in the Hat*’s publication began when William **3** Spaulding, the director of the education division at the publishing company Houghton Mifflin, read Hersey’s article and had an idea. Spaulding agreed that there was a need for appealing books for beginning **4** readers. He thought he knew who should write one. He arranged to have dinner with Theodor Geisel, who wrote and illustrated children’s books under the name “Dr. Seuss,” and issued him a challenge: “Write me a story that first graders can’t put down!”

2

The writer wants to include a quotation by Hersey that supports the topic of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) interesting, since “learning starts with failure; the first failure is the beginning of education.”
- C) interesting because “journalism allows its readers to witness history; fiction gives its readers an opportunity to live it.”
- D) interesting with “drawings like those of the wonderfully imaginative geniuses among children’s illustrators.”

3

- A) NO CHANGE
- B) Spaulding the director
- C) Spaulding, the director,
- D) Spaulding—the director

4

Which choice most effectively combines the sentences at the underlined portion?

- A) readers, and he
- B) readers—namely, he
- C) readers; and Spaulding
- D) readers, and meanwhile he

Having **5** known Spaulding for many years and having maintained a professional relationship with him, Geisel was an experienced writer and illustrator.

**6** However, this new project presented him with an obstacle. Spaulding told Geisel to write his entire book using a restricted vocabulary from an elementary school list of 348 words. Geisel started two stories, only to abandon them when he found that he needed to use words that were not on the list. On the verge of giving up,

**7** Geisel’s story finally hit upon an image that became its basis: a cat wearing a battered stovepipe hat. His main character established, Geisel commenced the difficult task of writing a book with a limited vocabulary. **8** At the end of a duration nine months long, *The Cat in the Hat* was complete.

5

Which choice best supports the information that follows in the sentence?

- A) NO CHANGE
- B) acquired a reputation for perfectionism and for setting high standards for his work,
- C) been interested in politics before breaking into the genre of children’s literature,
- D) published nine children’s books and having received three nominations for the prestigious Caldecott Medal,

6

- A) NO CHANGE
- B) For example,
- C) Furthermore,
- D) At any rate,

7

- A) NO CHANGE
- B) an image that Geisel finally hit upon became the basis of his story:
- C) Geisel finally hit upon the image that became the basis for his story:
- D) the story was finally based on an image that Geisel hit upon:

8

- A) NO CHANGE
- B) After thirty-six weeks—or nine months—had passed,
- C) After a length of nine months had elapsed,
- D) Nine months later,

The book was a hit. Children were entertained by its plot about the antics of a mischievous cat and **9** is captivated by its eye-catching illustrations and memorable rhythms and rhymes. Its sales inspired another publishing company, Random House, to establish a series for early readers called Beginner Books, which featured works by Geisel and other writers, and other publishers quickly followed suit. In the years that **10** followed. Many talented writers and illustrators of children's books imitated Geisel's formula of restricted vocabulary and whimsical artwork. But perhaps the best proof of *The Cat in the Hat's* success is not its influence on other books but its **11** limited vocabulary and appealing word choices.

9

- A) NO CHANGE
- B) was
- C) has been
- D) DELETE the underlined portion.

10

- A) NO CHANGE
- B) followed; many
- C) followed, many
- D) followed—many

11

The writer wants a conclusion that restates the main themes of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) impressive worldwide sales that continue to remain high to this day.
- C) enduring ability to delight children and engage them in learning how to read.
- D) important role in the history of illustration in the twentieth century.

Questions 12-22 are based on the following passage.

### Keep Student Volunteering Voluntary

A growing number of public schools in the United States require students to complete community service hours to graduate. Such volunteering, be it helping at a local animal shelter, **12** when they pick up litter, or working at a health-care facility, has obvious benefits for the community it serves and teaches students important life skills. But critics say that making volunteerism compulsory misses the point of the act.

**13** By its very definition, volunteer work is done willingly. By requiring students to do community service in order to graduate, school **14** officials' are taking away students' choice to give up their time for nonprofit activities, making volunteerism less meaningful and pleasurable. According to a psychological concept called the reactance theory, the loss of freedom in choosing an activity can cause a negative reaction. For instance, instead of focusing on the good they are doing, students may become resentful of the demands that compulsory volunteering places on their schedules.

12

- A) NO CHANGE
- B) to pick up litter,
- C) litter collection,
- D) picking up litter,

13

The writer wants a transition from the previous paragraph that highlights the criticism of compulsory volunteering mentioned in the previous paragraph. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Whatever the work may be,
- C) For many students,
- D) Fortunately for communities in need,

14

- A) NO CHANGE
- B) officials are taking away students
- C) officials are taking away student's
- D) officials are taking away students'

Proponents of compulsory **15** volunteering who are in favor of it point out that it allows young people to garner the benefits that volunteering offers. Students who volunteer report increased self-esteem, better relationship-building skills, and **16** increasingly busy schedules. Some studies have also found that students who do community service are more likely to volunteer as adults, and thus **17** effect society positively over the course of many years.

15

- A) NO CHANGE
- B) volunteering, advocating it,
- C) volunteering
- D) volunteering and its advocates

16

Which choice provides a supporting example that is most similar to the examples already in the sentence?

- A) NO CHANGE
- B) a closer connection with their community.
- C) less time spent engaging in social activities.
- D) little increase in academic achievement.

17

- A) NO CHANGE
- B) affect
- C) effecting
- D) affects

However, most research looks at students who volunteer in general, not making a distinction between students who are required to volunteer by their schools and those who volunteer willingly. One recent study by Sara E. Helms, assistant professor of economics at Samford University in Birmingham, Alabama, did focus specifically on **18** mandatory volunteering. She found that students who were required to volunteer rushed to complete their service hours in early high **19** school, they then did significantly less regular volunteer work in the twelfth grade **20** than the service hours of those not required to volunteer. Helms concluded that compulsory volunteering does not necessarily create lifelong volunteers.

18

- A) NO CHANGE
- B) coercive
- C) forcible
- D) imperative

19

- A) NO CHANGE
- B) school; they then,
- C) school. They, then
- D) school; they then

20

- A) NO CHANGE
- B) than did students who were
- C) than hours worked by students
- D) compared with students



Instead of requiring students to volunteer, schools **21** have to recognize that not all students are equally well suited to the same activities. Many studies show that when schools simply tell students about opportunities for community service and connect them with organizations that need help, more students volunteer of their own free will. **22**

21

Which choice most effectively sets up the point made in the next sentence?

- A) NO CHANGE
- B) should allow students to spend their time participating in athletics and other extracurricular activities.
- C) should focus on offering arrangements that make volunteering an easy and attractive choice.
- D) are advised to recognize the limits of their ability to influence their students.

22

The writer wants a conclusion that states the main claim of the passage. Which choice best accomplishes this goal?

- A) It is imperative that schools do their part to find volunteers for the many worthwhile organizations in the United States.
- B) Schools that do this will produce more engaged, enthusiastic volunteers than schools that require volunteer work.
- C) Studies in the fields of psychology and economics have revolutionized researchers' understanding of volunteerism.
- D) It is important that students choose charitable work that suits their interests and values.

Questions 23-33 are based on the following passage and supplementary material.

### Marsupials Lend a Hand to Science

Marsupials (mammals that carry their young in a pouch) are a curiosity among biologists because they lack a corpus callosum, the collection of nerve fibers connecting the two hemispheres of the brain. In most other mammals, the left hemisphere of the brain controls the right side of the body, the right hemisphere controls the left, and the corpus callosum allows communication between the hemispheres. Scientists **23** are long believing that this structure enables complex tasks by sequestering skilled movement to a single hemisphere without sacrificing coordination between both sides of the body; this sequestration would explain handedness, the tendency to consistently prefer **24** one hand over the other, in humans. However, a recent finding of handedness in marsupials suggests that a **25** trait other than the presence of a corpus callosum **26** links as handedness: bipedalism.

23

- A) NO CHANGE
- B) will long be believing
- C) have long believed
- D) long believe

24

- A) NO CHANGE
- B) and favor the use of one hand over the other,
- C) one hand over the other that could be chosen,
- D) one hand on a regular basis,

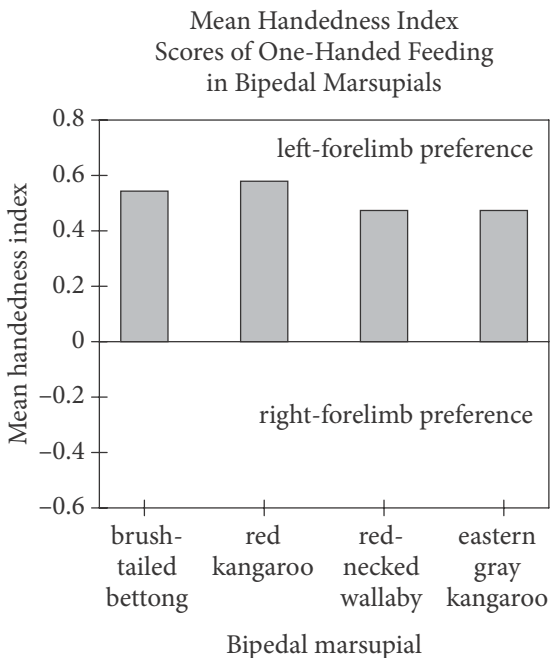
25

- A) NO CHANGE
- B) trait,
- C) trait;
- D) trait:

26

- A) NO CHANGE
- B) correlates with
- C) correlates from
- D) links on

Researchers at Saint Petersburg State University and the University of Tasmania observed marsupials walking on either two legs (bipeds) or four (quadrupeds) and performing tasks such as bringing food to their mouths. The scientists employed a mean handedness index; **27** negative scores indicated a left-forelimb preference and positive scores indicated a right-forelimb preference. While eating, the eastern gray kangaroo, red-necked wallaby, red **28** kangaroo and, brush-tailed bettong, all bipedal marsupials, preferred using their left forelimb, as revealed by **29** positive mean handedness index values less than 0.2 for all four species. These results suggest handedness among these animals.



Adapted from Andrey Giljov et al., "Parallel Emergence of True Handedness in the Evolution of Marsupials and Placentals." ©2015 by Elsevier Ltd.

27

Which choice accurately reflects the information in the graph?

- A) NO CHANGE
- B) scores of 0 or less indicated a left-forelimb preference and positive scores indicated a lack of forelimb preference.
- C) positive scores indicated a lack of forelimb preference and negative scores indicated a right-forelimb preference.
- D) positive scores indicated a left-forelimb preference and negative scores indicated a right-forelimb preference.

28

- A) NO CHANGE
- B) kangaroo, and
- C) kangaroo; and
- D) kangaroo—and,

29

Which choice most accurately reflects the data in the graph?

- A) NO CHANGE
- B) positive mean handedness index values greater than 0.6
- C) positive mean handedness index values between 0.4 and 0.6
- D) mean handedness index values of 0

30 Having four feet, quadrupedal marsupials in the study did not show a strong preference for the use of one forelimb. For instance, gray short-tailed opossums and sugar gliders were assigned mean handedness values very close to zero—they used their right and left forelimbs nearly equally. In effect, the study provided no evidence of handedness among quadrupedal marsupials.

30

Which choice provides the best transition from the previous paragraph?

- A) NO CHANGE
- B) Like most other mammals,
- C) In contrast to their bipedal counterparts,
- D) While using their forelimbs for eating,

31 Kangaroos, though, still do not exhibit handedness to the extent that humans do. As the researchers noted, the quadrupeds typically live in trees and employ all four limbs in climbing. The bipeds, on the other hand, are far less arboreal, leaving their forelimbs relatively free for tasks in 32 whom handedness may confer an evolutionary advantage. Why the majority of marsupials studied preferred their left forelimbs while the majority of humans prefer their right remains a mystery, however, 33 as does the mechanism by which, in the absence of a corpus callosum, the hemispheres of the marsupial brain communicate.

31

Which choice presents a main claim of the passage?

- A) NO CHANGE
- B) For the marsupials in the study, then, handedness seems to be associated with bipedalism.
- C) There are many things scientists do not understand about the marsupial brain.
- D) Additional studies on this phenomenon will need to be performed with other mammals.

32

- A) NO CHANGE
- B) which
- C) what
- D) whose

33

The writer wants to conclude the passage by recalling a topic from the first paragraph that requires additional research. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) though researchers should not neglect the sizable minority of humans who are left handed.
- C) and scientists believe that studies like this one may someday yield insights into the causes of certain neurological disorders.
- D) and an additional study is planned to study handedness in other animals that stand upright only some of the time.

Questions 34-44 are based on the following passage.

### An Employee Benefit That Benefits Employers

— 1 —

According to a 2014 report from the Society for Human Resource Management, 54 percent of surveyed companies provide tuition assistance to employees pursuing an undergraduate degree, and 50 percent do so for employees working toward a graduate degree.

**34** Despite these findings, more companies should consider helping employees pay for education because doing so helps **35** increase customer satisfaction and improve the quality of the companies' business.

**34**

Which choice provides the most effective transition from the previous sentence to the information that immediately follows in this sentence?

- A) NO CHANGE
- B) In addition to the 2014 report,
- C) Although these levels are impressive,
- D) Whether they want to or not,

**35**

Which choice most effectively establishes the main idea of the passage?

- A) NO CHANGE
- B) solve the problem of rising tuition costs
- C) strengthen the US economy
- D) attract and retain employees

— 2 —

Tuition-reimbursement programs signal that employers offer their **36** workers' opportunities for personal and professional development. According to professor of management Peter Cappelli, such opportunities are appealing to highly motivated and disciplined individuals and may attract applicants with these desirable qualities. Many in the business community concur. Explaining his company's decision to expand its tuition-assistance program, John Fox, the director of dealer training at Fiat Chrysler Automobiles in the United States, **37** who stressed the importance of drawing skilled employees to Fiat Chrysler's car dealerships: "This is a benefit that can surely bring top talent to our dealers," he said.

**36**

- A) NO CHANGE
- B) workers opportunities'
- C) workers opportunities
- D) worker's opportunity's

**37**

- A) NO CHANGE
- B) stressed
- C) stressing
- D) and he stressed

— 3 —

Paying for tuition also helps businesses retain **38** employees. Retaining employees is important not only because it ensures a skilled and experienced workforce but also because it mitigates the considerable costs of finding, hiring, and training new workers. Employees whose tuition is reimbursed often stay with their employer even after they complete their **39** degrees. Because their new qualifications give them opportunities for advancement within the company. The career of Valerie Lincoln, an employee at the aerospace company United Technologies Corporation **40** (UTC) is a significant success story for her company's tuition-reimbursement program. In eight years at UTC, Lincoln earned associate and bachelor's degrees in business and advanced from an administrative assistant position to an accounting associate position. This allowed UTC to retain an employee with a **41** deep knowledge of her industry and years of valuable experience.

38

Which choice most effectively combines the sentences at the underlined portion?

- A) employees, and this retention
- B) employees, the retaining of whom
- C) employees, which
- D) employees; that

39

- A) NO CHANGE
- B) degrees: because
- C) degrees because
- D) degrees; because

40

- A) NO CHANGE
- B) (UTC)—
- C) (UTC):
- D) (UTC),

41

- A) NO CHANGE
- B) hidden
- C) large
- D) spacious



— 4 —

Tuition reimbursement can be expensive, and many companies would find it impractical to pay for multiple degrees for all employees. Businesses have succeeded in **42** minimizing and keeping down costs and ensuring the relevance of employees' coursework by offering fixed amounts of reimbursement each year and stipulating which subjects workers can study. Even with these methods, tuition reimbursement may not be appropriate in all cases, especially if classes are likely **43** to divert employees' time and energy from their jobs.

**Question 44** asks about the previous passage as a whole.

**42**

- A) NO CHANGE
- B) minimizing costs associated with employees' coursework
- C) being effective at keeping down costs
- D) keeping down costs

**43**

- A) NO CHANGE
- B) diverted
- C) in diverting
- D) diversions for

**Think about the previous passage as a whole as you answer question 44.**

**44**

The writer wants to insert the following sentence.

Still, since securing an excellent workforce is crucial to a business's success, employers should give serious thought to investing in reimbursement programs.

To make the passage most logical, the sentence should be placed immediately after the last sentence in paragraph

- A) 1.
- B) 2.
- C) 3.
- D) 4.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



# Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

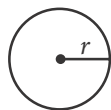
## DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 16-20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

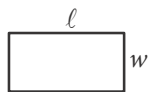
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

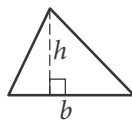


$$A = \pi r^2$$

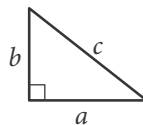
$$C = 2\pi r$$



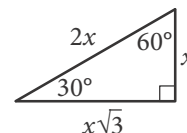
$$A = \ell w$$



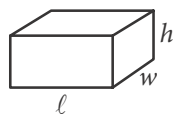
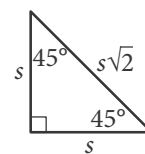
$$A = \frac{1}{2}bh$$



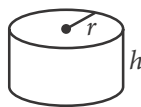
$$c^2 = a^2 + b^2$$



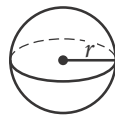
Special Right Triangles



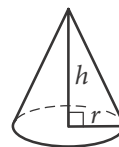
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

$$2z + 1 = z$$

What value of  $z$  satisfies the equation above?

- A)  $-2$
- B)  $-1$
- C)  $\frac{1}{2}$
- D)  $1$

2

A television with a price of \$300 is to be purchased with an initial payment of \$60 and weekly payments of \$30. Which of the following equations can be used to find the number of weekly payments,  $w$ , required to complete the purchase, assuming there are no taxes or fees?

- A)  $300 = 30w - 60$
- B)  $300 = 30w$
- C)  $300 = 30w + 60$
- D)  $300 = 60w - 30$

3

Shipping Charges

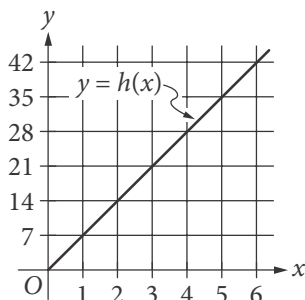
Merchandise weight (pounds)	Shipping charge
5	\$16.94
10	\$21.89
20	\$31.79
40	\$51.59

The table above shows shipping charges for an online retailer that sells sporting goods. There is a linear relationship between the shipping charge and the weight of the merchandise. Which function can be used to determine the total shipping charge  $f(x)$ , in dollars, for an order with a merchandise weight of  $x$  pounds?

- A)  $f(x) = 0.99x$
- B)  $f(x) = 0.99x + 11.99$
- C)  $f(x) = 3.39x$
- D)  $f(x) = 3.39x + 16.94$



4



The line in the  $xy$ -plane above represents the relationship between the height  $h(x)$ , in feet, and the base diameter  $x$ , in feet, for cylindrical Doric columns in ancient Greek architecture. How much greater is the height of a Doric column that has a base diameter of 5 feet than the height of a Doric column that has a base diameter of 2 feet?

- A) 7 feet
- B) 14 feet
- C) 21 feet
- D) 24 feet

5

$$\sqrt{9x^2}$$

If  $x > 0$ , which of the following is equivalent to the given expression?

