

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.

The following passage is adapted from Leo Tolstoy's 1873 novel, *Anna Karenina* (translated from the original Russian by Constance Garnett). Prior to this excerpt, one of the major characters, Levin, has realized that he is in love with his longtime friend Kitty Shtcherbatsky.

At four o'clock, conscious of his throbbing heart, Levin stepped out of a hired sledge at the Zoological Gardens, and turned along the path to the frozen mounds and the skating ground, knowing that he
 (5) would certainly find her there, as he had seen the Shtcherbatskys' carriage at the entrance.

It was a bright, frosty day. Rows of carriages, sledges, drivers, and policemen were standing in the approach. Crowds of well-dressed people, with hats
 (10) bright in the sun, swarmed about the entrance and along the well-swept little paths between the little houses adorned with carving in the Russian style. The old curly birches of the gardens, all their twigs laden with snow, looked as though freshly decked in
 (15) sacred vestments.

He walked along the path towards the skating-ground, and kept saying to himself—"You mustn't be excited, you must be calm. What's the matter with you? What do you want? Be quiet, stupid," he
 (20) conjured his heart. And the more he tried to compose himself, the more breathless he found himself. An acquaintance met him and called him by his name, but Levin did not even recognize him. He went towards the mounds, whence came the clank
 (25) of the chains of sledges as they slipped down or were dragged up, the rumble of the sliding sledges, and the sounds of merry voices. He walked on a few steps, and the skating-ground lay open before his

eyes, and at once, amidst all the skaters, he knew her.
 (30) He knew she was there by the rapture and the terror that seized on his heart. She was standing talking to a lady at the opposite end of the ground. There was apparently nothing striking either in her dress or her attitude. But for Levin she was as easy to find
 (35) in that crowd as a rose among nettles. Everything was made bright by her. She was the smile that shed light on all round her. "Is it possible I can go over there on the ice, go up to her?" he thought. The place where she stood seemed to him a holy shrine, unapproachable, and there was one moment when he
 (40) was almost retreating, so overwhelmed was he with terror. He had to make an effort to master himself, and to remind himself that people of all sorts were moving about her, and that he too might come there
 (45) to skate. He walked down, for a long while avoiding looking at her as at the sun, but seeing her, as one does the sun, without looking.

On that day of the week and at that time of day people of one set, all acquainted with one another, used to meet on the ice. There were crack skaters
 (50) there, showing off their skill, and learners clinging to chairs with timid, awkward movements, boys, and elderly people skating with hygienic motives. They seemed to Levin an elect band of blissful beings
 (55) because they were here, near her. All the skaters, it seemed, with perfect self-possession, skated towards her, skated by her, even spoke to her, and were happy, quite apart from her, enjoying the capital ice and the fine weather.

(60) Nikolay Shtcherbatsky, Kitty's cousin, in a short jacket and tight trousers, was sitting on a garden seat with his skates on. Seeing Levin, he shouted to him:

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- “Ah, the first skater in Russia! Been here long?
(65) First-rate ice—do put your skates on.”
1. According to the passage, how did Levin first know that Kitty was at the Zoological Gardens?
 - A) Kitty's carriage was parked near the entrance.
 - B) Nikolay said he had been skating with Kitty earlier.
 - C) He saw her talking with another woman near the pond.
 - D) Kitty invited him to meet her there at a certain time.
 2. As used in line 10, “swarmed” most nearly means
 - A) invaded.
 - B) gathered.
 - C) flew.
 - D) obstructed.
 3. The passage most strongly suggests that which of the following is true of Levin?
 - A) He worries about his appearance.
 - B) He wishes he were more impressive.
 - C) He is an extremely passionate person.
 - D) He is wary of his surroundings.
 4. Which choice provides the best evidence for the answer to the previous question?
 - A) Lines 7–12 (“It was a bright, frosty day . . . in the Russian style”)
 - B) Lines 22–27 (“An acquaintance met him . . . merry voices”)
 - C) Lines 38–45 (“The place where . . . there to skate”)
 - D) Lines 48–53 (“On that day . . . hygienic motives”)
 5. What theme does the passage communicate through the experiences of Levin?
 - A) Love is a powerful emotion.
 - B) People long to have company.
 - C) Life should be filled with joy.
 - D) People are meant to work hard.
 6. The passage most strongly suggests that which of the following is true of how Levin appears to others?
 - A) People think that Levin looks agitated because of the way he is acting.
 - B) People think that Levin is sick because he seems to be feverish.
 - C) People think that Levin seems normal because he is doing nothing unusual.
 - D) People think that Levin is in trouble because he is not protecting himself emotionally.
 7. Which choice provides the best evidence for the answer to the previous question?
 - A) Lines 1–6 (“At four o'clock . . . at the entrance”)
 - B) Lines 9–12 (“Crowds . . . the Russian style”)
 - C) Lines 23–29 (“He went . . . he knew her”)
 - D) Lines 60–65 (“Nikolay Shtcherbatsky . . . your skates on”)
 8. As used in line 20, “conjured” most nearly means
 - A) begged.
 - B) created.
 - C) summoned.
 - D) tricked.