- A)  $3x$
- B)  $3x^2$
- C)  $18x$
- D)  $18x^4$

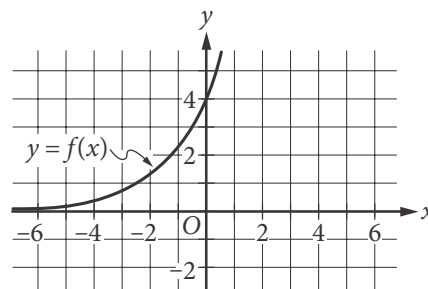
6

$$\frac{x^2 - 1}{x - 1} = -2$$

What are all values of  $x$  that satisfy the equation above?

- A)  $-3$
- B)  $0$
- C)  $1$
- D)  $-3$  and  $-1$

7

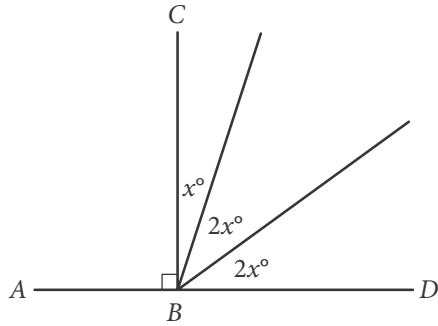


The graph of  $y = f(x)$  is shown in the  $xy$ -plane. What is the value of  $f(0)$ ?

- A) 0
- B) 2
- C) 3
- D) 4



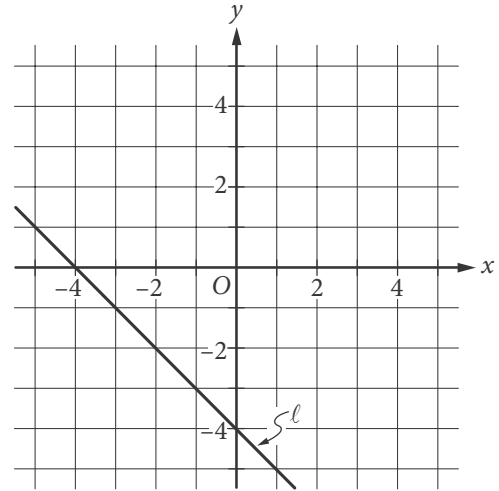
8



In the figure above, point  $B$  lies on  $\overline{AD}$ . What is the value of  $3x$  ?

- A) 18
- B) 36
- C) 54
- D) 72

9

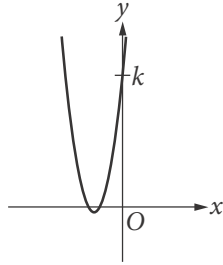


Which of the following is an equation of line  $l$  in the  $xy$ -plane above?

- A)  $x - y = -4$
- B)  $x - y = 4$
- C)  $x + y = -4$
- D)  $x + y = 4$



10



The graph of  $y = 2x^2 + 10x + 12$  is shown. If the graph crosses the  $y$ -axis at the point  $(0, k)$ , what is the value of  $k$ ?

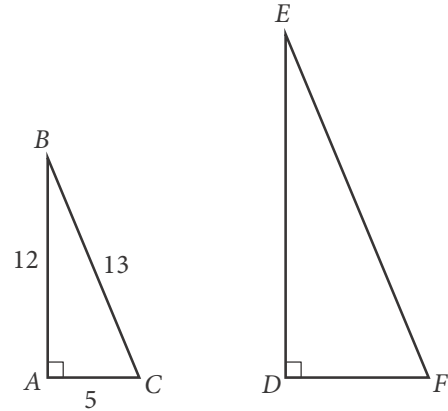
- A) 2
- B) 6
- C) 10
- D) 12

11

A circle in the  $xy$ -plane has center  $(5, 7)$  and radius 2. Which of the following is an equation of the circle?

- A)  $(x - 5)^2 + (y - 7)^2 = 4$
- B)  $(x + 5)^2 + (y + 7)^2 = 4$
- C)  $(x - 5)^2 + (y - 7)^2 = 2$
- D)  $(x + 5)^2 + (y + 7)^2 = 2$

12



In the figure above, triangle  $ABC$  is similar to triangle  $DEF$ . What is the value of  $\cos(E)$ ?

- A)  $\frac{12}{5}$
- B)  $\frac{12}{13}$
- C)  $\frac{5}{12}$
- D)  $\frac{5}{13}$



13

In the  $xy$ -plane, the graph of the function  $f(x) = x^2 + 5x + 4$  has two  $x$ -intercepts. What is the distance between the  $x$ -intercepts?

- A) 1
- B) 2
- C) 3
- D) 4

14

$$\sqrt{4x} = x - 3$$

What are all values of  $x$  that satisfy the given equation?

- I. 1
  - II. 9
- A) I only
  - B) II only
  - C) I and II
  - D) Neither I nor II

15

$$-3x + y = 6$$

$$ax + 2y = 4$$

In the system of equations above,  $a$  is a constant. For which of the following values of  $a$  does the system have no solution?

- A)  $-6$
- B)  $-3$
- C)  $3$
- D)  $6$

**DIRECTIONS**

For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $7/2$ . (If 

3	1	/	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

 is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

**Answer:  $\frac{7}{12}$**

Write answer in boxes. →

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Grid in result. ←

**Answer: 2.5**

	2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3

2	0	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3

**NOTE:**

You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.





16

$$T = 5c + 12f$$

A manufacturer shipped units of a certain product to two locations. The equation above shows the total shipping cost  $T$ , in dollars, for shipping  $c$  units to the closer location and shipping  $f$  units to the farther location. If the total shipping cost was \$47,000 and 3000 units were shipped to the farther location, how many units were shipped to the closer location?

17

$$|2x + 1| = 5$$

If  $a$  and  $b$  are the solutions to the equation above, what is the value of  $|a - b|$ ?

18

Juan purchased an antique that had a value of \$200 at the time of purchase. Each year, the value of the antique is estimated to increase 10% over its value the previous year. The estimated value of the antique, in dollars, 2 years after purchase can be represented by the expression  $200a$ , where  $a$  is a constant. What is the value of  $a$ ?

19

$$2x + 3y = 1200$$

$$3x + 2y = 1300$$

Based on the system of equations above, what is the value of  $5x + 5y$ ?

20

If  $u + t = 5$  and  $u - t = 2$ , what is the value of  $(u - t)(u^2 - t^2)$ ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



# Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

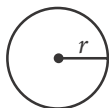
## DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

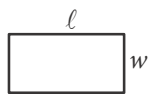
- The use of a calculator is permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

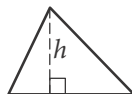


$$A = \pi r^2$$

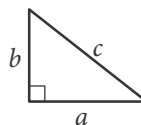
$$C = 2\pi r$$



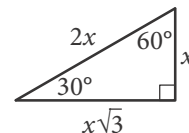
$$A = \ell w$$



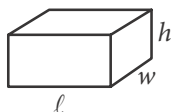
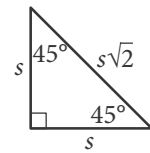
$$A = \frac{1}{2}bh$$



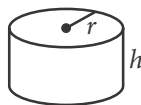
$$c^2 = a^2 + b^2$$



Special Right Triangles



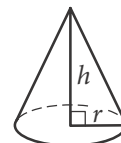
$$V = \ell wh$$



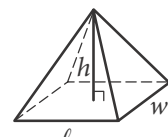
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



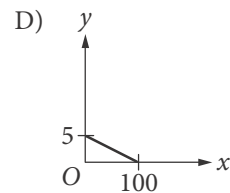
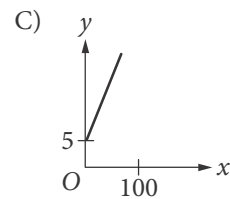
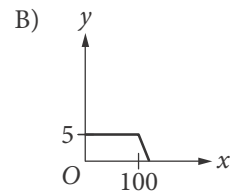
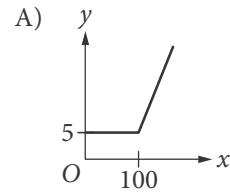
1

A helicopter, initially hovering 40 feet above the ground, begins to gain altitude at a rate of 21 feet per second. Which of the following functions represents the helicopter's altitude above the ground  $y$ , in feet,  $t$  seconds after the helicopter begins to gain altitude?

- A)  $y = 40 + 21$
- B)  $y = 40 + 21t$
- C)  $y = 40 - 21t$
- D)  $y = 40t + 21$

2

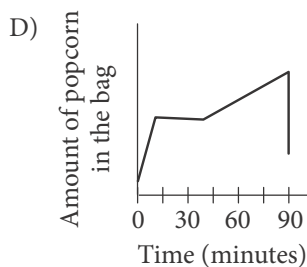
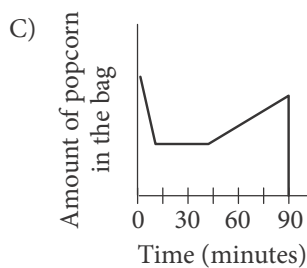
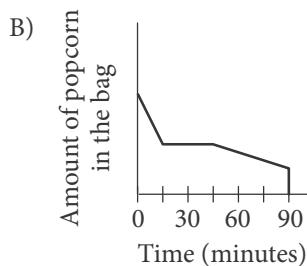
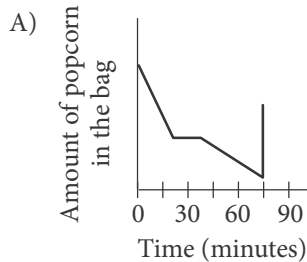
A text messaging plan charges a flat fee of \$5 per month for up to 100 text messages sent plus \$0.25 for each additional text message sent that month. Which of the following graphs represents the cost,  $y$ , of sending  $x$  texts in a month?





3

Jake buys a bag of popcorn at a movie theater. He eats half of the popcorn during the 15 minutes of previews. After eating half of the popcorn, he stops eating for the next 30 minutes. Then he gradually eats the popcorn until he accidentally spills all of the remaining popcorn. Which of the following graphs could represent the situation?



4

If  $20 - x = 15$ , what is the value of  $3x$  ?

- A) 5
- B) 10
- C) 15
- D) 35

5

$$f(x) = \frac{x+3}{2}$$

For the function  $f$  defined above, what is the value of  $f(-1)$  ?

- A) -2
- B) -1
- C) 1
- D) 2



6

Which of the following is equivalent to  $2x(x^2 - 3x)$  ?

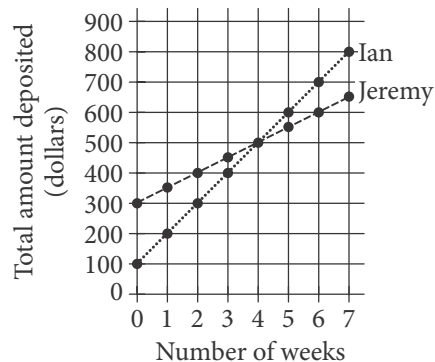
- A)  $-4x^2$
- B)  $3x^3 - x^2$
- C)  $2x^3 - 3x$
- D)  $2x^3 - 6x^2$

7

A retail company has 50 large stores located in different areas throughout a state. A researcher for the company believes that employee job satisfaction varies greatly from store to store. Which of the following sampling methods is most appropriate to estimate the proportion of all employees of the company who are satisfied with their job?

- A) Selecting one of the 50 stores at random and then surveying each employee at that store
- B) Selecting 10 employees from each store at random and then surveying each employee selected
- C) Surveying the 25 highest-paid employees and the 25 lowest-paid employees
- D) Creating a website on which employees can express their opinions and then using the first 50 responses

8



The two graphs above show the total amounts of money that Ian and Jeremy each have deposited into their savings accounts for the first seven weeks after opening their accounts. After they made their initial deposits, how much more did Ian deposit each week than Jeremy?

- A) \$200
- B) \$100
- C) \$50
- D) \$25

9

$$h(x) = 2^x$$

The function  $h$  is defined above. What is  $h(5) - h(3)$  ?

- A) 2
- B) 4
- C) 24
- D) 28



10

A researcher surveyed a random sample of students from a large university about how often they see movies. Using the sample data, the researcher estimated that 23% of the students in the population saw a movie at least once per month. The margin of error for this estimation is 4%. Which of the following is the most appropriate conclusion about all students at the university, based on the given estimate and margin of error?

- A) It is unlikely that less than 23% of the students see a movie at least once per month.
- B) At least 23%, but no more than 25%, of the students see a movie at least once per month.
- C) The researcher is between 19% and 27% sure that most students see a movie at least once per month.
- D) It is plausible that the percentage of students who see a movie at least once per month is between 19% and 27%.

11

List A	1	2	3	4	5	6
List B	2	3	3	4	4	5

The table above shows two lists of numbers. Which of the following is a true statement comparing list A and list B?

- A) The means are the same, and the standard deviations are different.
- B) The means are the same, and the standard deviations are the same.
- C) The means are different, and the standard deviations are different.
- D) The means are different, and the standard deviations are the same.

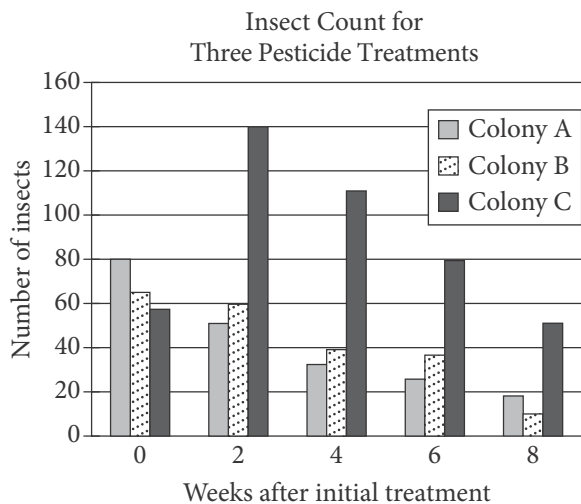
12

A book was on sale for 40% off its original price. If the sale price of the book was \$18.00, what was the original price of the book? (Assume there is no sales tax.)

- A) \$7.20
- B) \$10.80
- C) \$30.00
- D) \$45.00



Questions 13 and 14 refer to the following information.



Three colonies of insects were each treated with a different pesticide over an 8-week period to test the effectiveness of the three pesticides. Colonies A, B, and C were treated with Pesticides A, B, and C, respectively. Each pesticide was applied every 2 weeks to one of the three colonies over the 8-week period. The bar graph above shows the insect counts for each of the three colonies 0, 2, 4, 6, and 8 weeks after the initial treatment.

13

Which of the following colonies showed a decrease in size every two weeks after the initial treatment with pesticide?

- I. Colony A
  - II. Colony B
  - III. Colony C
- A) I only  
 B) III only  
 C) I and II only  
 D) I, II, and III

14

Of the following, which is closest to the ratio of the total number of insects in all three colonies in week 8 to the total number of insects at the time of initial treatment?

- A) 2 to 5  
 B) 1 to 4  
 C) 3 to 5  
 D) 1 to 2

15

A right circular cone has a volume of  $24\pi$  cubic inches. If the height of the cone is 2 inches, what is the radius, in inches, of the base of the cone?

- A)  $2\sqrt{3}$   
 B) 6  
 C) 12  
 D) 36



16

In 2015 the populations of City X and City Y were equal. From 2010 to 2015, the population of City X increased by 20% and the population of City Y decreased by 10%. If the population of City X was 120,000 in 2010, what was the population of City Y in 2010?

- A) 60,000
- B) 90,000
- C) 160,000
- D) 240,000

17

The volume of a sphere is given by the formula

$$V = \frac{4}{3}\pi r^3, \text{ where } r \text{ is the radius of the sphere. Which}$$

of the following gives the radius of the sphere in terms of the volume of the sphere?

- A)  $\frac{4\pi}{3V}$
- B)  $\frac{3V}{4\pi}$
- C)  $\sqrt[3]{\frac{4\pi}{3V}}$
- D)  $\sqrt[3]{\frac{3V}{4\pi}}$

18

Survey Results

Answer	Percent
Never	31.3%
Rarely	24.3%
Often	13.5%
Always	30.9%

The table above shows the results of a survey in which tablet users were asked how often they would watch video advertisements in order to access streaming content for free. Based on the table, which of the following is closest to the probability that a tablet user answered “Always,” given that the tablet user did not answer “Never”?

- A) 0.31
- B) 0.38
- C) 0.45
- D) 0.69

19

$$y = -(x - 3)^2 + a$$

In the equation above,  $a$  is a constant. The graph of the equation in the  $xy$ -plane is a parabola. Which of the following is true about the parabola?

- A) Its minimum occurs at  $(-3, a)$ .
- B) Its minimum occurs at  $(3, a)$ .
- C) Its maximum occurs at  $(-3, a)$ .
- D) Its maximum occurs at  $(3, a)$ .





20

The maximum value of a data set consisting of 25 positive integers is 84. A new data set consisting of 26 positive integers is created by including 96 in the original data set. Which of the following measures must be 12 greater for the new data set than for the original data set?

- A) The mean
- B) The median
- C) The range
- D) The standard deviation

21

$$0.10x + 0.20y = 0.18(x + y)$$

Clayton will mix  $x$  milliliters of a 10% by mass saline solution with  $y$  milliliters of a 20% by mass saline solution in order to create an 18% by mass saline solution. The equation above represents this situation. If Clayton uses 100 milliliters of the 20% by mass saline solution, how many milliliters of the 10% by mass saline solution must he use?

- A) 5
- B) 25
- C) 50
- D) 100

22

The first year Eleanor organized a fund-raising event, she invited 30 people. For each of the next 5 years, she invited double the number of people she had invited the previous year. If  $f(n)$  is the number of people invited to the fund-raiser  $n$  years after Eleanor began organizing the event, which of the following statements best describes the function  $f$ ?

- A) The function  $f$  is a decreasing linear function.
- B) The function  $f$  is an increasing linear function.
- C) The function  $f$  is a decreasing exponential function.
- D) The function  $f$  is an increasing exponential function.

23

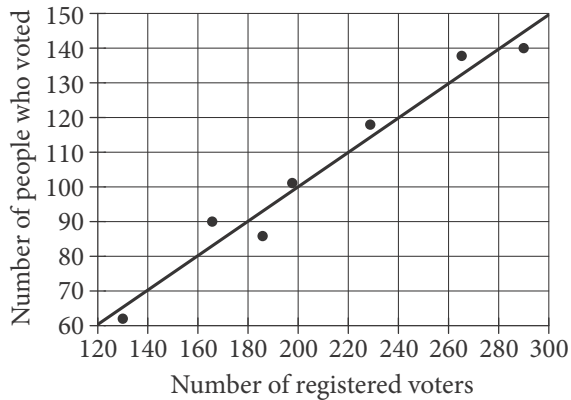
$x$	$a$	$3a$	$5a$
$y$	0	$-a$	$-2a$

Some values of  $x$  and their corresponding values of  $y$  are shown in the table above, where  $a$  is a constant. If there is a linear relationship between  $x$  and  $y$ , which of the following equations represents the relationship?

- A)  $x + 2y = a$
- B)  $x + 2y = 5a$
- C)  $2x - y = -5a$
- D)  $2x - y = 7a$



24



The scatterplot above shows the number of registered voters,  $x$ , and the number of people who voted in the last election,  $y$ , for seven districts in a town. A line of best fit for the data is also shown. Which of the following could be the equation of the line of best fit?

- A)  $y = -0.5x$
- B)  $y = 0.5x$
- C)  $y = -2x$
- D)  $y = 2x$

25

$$\begin{aligned} 2.4x - 1.5y &= 0.3 \\ 1.6x + 0.5y &= -1.3 \end{aligned}$$

The system of equations above is graphed in the  $xy$ -plane. What is the  $x$ -coordinate of the intersection point  $(x, y)$  of the system?

- A)  $-0.5$
- B)  $-0.25$
- C)  $0.8$
- D)  $1.75$

26

Keith modeled the growth over several hundred years of a tree population by estimating the number of the trees' pollen grains per square centimeter that were deposited each year within layers of a lake's sediment. He estimated there were 310 pollen grains per square centimeter the first year the grains were deposited, with a 1% annual increase in the number of grains per square centimeter thereafter. Which of the following functions models  $P(t)$ , the number of pollen grains per square centimeter  $t$  years after the first year the grains were deposited?

- A)  $P(t) = 310^t$
- B)  $P(t) = 310^{1.01t}$
- C)  $P(t) = 310(0.99)^t$
- D)  $P(t) = 310(1.01)^t$



27

$$\frac{2}{3}(9x - 6) - 4 = 9x - 6$$

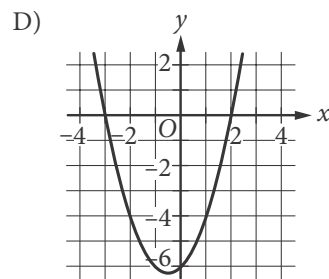
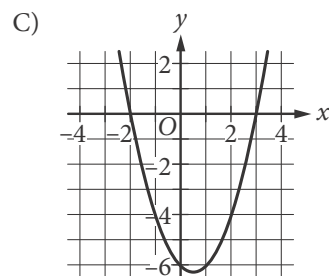
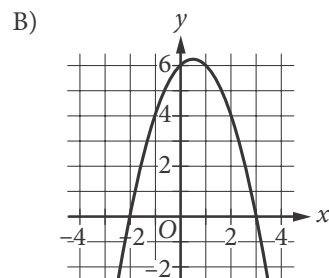
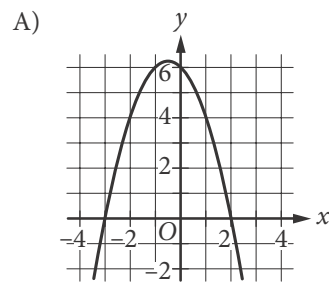
Based on the equation above, what is the value of  $3x - 2$ ?

- A)  $-4$
- B)  $-\frac{4}{5}$
- C)  $-\frac{2}{3}$
- D)  $4$

28

$$f(x) = (x + 3)(x - k)$$

The function  $f$  is defined above. If  $k$  is a positive integer, which of the following could represent the graph of  $y = f(x)$  in the  $xy$ -plane?





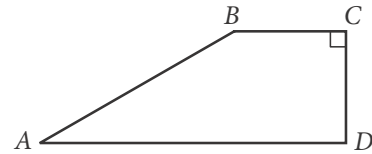
29

$$H = 1.88L + 32.01$$

The formula above can be used to approximate the height  $H$ , in inches, of an adult male based on the length  $L$ , in inches, of his femur. What is the meaning of 1.88 in this context?

- A) The approximate femur length, in inches, for a man with a height of 32.01 inches
- B) The approximate increase in a man's femur length, in inches, for each increase of 32.01 inches in his height
- C) The approximate increase in a man's femur length, in inches, for each one-inch increase in his height
- D) The approximate increase in a man's height, in inches, for each one-inch increase in his femur length

30



In quadrilateral  $ABCD$  above,  $\overline{AD} \perp \overline{BC}$  and  $CD = \frac{1}{2}AB$ . What is the measure of angle  $B$ ?

- A)  $150^\circ$
- B)  $135^\circ$
- C)  $120^\circ$
- D)  $90^\circ$


**DIRECTIONS**

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If 

3	1	/	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

 is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Answer:  $\frac{7}{12}$

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Grid in result.

Answer: 2.5

	2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3

2	0	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3

**NOTE:**

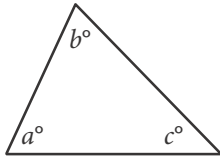
You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

Lynne has \$8.00 to spend on apples and oranges. Apples cost \$0.65 each, and oranges cost \$0.75 each. If there is no tax on this purchase and she buys 5 apples, what is the maximum number of whole oranges she can buy?

32



Note: Figure not drawn to scale.

In the triangle above,  $a = 34$ . What is the value of  $b + c$ ?

33

700, 1200, 1600, 2000,  $x$

If the mean of the five numbers above is 1600, what is the value of  $x$ ?

34

The relationship between  $x$  and  $y$  can be written as  $y = mx$ , where  $m$  is a constant. If  $y = 17$  when  $x = a$ , what is the value of  $y$  when  $x = 2a$ ?



35

$$a(x + b) = 4x + 10$$

In the equation above,  $a$  and  $b$  are constants. If the equation has infinitely many solutions for  $x$ , what is the value of  $b$ ?

36

In the  $xy$ -plane, a line that has the equation  $y = c$  for some constant  $c$  intersects a parabola at exactly one point. If the parabola has the equation  $y = -x^2 + 5x$ , what is the value of  $c$ ?

Questions 37 and 38 refer to the following information.

The peregrine falcon can reach speeds of up to 200 miles per hour while diving to catch prey, making it the fastest animal on the planet when in a dive.

37

What is a peregrine falcon's maximum speed while diving to catch prey, in feet per second? (Round your answer to the nearest whole number.  
1 mile = 5280 feet)

38

If a peregrine falcon dove at its maximum speed for half a mile to catch prey, how many seconds would the dive take? (Round your answer to the nearest second.)

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

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## Answer Explanations

# SAT Practice Test #10

## Section 1: Reading Test

### QUESTION 1

**Choice A is the best answer.** Throughout the passage, the narrator refers to Miss Spivey’s 1938 class as “we” and “us” and describes interactions between Miss Spivey and her students as a firsthand observer, indicating that the narrator was a member of this 1938 class. Therefore, the narrator of the passage can best be described as one of Miss Spivey’s former students.

Choice B is incorrect because the narrator refers to Miss Spivey’s predecessor, Miss Chandler, by name, not as “I” or “me,” and therefore the narrator isn’t Miss Spivey’s predecessor. Choice C is incorrect because the passage identifies the narrator as a member of Miss Spivey’s 1938 class and also mentions the narrator’s mother and brother, Ralphord. Choice D is incorrect because the narrator refers to Miss Spivey by name and as “she” and “her,” not as “I” or “me,” and thus can’t be Miss Spivey herself.

### QUESTION 2

**Choice B is the best answer.** The description of the train’s arrival in the first paragraph suggests that Threestep is a rural town: instead of a paved platform, the tracks are lined with “burned grass.” Meanwhile, the description of the school in the sixth paragraph implies that the community is small: instead of individual rooms for separate grade levels, the school’s single room contains twenty-six students spread “across seven grade levels.” Therefore, Threestep is mainly presented in the passage as a small rural town.

Choice A is incorrect because the narrator describes Threestep as uncomfortably hot for its residents, not as a summer retreat for vacationers. Choice C is incorrect because Miss Spivey refers to prominent universities located in other cities, not ones located in Threestep. Choice D is incorrect because in the first paragraph Threestep is characterized as a small rural town that is experiencing “hard times,” not as a comfortable suburb.

### QUESTION 3

**Choice D is the best answer.** In the first paragraph, Miss Spivey remarks that the heat in Georgia is nothing compared to the heat she experienced in Timbuktu. Later in this paragraph the narrator states, “I believe her remark irritated some of the people gathered to welcome her on the burned grass alongside the tracks. When folks are sweating through their shorts, they don’t like to hear that this is *nothing* compared to someplace else.” Hence it can reasonably be inferred from the passage that some of the people at the train station regard Miss Spivey’s comment about the Georgia heat with resentment because they feel that she is minimizing their discomfort.

Choice A is incorrect because Miss Spivey informs the people at the train station that she has experienced even more extreme heat, so they wouldn’t have assumed that she is experiencing intense heat for the first time. Choice B is incorrect because the passage indicates that the people at the station know Miss Spivey is coming to Threestep to work, not that they doubt she will stay there very long. Choice C is incorrect because the passage doesn’t indicate that the people at the train station imagine that she is superior to them.

### QUESTION 4

**Choice B is the best answer.** The previous question asks what can be inferred from the passage about the reaction of the people at the train station to Miss Spivey’s comment about the Georgia heat. The answer, that it can be reasonably inferred from the passage that some of the people at the train station regard Miss Spivey’s comment about the Georgia heat with resentment because they feel that she’s minimizing their discomfort, is best supported in the first paragraph: “I believe her remark irritated some of the people gathered to welcome her on the burned grass alongside the tracks. When folks are sweating through their shorts, they don’t like to hear that this is *nothing* compared to someplace else.”

Choices A, C, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they describe Miss Spivey’s appearance (choice A), reflect on why people viewed her arrival positively in spite of their irritation over her remark (choice C), and outline her education (choice D).

### QUESTION 5

**Choice A is the best answer.** In the second paragraph, Miss Spivey describes a break she took from her formal education as a “fruitful intermission.” She explains that she “traveled extensively in the Near East and Africa with a friend of her grandmother’s, one Janet Miller” during this time. Therefore, Miss Spivey most likely uses the phrase “fruitful intermission” to indicate that she benefited from taking time off from her studies to travel.

Choice B is incorrect because Miss Spivey’s use of the phrase “fruitful intermission” doesn’t indicate that her travels with Janet Miller encouraged her to start medical school. Choice C is incorrect because Miss Spivey uses the phrase “fruitful intermission” to refer to a break in her formal education after boarding school, not during her early years there. Choice D is incorrect because Miss Spivey’s use of the phrase “fruitful intermission” doesn’t indicate that this break lasted longer than she had expected.

## QUESTION 6

**Choice A is the best answer.** In the second paragraph, Miss Spivey tells her class that she went to Barnard College in New York City, which prompts Ralphord to ask her what she studied at “Barnyard College.” In response, Miss Spivey explains that Barnard College “was the sister school of Columbia University, of which, she expected, we all had heard.” This interaction implies that, contrary to Miss Spivey’s expectations, the names of prestigious East Coast schools aren’t common knowledge among her pupils. Thus the interaction between Miss Spivey and Ralphord serves mainly to suggest that Miss Spivey has an exaggerated view of what information should be considered common knowledge.

Choice B is incorrect because the interaction between Miss Spivey and Ralphord establishes an atmosphere of misunderstanding, not friendliness. Choice C is incorrect because Ralphord’s question demonstrates his naivety rather than his precociousness. Choice D is incorrect because the passage doesn’t suggest that Ralphord’s question is an attempt to amuse Miss Spivey.

## QUESTION 7

**Choice D is the best answer.** The third paragraph describes Miss Spivey as having “wandered,” or walked aimlessly, into a lecture by John Dewey. Following her interactions with the professor, Miss Spivey was inspired to work as an educator; consequently, she “marched,” or walked purposefully, to sign up for the Teacher’s College. Hence, by describing Miss Spivey as having “wandered” in the former situation and “marched” in the latter, the narrator is most likely suggesting that Miss Spivey’s initial encounter with Dewey’s ideas was somewhat accidental but ultimately motivated her to decisive action.

Choices A and C are incorrect because the narrator’s description of Miss Spivey as having “wandered” into Dewey’s class and “marched” to sign up for the Teacher’s College suggests that her accidental encounter with him motivated her to begin studying to be a teacher, not that Dewey saw Miss Spivey as lacking confidence in her ability to teach (choice A) or that she was anxious to be in charge of her own classroom (choice C). Choice B is incorrect

because Miss Spivey didn't express a desire to teach in the poorest, most remote corner of America until two years after talking with Dewey over coffee.

### QUESTION 8

**Choice C is the best answer.** According to the third paragraph, after two years at the Teacher's College, Miss Spivey told a woman from the WPA that "she wanted to bring democracy and education to the poorest, darkest, most remote and forgotten corner of America." Consequently, "they sent her to Threestep, Georgia," according to the fourth paragraph. Thus Miss Spivey ended up in Threestep as a direct result of talking with a woman at the WPA.

Choices A and B are incorrect because Miss Spivey ended up in Threestep as a direct result of talking with a woman at the WPA, not as an immediate consequence of her friendship with Janet Miller (choice A), or her decision to attend college in New York City (choice B). Choice D is incorrect because Miss Chandler is mentioned as Miss Spivey's predecessor in Threestep, but Miss Spivey's arrival in town doesn't occur as a direct result of Miss Chandler's retirement.

### QUESTION 9

**Choice C is the best answer.** The ninth paragraph describes the students' reaction to Miss Spivey's announcement that she had seen camels on her trip to Baghdad: "We all hung there for a minute, thinking hard, until Mavis Davis spoke up." Mavis reminds the other students that camels appear in a story they are familiar with. Thus, when Miss Spivey announces that she had seen camels, the students' reaction suggests that they are baffled.

Choices A, B, and D are incorrect because when Miss Spivey announces that she had seen camels, the students' reaction suggests that they are baffled, not delighted (choice A), fascinated (choice B), or worried (choice D).

### QUESTION 10

**Choice B is the best answer.** The previous question asks what the students' reaction suggests about them when Miss Spivey announces that she had seen camels. The answer, that their reaction suggests that they are baffled, is best supported in the ninth paragraph: "We all hung there for a minute, thinking hard, until Mavis Davis spoke up."

Choices A, C, and D are incorrect because the cited lines don't provide the best evidence for the answer to the previous question. Instead, they describe Miss Spivey's anticipation of a delighted or amazed response to her announcement that she had seen camels (choice A),



relay Mavis’s reference to a story familiar to the students (choice C), and reflect on the subdued nature of Miss Spivey’s response to Mavis (choice D).

## QUESTION 11

**Choice D is the best answer.** Throughout the passage, the author contends that efforts to make driving more unpleasant can curtail the negative environmental effects of car use, such as the rapid growth of “energy-hungry subdivisions.” According to the second paragraph, “one of the few forces with a proven ability to slow the growth of suburban sprawl has been the ultimately finite tolerance of commuters for long, annoying commutes.” Consequently, according to the last paragraph, “from an environmental perspective, inconvenient travel is a worthy goal.” Thus the main purpose of the passage is to argue that one way to reduce the negative environmental effects of traffic is to make driving less agreeable.

Choice A is incorrect because the author introduces the claim that efforts to reduce traffic actually increase traffic as a supporting point, not as the main purpose of the passage. Choice B is incorrect because, in the second paragraph, the author does dispute the environmental value of making car travel more convenient, but this isn’t the main purpose of the passage. Choice C is incorrect because the negative environmental consequences of car-focused development and suburban sprawl are supporting details of the passage, not its main purpose.

## QUESTION 12

**Choice A is the best answer.** In the first paragraph, the author states, “Building good transit isn’t a bad idea, but it can actually backfire if the new trains and buses merely clear space on highway lanes for those who would prefer to drive—a group that, historically, has included almost everyone with access to a car.” In this sentence, the author bases his claim about the unintended consequences of building public transit on the expectation that most people would prefer to drive a car than take trains and buses. Hence this sentence best supports the idea that the author assumes that, all things being equal, people would rather drive than take mass transit.

Choices B, C, and D are incorrect because the cited lines don’t provide the best support for the idea that the author assumes that, all things being equal, people would rather drive than take mass transit. Instead, they argue that in order to have positive environmental effects, new transit options have to persuade a substantial number of people not to drive (choice B), contend that unpopular efforts to make driving less convenient are necessary to reduce driving (choice C), and connect increased commute times to a reduction in suburban sprawl (choice D).

### QUESTION 13

**Choice A is the best answer.** The first paragraph states, “That means that a new transit system has to be backed up by something that impels complementary reductions in car use.” In other words, new public transportation initiatives need to be supported, or reinforced, by policies that reduce car use. Thus “backed up,” as used in the passage, most nearly means supported.

Choices B, C, and D are incorrect because in the context of the passage, “backed up” means supported, not copied (choice B), substituted (choice C), or jammed (choice D).

### QUESTION 14

**Choice B is the best answer.** In the first paragraph, the author introduces some proposals for reducing car traffic by making driving slower and less convenient. However, he also acknowledges that “those ideas are not popular.” Thus, in the first paragraph, the author concedes that his recommendations aren’t widely supported.

Choice A is incorrect because, in the first paragraph, the author doesn’t indicate that his recommendations are costly to implement. Choice C is incorrect because the author concedes that his recommendations are unpopular with the general public, not strongly opposed by experts. Choice D is incorrect because the author suggests that his recommendations are environmentally beneficial in the long term, not environmentally harmful in the short term.

### QUESTION 15

**Choice C is the best answer.** In the second paragraph, the author argues that “if, in a misguided effort to do something of environmental value, municipalities take steps that make long-distance car commuting faster or more convenient . . . we actually make the sprawl problem worse.” That is, measures that make driving more convenient actually harm the environment because they encourage more people to live in suburban developments, which represents wasteful expansion in his view. Therefore, based on the passage, the author would most likely characterize many attempts to improve traffic as well intentioned but ultimately leading to environmental harm.

Choices A, B, and D are incorrect because the author doesn’t characterize attempts to improve traffic as doomed to fail due to drivers’ reluctance to change their behavior (choice A), as overestimating drivers’ tolerance of long commutes (choice B), or as viable only if they make driving more economical and productive (choice D).

## QUESTION 16

**Choice C is the best answer.** The previous question asks how the author would most likely characterize many attempts to improve traffic. The answer, that the author would most likely characterize such attempts as well intentioned but ultimately leading to environmental harm, is best supported in the second paragraph: “If, in a misguided effort to do something of environmental value, municipalities take steps that make long-distance car commuting faster or more convenient—by adding lanes, building bypasses, employing traffic-control measures that make it possible for existing roads to accommodate more cars with fewer delays, replacing tollbooths with radio-based systems that don’t require drivers even to slow down—we actually make the sprawl problem worse.”

Choices A, B, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they assert that public transit improvements must be supported by measures to reduce car use (choice A), indicate that tolerance for long commutes has grown recently, but has a natural limit (choice B), and elaborate on why improvements in public transport can fail to decrease road use (choice D).

## QUESTION 17

**Choice D is the best answer.** The second paragraph discusses how efforts to make commuting more convenient can have the unintended consequence of encouraging people to live farther away from their jobs: “If you cut commuting time by 10 percent, people who now drive fifty miles each way to work can justify moving five miles farther out, because their travel time won’t change.” Therefore, according to the passage, reducing commuting time for drivers can have the effect of making drivers more willing to live farther from their places of employment.

Choices A, B, and C are incorrect because the passage doesn’t suggest that reducing commuting time can make drivers more productive employees (choice A), can cause mass transit to be extended farther into suburban areas (choice B), or can result in less government funding for mass transit (choice C).

## QUESTION 18

**Choice C is the best answer.** The last paragraph asserts, “No one ever promotes a transit scheme by arguing that it would make traveling less convenient.” In other words, nobody advocates, or pushes for, changes to the transportation system by arguing that they would make traveling less convenient. Thus “promotes,” as used in the passage, most nearly means advocates.

Choices A, B, and D are incorrect because in the context of the passage, “promotes” means advocates, not upgrades (choice A), serves (choice B), or develops (choice D).

### QUESTION 19

**Choice B is the best answer.** Figure 1 presents data related to the effect of route capacity reduction on selected regions. In the row pertaining to Southampton city center, the number 5,316 appears under the heading “Vehicles per day on altered road” in the column that specifies “Before alteration.” Thus, according to figure 1, the number of vehicles that traveled on the altered road through Southampton city center per day before the route was altered is 5,316.