9. The author's use of the word "throbbing" in line 1 implies that Levin
- A) has cut himself badly.
 B) has a sudden pain in his chest.
 C) is about to collapse.
 D) is in an agitated state.
10. Based on the tone of this passage, what emotion does the author wish the reader to feel about Levin?
- A) Empathy
 B) Cynicism
 C) Hostility
 D) Disgust

Questions 11–20 are based on the following passage.

This passage is adapted from a speech delivered by President Franklin Roosevelt on January 6, 1941, to the United States Congress. In the passage, Roosevelt reveals his intention to preserve and spread American ideals around the world.

The Nation takes great satisfaction and much strength from the things which have been done to make its people conscious of their individual stake in the preservation of democratic life in America.

(5) Those things have toughened the fibre of our people, have renewed their faith and strengthened their devotion to the institutions we make ready to protect.

Certainly this is no time for any of us to stop thinking about the social and economic problems which are the root cause of the social revolution which is today a supreme factor in the world.

(10) For there is nothing mysterious about the foundations of a healthy and strong democracy. The basic things expected by our people of their political and economic systems are simple. They are:

- Equality of opportunity for youth and for others.
- Jobs for those who can work.
- Security for those who need it.
- The ending of special privilege for the few.

- (20) • The preservation of civil liberties for all.
- The enjoyment of the fruits of scientific progress in a wider and constantly rising standard of living.

These are the simple, basic things that must never be lost sight of in the turmoil and unbelievable complexity of our modern world. The inner and abiding strength of our economic and political systems is dependent upon the degree to which they fulfill these expectations.

Many subjects connected with our social economy call for immediate improvement.

(30) As examples:

- We should bring more citizens under the coverage of old-age pensions and unemployment insurance.
- We should widen the opportunities for adequate medical care.
- We should plan a better system by which persons deserving or needing gainful employment may obtain it.

I have called for personal sacrifice. I am assured of the willingness of almost all Americans to respond to that call.

A part of the sacrifice means the payment of more money in taxes. In my Budget Message I shall recommend that a greater portion of this great defense program be paid for from taxation than we are paying today. No person should try, or be allowed, to get rich out of this program; and the principle of tax payments in accordance with ability to pay should be constantly before our eyes to guide our legislation.

(45) If the Congress maintains these principles, the voters, putting patriotism ahead of pocketbooks, will give you their applause.

In the future days, which we seek to make secure, we look forward to a world founded upon four essential human freedoms.

(50) The first is freedom of speech and expression—everywhere in the world.

The second is freedom of every person to worship God in his own way—everywhere in the world.

(60) The third is freedom from want—which, translated into world terms, means economic

understandings which will secure to every nation a healthy peacetime life for its inhabitants—everywhere in the world.

- (65) The fourth is freedom from fear—which, translated into world terms, means a world-wide reduction of armaments to such a point and in such a thorough fashion that no nation will be in a position to commit an act of physical aggression against any neighbor—anywhere in the world.

That is no vision of a distant millennium. It is a definite basis for a kind of world attainable in our own time and generation. That kind of world is the very antithesis of the so-called new order of tyranny which the dictators seek to create with the crash of a bomb.

- (75) To that new order we oppose the greater conception—the moral order. A good society is able to face schemes of world domination and foreign revolutions alike without fear.

Since the beginning of our American history, we have been engaged in change—in a perpetual peaceful revolution—a revolution which goes on steadily, quietly adjusting itself to changing conditions—without the concentration camp or the quick-lime in the ditch. The world order which we seek is the cooperation of free countries, working together in a friendly, civilized society.

This nation has placed its destiny in the hands and heads and hearts of its millions of free men and women; and its faith in freedom under the guidance of God. Freedom means the supremacy of human rights everywhere. Our support goes to those who struggle to gain those rights or keep them.

- (85) Our strength is our unity of purpose. To that high concept there can be no end save victory.