Choice A is incorrect because 3,081 is the number of vehicles per day that traveled on the Southampton city center road after it was altered, not before. Choice C is incorrect because 24,101 is the number of vehicles per day that traveled on roads surrounding the Southampton city center road after it was altered. Choice D is incorrect because 26,522 is the number of vehicles that traveled on roads surrounding the Southampton city center road before it was altered.

### QUESTION 20

**Choice B is the best answer.** In the first paragraph, the author of the passage argues that “to have environmental value . . . a new transit system has to be backed up by something that impels complementary reductions in car use—say, the physical elimination of traffic lanes.” According to figure 1, reducing route capacity resulted in a net reduction in regional traffic in all five areas studied. Therefore, the data in figure 1 support the author’s argument because the data show that reducing road capacity can lead to a net reduction in traffic.

Choice A is incorrect. Figure 1 data support the author’s argument that route capacity reduction results in a reduction of car use, but the figure doesn’t provide data relating to the “induced traffic” phenomenon. Choices C and D are incorrect because figure 1 data support, not weaken, the author’s argument that route capacity reduction such as elimination of traffic lanes results in reduction of traffic.

### QUESTION 21

**Choice D is the best answer.** Figure 2 presents data related to an opinion poll of transportation engineers. According to the y-axis label, the engineers were asked whether a significant road space reallocation could result in people changing various aspects of their driving. The graph shows four different answer possibilities: “yes,” “yes (in exceptional circumstances),” “no,” and “don’t know.” The question asks for the aspect of driver behavior that the engineers surveyed thought was least likely to change in the event of a reallocation of road space according to figure 2: when they travel,

their means of traveling, how often they make a journey, or their driving style. Of these four choices, “their driving style,” received the smallest percentage of “yes” and “yes (in exceptional circumstances)” responses and the largest percentage of “no” responses. Hence, based on figure 2, the engineers surveyed were most skeptical of the idea that, in the event of a reallocation of road space, drivers would change their driving style.

Choices A, B, and C are incorrect because, according to figure 2, when the engineers were asked whether they thought that drivers would change when they travel (choice A), their means of traveling (choice B), or how often they make a journey (choice C) in the event of a significant road space reallocation, they gave more “yes” or “yes (in exceptional circumstances)” answers, and fewer “no” answers than they gave in response to the question of whether they thought drivers would change their driving style. Thus the engineers were less skeptical of these potential changes than they were of the idea that drivers would change their driving style in the event of a significant road space reallocation.

## QUESTION 22

**Choice D is the best answer.** The first paragraph asserts that textbook authors in the early 1990s believed that “sensations of pressure and vibration . . . travel only along myelinated, fast-signaling nerve fibers.” Thus, based on the passage, textbook authors in the early 1990s would most likely have expected that the ability to perceive vibrations would be impaired as a result of blocking fast fibers.

Choices A, B, and C are incorrect because the passage indicates that textbook authors in the early 1990s believed blocking fast nerve fibers would impair sensations of vibration, not that blocking would increase the firing rate of other fibers (choice A), cause gentle stimuli to be perceived as painful (choice B), or make the body compensate by using slow fibers to sense pressure (choice C).

## QUESTION 23

**Choice B is the best answer.** The previous question asks what condition textbook authors in the early 1990s would most likely have expected to result from blocking fast fibers. The answer, that they would most likely have expected blocking fast fibers to result in an impairment of the ability to perceive vibrations, is best supported in the first paragraph, which refers to the views of textbook authors in the early 1990s: “Sensations of pressure and vibration were believed to travel only along myelinated, fast-signaling nerve fibers, which also give information about location.”

Choices A, C, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they assert that textbook authors in the early 1990s believed

slow-conducting nerves responded only to pain and temperature stimuli (choice A), noted that blocking slow fibers only seemed to reduce sensitivity to warmth or small painful shocks (choice C), and knew that fast-conducting fibers responded to touch at a signal rate of 35 to 75 m/s (choice D).

### QUESTION 24

**Choice A is the best answer.** The second paragraph states, “Håkan Olausson and his Gothenburg University colleagues Åke Vallbo and Johan Wessberg wondered if slow fibers responsive to gentle pressure might be active in humans as well as in other mammals.” In other words, the researchers wondered if these nerves were present, or existent, in humans and other mammals. Therefore, in the context of the passage, the word “active” most nearly means present.

Choices B, C, and D are incorrect because in the context of the passage, “active” most nearly means present, not attentive (choice B), movable (choice C), or restless (choice D).

### QUESTION 25

**Choice C is the best answer.** The second paragraph states, “Using a technique called microneurography, in which a fine filament is inserted into a single nerve to capture its electrical impulses, the scientists were able to measure how quickly—or slowly—the nerves fired.” In other words, the researchers used the technique known as microneurography to record, or register, the electrical signals sent by nerve fibers. Therefore, in the context of the passage, the word “capture” most nearly means record.

Choices A, B, and D are incorrect because in the context of the passage, “capture” most nearly means record, not occupy (choice A), seize (choice B), or influence (choice D).

### QUESTION 26

**Choice C is the best answer.** According to the passage, different types of nerve fibers carry signals at different speeds, either fast or slow. The second paragraph outlines a study led by Håkan Olausson in 1993 that measured the response time of nerves when exposed to gentle pressure. Olausson and his team found that “soft stroking prompted two different signals” in test subjects’ nerve fibers, “one immediate and one delayed.” Therefore, the conclusion that is best supported by the findings of Olausson’s 1993 experiment is that gentle pressure is sensed not only by fast fibers but also by slow fibers.

Choices A and D are incorrect because according to the passage, Olausson’s 1993 study didn’t compare how signal speed was affected by stimulation in different bodily areas (choice A) or by different

amounts of pressure applied to the nerve (choice D). Choice B is incorrect because the passage notes that only human hairy skin contains slow nerve fibers, not that hair causes signal speeds to slow.

## QUESTION 27

**Choice B is the best answer.** The previous question asks which conclusion is best supported by the findings of Olausson’s 1993 experiment. The answer, that Olausson’s 1993 experiment best supports the conclusion that gentle pressure is sensed not only by fast fibers but also by slow fibers, is best supported in the second paragraph: Olausson’s team “showed that soft stroking prompted two different signals, one immediate and one delayed.”

Choices A, C, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they describe a technique used by Olausson’s team (choice A), quantify the amount of time between the fast signals and the slow signals observed by Olausson’s team (choice C), and introduce a further study conducted by Olausson’s team in 1999 (choice D).

## QUESTION 28

**Choice D is the best answer.** This sentence from the fourth paragraph outlines a quandary that arose from the 1999 study conducted by Olausson’s team: “But why exactly humans might have such fibers, which respond only to a narrow range of rather subtle stimuli, was initially mystifying.” The passage presents this line of inquiry as a justification for the team’s subsequent research on CT fibers. Thus this sentence serves mainly to show a problem from the perspective of Olausson’s team.

Choices A, B, and C are incorrect. The cited lines serve mainly to show a problem from the perspective of Olausson’s team, not to identify factors Olausson had previously failed to consider (choice A), propose a solution to a dilemma encountered by Olausson (choice B), or anticipate a potential criticism of Olausson by the reader (choice C).

## QUESTION 29

**Choice A is the best answer.** According to the fifth paragraph, Olausson set out to discover, in his team’s 1999 research, whether a CT nerve “can distinguish *where* the brush touches the arm, and whether it can discern the difference between a goat-hair brush and a feather. Most importantly, could that same fiber convey a pleasant sensation?” Therefore, it can reasonably be inferred that one of the intended goals of the 1999 experiment was to determine the precise nature of sensations that CT fibers can convey.

Choices B, C, and D are incorrect because in their 1999 research, Olausson’s team didn’t seek to determine the relationship between human body hair and CT fiber function (choice B), the role played by CT fibers in the perception of pain (choice C), or the effects of microneurography on CT fiber signaling (choice D).

### QUESTION 30

**Choice D is the best answer.** In the 1999 study, Olausson’s team conducted experiments on a patient known as G.L. The researchers wanted to learn more about what type of sensations slow-conducting CT nerve fibers transmit, and G.L. was of special interest to them, according to the sixth paragraph: “More than 2 decades earlier . . . she had lost responsiveness to pressure, and a nerve biopsy confirmed that G.L.’s quick-conducting fibers were gone. . . . But she could still sense warmth, suggesting that her slow-conducting unmyelinated fibers were intact.” The fact that G.L.’s slow-conducting fibers were still intact while her other nerves were unresponsive allowed Olausson’s team to study her slow-conducting CT fibers in isolation. Thus the main purpose of the sixth paragraph is to indicate why G.L.’s medical condition was of value to Olausson’s experiment.

Choices A, B, and C are incorrect because the sixth paragraph doesn’t indicate that Olausson’s team set out to relieve any of the neurological conditions that G.L. exhibited (choice A), compare G.L.’s nerve function with that of other adults (choice B), or detail any procedures that G.L. had experienced during previous experiments (choice C).

### QUESTION 31

**Choice A is the best answer.** According to the last paragraph, “in normal subjects, both the somatosensory and insular cortices were activated [by gentle brushing], but only the insular cortex [which processes emotion] was active when researchers brushed G.L.’s arm.” Therefore, according to the passage, G.L. differed from Olausson’s other test subjects in terms of the number of cortices activated in the brain during gentle brushing.

Choice B is incorrect because the passage doesn’t address the physical dimensions of the somatosensory cortex in G.L. or other test subjects. Choice C is incorrect because G.L. differed from other test subjects in terms of the number of cortices activated in the brain during gentle brushing, not in terms of the intensity of nerve signals required to activate the insular cortex. Choice D is incorrect because MRI scanning is discussed in the passage as a method used to locate brain activity, not as a focus of study in Olausson’s research.



## QUESTION 32

**Choice B is the best answer.** According to the last paragraph, Olausson’s 1999 research, in which CT fibers were stimulated, “solidified the notion that CT fibers convey a more emotional quality of touch.” Hence humans experience an emotional aspect of touch when CT fibers are exposed to a stimulus, according to the passage.

Choice A is incorrect because the passage doesn’t indicate that humans experience an emotional aspect of touch when brain cortices are shielded from nerve signals. Choice C is incorrect because the suppression of G.L.’s pain-sensing fibers did help Olausson study CT fibers in isolation and determine that they transmit an emotional aspect of touch, but the passage doesn’t suggest that suppressing these fibers is what allows humans to experience this emotional aspect of touch. Choice D is incorrect because the passage indicates that CT fibers transmit an emotional aspect of touch rather than conscious aspects of sensation, not that humans must ignore the conscious aspects of sensation in order to experience the emotional aspects of touch.

## QUESTION 33

**Choice C is the best answer.** In the first paragraph of Passage 1, Beveridge portrays America as “a noble land that God has given us; a land that can feed and clothe the world; a land whose coast lines would enclose half the countries of Europe.” Thus, in Passage 1, Beveridge asserts that the resources and immensity of the United States constitute a divine gift to the American people.

Choice A is incorrect because Beveridge envisions Americans occupying foreign lands, not being subject to foreign invasion; moreover, he asserts that the resources and immensity of the United States constitute a divine gift, not a safeguard against invasion. Choice B is incorrect because Beveridge asserts that American society constitutes an improvement on English society, not that the resources and immensity of the United States replicate conditions in Europe. Choice D is incorrect because Beveridge doesn’t assert that the resources and immensity of the United States constitute a source of envy for people in other countries.

## QUESTION 34

**Choice B is the best answer.** In the second paragraph of Passage 1, Beveridge commands his audience several times to think of a future in which American laws and customs have been extended to foreign countries, leading American citizens to move to those places. According to Beveridge, this will provide Hawaii and Puerto Rico with “justice and safety,” the Philippines with “order and equity,” and Cuba with a “civilization of energy and industry.” Thus, in the second paragraph of Passage 1, the commands given by Beveridge mainly serve to anticipate the benefits of a proposed policy.

Choices A, C, and D are incorrect because Beveridge's commands serve to anticipate the benefits of a proposed foreign policy, not to remind the audience of its civic responsibilities (choice A), emphasize the urgency of a national problem (choice C), or refute an argument advanced by opponents (choice D).

### QUESTION 35

**Choice B is the best answer.** The fourth paragraph of Passage 2 asserts that "a truth once spoken can never be recalled. It goes on and on, and no one can set a limit to its ever-widening influence." In other words, when a true idea has been introduced to the world, it can never be retracted, or taken back. Therefore, in the context of the passage, the word "recalled" most nearly means retracted.

Choices A, C, and D are incorrect because in the context of the passage, "recalled" most nearly means retracted, not repeated (choice A), rejected (choice C), or remembered (choice D).

### QUESTION 36

**Choice D is the best answer.** In the fourth paragraph of Passage 2, Bryan argues that the principle of self-rule set forth in the Declaration of Independence is, in fact, a value that all people instinctively aspire to. Indeed, for Bryan, "[God] never made a race of people so low in the scale of civilization or intelligence that it would welcome a foreign master." Therefore, it can reasonably be inferred from Passage 2 that Bryan considers the preference for national sovereignty over foreign rule to be a manifestation of an innate drive in humans toward self-rule.

Choices A and C are incorrect because it can reasonably be inferred that Bryan considers the preference for national sovereignty over foreign rule to be a manifestation of a universal drive in humans that's independent of circumstances, not a reaction to the excesses of imperial governments in the modern era (choice A) or a testament to the effects of the foreign policy of the United States (choice C). Choice B is incorrect because Bryan indicates that a preference for self-rule is universal, not that belief in human equality is widespread.

### QUESTION 37

**Choice C is the best answer.** The previous question asks what can reasonably be inferred from Passage 2 about Bryan's views on the preference for national sovereignty over foreign rule. The answer, that Bryan considers the preference to be a manifestation of an innate drive in humans toward self-rule, is best supported in the fourth paragraph of Passage 2: "[God] never made a race of people so low in the scale of civilization or intelligence that it would welcome a foreign master."

Choices A, B, and D are incorrect because the cited lines don't provide the best evidence for the answer to the previous question. Instead, they indicate that explicitly promoting imperialism would run counter to the words of American founding father Patrick Henry (choice A), assert that once a truth is uttered, its influence will continually grow (choice B), and introduce the notion that, in Bryan's view, an imperial project in the Philippines would hurt not only the people of that nation but also the people of the United States (choice D).

## QUESTION 38

**Choice A is the best answer.** The last paragraph of Passage 2 states, "Those who would have this Nation enter upon a career of empire must consider, not only the effect of imperialism on the Filipinos, but they must also calculate its effects upon our own nation." In other words, proponents of imperial conquest must evaluate, or assess, the consequences of this policy for the United States. Therefore, in the context of the passage, the word "calculate" most nearly means evaluate.

Choices B, C, and D are incorrect because in the context of the passage, "calculate" most nearly means evaluate, not design (choice B), assume (choice C), or multiply (choice D).

## QUESTION 39

**Choice A is the best answer.** In the first paragraph of Passage 1, Beveridge references the founding and history of the United States as "a glorious history" that was bestowed upon God's "chosen people," a history heroic with faith in its mission and future, and "statesmen, who flung the boundaries of the Republic out into unexplored lands." Similarly, in the second paragraph of Passage 2, Bryan declares, "Our whole history has been an encouragement . . . to all who are denied a voice in their own government." Bryan goes on to extol the virtues of several figures who were instrumental in the founding of the United States, including Thomas Jefferson and George Washington. Hence, in developing their respective arguments, Beveridge (Passage 1) and Bryan (Passage 2) both express admiration for the founding and history of the United States.

Choice B is incorrect because neither Bryan, in Passage 1, nor Beveridge, in Passage 2, expresses admiration for the vibrancy and diversity of American culture. Choice C is incorrect because Bryan expresses admiration for the worldwide history of struggles for independence, but Beveridge doesn't. Choice D is incorrect because Beveridge expresses admiration for the idealism that permeates many aspects of American society, but Bryan doesn't.

## QUESTION 40

**Choice B is the best answer.** In the first paragraph of Passage 1, Beveridge argues that Americans are “imperial by virtue of their power” and are therefore justified in being “the propagandists . . . of liberty.” In the second paragraph, he extols the benefits that will arise from American administration of various island nations. Meanwhile, in the last sentence of Passage 2, Bryan cautions, “We cannot repudiate the principle of self-government in the Philippines without weakening that principle here”; in other words, imperial expansion by the United States would erode a key American value. Therefore, the difference between how the speakers view liberty as it is realized in the United States is that Beveridge considers it so exemplary as to justify the conquest of other regions, whereas Bryan warns that its exemplary quality would be undermined by imperial expansion.

Choice A is incorrect because Beveridge doesn’t present the concept of liberty as it’s realized in the United States as the direct inheritance of European colonization. Choice C is incorrect because Beveridge doesn’t argue that the concept of liberty as it’s realized in the United States arose organically as the country matured; instead, both Beveridge and Bryan emphasize the divinely inspired, intrinsic nature of the American concept of liberty. Choice D is incorrect because Bryan views the concept of liberty as it’s realized in the United States as encompassing a desire for self-rule and argues that this desire is universal and not unique to the United States.

## QUESTION 41

**Choice D is the best answer.** In Passage 1, Beveridge advocates for American administration of island nations, such as the Philippines. However, in the first paragraph of Passage 2, Bryan warns, “If it is right for the United States to hold the Philippine Islands permanently and imitate European empires in the government of colonies, the Republican party . . . must expect the subject races to protest against such a policy and to resist to the extent of their ability.” Thus it can most reasonably be inferred from Passage 2 that Bryan would criticize the vision of American governance of island territories that Beveridge presents in Passage 1 for being naive, since the islanders would object to being governed by Americans.

Choices A, B, and C are incorrect because, in Passage 2, Bryan doesn’t imply that Beveridge’s vision of American governance of island territories is unrealistic due to most Americans’ unwillingness to relocate to distant islands (choice A), deceptive due to the fact that economic domination would be the true goal of the American government (choice B), or impractical due to the islanders’ insistence upon an equal distribution of resources (choice C).

## QUESTION 42

**Choice A is the best answer.** The previous question asks what criticism Bryan would most likely make of Beveridge’s vision of American governance of island territories. The answer, that Bryan would criticize this vision for being naive, since islanders would object to being governed by Americans, is best supported by the first paragraph of Passage 2: “If it is right for the United States to hold the Philippine Islands permanently and imitate European empires in the government of colonies, the Republican party ought to state its position and defend it, but it must expect the subject races to protest against such a policy and to resist to the extent of their ability.”

Choices B, C, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they assert that the people of the Philippines don’t need encouragement from Americans to resist imperialism (choice B), state that American history encourages resistance to imperialism by all people, including the people of the Philippines (choice C), and note the enduring resonance of Patrick Henry’s famous quote about liberty (choice D).

## QUESTION 43

**Choice A is the best answer.** The passage summarizes research on the relationship between plowing and weed growth. According to the fourth paragraph, the research of Karl Hartmann suggests that plowing fields during the day leads to weed growth because exposure to even small amounts of light can “induce seed germination,” or cause seeds to sprout. Thus, according to the passage, exposure to light allows seeds to begin to develop.

Choices B and D are incorrect because the passage indicates that small amounts of light cause seeds to sprout, but it doesn’t explicitly assert that light exposure allows seeds to absorb necessary nutrients (choice B) and doesn’t discuss whether light exposure helps seeds achieve maximum growth (choice D). Choice C is incorrect because the passage doesn’t indicate that light exposure can help seeds withstand extreme temperatures.