11. Which phrase from the passage most clearly reflects President Roosevelt's purpose in making this speech?

- A) Lines 2–4 (“to make . . . democratic life”)
B) Lines 8–11 (“to stop thinking . . . the world”)
C) Lines 54–55 (“[to] look forward to . . . freedoms”)
D) Lines 79–80 (“to face . . . without fear”)

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

- A) Lines 13–15 (“The basic things . . . are simple”)
B) Lines 29–30 (“Many subjects . . . improvement”)
C) Lines 50–52 (“If the Congress . . . applause”)
D) Lines 53–55 (“In the future days . . . freedoms”)

13. As used in line 39, “sacrifice” most nearly means

- A) religious offerings to a deity.
B) service in the military.
C) losses of limbs in battle.
D) surrender of interests to a greater good.

14. The passage most strongly suggests a relationship between which of the following phenomena?

- A) Protection of human rights abroad and military service
B) Spread of freedom abroad and defense of democracy at home
C) Defeat of tyrants abroad and establishment of democratic government at home
D) Investment in global democracies abroad and strengthening of patriotism at home

15. Which choice provides the best evidence for the answer to the previous question?
- A) Lines 23–28 (“These are . . . expectations”)
 - B) Lines 50–52 (“If the Congress . . . applause”)
 - C) Lines 71–76 (“That is no . . . of a bomb”)
 - D) Lines 92–95 (“Freedom means . . . unity of purpose”)
16. In line 51, “pocketbooks” most nearly refers to
- A) local, state, and national taxes.
 - B) war debt accumulated by the nation.
 - C) citizens’ individual monetary interests.
 - D) Americans’ personal investment in the defense industry.
17. In lines 71–73 (“That is no . . . generation”), President Roosevelt is most likely responding to what implicit counterclaim to his own argument?
- A) The spread of global democracy is idealistic and unrealistic.
 - B) The defeat of tyrannical dictators in Europe is implausible.
 - C) The commitment of the American people to the war effort is limited.
 - D) The resources of the United States are insufficient to wage war abroad.
18. Which choice offers evidence that the spread of global democracy is achievable?
- A) Lines 46–47 (“No person . . . this program”)
 - B) Lines 54–55 (“we look forward . . . human freedoms”)
 - C) Lines 81–82 (“Since the beginning . . . in change”)
 - D) Line 95 (“Our strength . . . purpose”)
19. In lines 60–64 (“The third is . . . world”), President Roosevelt sets a precedent by which he would most likely support which of the following policies?
- A) Military defense of political borders
 - B) Investment in overseas business ventures
 - C) Aid to nations struggling due to conflict and other causes
 - D) Reduction of domestic services to spur job growth
20. The author refers to “the so-called new order of tyranny” primarily to
- A) connect the global conflict for human rights to citizens on a personal level.
 - B) demonstrate the power of the global opposition to the United States.
 - C) offer an alternative vision of the world without democracy.
 - D) provide examples of the political and social revolutions underway.

Questions 21–31 are based on the following passage and supplementary material.

The United States Constitution has been amended twenty-seven times since its ratification. Rights such as freedom of speech, religion, and press, for example, are granted by the First Amendment. This passage focuses on the Nineteenth Amendment, which gave women the right to vote.

The American political landscape is constantly shifting on a myriad of issues, but the voting process itself has changed over the years as well. Electronic ballot casting, for example, provides the public with
(5) instantaneous results, and statisticians are more accurate than ever at forecasting our next president. Voting has always been viewed as an intrinsic American right and was one of the major reasons for the nation's secession from Britain's monarchical
(10) rule. Unfortunately, although all men were constitutionally deemed "equal," true equality of the sexes was not extended to the voting booths until 1920.

The American women's suffrage movement began in 1848, when Elizabeth Cady Stanton and Lucretia
(15) Mott organized the Seneca Falls Convention. The meeting, initially an attempt to have an open dialogue about women's rights, drew a crowd of nearly three hundred women and included several dozen men. Topics ranged from a woman's role in society
(20) to law, but the issue of voting remained a contentious one. A freed slave named Frederick Douglass spoke eloquently about the importance of women in politics and swayed the opinion of those in attendance. At the end of the convention, one hundred
(25) people signed the Seneca Falls Declaration, which listed "immediate admission to all the rights and privileges which belong to [women] as citizens of the United States."