## QUESTION 44

**Choice B is the best answer.** In the second paragraph of the passage, the following question is posed: “Do the blades of a plow, which can reach more than a foot beneath the soil surface, bring some of these buried seeds to the surface where their germination is induced by exposure to sunlight?” The passage goes on to describe research conducted both in the laboratory and in the field that sought to answer this question. Hence the question in the second paragraph primarily serves to introduce the specific research topic addressed in the passage.

Choice A is incorrect because the question in the second paragraph doesn't primarily serve to emphasize the provisional nature of the findings discussed in the passage. Sauer and Struik's 1960s lab experiments, described in the third paragraph, produced findings that could be characterized as provisional; however, Karl Hartmann's research described in the fourth paragraph clearly demonstrated that plowing at night can be an effective way to reduce weed growth. Choice C is incorrect because the impact of the studies analyzed in the passage has been real and practical, not hypothetical. Choice D is incorrect because the question in the second paragraph doesn't indicate that there is any significant disagreement about the methods explored in the passage.

### QUESTION 45

**Choice D is the best answer.** The last sentence of the second paragraph asks, "Do the blades of a plow . . . bring some of these buried seeds to the surface where their germination is induced by exposure to sunlight?" In other words, does some farm equipment bring buried seeds to the surface where their sprouting is stimulated, or activated, by exposure to sunlight? Therefore, in the context of the passage, the word "induced" most nearly means stimulated.

Choices A, B, and C are incorrect because in the context of the passage, "induced" most nearly means stimulated, not lured (choice A), established (choice B), or convinced (choice C).

### QUESTION 46

**Choice C is the best answer.** The question asks which selection from the passage best supports the idea that seeds present in fields plowed at night are exposed to some amount of light. The fourth paragraph asserts that plowing at night can reduce the germination of weed seeds. The paragraph concludes that "although even under these conditions hundreds of millions of photons strike each square millimeter of ground each second, this illumination is below the threshold needed to stimulate the germination of most seeds." Thus this sentence best supports the idea that seeds present in fields plowed at night are exposed to some amount of light.

Choices A, B, and D are incorrect because the cited lines don't provide the best support for the idea that seeds present in fields plowed at night are exposed to some amount of light. Instead, they relay Hartmann's initial reasoning about seed exposure to light in fields plowed during the day (choice A), affirm that even minute durations of sunlight exposure can induce seed germination (choice B), and explain Hartmann's initial skepticism regarding his own idea about the effectiveness of nighttime plowing as a weed deterrent (choice D).

## QUESTION 47

**Choice A is the best answer.** The sixth paragraph describes an experiment conducted by Karl Hartmann with the help of farmer Karl Seydel. Seydel plowed one strip of land during the day and the other at night to see what effect this had on weed growth. However, “no crops were planted in these pilot experiments, to avoid possible competition with the emerging weeds.” Thus the passage suggests that if Seydel had planted wheat or corn on the two agricultural strips in Hartmann’s experiment, the percentage of the surface of each strip covered with weeds would likely have been lower than the percentage that Hartmann found.

Choice B is incorrect. If Seydel had planted wheat or corn crops on the two agricultural strips, the percentage of weeds wouldn’t have been higher than the percentage predicted because competition with the crops would have prevented some weed growth. Choice C is incorrect because a reduction in weed growth would have been easily observable, not nearly impossible for Hartmann to determine. Choice D is incorrect. Hartmann’s original projection was that plowing at night wouldn’t provide more effective weed control. Therefore, the dramatic drop in the percentage of weeds covering the strip plowed at night wouldn’t have been comparable with Hartmann’s original projection, regardless of whether crops were planted.

## QUESTION 48

**Choice B is the best answer.** The previous question asks what the passage suggests about the percentage of surface that would have been covered with weeds if Seydel had planted wheat or corn on the two agricultural strips in Hartmann’s experiment. The answer, that the percentage of surface with weeds would have been lower than the percentage Hartmann found, is best supported in the sixth paragraph: “No crops were planted in these pilot experiments, to avoid possible competition with the emerging weeds.”

Choices A, C, and D are incorrect because the cited lines don’t provide the best evidence for the answer to the previous question. Instead, they describe the conditions of Hartmann’s experiment (choice A), characterize the results of the experiment as dramatic (choice C), and report the results of the experiment (choice D).

## QUESTION 49

**Choice C is the best answer.** The sixth paragraph states, in reference to Hartmann’s experiment, “The results were dramatic. More than 80 percent of the surface of the field plowed in daylight was covered by weeds, whereas only about 2 percent of the field plowed at night was covered by weeds.” In other words, the outcome of the experiment was impressive, or striking. Therefore, in the context of the passage, the word “dramatic” most nearly means impressive.

Choices A, B, and D are incorrect because, in the context of the passage, “dramatic” most nearly means impressive, not theatrical (choice A), sudden (choice B), or emotional (choice D).

### QUESTION 50

**Choice A is the best answer.** According to the table, 0 weed seedlings emerged in sample A when the soil was disturbed in darkness. This is the lowest number of seedlings recorded among all the samples in the table when the soil was disturbed in darkness.

Choices B, C, and D are incorrect because sample B (choice B), sample C (choice C), and sample D (choice D) had 1, 2, and 3 seedlings emerge, respectively, when the soil was disturbed in darkness. These totals are all greater than 0, the number of seedlings that emerged from sample A when the soil was disturbed in darkness.

### QUESTION 51

**Choice C is the best answer.** According to the table, 14 weed seedlings emerged in sample I when the soil was disturbed in light. This is the highest number of seedlings recorded among all the samples in the table when the soil was disturbed in light.

Choices A, B, and D are incorrect because sample G (choice A), sample H (choice B), and sample J (choice D) had 0, 2, and 5 seedlings emerge, respectively, when the soil was disturbed in light. This is less than the 14 seedlings that emerged from sample I when the soil was disturbed in light.

### QUESTION 52

**Choice D is the best answer.** The data presented in the table show that in nine of the ten soil samples studied, fewer weeds grew in the soil when it was disturbed in darkness than when it was disturbed in light. The fourth paragraph relays Karl Hartmann’s hypothesis based on Sauer and Struik’s studies of weed growth in the 1960s: “Thus the germination of weed seeds would be minimized if farmers simply plowed their fields during the night, when the photon fluence rate [the rate at which photons hit the surface] is below  $10^{15}$  photons per square meter per second.” Therefore, the data presented in the table most directly support the claim made in the fourth paragraph of the passage.

Choices A, B, and C are incorrect because the cited lines aren’t directly supported by the data presented in the table. While the findings in the table report on weed growth in soil stirred up during the day and night, these lines discuss the prehistoric use of plowing to control weeds (choice A), the number of weed seeds buried beneath the soil surface (choice B), and the depth at which seeds are buried that prevents them from germinating (choice C).



## Section 2: Writing and Language Test

### QUESTION 1

**Choice A is the best answer.** The conjunction “and” appropriately separates the last two nouns in the series, “radio” and “other media.”

Choices B, C, and D are incorrect because “and with,” “and also,” and “and competing with” disrupt the parallel structure of the series of three nouns (“television,” “radio,” “[other] media”) introduced by “competing with.”

### QUESTION 2

**Choice D is the best answer.** The topic of the passage is the creation of *The Cat in the Hat* as a means of getting children more interested in learning to read. Hersey’s suggestion that one way of making children’s books more interesting was to use “drawings like those of the wonderfully imaginative geniuses among children’s illustrators” best supports the topic of the passage.

Choices A, B, and C are incorrect because they don’t support the topic of the passage. A sense of wholeness and accomplishment, the value of failure, and a difference between journalism and fiction don’t support the idea of making children’s literature more interesting.

### QUESTION 3

**Choice A is the best answer.** The comma after “Spaulding” is paired correctly with the comma after “Mifflin” to set off grammatically nonessential information.

Choice B is incorrect because a comma is needed after “Spaulding” to set off the nonessential phrase that ends with “Mifflin.” Choice C is incorrect because placing a comma after “Spaulding” and after “director” wrongly indicates that “the director” could be deleted without changing the meaning of the sentence. Choice D is incorrect because a dash can’t be paired with a comma to set off grammatically nonessential information.

### QUESTION 4

**Choice A is the best answer.** This choice most effectively combines the sentences at the underlined portion because it’s concise and correctly indicates that Spaulding saw a need for appealing books for beginning readers at the same time that he thought he knew who should write one.

Choice B is incorrect because “namely” indicates that a more specific restatement of an earlier point or an example will follow. In this case, what follows the idea that Spaulding saw a need for appealing books is his thought about who should write one. Choice C is incorrect because the repetition of Spaulding’s name is unnecessary.

Choice D is incorrect because the adverb “meanwhile” is redundant; the conjunction “and” is sufficient to indicate that Spaulding had two thoughts simultaneously.

### QUESTION 5

**Choice D is the best answer.** This choice, which indicates that Geisel published nine children’s books and received three nominations for the prestigious Caldecott Medal, supports the information that follows in the sentence about Geisel being an experienced writer and illustrator.

Choices A, B, and C are incorrect. Geisel’s long relationship with Spaulding, Geisel’s reputation for perfectionism and for setting high standards, and his interest in politics don’t support the idea that Geisel was an experienced writer and illustrator.

### QUESTION 6

**Choice A is the best answer;** “however” correctly indicates that even though Geisel was an experienced writer and illustrator, the new project presented him with an obstacle.

Choices B, C, and D are incorrect because none of these transitional words or phrases shows the true relationship between the challenging nature of the new project and Geisel’s experience. “For example,” “furthermore,” and “at any rate” indicate that what follows is an instance of, additional to, or unrelated to what was stated in the previous sentence.

### QUESTION 7

**Choice C is the best answer.** The introductory phrase “on the verge of giving up” doesn’t have its own subject. Instead, the subject appears at the beginning of the sentence’s main clause and makes clear what is being described in the introductory phrase. “Geisel” is the logical subject of the sentence because he can be described as being “on the verge of giving up.”

Choices A, B, and D are incorrect because “Geisel’s story,” “an image,” and “the story” can’t be described as being “on the verge of giving up.”

### QUESTION 8

**Choice D is the best answer.** This choice concisely indicates that it took Geisel nine months to complete *The Cat in the Hat*.

Choices A, B, and C are incorrect because they’re repetitive. “Duration” and “long” (choice A), “thirty-six weeks” (choice B), and “length” (choice C) unnecessarily repeat the idea that nine months had passed.

## QUESTION 9

**Choice D is the best answer.** The underlined portion should be deleted because it isn't necessary. Since "were entertained" appears earlier in the sentence, the past participle "captivated" is sufficient without the repetition of "were."

Choices A, B, and C are incorrect because "is captivated," "was captivated," and "has been captivated" are singular verbs that don't agree in number with the plural subject "children."

## QUESTION 10

**Choice C is the best answer.** The comma after "followed" is used correctly to separate the dependent phrase "in the years that followed" from the independent clause that begins with "many."

Choices A, B, and D are incorrect because a period, a semicolon, or a dash can't be used in this way to separate an introductory dependent phrase from an independent clause.

## QUESTION 11

**Choice C is the best answer.** This choice indicates that *The Cat in the Hat's* success is attributable to its enduring ability to delight children and engage them in learning how to read. This idea restates the main themes of the passage, which are the need to make books appealing to beginning readers and the importance of engaging those readers through interesting plots and illustrations.

Choices A, B, and D are incorrect. The idea that the best proof of *The Cat in the Hat's* success is its limited vocabulary and appealing word choices, its impressive worldwide sales, or its important role in the history of twentieth-century illustration doesn't restate the main themes of the passage.

## QUESTION 12

**Choice D is the best answer.** The gerund "picking up" is parallel in structure to the other gerunds in the sentence, "helping" and "working."

Choices A, B, and C are incorrect because they don't maintain parallelism in the sentence. "When they pick up litter," "to pick up litter," and "litter collection" don't contain gerunds.

## QUESTION 13

**Choice A is the best answer.** The transitional phrase "by its very definition" points to the criticism in the previous paragraph that when volunteering is compulsory, it's no longer volunteerism.

Choices B, C, and D are incorrect because the reference to general work, students, or communities in need doesn't highlight the criticism of compulsory volunteering mentioned in the previous paragraph.

### QUESTION 14

**Choice D is the best answer.** The plural noun "officials" correctly refers to the people who require students to give up time for nonprofit activities. Additionally, the plural possessive noun "students'" indicates that the choice to give up personal time is supposed to belong to multiple students.

Choice A is incorrect because "officials'" is a plural possessive noun, but nothing belongs to the officials in this sentence. Choice B is incorrect because "students" is a plural noun, but the plural possessive noun "students'" is needed to indicate that the choice is supposed to belong to students. Choice C is incorrect because "student's" is a singular possessive noun, but the plural possessive noun "students'" is needed to show that the choice is supposed to belong to multiple students.

### QUESTION 15

**Choice C is the best answer.** This choice is clear and concise and doesn't repeat the idea of proponents that begins the sentence.

Choices A, B, and D are incorrect because they're repetitive. Since proponents are people who support a cause, describing proponents of compulsory volunteering as being in favor of it, advocating it, or being advocates creates redundancy.

### QUESTION 16

**Choice B is the best answer.** This choice, a closer connection with their community, is a benefit of volunteering and provides a supporting example that is most similar to the other examples of benefits offered in the sentence: increased self-esteem and better relationship-building skills.

Choices A, C, and D are incorrect because they don't provide supporting examples that are similar to the examples in the sentence. Increasingly busy schedules, less time spent engaging in social activities, and little increase in academic achievement aren't benefits of volunteering.

### QUESTION 17

**Choice B is the best answer.** The infinitive "[to] affect" parallels the earlier infinitive "[to] volunteer" ("are more likely to volunteer," "[are more likely to] affect"). Moreover, "affect," meaning "to influence," is used correctly to indicate that students who do community service positively influence society.

Choices A and C are incorrect because the verb “effect” generally means “to bring about” and the noun “effect” means “result,” neither of which makes sense in the sentence. Choice D is incorrect because the singular verb “affects” doesn’t work here, where the infinitive “affect” is required.

## QUESTION 18

**Choice A is the best answer;** “mandatory” is the most precise word to use when describing the volunteering that students are required to do.

Choices B, C, and D are incorrect because the meanings of these words don’t fit the context of the sentence. “Coercive” and “forcible” suggest that threats or force are used to make someone do something. “Imperative” suggests that something is very important or necessary. None of these words is appropriate to use when describing the volunteering that students are required to do.

## QUESTION 19

**Choice D is the best answer.** The semicolon is used correctly to separate the independent clause that begins with “she” from the independent clause that begins with “they.” In addition, this choice contains no unnecessary punctuation.

Choice A is incorrect because a comma can’t be used by itself to join two independent clauses. Choice B is incorrect because it’s unnecessary to place a comma between the adverb “then” and the verb “did,” which the adverb describes. Choice C is incorrect because no punctuation is needed to separate the subject “they” from the adverb “then.”

## QUESTION 20

**Choice B is the best answer** because “than did students who were” results in a logical comparison between two types of students: those who were required to volunteer (“they then did”) and those who weren’t (“than did those”).

Choices A and C are incorrect because each illogically compares “hours” to students (“they”). Choice D is incorrect because it results in a nonstandard expression; “less” is already comparative, meaning that “compared with” isn’t appropriate.

## QUESTION 21

**Choice C is the best answer.** The idea that schools should focus on offering arrangements that make volunteering an easy and attractive choice most effectively sets up the point made in the next sentence: more students willingly volunteer when schools tell them about volunteering opportunities and connect them with organizations.

Choices A, B, and D are incorrect because they don't effectively set up the point made in the next sentence. The ideas that schools have to recognize that not all students are equally well suited to the same activities, should allow students to spend their time participating in athletics and other extracurricular activities, and are advised to recognize the limits of their ability to influence their students don't set up the point that students willingly volunteer when schools connect them to volunteer opportunities and organizations.

## QUESTION 22

**Choice B is the best answer.** This choice provides a conclusion that states the main claim of the passage: schools that don't make volunteering compulsory will produce more engaged, enthusiastic volunteers than will schools that require volunteer work.

Choices A, C, and D are incorrect. The idea that schools should find volunteers for organizations in the United States, that psychological and economic studies have revolutionized understandings of volunteerism, or that students should choose charitable work that suits their interests and values doesn't state the passage's main claim that schools that don't require volunteering produce more engaged, enthusiastic volunteers.

## QUESTION 23

**Choice C is the best answer.** The present perfect tense verb "have believed" correctly indicates that scientists in the past believed that the corpus callosum enables complex tasks and that scientists continue to hold this belief in the present.

Choices A, B, and D are incorrect because they don't describe a belief that originated in the past and continues in the present. The present progressive tense verb "are believing," the future progressive tense verb "will be believing," and the simple present tense verb "believe" aren't appropriate to use in a case that requires a present perfect tense verb.

## QUESTION 24

**Choice A is the best answer.** This choice concisely defines handedness without unnecessarily repeating the ideas of preference or consistency.

Choices B and C are incorrect because "favor the use of" and "could be chosen," respectively, repeat the idea of "prefer," which appears earlier in the sentence. Choice D is incorrect because "on a regular basis" is synonymous with "consistently," which also appears earlier in the sentence.

## QUESTION 25

**Choice A is the best answer.** No punctuation is necessary between the noun “trait” and the preposition “other than.”

Choices B, C, and D are incorrect because neither a comma, a semicolon, nor a colon is necessary to separate the noun “trait” from the phrase that follows.

## QUESTION 26

**Choice B is the best answer.** The phrase “correlates with” is idiomatic when indicating that two things are directly related to each other. In the passage, handedness in marsupials is believed to be related to the trait of bipedalism in those mammals.

Choices A, C, and D are incorrect because “links as,” “correlates from,” and “links on” aren’t idiomatic when indicating that two things are directly related to each other.

## QUESTION 27

**Choice D is the best answer.** According to the graph, positive mean handedness index scores indicated a left-forelimb preference and negative scores indicated a right-forelimb preference.

Choices A, B, and C are incorrect because they don’t accurately reflect the information in the graph.

## QUESTION 28

**Choice B is the best answer.** The comma after “kangaroo” and before the conjunction “and” is used correctly to separate the last two items, “red kangaroo” and “brush-tailed bettong,” in the list of bipedal marsupials.

Choice A is incorrect because the comma needs to be placed immediately before the conjunction “and,” not after it. Choice C is incorrect because a semicolon isn’t used to separate individual items in a simple list. Choice D is incorrect because a dash isn’t used to separate items in a list, and the comma after “and” is unnecessary.

## QUESTION 29

**Choice C is the best answer.** According to the graph, the four bipedal marsupials had positive mean handedness index values between 0.4 and 0.6, which revealed their preference for using their left forelimbs.

Choices A, B, and D are incorrect because they don’t accurately reflect the data in the graph. The four bipedal marsupials didn’t have positive mean handedness index values less than 0.2 or greater than 0.6, and they didn’t have mean handedness index values of 0.

### QUESTION 30

**Choice C is the best answer.** The transitional phrase “in contrast to” provides the best transition from the previous paragraph, which illustrates bipedal marsupials’ forelimb preference, to this paragraph, which discusses how quadrupedal marsupials differ from their bipedal counterparts by not showing a strong forelimb preference.

Choices A, B, and D are incorrect because they don’t provide a transition from the previous paragraph. The introductory phrases “having four feet,” “like most other mammals,” and “while using their forelimbs for eating” don’t establish a connection between the discussion of bipedal marsupials’ forelimb preference in the previous paragraph and quadrupedal marsupials’ forelimb preference in this paragraph.