Stanton and Mott's first victory came thirty years
(30) later when a constitutional amendment allowing women to vote was proposed to Congress in 1878. Unfortunately, election practices were already a controversial issue, as unfair laws that diminished the African-American vote had been passed during
(35) Reconstruction. Questionable literacy tests and a "vote tax" levied against the poor kept minority turnout to a minimum. And while several states al-

lowed women to vote, federal consensus was hardly as equitable. The rest of the world, however, was
(40) taking note—and women were ready to act.

In 1893, New Zealand allowed women the right to vote, although women could not run for office in New Zealand. Other countries began reviewing and ratifying their own laws as well. The United King-
(45) dom took small steps by allowing married women to vote in local elections in 1894. By 1902, all women in Australia could vote in elections, both local and parliamentary.

The suffrage movement in America slowly built
(50) momentum throughout the early twentieth century and exploded during World War I. President Woodrow Wilson called the fight abroad a war for democracy, which many suffragettes viewed as hypocritical. Democracy, after all, was hardly worth fighting for
(55) when half of a nation's population was disqualified based on gender. Public acts of civil disobedience, rallies, and marches galvanized pro-women advocates while undermining defenders of the status quo. Posters read "Kaiser Wilson" and called into ques-
(60) tion the authenticity of a free country with unjust laws. The cry for equality was impossible to ignore and, in 1919, with the support of President Wilson, Congress passed the Nineteenth Amendment to the Constitution. It was ratified one year later by two-
(65) thirds of the states, effectively changing the Constitution. Only one signatory from the original Seneca Falls Declaration lived long enough to cast her first ballot in a federal election.

America's election laws were far from equal for
(70) all, as tactics to dissuade or prohibit African Americans from effectively voting were still routinely employed. However, the suffrage movement laid the groundwork for future generations. Laws, like people's minds, could change over time. The civil
(75) rights movement in the mid- to late twentieth century brought an end to segregation and so-called Jim Crow laws that stifled African-American advancement. The Voting Rights Act of 1965 was the final nail in the coffin; what emerged was a free nation
(80) guided by elections determined not by skin color or gender, but by the ballot box.

Women's Suffrage in the United States

- 1848 ▶ Seneca Falls Convention.
- 1878 ▶ 19th Amendment submitted; not ratified.
- 1911 ▶ Several states now grant women suffrage.
- 1914 ▶ Start of World War I.
- 1917 ▶ Picketing at the White House.
- 1918 ▶ Amendment passes in the House but fails in the Senate.
- 1919 ▶ Both the House and Senate pass the amendment.
- 1920 ▶ 19th Amendment ratified.

21. The stance the author takes in the passage is best described as that of
- A) an advocate of women's suffrage proposing a constitutional amendment.
 - B) a legislator reviewing the arguments for and against women's suffrage.
 - C) a scholar evaluating the evolution and impact of the women's suffrage movement.
 - D) a historian summarizing the motivations of women's suffrage leaders.
22. Lines 69–70 (“America’s election laws . . . equal for all”) most clearly support which explicit claim?
- A) The founders of the Constitution did not provide for free and fair elections.
 - B) The United States still had work to do to secure equal voting rights for some people.
 - C) Most women in the United States did not want suffrage and equal rights.
 - D) The women's suffrage movement perpetuated discriminatory voting laws.
23. Which choice provides the best evidence for the answer to the previous question?
- A) Lines 13–14 (“The American . . . in 1848”)
 - B) Lines 41–42 (“In 1893 . . . to vote”)
 - C) Lines 63–64 (“Congress . . . the Constitution”)
 - D) Lines 78–79 (“The Voting Rights Act . . . the coffin”)
24. As used in line 57, “galvanized” most nearly means
- A) displaced.
 - B) divided.
 - C) excited.
 - D) organized.
25. The main rhetorical effect of lines 73–74 (“Laws, like . . . could change”) is to
- A) connect the success of legislative reform with shifts in public sentiment.
 - B) dissuade reformers from focusing on grassroots activity rather than political campaigns.
 - C) evaluate the effectiveness of judicial rulings based on popular response to public polls.
 - D) reject the need for legal actions and court proceedings to attain social change.