### QUESTION 31

**Choice B is the best answer.** A main claim of the passage is that scientists now believe there’s a correlation between bipedalism and handedness in marsupials. Choice B, by mentioning that bipedal marsupials in the study demonstrated handedness, references this main claim.

Choices A, C, and D are incorrect because they don’t present a main claim of the passage. The passage isn’t about how kangaroos still don’t exhibit handedness to the extent that humans do, the many things scientists don’t understand about the marsupial brain, or additional studies on the phenomenon of handedness that will need to be performed with other mammals.

### QUESTION 32

**Choice B is the best answer.** “Which” is a standard relative pronoun in reference to a concept such as a task.

Choice A is incorrect because “whom” is used to refer to people, not concepts. Choice C is incorrect because “what” isn’t a typical relative pronoun and isn’t idiomatic in context (“tasks in what handedness may confer an evolutionary advantage”). Choice D is incorrect because “whose” nonsensically suggests that tasks have handedness.

### QUESTION 33

**Choice A is the best answer.** No change is needed because this choice concludes the passage by recalling a topic from the first paragraph that requires additional research: scientists’ enduring question about how the left and right hemispheres of marsupials’ brains communicate since these mammals lack a corpus callosum.



Choices B, C, and D are incorrect because none of these choices concludes the passage by recalling a topic from the first paragraph that requires additional research. The first paragraph doesn't refer to the minority of humans who are left handed, the fact that studies like this one may someday yield insights into the causes of neurological disorders, or an additional study to examine handedness in other animals that sometimes stand upright.

### QUESTION 34

**Choice C is the best answer.** “Although these levels are impressive” provides the most effective transition from the previous sentence, which indicates the percent of surveyed companies that provide employees with tuition assistance, to the information that follows in this sentence, that even more companies should consider providing such assistance.

Choice A is incorrect because “despite these findings” suggests that regardless of the percentages, more companies should consider providing tuition assistance, which is illogical. Choice B is incorrect because the information that follows in the sentence isn't additional to the 2014 study. Choice D is incorrect because the issue of whether companies want or don't want to provide tuition assistance isn't mentioned in the previous sentence.

### QUESTION 35

**Choice D is the best answer.** This choice most effectively establishes the main idea of the passage, which is that companies should offer tuition assistance because doing so helps attract and retain employees. This main idea is supported in the second paragraph, which argues that tuition assistance appeals to highly motivated and disciplined individuals, and in the third paragraph, which claims that employees receiving tuition assistance often stay with their employers even after they complete their degrees.

Choices A, B, and C are incorrect because they don't establish the passage's main idea. The passage isn't about increasing customer satisfaction, solving the problem of rising tuition costs, or strengthening the US economy.

### QUESTION 36

**Choice C is the best answer.** The plural noun “workers” correctly indicates that companies have more than one worker. The plural noun “opportunities” indicates that employers offer workers multiple chances for personal and professional development.

Choices A and B are incorrect because the plural possessive nouns “workers'” and “opportunities'” should be the plural nouns “workers” and “opportunities,” since nothing belongs to the workers

or opportunities in the sentence. Choice D is incorrect because the singular nouns “worker” and “opportunity” should be plural, and the apostrophes indicating possession aren’t needed.

### QUESTION 37

**Choice B is the best answer.** The main verb “stressed” provides a simple predicate for the subject “John Fox” to create a grammatically complete sentence.

Choices A and C are incorrect because “who stressed” and “stressing” leave the sentence without an independent clause. Choice D is incorrect because although “he stressed” gives the sentence an independent clause, that clause is improperly joined by “and” to the phrases “John Fox” and “the director of dealer training at Fiat Chrysler Automobiles in the United States.”

### QUESTION 38

**Choice C is the best answer.** This choice most effectively combines the sentences at the underlined portion because the pronoun “which” creates a relative clause (“which . . . workers”) that clearly and concisely describes “retain.”

Choice A is incorrect because “retention” repeats the idea of “retain,” which is already mentioned in the sentence. Choice B is incorrect because “retaining” repeats the idea of “retain,” and the pronoun “whom” repeats the idea of “employees.” Choice D is incorrect because the pronoun “that” doesn’t have a clear antecedent and therefore creates a vague sentence.

### QUESTION 39

**Choice C is the best answer.** The subordinate conjunction “because” begins the dependent clause “because their new qualifications give them opportunities for advancement within the company.” No punctuation is needed to separate this dependent clause from the independent clause that directly precedes it.

Choices A and D are incorrect because placing a period or a semicolon after “degrees” results in a rhetorically ineffective sentence fragment. Choice B is incorrect because no punctuation is needed between the noun and subordinate conjunction. (Although colons can be used to introduce additional explanatory information in a sentence, they’re not typically used between a main clause and a dependent clause beginning with a subordinate conjunction such as “because.”)

### QUESTION 40

**Choice D is the best answer.** The comma after “(UTC)” is paired correctly with the comma after “Lincoln” to set off grammatically nonessential information. The information between the commas, which describes who Valerie Lincoln is, could be removed and the sentence would still make sense.

Choice A is incorrect because a comma is needed after “(UTC)” to set off the grammatically nonessential phrase. Choices B and C are incorrect because neither a dash nor a colon can be paired with a comma to set off grammatically nonessential information.

## QUESTION 41

**Choice A is the best answer.** The adjective “deep” is used idiomatically with “knowledge” to indicate that Lincoln possessed extensive, in-depth information about her industry.

Choice B is incorrect because “hidden” doesn’t make sense within the context of the sentence. A person whose knowledge is hidden wouldn’t be an asset to a company. Choices C and D are incorrect because “large” and “spacious” aren’t idiomatic when describing the extent of a person’s knowledge.

## QUESTION 42

**Choice D is the best answer.** “Keeping down costs” clearly and concisely identifies what businesses have succeeded in doing.

Choices A, B, and C are incorrect because they’re redundant. In choice A, the verbs “minimizing” and “keeping down” are synonyms, so only one is needed in the sentence. In choice B, “employees’ coursework” isn’t needed because this phrase already appears in the sentence. In choice C, “being effective” repeats the idea of “succeeded,” which appears earlier in the sentence.

## QUESTION 43

**Choice A is the best answer.** The infinitive “[to] divert” is grammatically correct when preceded by “are likely,” indicating that classes can redirect employees’ time and energy away from their jobs.

Choices B, C, and D are incorrect because “diverted,” “in diverting,” and “diversions for” create ungrammatical sentences.

## QUESTION 44

**Choice D is the best answer.** To make the passage most logical, the sentence should be placed after the last sentence of paragraph 4. The use of “still” in the inserted sentence indicates that a contrast to what was stated previously will follow. Paragraph 4 ends by stating that tuition reimbursement may not be appropriate in all cases, and the inserted sentence indicates that despite this fact, employers should give serious thought to investing in reimbursement programs. Moreover, the inserted sentence restates the passage’s main claim and, therefore, effectively concludes the passage.

Choices A, B, and C are incorrect because placing the sentence at the end of paragraph 1, 2, or 3 would result in an illogical passage.

## Section 3: Math Test – No Calculator

### QUESTION 1

**Choice B is correct.** Subtracting  $z$  from both sides of  $2z + 1 = z$  results in  $z + 1 = 0$ . Subtracting 1 from both sides of  $z + 1 = 0$  results in  $z = -1$ .

Choices A, C, and D are incorrect. When each of these values is substituted for  $z$  in the given equation, the result is a false statement. Substituting  $-2$  for  $z$  yields  $2(-2) + 1 = -2$ , or  $-3 = -2$ .

Substituting  $\frac{1}{2}$  for  $z$  yields  $2\left(\frac{1}{2}\right) + 1 = \frac{1}{2}$ , or  $2 = \frac{1}{2}$ . Lastly, substituting 1 for  $z$  yields  $2(1) + 1 = 1$ , or  $3 = 1$ .

### QUESTION 2

**Choice C is correct.** To complete the purchase, the initial payment of \$60 plus the  $w$  weekly payments of \$30 must be equivalent to the \$300 price of the television. The total, in dollars, of  $w$  weekly payments of \$30 can be expressed by  $30w$ . It follows that  $300 = 30w + 60$  can be used to find the number of weekly payments,  $w$ , required to complete the purchase.

Choice A is incorrect. Since the television is to be purchased with an initial payment and  $w$  weekly payments, the price of the television must be equivalent to the sum, not the difference, of these payments. Choice B is incorrect. This equation represents a situation where the television is purchased using only  $w$  weekly payments of \$30, with no initial payment of \$60. Choice D is incorrect. This equation represents a situation where the  $w$  weekly payments are \$60 each, not \$30 each, and the initial payment is \$30, not \$60. Also, since the television is to be purchased with weekly payments and an initial payment, the price of the television must be equivalent to the sum, not the difference, of these payments.

### QUESTION 3

**Choice B is correct.** Since the relationship between the merchandise weight  $x$  and the shipping charge  $f(x)$  is linear, a function in the form  $f(x) = mx + b$ , where  $m$  and  $b$  are constants, can be used. In this situation, the constant  $m$  represents the additional shipping charge, in dollars, for each additional pound of merchandise shipped, and the constant  $b$  represents a one-time charge, in dollars, for shipping any weight, in pounds, of merchandise. Using any two pairs of values from the table, such as (10, 21.89) and (20, 31.79), and dividing the difference in the charges by the difference in the weights gives the value of  $m$ :  $m = \frac{31.79 - 21.89}{20 - 10}$ , which simplifies to  $\frac{9.9}{10}$ , or 0.99. Substituting the value of  $m$  and any pair of values from the table, such as (10, 21.89), for  $x$  and  $f(x)$ , respectively, gives the value of  $b$ :  $21.89 = 0.99(10) + b$ , or  $b = 11.99$ . Therefore, the function  $f(x) = 0.99x + 11.99$  can be used to determine the total shipping charge  $f(x)$ , in dollars, for an order with a merchandise weight of  $x$  pounds.

Choices A, C, and D are incorrect. If any pair of values from the table is substituted for  $x$  and  $f(x)$ , respectively, in these functions, the result is false. For example, substituting 10 for  $x$  and 21.89 for  $f(x)$  in  $f(x) = 0.99x$  yields  $21.89 = 0.99(10)$ , or  $21.89 = 9.9$ , which is false. Similarly, substituting the values (10, 21.89) for  $x$  and  $f(x)$  into the functions in choices C and D results in  $21.89 = 33.9$  and  $21.89 = 50.84$ , respectively. Both are false.

## QUESTION 4

**Choice C is correct.** It's given that the graph represents  $y = h(x)$ , thus the  $y$ -coordinate of each point on the graph corresponds to the height, in feet, of a Doric column with a base diameter of  $x$  feet. A Doric column with a base diameter of 5 feet is represented by the point (5, 35), and a Doric column with a base diameter of 2 feet is represented by the point (2, 14). Therefore, the column with a base diameter of 5 feet has a height of 35 feet, and the column with a base diameter of 2 feet has a height of 14 feet. It follows that the difference in heights of these two columns is  $35 - 14$ , or 21 feet.

Choice A is incorrect. This value is the slope of the line and represents the increase in the height of a Doric column for each increase in the base diameter by 1 foot. Choice B is incorrect. This value represents the height of a Doric column with a base diameter of 2 feet, or the difference in height between a Doric column with base diameter of 5 feet and a Doric column with base diameter of 3 feet. Choice D is incorrect and may result from conceptual or calculation errors.

## QUESTION 5

**Choice A is correct.** The expression  $\sqrt{9x^2}$  can be rewritten as  $(\sqrt{9})(\sqrt{x^2})$ . The square root symbol in an expression represents the principal square root, or the positive square root, thus  $\sqrt{9} = 3$ . Since  $x > 0$ , taking the square root of the second factor,  $\sqrt{x^2}$ , gives  $x$ . It follows that  $\sqrt{9x^2}$  is equivalent to  $3x$ .

Choice B is incorrect and may result from rewriting  $\sqrt{9x^2}$  as  $(\sqrt{9})(x^2)$  rather than  $(\sqrt{9})(\sqrt{x^2})$ . Choices C and D are incorrect and may result from misunderstanding the operation indicated by a radical symbol. In both of these choices, instead of finding the square root of the coefficient 9, the coefficient has been multiplied by 2. Additionally, in choice D,  $x^2$  has been squared to give  $x^4$ , instead of taking the square root of  $x^2$  to get  $x$ .

## QUESTION 6

**Choice A is correct.** Factoring the numerator of the rational expression  $\frac{x^2 - 1}{x - 1}$  yields  $\frac{(x + 1)(x - 1)}{x - 1}$ . The expression  $\frac{(x + 1)(x - 1)}{x - 1}$  can be rewritten as  $\left(\frac{x + 1}{1}\right)\left(\frac{x - 1}{x - 1}\right)$ . Since  $\frac{x - 1}{x - 1} = 1$ , when  $x$  is not equal to 1, it follows that  $\left(\frac{x + 1}{1}\right)\left(\frac{x - 1}{x - 1}\right) = \left(\frac{x + 1}{1}\right)(1)$  or  $x + 1$ . Therefore, the given equation is equivalent to  $x + 1 = -2$ . Subtracting 1 from both sides of  $x + 1 = -2$  yields  $x = -3$ .

Choices B, C, and D are incorrect. Substituting 0, 1, or -1, respectively, for  $x$  in the given equation yields a false statement. Substituting 0 for  $x$  in the given equation yields  $\frac{0^2 - 1}{0 - 1} = -2$  or  $1 = -2$ , which is false. Substituting 1 for  $x$  in the given equation makes the left-hand side  $\frac{1^2 - 1}{1 - 1} = \frac{0}{0}$ , which is undefined and not equal to -2. Substituting -1 for  $x$  in the given equation yields  $\frac{(-1)^2 - 1}{-1 - 1} = -2$ , or  $0 = -2$ , which is false. Therefore, these values don't satisfy the given equation.

### QUESTION 7

**Choice D is correct.** Since  $y = f(x)$ , the value of  $f(0)$  is equal to the value of  $f(x)$ , or  $y$ , when  $x = 0$ . The graph indicates that when  $x = 0$ ,  $y = 4$ . It follows that the value of  $f(0) = 4$ .

Choice A is incorrect. If the value of  $f(0)$  were 0, then when  $x = 0$ , the value of  $f(x)$ , or  $y$ , would be 0 and the graph would pass through the point (0, 0). Choice B is incorrect. If the value of  $f(0)$  were 2, then when  $x = 0$ , the value of  $f(x)$ , or  $y$ , would be 2 and the graph would pass through the point (0, 2). Choice C is incorrect. If the value of  $f(0)$  were 3, then when  $x = 0$ , the value of  $f(x)$ , or  $y$ , would be 3 and the graph would pass through the point (0, 3).

### QUESTION 8

**Choice C is correct.** Since point  $B$  lies on  $\overline{AD}$ , angles  $ABC$  and  $CBD$  are supplementary. It's given that angle  $ABC$  is a right angle; therefore, its measure is  $90^\circ$ . It follows that the measure of angle  $CBD$  is  $180^\circ - 90^\circ$ , or  $90^\circ$ . By the angle addition postulate, the measure of angle  $CBD$  is equivalent to  $x^\circ + 2x^\circ + 2x^\circ$ . Therefore,  $90 = x + 2x + 2x$ . Combining like terms gives  $90 = 5x$ . Dividing both sides of this equation by 5 yields  $x = 18$ . Therefore, the value of  $3x$  is  $3(18)$ , or 54.

Choice A is incorrect. This is the value of  $x$ . Choice B is incorrect. This is the value of  $2x$ . Choice D is incorrect. This is the value of  $4x$ .

### QUESTION 9

**Choice C is correct.** The equation defining any line can be written in the form  $y = mx + b$ , where  $m$  is the slope of the line and  $b$  is the  $y$ -coordinate of the  $y$ -intercept. Line  $\ell$  passes through the point (0, -4), which is the  $y$ -intercept. Therefore, for line  $\ell$ ,  $b = -4$ . The slope of a line is the ratio of the difference between the  $y$ -coordinates of any two points to the difference between the  $x$ -coordinates of the same points. Calculating the slope using two points that line  $\ell$  passes through, (-4, 0) and (0, -4), gives  $m = \frac{0 - (-4)}{(-4) - 0} = \frac{4}{-4}$ , or -1. Since  $m = -1$  and  $b = -4$ , the equation of line  $\ell$  can be written as  $y = (-1)x + (-4)$ , or  $y = -x - 4$ . Adding  $x$  to both sides of  $y = -x - 4$  yields  $x + y = -4$ .

Choices A and B are incorrect. These equations both represent lines with a positive slope, but line  $\ell$  has a negative slope. Choice D is incorrect. This equation represents a line that passes through the points (4, 0) and (0, 4), not the points (-4, 0) and (0, -4).

## QUESTION 10

**Choice D is correct.** Since the graph represents the equation  $y = 2x^2 + 10x + 12$ , it follows that each point  $(x, y)$  on the graph is a solution to this equation. Since the graph crosses the  $y$ -axis at  $(0, k)$ , then substituting 0 for  $x$  and  $k$  for  $y$  in  $y = 2x^2 + 10x + 12$  creates a true statement:  $k = 2(0)^2 + 10(0) + 12$ , or  $k = 12$ .

Choice A is incorrect. If  $k = 2$  when  $x = 0$ , it follows that  $2 = 2(0)^2 + 10(0) + 12$ , or  $2 = 12$ , which is false. Choice B is incorrect. If  $k = 6$  when  $x = 0$ , it follows that  $6 = 2(0)^2 + 10(0) + 12$ , or  $6 = 12$ , which is false. Choice C is incorrect. If  $k = 10$  when  $x = 0$ , it follows that  $10 = 2(0)^2 + 10(0) + 12$ , or  $10 = 12$ , which is false.

## QUESTION 11

**Choice A is correct.** A circle in the  $xy$ -plane with center  $(h, k)$  and radius  $r$  is defined by the equation  $(x - h)^2 + (y - k)^2 = r^2$ . Therefore, an equation of a circle with center  $(5, 7)$  and radius 2 is  $(x - 5)^2 + (y - 7)^2 = 2^2$ , or  $(x - 5)^2 + (y - 7)^2 = 4$ .

Choice B is incorrect. This equation defines a circle with center  $(-5, -7)$  and radius 2. Choice C is incorrect. This equation defines a circle with center  $(5, 7)$  and radius  $\sqrt{2}$ . Choice D is incorrect. This equation defines a circle with center  $(-5, -7)$  and radius  $\sqrt{2}$ .

## QUESTION 12

**Choice B is correct.** Since figures are drawn to scale unless otherwise stated and triangle  $ABC$  is similar to triangle  $DEF$ , it follows that the measure of angle  $B$  is equal to the measure of angle  $E$ . Furthermore, it follows that side  $AB$  corresponds to side  $DE$  and that side  $BC$  corresponds to side  $EF$ . For similar triangles, corresponding sides are proportional, so  $\frac{AB}{BC} = \frac{DE}{EF}$ . In right triangle  $DEF$ , the cosine of angle  $E$ , or  $\cos(E)$ , is equal to the length of the side adjacent to angle  $E$  divided by the length of the hypotenuse in triangle  $DEF$ . Therefore,  $\cos(E) = \frac{DE}{EF}$ , which is equivalent to  $\frac{AB}{BC}$ . Therefore,  $\cos(E) = \frac{12}{13}$ .