26. As a whole, the passage most strongly suggests which conclusion?
- American government adapts to the changing needs and ideas of society.
 - The best-organized reform movements are most likely to achieve their goals.
 - The nation is more vulnerable to change during the confusion of wartime.
 - The civil rights movement would not have happened without women suffragists.
27. Which choice provides the best evidence for the answer to the previous question?
- Lines 3–7 (“Electronic ballot casting . . . our next president”)
 - Lines 7–10 (“Voting has . . . monarchical rule”)
 - Lines 15–19 (“The meeting . . . dozen men”)
 - Lines 74–78 (“The civil rights . . . advancement”)
28. The graphic most clearly illustrates which idea?
- The Nineteenth Amendment happened as a result of World War I.
 - The states slowed reform of national voting rights laws.
 - Women’s suffrage resulted from a slow evolution of events.
 - Acts of civil disobedience won support for suffrage in Congress.
29. In line 60, the word “authenticity” most nearly means
- reliability.
 - realism.
 - legitimacy.
 - truth.
30. The passage suggests that President Wilson contributed to the success of the women’s suffrage movement by
- circulating government propaganda in support of women’s suffrage.
 - framing the fight in World War I as a fight for democracy and freedom.
 - engaging in a foreign war to distract the nation from political debate.
 - working with legislators to write the Nineteenth Amendment.
31. The graphic helps support which statement referred to in the passage?
- Early women suffragists did not live to vote in national elections.
 - The Nineteenth Amendment passed within a few years of its introduction.
 - A majority of state representatives opposed women’s suffrage in 1918.
 - Many state governments approved suffrage before the federal government did.

Questions 32–42 are based on the following passages.

Passage 1

Coffee is a pillar of the world economy, generating both jobs and profits. The plant produced revenue to the tune of \$15.4 billion in 2013 alone.

- Line The coffee industry is also one of the world’s largest
 (5) employers, supporting 26 million employees. Because of the global importance of coffee, scientists at the University at Buffalo and their international colleagues were compelled to sequence the genome of the most popular coffee plant. In the genome lies
 (10) the secrets of the bold flavor that people around the world have come to enjoy daily, as well as the caffeine kick that comes along with it. This new genetic information can be used to expand the market by creating new types of coffee varieties. The results of
 (15) the study can also safeguard the existing industry. Scientists can now modify the genetic material of

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the coffee plant. Heartier strains of popular coffee types can be created so that they are resistant to drought, disease, and bugs.

- (20) Researchers began their work by sequencing the genome of the type of coffee that makes up 30 percent of all coffee production. The conclusions drawn from this study will help save money and resources during the coffee production process.
- (25) Researchers were able to isolate the genetic information of the enzymes in the coffee plant that produce caffeine. With this information, it may be possible to reduce or eliminate caffeine from coffee. This would remove a costly step in the current process
- (30) of extracting caffeine from the coffee beans, while expanding the coffee market to people who avoid caffeine for health reasons, such as high blood pressure or pregnancy. The same research team plans to sequence the genome of other types of coffee in the future. It is their hope that the information will benefit the coffee producer, consumer, and also the environment.

Passage 2

- The Gibbon Genome Sequencing Consortium has successfully sequenced the genome of the Northern
- (40) white-cheeked gibbon. Both gibbons and humans have DNA that changes during the course of their lifetime. Some DNA changes in humans are the result of mutations, which cause cancer and other diseases. The changes in gibbons' DNA have resulted
- (45) in many changes to the species over a very short period of time. Although gibbons are close relatives to humans, their DNA changes do not cause disease. Understanding the pattern of the gibbon genome might turn out to be very important to humans. If
- (50) these changes in DNA can be understood, scientists may be able to use the information to better understand human disease.

- Cancer and other genetic diseases are caused by faulty gene regulation. Scientists have sought to understand human biology through the lens of gibbon DNA
- (55) structures for some time. Until now, there has simply been too much information to analyze. The endless rearrangements made it difficult to align gibbon DNA to that of humans, but it has finally been accomplished.
- (60) Scientists discovered a piece of DNA that is unique to the gibbon species. Gibbons have a specific repeat

- element, or a piece of DNA that copies itself multiple times throughout the genome. Repeat elements, in both gibbons and humans, are related to the
- (65) maintenance of genetic structures. Scientists hope to be able to answer the question "Why can gibbon DNA rearrange itself without causing diseases—unlike humans' DNA?" If this complicated biological question can be solved, scientists may be able to work
- (70) backward in order to help stop cancer, heart failure, and other human disease related to genetic repeats.

32. Which of the following best describes the central idea of Passage 1?
- A) Advancements in genome sequencing will lead to healthier food options worldwide.
- B) Genome sequencing of coffee can increase the profitability of coffee as a commodity.
- C) Removing caffeine from coffee will allow more people to drink and enjoy coffee.
- D) The coffee trade is an important sector of the global economy.
33. The author of Passage 2 would most likely agree that
- A) instead of studying nonhuman animals, scientists should look for a way to stop human DNA from changing when it replicates itself.
- B) sequencing the genome of other nonhuman primates could yield results that would be beneficial to people.
- C) the benefits of genome sequencing of gibbons and other nonhuman animals does not justify the great expense and resources used.
- D) scientists will be able to cure cancer once the mystery is solved of how the DNA of gibbons replicates itself without causing disease.

34. Passage 1 most strongly suggests that
- the coffee industry will fail without new developments stemming from genome sequencing.
 - newly developed varieties of coffee plants are more expensive for consumers than are existing varieties.
 - future research will lead to developments that could increase the profitability for coffee producers.
 - genome sequencing of coffee plants could help scientists understand diseases that affect humans.
35. Which choice provides the best evidence for the answer to the previous question?
- Lines 5–9 (“Because of the global . . . coffee plant”)
 - Lines 16–17 (“Scientists can . . . coffee plant”)
 - Lines 20–22 (“Researchers began . . . coffee production”)
 - Lines 28–33 (“This would remove . . . pregnancy”)
36. Passage 2 most strongly suggests which of the following?
- The genetic makeup of the Northern white-cheeked gibbon is more similar to that of humans than to other primates.
 - More research is needed before the findings of scientists studying the DNA of gibbons can be used to cure disease in humans.
 - Many diseases and illnesses that affect humans can only be understood by studying the DNA of plants and other animals.
 - Cancer and other diseases can be eliminated completely if enough funding is given to scientific research.
37. Which choice provides the best evidence for the answer to the previous question?
- Lines 40–44 (“Both gibbons . . . diseases”)
 - Lines 54–56 (“Scientists have sought . . . some time”)
 - Lines 63–65 (“Repeat elements . . . genetic structures”)
 - Lines 68–71 (“If this . . . genetic repeats”)
38. Which of the following best summarizes a shared purpose of the two authors?
- To explain how genome sequencing in animals and plants can benefit people in unexpected ways
 - To summarize how genome sequencing has changed the field of medicine and the study of diseases
 - To inform readers about how scientific research can be applied to improving the world economy
 - To convince readers to support funding for research in genome sequencing of plants and animals
39. As used in line 8, “compelled” most nearly means
- forced.
 - driven.
 - required.
 - constrained.
40. As used in line 65, “maintenance” most nearly means
- preservation.
 - protection.
 - organization.
 - repair.

41. Which point is the author of Passage 1 trying to make by using the phrase “a pillar of the world economy” in line 1 to refer to the coffee industry?
- A) Research into the coffee plant is important and should be continued.
- B) The coffee industry plays a significant role in global economics.
- C) Many jobs will be lost if the coffee industry goes into decline.
- D) The coffee industry provides financial stability for millions of people worldwide.
42. Which of the following can reasonably be inferred based on the information in both passages?
- A) Studying the genomes of animals closely related to humans can help scientists learn about diseases that affect humans.
- B) Expanding the customer base of the coffee industry will lead to higher profits and increase the stability of the global economy.
- C) The scientists who study coffee and those who study gibbons could learn more by collaborating.
- D) The genomes of other plants and nonhuman animals hold secrets that can benefit people and are worthy of exploration.

Questions 43–52 are based on the following passage and supplementary material.

In 1948, Swiss chemist George de Mestral was impressed with the clinging power of burrs snagged in his dog's fur and on his pant legs after he returned from a hike. While examining the burrs under a
 Line (5) microscope, he observed many hundreds of small fibers that grabbed like hooks. He experimented with replicas of the burrs and eventually invented Velcro,[®] a synthetic clinging fabric that was first marketed as “the zipperless zipper.” In the 1960s,