Choice A is incorrect. This value represents the tangent of angle  $F$ , or  $\tan(F)$ , which is defined as the length of the side opposite angle  $F$  divided by the length of the side adjacent to angle  $F$ . Choice C is incorrect. This value represents the tangent of angle  $E$ , or  $\tan(E)$ , which is defined as the length of the side opposite angle  $E$  divided by the length of the side adjacent to angle  $E$ . Choice D is incorrect. This value represents the sine of angle  $E$ , or  $\sin(E)$ , which is defined as the length of the side opposite angle  $E$  divided by the length of the hypotenuse.

## QUESTION 13

**Choice C is correct.** The  $x$ -intercepts of the graph of  $f(x) = x^2 + 5x + 4$  are the points  $(x, f(x))$  on the graph where  $f(x) = 0$ . Substituting 0 for  $f(x)$  in the function equation yields  $0 = x^2 + 5x + 4$ . Factoring the right-hand side of  $0 = x^2 + 5x + 4$  yields  $0 = (x + 4)(x + 1)$ .

If  $0 = (x + 4)(x + 1)$ , then  $0 = x + 4$  or  $0 = x + 1$ . Solving both of these equations for  $x$  yields  $x = -4$  and  $x = -1$ . Therefore, the  $x$ -intercepts of the graph of  $f(x) = x^2 + 5x + 4$  are  $(-4, 0)$  and  $(-1, 0)$ . Since both points lie on the  $x$ -axis, the distance between  $(-4, 0)$  and  $(-1, 0)$  is equivalent to the number of unit spaces between  $-4$  and  $-1$  on the  $x$ -axis, which is 3.

Choice A is incorrect. This is the distance from the origin to the  $x$ -intercept  $(-1, 0)$ . Choice B is incorrect and may result from incorrectly calculating the  $x$ -intercepts. Choice D is incorrect. This is the distance from the origin to the  $x$ -intercept  $(-4, 0)$ .

### QUESTION 14

**Choice B is correct.** Squaring both sides of the equation  $\sqrt{4x} = x - 3$  yields  $4x = (x - 3)^2$ , or  $4x = (x - 3)(x - 3)$ . Applying the distributive property on the right-hand side of the equation  $4x = (x - 3)(x - 3)$  yields  $4x = x^2 - 3x - 3x + 9$ . Subtracting  $4x$  from both sides of  $4x = x^2 - 3x - 3x + 9$  yields  $0 = x^2 - 3x - 3x - 4x + 9$ , which can be rewritten as  $0 = x^2 - 10x + 9$ . Factoring the right-hand side of  $0 = x^2 - 10x + 9$  gives  $0 = (x - 1)(x - 9)$ . By the zero product property, if  $0 = (x - 1)(x - 9)$ , then  $0 = x - 1$  or  $0 = x - 9$ . Adding 1 to both sides of  $0 = x - 1$  gives  $x = 1$ . Adding 9 to both sides of  $0 = x - 9$  gives  $x = 9$ . Substituting these values for  $x$  into the given equation will determine whether they satisfy the equation. Substituting 1 for  $x$  in the given equation yields  $\sqrt{4(1)} = 1 - 3$ , or  $\sqrt{4} = -2$ , which is false. Therefore,  $x = 1$  doesn't satisfy the given equation. Substituting 9 for  $x$  in the given equation yields  $\sqrt{4(9)} = 9 - 3$  or  $\sqrt{36} = 6$ , which is true. Therefore,  $x = 9$  satisfies the given equation.

Choices A and C are incorrect because  $x = 1$  doesn't satisfy the given equation:  $\sqrt{4x}$  represents the principal square root of  $4x$ , which can't be negative. Choice D is incorrect because  $x = 9$  does satisfy the given equation.

### QUESTION 15

**Choice A is correct.** A system of two linear equations has no solution if the graphs of the lines represented by the equations are parallel and are not equivalent. Parallel lines have equal slopes but different  $y$ -intercepts. The slopes and  $y$ -intercepts for the two given equations can be found by solving each equation for  $y$  in terms of  $x$ , thus putting the equations in slope-intercept form. This yields  $y = 3x + 6$  and  $y = \left(-\frac{a}{2}\right)x + 2$ . The slope and  $y$ -intercept of the line with equation  $-3x + y = 6$  are 3 and  $(0, 6)$ , respectively. The slope and  $y$ -intercept of the line with equation  $ax + 2y = 4$  are represented by the expression  $-\frac{a}{2}$  and the point  $(0, 2)$ , respectively. The value of  $a$  can be found by setting the two slopes equal to each other, which gives  $-\frac{a}{2} = 3$ . Multiplying both sides of this equation by  $-2$  gives  $a = -6$ . When  $a = -6$ , the lines are parallel and have different  $y$ -intercepts.



Choices B, C, and D are incorrect because these values of  $a$  would result in two lines that are not parallel, and therefore the resulting system of equations would have a solution.

### QUESTION 16

**The correct answer is 2200.** If the total shipping cost was \$47,000, then  $T = 47,000$ . If 3000 units were shipped to the farther location, then  $f = 3000$ . Substituting 47,000 for  $T$  and 3000 for  $f$  in the equation  $T = 5c + 12f$  yields  $47,000 = 5c + 12(3000)$ . Multiplying 12 by 3000 yields  $47,000 = 5c + 36,000$ . Subtracting 36,000 from both sides of the equation yields  $11,000 = 5c$ . Dividing both sides by 5 yields  $c = 2200$ . Therefore, 2200 units were shipped to the closer location.

### QUESTION 17

**The correct answer is 5.** By definition of absolute value, if  $|2x + 1| = 5$ , then  $2x + 1 = 5$  or  $-(2x + 1) = 5$ , which can be rewritten as  $2x + 1 = -5$ . Subtracting 1 from both sides of  $2x + 1 = 5$  and  $2x + 1 = -5$  yields  $2x = 4$  and  $2x = -6$ , respectively. Dividing both sides of  $2x = 4$  and  $2x = -6$  by 2 yields  $x = 2$  and  $x = -3$ , respectively. If  $a$  and  $b$  are the solutions to the given equation, then  $a = 2$  and  $b = -3$ . It follows then that  $|a - b| = |2 - (-3)| = |5|$ , which is 5. Similarly, if  $a = -3$  and  $b = 2$ , it follows that  $|a - b| = |-3 - 2| = |-5|$ , which is also 5.

### QUESTION 18

**The correct answer is 1.21.** It's given that each year, the value of the antique is estimated to increase by 10% over its value the previous year. Increasing a quantity by 10% is equivalent to the quantity increasing to 110% of its original value or multiplying the original quantity by 1.1. Therefore, 1 year after the purchase, the estimated value of the antique is  $200(1.1)$  dollars. Then, 2 years after purchase, the estimated value of the antique is  $200(1.1)(1.1)$ , or  $200(1.21)$  dollars. It's given that the estimated value of the antique after 2 years is  $200a$  dollars. Therefore,  $200(1.21) = 200a$ . It follows that  $a = 1.21$ .

### QUESTION 19

**The correct answer is 2500.** Adding the given equations yields  $(2x + 3y) + (3x + 2y) = (1200 + 1300)$ . Combining like terms yields  $5x + 5y = 2500$ . Therefore, the value of  $5x + 5y$  is 2500.

### QUESTION 20

**The correct answer is 20.** Factoring the expression  $u^2 - t^2$  yields  $(u - t)(u + t)$ . Therefore, the expression  $(u - t)(u^2 - t^2)$  can be rewritten as  $(u - t)(u - t)(u + t)$ . Substituting 5 for  $u + t$  and 2 for  $u - t$  in this expression yields  $(2)(2)(5)$ , which is equal to 20.

## Section 4: Math Test – Calculator

### QUESTION 1

**Choice B is correct.** It's given that the helicopter's initial height is 40 feet above the ground and that when the helicopter's altitude begins to increase, it increases at a rate of 21 feet per second. Therefore, the altitude gain  $t$  seconds after the helicopter begins rising is represented by the expression  $21t$ . Adding this expression to the helicopter's initial height gives the helicopter's altitude above the ground  $y$ , in feet,  $t$  seconds after the helicopter begins to gain altitude:  $y = 40 + 21t$ .

Choice A is incorrect. This is the helicopter's altitude above the ground 1 second after it began to gain altitude, not  $t$  seconds after it began to gain altitude. Choice C is incorrect because adding the expression  $-21t$  makes this function represent a decrease in altitude. Choice D is incorrect and is the result of using the initial height of 40 feet as the rate at which the helicopter's altitude increases per second and the rate of 21 feet per second as the initial height.

### QUESTION 2

**Choice A is correct.** The text messaging plan charges a flat fee of \$5 per month for up to 100 text messages. This is represented graphically with a constant value of  $y = 5$  for  $0 \leq x \leq 100$ . After 100 messages, each additional message sent costs \$0.25. This is represented graphically with an increase of 0.25 on the  $y$ -axis for every increase of 1 on the  $x$ -axis. Choice A matches these descriptions.

Choice B is incorrect. This choice shows a linear decrease after  $x = 100$ , indicating the price of the plan would decrease, rather than increase, after 100 text messages. Choices C and D are incorrect. These choices don't represent a constant value of  $y = 5$  for  $0 \leq x \leq 100$ , which is needed to represent the \$5 per month for the first 100 text messages.

### QUESTION 3

**Choice B is correct.** During the first 15 minutes Jake is in the theater, or from 0 to 15 minutes, Jake's popcorn amount decreases by half. This is represented graphically by a linear decrease. From 15 to 45 minutes, Jake stops eating popcorn. This is represented graphically by a constant  $y$ -value. From 45 to 90 minutes, Jake eats more popcorn. This is represented graphically by another linear decrease as the amount of popcorn in the bag gradually goes down. At 90 minutes, Jake spills all of his remaining popcorn. This is represented graphically by a vertical drop in the  $y$ -value to 0. Choice B matches these representations.

Choices A, C, and D are incorrect. At no point during this period of time did Jake buy more popcorn. All of these graphs represent an increase in the amount of popcorn in Jake's bag at some point during this period of time.

## QUESTION 4

**Choice C is correct.** Subtracting 20 from both sides of the given equation yields  $-x = -5$ . Dividing both sides of the equation  $-x = -5$  by  $-1$  yields  $x = 5$ . Lastly, substituting 5 for  $x$  in  $3x$  yields the value of  $3x$ , or  $3(5) = 15$ .

Choice A is incorrect. This is the value of  $x$ , not the value of  $3x$ . Choices B and D are incorrect. If  $3x = 10$  or  $3x = 35$ , then it follows that  $x = \frac{10}{3}$  or  $x = \frac{35}{3}$ , respectively. Substituting  $\frac{10}{3}$  and  $\frac{35}{3}$  for  $x$  in the given equation yields  $\frac{50}{3} = 15$  and  $\frac{25}{3} = 15$ , respectively, both of which are false statements. Since  $3x = 10$  and  $3x = 35$  both lead to false statements, then  $3x$  can't be equivalent to either 10 or 35.

## QUESTION 5

**Choice C is correct.** The value of  $f(-1)$  can be found by substituting  $-1$  for  $x$  in the given function  $f(x) = \frac{x+3}{2}$ , which yields  $f(-1) = \frac{-1+3}{2}$ .

Rewriting the numerator by adding  $-1$  and 3 yields  $\frac{2}{2}$ , which equals 1. Therefore,  $f(-1) = 1$ .

Choice A is incorrect and may result from miscalculating the value of  $\frac{-1+3}{2}$  as  $\frac{-4}{2}$ , or  $-2$ . Choice B is incorrect and may result from misinterpreting the value of  $x$  as the value of  $f(-1)$ . Choice D is incorrect and may result from adding the expression  $-1 + 3$  in the numerator.

## QUESTION 6

**Choice D is correct.** To determine which option is equivalent to the given expression, the expression can be rewritten using the distributive property by multiplying each term of the binomial  $(x^2 - 3x)$  by  $2x$ , which gives  $2x^3 - 6x^2$ .

Choices A, B, and C are incorrect and may result from incorrectly applying the laws of exponents or from various computation errors when rewriting the expression.

## QUESTION 7

**Choice B is correct.** Selecting employees from each store at random is most appropriate because it's most likely to ensure that the group surveyed will accurately represent each store location and all employees.

Choice A is incorrect. Surveying employees at a single store location will only provide an accurate representation of employees at that location, not at all 50 store locations. Choice C is incorrect. Surveying the highest- and lowest-paid employees will not give an accurate representation of employees across all pay grades at the company.

Choice D is incorrect. Collecting only the first 50 responses mimics the results of a self-selected survey. For example, the first 50 employees to respond to the survey could be motivated by an overwhelming positive or negative experience and thus will not accurately represent all employees.

### QUESTION 8

**Choice C is correct.** The graph for Ian shows that the initial deposit was \$100 and that each week the total amount deposited increased by \$100. Therefore, Ian deposited \$100 each week. The graph for Jeremy shows that the initial deposit was \$300 and that each week the total amount deposited increased by \$50. Therefore, Jeremy deposited \$50 each week. Thus, Ian deposited \$50 more than Jeremy did each week.

Choice A is incorrect. This is the difference between the initial deposits in the savings accounts. Choice B is incorrect. This is the amount Ian deposited each week. Choice D is incorrect. This is half the amount that Jeremy deposited each week.

### QUESTION 9

**Choice C is correct.** The value of the expression  $h(5) - h(3)$  can be found by substituting 5 and 3 for  $x$  in the given function. Substituting 5 for  $x$  in the function yields  $h(5) = 2^5$ , which can be rewritten as  $h(5) = 32$ . Substituting 3 for  $x$  in the function yields  $h(3) = 2^3$ , which can be rewritten as  $h(3) = 8$ . Substituting these values into the expression  $h(5) - h(3)$  produces  $32 - 8 = 24$ .

Choice A is incorrect. This is the value of  $5 - 3$ , not of  $h(5) - h(3)$ . Choice B is incorrect. This is the value of  $h(5 - 3)$ , or  $h(2)$ , not of  $h(5) - h(3)$ . Choice D is incorrect and may result from calculation errors.

### QUESTION 10

**Choice D is correct.** The margin of error is applied to the sample statistic to create an interval in which the population statistic most likely falls. An estimate of 23% with a margin of error of 4% creates an interval of  $23\% \pm 4\%$ , or between 19% and 27%. Thus, it's plausible that the percentage of students in the population who see a movie at least once a month is between 19% and 27%.

Choice A is incorrect and may result from interpreting the estimate of 23% as the minimum number of students in the population who see a movie at least once per month. Choice B is incorrect and may result from interpreting the estimate of 23% as the minimum number of students in the population who see a movie at least once per month and adding half of the margin of error to conclude that it isn't possible that more than 25% of students in the population see a movie at least once per month. Choice C is incorrect and may result from interpreting the sample statistic as the researcher's level of confidence in the survey results and applying the margin of error to the level of confidence.

## QUESTION 11

**Choice A is correct.** The mean number of each list is found by dividing the sum of all the numbers in each list by the count of the numbers in each list. The mean of list A is  $\frac{1 + 2 + 3 + 4 + 5 + 6}{6} = 3.5$ , and the mean of list B is  $\frac{2 + 3 + 3 + 4 + 4 + 5}{6} = 3.5$ . Thus, the means are the same. The standard deviations can be compared by inspecting the distances of the numbers in each list from the mean. List A contains two numbers that are 0.5 from the mean, two numbers that are 1.5 from the mean, and two numbers that are 2.5 from the mean. List B contains four numbers that are 0.5 from the mean and two numbers that are 1.5 from the mean. Overall, list B contains numbers that are closer to the mean than are the numbers in list A, so the standard deviations of the lists are different.

Choice B is incorrect and may result from assuming that two data sets with the same mean must also have the same standard deviation. Choices C and D are incorrect and may result from an error in calculating the means.

## QUESTION 12

**Choice C is correct.** Let  $x$  represent the original price of the book. Then, 40% off of  $x$  is  $(1 - 0.40)x$ , or  $0.60x$ . Since the sale price is \$18.00, then  $0.60x = 18$ . Dividing both sides of this equation by 0.60 yields  $x = 30$ . Therefore, the original price of the book was \$30.

Choice A is incorrect and may result from computing 40% of the sale price. Choice B is incorrect and may result from computing 40% off the sale price instead of the original price. Choice D is incorrect and may result from computing the original price of a book whose sale price is \$18 when the sale is for 60% off the original price.

## QUESTION 13

**Choice C is correct.** According to the bar graph, the number of insects in colony A at week 0 was approximately 80, and this number decreased over each respective two-week period to approximately 50, 32, 25, and 18. Similarly, the graph shows that the number of insects in colony B at week 0 was approximately 64, and this number also decreased over each respective two-week period to approximately 60, 40, 38, and 10. Finally, the graph shows that the number of insects in colony C at week 0 was approximately 58; however, the number of insects increased in week 2, to approximately 140. Therefore, only colony A and colony B showed a decrease in size every two weeks after the initial treatment.

Choice A is incorrect. Colony B also showed a decrease in size every two weeks. Choices B and D are incorrect. Colony C showed an increase in size between weeks 0 and 2.

### QUESTION 14

**Choice A is correct.** According to the bar graph, the total number of insects in all three colonies in week 8 was approximately  $20 + 10 + 50 = 80$ , and the total number of insects at the time of initial treatment (week 0) was approximately  $80 + 65 + 55 = 200$ . The ratio of these approximations is 80 to 200, which is equivalent to 2 to 5. Therefore, the ratio 2 to 5 is closest to the ratio of the total number of insects in all three colonies in week 8 to the total number of insects at the time of initial treatment.

Choices B, C, and D are incorrect and may result from setting up ratios using weeks other than week 8 and week 0 or from calculation errors.

### QUESTION 15

**Choice B is correct.** The formula for the volume  $V$  of a right circular cone is  $V = \frac{1}{3}\pi r^2 h$ , where  $r$  is the radius of the base and  $h$  is the height of the cone. It's given that the cone's volume is  $24\pi$  cubic inches and its height is 2 inches. Substituting  $24\pi$  for  $V$  and 2 for  $h$  yields  $24\pi = \frac{1}{3}\pi r^2(2)$ . Rewriting the right-hand side of this equation yields  $24\pi = \left(\frac{2\pi}{3}\right)r^2$ , which is equivalent to  $36 = r^2$ . Taking the square root of both sides of this equation gives  $r = \pm 6$ . Since the radius is a measure of length, it can't be negative. Therefore, the radius of the base of the cone is 6 inches.

Choice A is incorrect and may result from using the formula for the volume of a right circular cylinder instead of a right circular cone. Choice C is incorrect. This is the diameter of the cone. Choice D is incorrect and may result from not taking the square root when solving for the radius.

### QUESTION 16

**Choice C is correct.** It's given that the population of City X was 120,000 in 2010, and that it increased by 20% from 2010 to 2015. Therefore, the population of City X in 2015 was  $120,000(1 + 0.20) = 144,000$ . It's also given that the population of City Y decreased by 10% from 2010 to 2015. If  $y$  represents the population of City Y in 2010, then  $y(1 - 0.10) = 144,000$ . Solving this equation for  $y$  yields  $y = \frac{144,000}{1 - 0.10}$ . Simplifying the denominator yields  $\frac{144,000}{0.90}$ , or 160,000.

Choice A is incorrect. If the population of City Y in 2010 was 60,000, then the population of City Y in 2015 would have been  $60,000(0.90) = 54,000$ , which is not equal to the City X population in 2015 of 144,000. Choice B is incorrect because  $90,000(0.90) = 81,000$ , which is not equal to the City X population in 2015 of 144,000. Choice D is incorrect because  $240,000(0.90) = 216,000$ , which is not equal to the City X population in 2015 of 144,000.