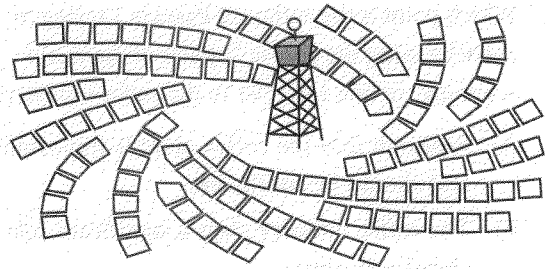
- (10) NASA used de Mestral's invention on space suits, and now, of course, we see it everywhere.
- You might say that de Mestral was the father of biomimicry, an increasingly essential field that studies nature, looking for efficiencies in materials and
 (15) systems, and asks the question “How can our homes, our electronics, our cities work better?” As one biomimetics company puts it: “Nature is the largest laboratory that ever existed and ever will.”
- Architecture is one field that is constantly
 (20) exploring new ways to incorporate biomimicry. Architects have studied everything from beehives to beaver dams to learn how to best use materials, geometry, and physics in buildings. Termite mounds,
 (25) for example, very efficiently regulate temperature, humidity, and airflow, so architects in Zimbabwe are working to apply what they've learned from termite mounds to human-made structures.
- Says Michael Pawlyn, author of *Biomimicry in Architecture*, “If you look beyond the nice shapes
 (30) in nature and understand the principles behind them, you can find some adaptations that can lead to new, innovative solutions that are radically more resource-efficient. It's the direction we need to take in the coming decades.”
- (35) Designers in various professional fields are drawing on biomimicry; for example, in optics, scientists have examined the surface of insect eyes in hopes of reducing glare on handheld device screens. Engineers in the field of robotics worked to replicate the
 (40) property found in a gecko's feet that allows adhesion to smooth surfaces.
- Sometimes what scientists learn from nature isn't more advanced, but simpler. The abalone shrimp, for example, makes its shell out of calcium carbonate,
 (45) the same material as soft chalk. It's not a rare or complex substance, but the unique arrangement of the material in the abalone's shell makes it extremely tough. The walls of the shell contain microscopic pieces of calcium carbonate stacked like bricks,
 (50) which are bound together using proteins just as concrete mortar is used. The result is a shell three thousand times harder than chalk and as tough as Kevlar[®] (the material used in bullet-proof vests).

Often it is necessary to look at the nanoscale structures of a living material's exceptional properties in order to re-create it synthetically. Andrew Parker, an evolutionary biologist, looked at the skin of the thorny devil (a type of lizard) under a scanning electron microscope, in search of the features that let the animal channel water from its back to its mouth.

Examples like this from the animal world abound. Scientists have learned that colorful birds don't always have pigment in their wings but are sometimes completely brown; it's the layers of keratin in their wings that produce color. Different colors, which have varying wavelengths, reflect differently through keratin. The discovery of this phenomenon can be put to use in creating paints and cosmetics that won't fade or chip. At the same time, paint for outdoor surfaces can be made tougher by copying the structures found in antler bone. Hearing aids are being designed to capture sound as well as the ears of the *Ormia* fly do. And why can't we have a self-healing material like our own skin? Researchers at the Beckman Institute at the University of Illinois are creating just that; they call it an "autonomic materials system." A raptor's feathers, a whale's fluke, a mosquito's proboscis—all have functional features we can learn from.

The driving force behind these innovations, aside from improved performance, is often improved energy efficiency. In a world where nonrenewable energy resources are dwindling and carbon emissions threaten the planet's health, efficiency has never been more important. Pawlyn agrees: "For me, biomimicry is one of the best sources of innovation to get to a world of zero waste because those are the rules under which biological life has had to exist."

Biomimicry is a radical field and one whose practitioners need to be radically optimistic, as Pawlyn is when he says, "We could use natural products such as cellulose, or even harvest carbon from the atmosphere to create bio-rock."



Tiny florets in a sunflower's center are arranged in an interlocking spiral, which inspired engineers in the design of this solar power plant. Mirrors positioned at the same angle as the florets bounce light toward the power plant's central tower.

Adapted from David Ferris, "Innovate: Solar Designs from Nature." © 2014 by Sierra Club.

43. The central idea of the passage is primarily concerned with
- the field of biomimicry, the study of materials and systems found in nature and replicated in ways that benefit people.
 - the work of George de Mestral, the Swiss chemist who invented Velcro® after observing burrs under a microscope.
 - the ways in which architects use termite mounds as models for human-made structures in Zimbabwe.
 - how scientists are seeking ways to improve energy efficiency as nonrenewable energy sources decline.
44. Which choice provides the best evidence for the answer to the previous question?
- Lines 1–6 ("In 1948 . . . hooks")
 - Lines 12–18 ("You might say . . . ever will")
 - Lines 23–27 ("Termite mounds . . . structures")
 - Lines 80–85 ("The driving . . . more important")