## QUESTION 17

**Choice D is correct.** Dividing both sides of the equation  $V = \frac{4}{3}\pi r^3$  by  $\frac{4}{3}\pi$  results in  $\frac{3V}{4\pi} = r^3$ . Taking the cube root of both sides produces  $\sqrt[3]{\frac{3V}{4\pi}} = r$ . Therefore,  $\sqrt[3]{\frac{3V}{4\pi}}$  gives the radius of the sphere in terms of the volume of the sphere.

Choice A is incorrect. This expression is equivalent to the reciprocal of  $r^3$ . Choice B is incorrect. This expression is equivalent to  $r^3$ . Choice C is incorrect. This expression is equivalent to the reciprocal of  $r$ .

## QUESTION 18

**Choice C is correct.** It's given that the tablet user did not answer "Never," so the tablet user could have answered only "Rarely," "Often," or "Always." These answers make up  $24.3\% + 13.5\% + 30.9\% = 68.7\%$  of the answers the tablet users gave in the survey. The answer "Always" makes up 30.9% of the answers tablet users gave in the survey. Thus, the probability is  $\frac{30.9\%}{68.7\%}$ , or  $\frac{0.309}{0.687} = 0.44978$ , which rounds up to 0.45.

Choice A is incorrect. This reflects the tablet users in the survey who answered "Always." Choice B is incorrect. This reflects all tablet users who did not answer "Never" or "Always." Choice D is incorrect. This reflects all tablet users in the survey who did not answer "Never."

## QUESTION 19

**Choice D is correct.** The vertex form of a quadratic equation is  $y = n(x - h)^2 + k$ , where  $(h, k)$  gives the coordinates of the vertex of the parabola in the  $xy$ -plane and the sign of the constant  $n$  determines whether the parabola opens upward or downward. If  $n$  is negative, the parabola opens downward and the vertex is the maximum. The given equation has the values  $h = 3$ ,  $k = a$ , and  $n = -1$ . Therefore, the vertex of the parabola is  $(3, a)$  and the parabola opens downward. Thus, the parabola's maximum occurs at  $(3, a)$ .

Choice A is incorrect and may result from interpreting the given equation as representing a parabola in which the vertex is a minimum, not a maximum, and from misidentifying the value of  $h$  in the given equation as  $-3$ , not 3. Choice B is incorrect and may result from interpreting the given equation as representing a parabola in which the vertex is a minimum, not a maximum. Choice C is incorrect and may result from misidentifying the value of  $h$  in the given equation as  $-3$ , not 3.

## QUESTION 20

**Choice C is correct.** Let  $m$  be the minimum value of the original data set. The range of a data set is the difference between the maximum value and the minimum value. The range of the original data set is therefore  $84 - m$ . The new data set consists of the original set and the positive integer 96. Thus, the new data set has the same minimum  $m$  and a maximum of 96. Therefore, the range of the new data set is  $96 - m$ . The difference in the two ranges can be found by subtracting the ranges:  $(96 - m) - (84 - m)$ . Using the distributive property, this can be rewritten as  $96 - m - 84 + m$ , which is equal to 12. Therefore, the range of the new data set must be 12 greater than the range of the original data set.

Choices A, B, and D are incorrect. Only the maximum value of the original data set is known, so the amount that the mean, median, and standard deviation of the new data set differ from those of the original data set can't be determined.

## QUESTION 21

**Choice B is correct.** It's given that Clayton uses 100 milliliters of the 20% by mass solution, so  $y = 100$ . Substituting 100 for  $y$  in the given equation yields  $0.10x + 0.20(100) = 0.18(x + 100)$ , which can be rewritten as  $0.10x + 20 = 0.18x + 18$ . Subtracting  $0.10x$  and 18 from both sides of the equation gives  $2 = 0.08x$ . Dividing both sides of this equation by 0.08 gives  $x = 25$ . Thus, Clayton uses 25 milliliters of the 10% by mass saline solution.

Choices A, C, and D are incorrect and may result from calculation errors.

## QUESTION 22

**Choice D is correct.** It's given that the number of people Eleanor invited the first year was 30 and that the number of people invited doubles each of the following years, which is the same as increasing by a constant factor of 2. Therefore, the function  $f$  can be defined by  $f(n) = 30(2)^n$ , where  $n$  is the number of years after Eleanor began organizing the event. This is an increasing exponential function.

Choices A and B are incorrect. Linear functions increase or decrease by a constant number over equal intervals, and exponential functions increase or decrease by a constant factor over equal intervals.

Since the number of people invited increases by a constant factor each year, the function  $f$  is exponential rather than linear. Choice C is incorrect. The value of  $f(n)$  increases as  $n$  increases, so the function  $f$  is increasing rather than decreasing.



### QUESTION 23

**Choice A is correct.** The slope-intercept form of a linear equation in the  $xy$ -plane is  $y = mx + b$ , where  $m$  is the slope of the graph of the equation and  $b$  is the  $y$ -coordinate of the  $y$ -intercept of the graph. Any two ordered pairs  $(x_1, y_1)$  and  $(x_2, y_2)$  that satisfy a linear equation can be used to compute the slope of the graph of the equation using the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Substituting the two pairs  $(a, 0)$  and  $(3a, -a)$  from the table into the formula gives  $m = \frac{-a - 0}{3a - a}$ , which can be rewritten as  $\frac{-a}{2a}$ , or  $-\frac{1}{2}$ . Substituting this value for  $m$  in the slope-intercept form of the equation produces  $y = -\frac{1}{2}x + b$ . Substituting values from the ordered pair  $(a, 0)$  in the table into this equation produces  $0 = -\frac{1}{2}(a) + b$ , which simplifies to  $b = \frac{a}{2}$ . Substituting this value for  $b$  in the slope-intercept form of the equation produces  $y = -\frac{1}{2}x + \frac{a}{2}$ . Rewriting this equation in standard form by adding  $\frac{1}{2}x$  to both sides and then multiplying both sides by 2 gives the equation  $x + 2y = a$ .

Choice B is incorrect and may result from a calculation error when determining the  $y$ -intercept of the graph of the equation. Choices C and D are incorrect and may result from an error in calculation when determining the slope of the graph of the equation.

### QUESTION 24

**Choice B is correct.** The slope-intercept form of a linear equation is  $y = mx + b$ , where  $m$  is the slope of the graph of the equation and  $b$  is the  $y$ -coordinate of the  $y$ -intercept of the graph. Any two ordered pairs  $(x_1, y_1)$  and  $(x_2, y_2)$  that satisfy a linear equation can be used to compute the slope of the graph of the equation using the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . Substituting the coordinates of  $(120, 60)$  and  $(160, 80)$ , which lie on the line of best fit, into this formula gives  $m = \frac{80 - 60}{160 - 120}$ , which simplifies to  $\frac{20}{40}$ , or 0.5. Substituting this value for  $m$  in the slope-intercept form of the equation produces  $y = 0.5x + b$ . Substituting values from the ordered pair  $(120, 60)$  into this equation produces  $60 = 0.5(120) + b$ , so  $b = 0$ . Substituting this value for  $b$  in the slope-intercept form of the equation produces  $y = 0.5x + 0$ , or  $y = 0.5x$ .

Choices A, C, and D are incorrect and may result from an error in calculation when determining the slope of the line of best fit.

### QUESTION 25

**Choice A is correct.** The intersection point  $(x, y)$  of the two graphs can be found by multiplying the second equation in the system  $1.6x + 0.5y = -1.3$  by 3, which gives  $4.8x + 1.5y = -3.9$ . The  $y$ -terms in the equation  $4.8x + 1.5y = -3.9$  and the first equation in the system  $2.4x - 1.5y = 0.3$  have coefficients that are opposites. Adding the left- and right-hand sides of the equations  $4.8x + 1.5y = -3.9$  and  $2.4x - 1.5y = 0.3$

produces  $7.2x + 0.0y = -3.6$ , which is equivalent to  $7.2x = -3.6$ . Dividing both sides of the equation by 7.2 gives  $x = -0.5$ . Therefore, the  $x$ -coordinate of the intersection point  $(x, y)$  of the system is  $-0.5$ .

Choice B is incorrect. An  $x$ -value of  $-0.25$  produces  $y$ -values of  $-0.6$  and  $-1.8$  for each equation in the system, respectively. Since the same ordered pair doesn't satisfy both equations, neither point can be the intersection point. Choice C is incorrect. An  $x$ -value of  $0.8$  produces  $y$ -values of  $1.08$  and  $-5.16$  for each equation in the system, respectively. Since the same ordered pair doesn't satisfy both equations, neither point can be the intersection point. Choice D is incorrect. An  $x$ -value of  $1.75$  produces  $y$ -values of  $2.6$  and  $-8.2$  for each equation in the system, respectively. Since the same ordered pair doesn't satisfy both equations, neither point can be the intersection point.

### QUESTION 26

**Choice D is correct.** A model for a quantity that increases by  $r\%$  per time period is an exponential function of the form  $P(t) = I\left(1 + \frac{r}{100}\right)^t$ , where  $I$  is the initial value at time  $t = 0$  and each increase of  $t$  by 1 represents 1 time period. It's given that  $P(t)$  is the number of pollen grains per square centimeter and  $t$  is the number of years after the first year the grains were deposited. There were 310 pollen grains at time  $t = 0$ , so  $I = 310$ . This number increased 1% per year after year  $t = 0$ , so  $r = 1$ . Substituting these values into the form of the exponential function gives  $P(t) = 310\left(1 + \frac{1}{100}\right)^t$ , which can be rewritten as  $P(t) = 310(1.01)^t$ .

Choices A, B, and C are incorrect and may result from errors made when setting up an exponential function.

### QUESTION 27

**Choice A is correct.** Subtracting  $\left(\frac{2}{3}\right)(9x - 6)$  from both sides of the given equation yields  $-4 = \left(\frac{1}{3}\right)(9x - 6)$ , which can be rewritten as  $-4 = 3x - 2$ .

Choices B and D are incorrect and may result from errors made when manipulating the equation. Choice C is incorrect. This is the value of  $x$ .

### QUESTION 28

**Choice D is correct.** The graph of a quadratic function in the form  $f(x) = a(x - b)(x - c)$  intersects the  $x$ -axis at  $(b, 0)$  and  $(c, 0)$ . The graph will be a parabola that opens upward if  $a$  is positive and downward if  $a$  is negative. For the function  $f$ ,  $a = 1$ ,  $b = -3$ , and  $c = k$ . Therefore, the graph of the function  $f$  opens upward and intersects the  $x$ -axis at  $(-3, 0)$  and  $(k, 0)$ . Since  $k$  is a positive integer, the intersection point  $(k, 0)$  will have an  $x$ -coordinate that is a positive integer. The only graph that opens upward, passes through the point  $(-3, 0)$ , and has another  $x$ -intercept with a positive integer as the  $x$ -coordinate is choice D.

Choices A and B are incorrect. Both graphs open downward rather than upward. Choice C is incorrect. The graph doesn't pass through the point  $(-3, 0)$ .

### QUESTION 29

**Choice D is correct.** It's given that  $L$  is the femur length, in inches, and  $H$  is the height, in inches, of an adult male. Because  $L$  is multiplied by 1.88 in the equation, for every increase in  $L$  by 1, the value of  $H$  increases by 1.88. Therefore, the meaning of 1.88 in this context is that a man's height increases by approximately 1.88 inches for each one-inch increase in his femur length.

Choices A, B, and C are incorrect and may result from misinterpreting the context and the values the variables are representing.

### QUESTION 30

**Choice A is correct.** A segment can be drawn inside of quadrilateral  $ABCD$  from point  $B$  to point  $F$  (not shown) on segment  $AD$  such that segment  $BF$  is perpendicular to segment  $AD$ . This will create rectangle  $FBCD$  such that  $FB = CD$ . This will also create right triangle  $ABF$  such that  $FB = \frac{1}{2}AB$ . An acute angle in a right triangle has measure  $30^\circ$  if and only if the side opposite this angle is half the length of the hypotenuse. (Such a triangle is called a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle.) Since  $AB$  is the hypotenuse of right triangle  $ABF$  and  $FB = \frac{1}{2}AB$ , triangle  $ABF$  must be a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle and angle  $ABF$  must measure  $60^\circ$ . The measure of angle  $ABC$  equals the sum of the measures of angles  $ABF$  and  $FBC$ . Because angle  $FBC$  is in rectangle  $FBCD$ , it has a measure of  $90^\circ$ . Therefore, the measure of angle  $ABC$ , or angle  $B$  shown in the original figure, is  $60^\circ + 90^\circ = 150^\circ$ .

Choice B is incorrect and may result from identifying triangle  $ABF$  as a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle and the measure of angle  $ABF$  as  $45^\circ$ . Choice C is incorrect and may result from adding the measures of angles  $BAF$  and  $FBC$  rather than angles  $ABF$  and  $FBC$ . Choice D is incorrect and may result from finding the measure of angle  $D$  rather than angle  $B$ .

### QUESTION 31

**The correct answer is 6.** It's given that apples cost \$0.65 each and oranges cost \$0.75 each. If  $x$  is the number of apples, the cost for buying  $x$  apples is  $0.65x$  dollars. If  $y$  is the number of oranges, the cost for buying  $y$  oranges is  $0.75y$  dollars. Lynne has \$8.00 to spend; therefore, the inequality for the number of apples and oranges Lynne can buy is  $0.65x + 0.75y \leq 8.00$ . Since Lynne bought 5 apples,  $x = 5$ . Substituting 5 for  $x$  yields  $0.65(5) + 0.75y \leq 8.00$ , which can be rewritten as  $3.25 + 0.75y \leq 8.00$ . Subtracting 3.25 from both sides of the inequality yields  $0.75y \leq 4.75$ . Dividing both sides of this inequality by 0.75 yields  $y \leq 6.33$ . Therefore, the maximum number of whole oranges Lynne can buy is 6.

**QUESTION 32**

**The correct answer is 146.** According to the triangle sum theorem, the sum of the measures of the three angles of a triangle is  $180^\circ$ . This triangle is made up of angles with measures of  $a^\circ$ ,  $b^\circ$ , and  $c^\circ$ . Therefore,  $a + b + c = 180$ . Substituting 34 for  $a$  yields  $34 + b + c = 180$ . Subtracting 34 from each side of the equation yields  $b + c = 146$ .

**QUESTION 33**

**The correct answer is 2500.** The mean number of the list is found by dividing the sum of all the numbers in the list by the count of numbers in the list. It's given that the mean of the five numbers in this list is 1600; therefore,  $\frac{700 + 1200 + 1600 + 2000 + x}{5} = 1600$ . Multiplying both sides of this equation by 5 gives  $700 + 1200 + 1600 + 2000 + x = 8000$ . The left-hand side of this equation can be rewritten as  $5500 + x = 8000$ . Subtracting 5500 from both sides of this equation gives  $x = 2500$ .

**QUESTION 34**

**The correct answer is 34.** Substituting the values  $y = 17$  and  $x = a$  into the equation  $y = mx$  yields  $17 = ma$ . Solving for  $a$  gives  $a = \frac{17}{m}$ . This can be substituted for  $a$  in  $x = 2a$ , which yields  $x = 2\left(\frac{17}{m}\right)$ , or  $x = \frac{34}{m}$ . Substituting  $x = \frac{34}{m}$  into the equation  $y = mx$  yields  $y = m\left(\frac{34}{m}\right)$ . This equation can be rewritten as  $y = 34$ .

**QUESTION 35**

**The correct answer is  $\frac{5}{2}$ .** Applying the distributive property of multiplication on the left-hand side of  $a(x + b) = 4x + 10$  yields  $ax + ab = 4x + 10$ . If  $a(x + b) = 4x + 10$  has infinitely many solutions, then  $ax + ab = 4x + 10$  must be true for all values of  $x$ . It follows that  $ax = 4x$  and  $ab = 10$ . Since  $ax = 4x$ , it follows that  $a = 4$ . Substituting 4 for  $a$  in  $ab = 10$  yields  $4b = 10$ . Dividing both sides of  $4b = 10$  by 4 yields  $b = \frac{10}{4}$ , which simplifies to  $\frac{5}{2}$ . Either  $5/2$  or 2.5 may be entered as the correct answer.

**QUESTION 36**

**The correct answer is  $\frac{25}{4}$ .** If a line intersects a parabola at a point, the coordinates of the intersection point must satisfy the equation of the line and the equation of the parabola. Since the equation of the line is  $y = c$ , where  $c$  is a constant, the  $y$ -coordinate of the intersection point must be  $c$ . It follows then that substituting  $c$  for  $y$  in the equation for the parabola will result in another true equation:  $c = -x^2 + 5x$ . Subtracting  $c$  from both sides of  $c = -x^2 + 5x$  and then dividing both sides by  $-1$  yields  $0 = x^2 - 5x + c$ . The solution to this quadratic equation would give the  $x$ -coordinate(s) of the point(s) of intersection.

Since it's given that the line and parabola intersect at exactly one point, the equation  $0 = x^2 - 5x + c$  has exactly one solution. A quadratic equation in the form  $0 = ax^2 + bx + c$  has exactly one solution when its discriminant  $b^2 - 4ac$  is equal to 0. In the equation  $0 = x^2 - 5x + c$ ,  $a = 1$ ,  $b = -5$ , and  $c = c$ . Therefore,  $(-5)^2 - 4(1)(c) = 0$ , or  $25 - 4c = 0$ . Subtracting 25 from both sides of  $25 - 4c = 0$  and then dividing both sides by  $-4$  yields  $c = \frac{25}{4}$ . Therefore, if the line  $y = c$  intersects the parabola defined by  $y = -x^2 + 5x$  at exactly one point, then  $c = \frac{25}{4}$ . Either  $25/4$  or  $6.25$  may be entered as the correct answer.

### QUESTION 37

**The correct answer is 293.** It's given that a peregrine falcon's maximum speed while diving is 200 miles per hour and that 1 mile = 5280 feet. Therefore, a peregrine falcon's maximum speed while diving is  $\left(\frac{200 \text{ miles}}{1 \text{ hour}}\right)\left(\frac{5280 \text{ feet}}{1 \text{ mile}}\right) = 1,056,000$  feet per hour. There are 60 minutes in 1 hour and 60 seconds in each minute, so there are  $(60)(60) = 3600$  seconds in 1 hour. A peregrine falcon's maximum speed while diving is therefore  $\left(\frac{1,056,000 \text{ feet}}{1 \text{ hour}}\right)\left(\frac{1 \text{ hour}}{3600 \text{ seconds}}\right)$ , which is approximately 293.33 feet per second. To the nearest whole number, this is 293 feet per second.

### QUESTION 38

**The correct answer is 9.** If  $x$  is the number of hours it will take the falcon to dive 0.5 mile, then the speed of 200 miles per hour can be used to create the proportion  $\frac{200 \text{ miles}}{1 \text{ hour}} = \frac{0.5 \text{ mile}}{x \text{ hours}}$ . This proportion can be rewritten as  $x \text{ hours} = \frac{0.5 \text{ mile}}{200 \frac{\text{miles}}{\text{hour}}}$ , which gives  $x = 0.0025$ . There are 60 minutes in 1 hour and 60 seconds in each minute, so there are  $(60)(60) = 3600$  seconds in one hour. Therefore, 0.0025 hour is equivalent to  $(0.0025 \text{ hour})\left(\frac{3600 \text{ seconds}}{1 \text{ hour}}\right) = 9$  seconds.

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