45. The author includes a quote in paragraph 4 in order to
- A) explain why architects are looking to biomimicry for solutions in architecture.
 - B) provide an argument for more scientists to study biomimicry.
 - C) give an explanation as to why someone might choose a career in architecture.
 - D) provide a counterargument to the author's central claim.
46. Based on the information in paragraph 6, how does the shell of an abalone shrimp compare with soft chalk?
- A) The essential building blocks are arranged in a similar manner, but the material that makes up the shell of an abalone shrimp is harder.
 - B) Both are made from the same essential building blocks, but the shell of the abalone shrimp is much harder because of the manner in which the materials are arranged.
 - C) The essential building blocks of both are the same, but the abalone shrimp shell is harder because the soft chalk lacks a protein binding the materials together.
 - D) They are made from different essential building blocks, but they have a similar hardness because the materials are arranged in a similar manner.
47. In paragraph 9, what is the most likely reason that the author included the quote from Pawlyn about efficiency?
- A) To convince readers that Pawlyn is an expert in his field
 - B) To prove that great strides are being made in creating products that do not generate waste
 - C) To demonstrate the limits of what biomimicry can achieve
 - D) To support the statement that energy efficiency "has never been more important"
48. In line 30, "principles" most nearly means
- A) sources.
 - B) attitudes.
 - C) standards.
 - D) theories.
49. It can be reasonably inferred from the passage that
- A) more scientists will utilize solutions developed through biomimicry in the future.
 - B) the field of biomimicry will eventually decline as more nonrenewable resources are discovered.
 - C) scientists will leave the fields they are currently working in and begin research in biomimicry.
 - D) doctors will create a self-healing skin called an "autonomic materials system" using methods based in biomimicry.

50. Which choice provides the best evidence for the answer to the previous question?
- A) Lines 35–38 (“Designers . . . screens”)
 - B) Lines 54–56 (“Often it is . . . synthetically”)
 - C) Lines 61–79 (“Examples like . . . learn from”)
 - D) Lines 89–94 (“Biomimicry . . . bio-rock”)

51. As used in line 90, “radical” most nearly means
- A) pervasive.
 - B) drastic.
 - C) essential.
 - D) revolutionary.

52. The graphic and caption that accompany this passage help illustrate how biomimicry can be used to
- A) make a solar plant more attractive.
 - B) decrease waste generated by energy sources.
 - C) improve the efficiency of existing models.
 - D) replicate a pattern common in nature.

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT TURN TO ANY OTHER SECTION IN THE TEST.

STOP

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.

The Age of the Librarian

When Kristen Harris **1** is in college, she worked in her university's library and was constantly told, “You really should be studying to be a librarian; this is **2** your home” however Harris was pursuing a bachelor's degree in elementary education at the time. Little did she realize that becoming a school librarian was indeed **3** elective. During the 21st century, the age of information, what could be more necessary than an individual trained to gather, process, and disseminate information? So, after teaching children in the classroom, Harris went back to school to earn her Master of Library Science degree.

1. A) NO CHANGE
B) has been
C) was
D) had been
2. A) NO CHANGE
B) your home,” however Harris
C) your home.”; However Harris
D) your home.” However, Harris
3. A) NO CHANGE
B) imminent
C) threatening
D) optional

Today, Harris is preparing a story time for a group of young students. As it has done with everything else, the technology revolution has elevated the school library to "Library 2.0," and Harris's tablet-integrated story time begins when she projects images for *The Very Cranky Bear* onto a projector screen. As a child, Harris got excited whenever a puppet appeared during story time, but now she uses an interactive app (application software) to enhance her own story time and 4 integrate this next generation of children.

As she introduces the children to the problem of cheering up a cranky 5 bear, Harris sees Miguel scouring the library shelves for another book by a popular author. 6 Miguel had said asking Harris for a book two weeks earlier "If you have any funny stories, I like those."

- 4. A) NO CHANGE
- B) enervate
- C) energize
- D) elucidate

- 5. A) NO CHANGE
- B) bear; Harris sees Miguel
- C) bear: Harris sees Miguel
- D) bear Harris sees Miguel

- 6. A) NO CHANGE
- B) Miguel had said, "If you have any funny stories, I like those, "asking Harris for a book two weeks earlier.
- C) Asking Harris for a book two weeks earlier, Miguel had said, "If you have any funny stories, I like those."
- D) Miguel asked Harris for a book two weeks earlier had said, "If you have any funny stories, I like those."

“It will always be satisfying,” reflects Harris, “the act of finding books for students and having them return to say, ‘I really liked that one. Are there any more by that author?’”

7 These days, Harris would call herself a media mentor as much as a librarian because she regularly visits her favorite websites for reviews of apps and other digital tools to suggest to students and parents. Librarians have always been an important resource for families in a community, but this importance has grown exponentially because of the advent of technology. Librarians are offering guidance about new media to address the changing information needs in our communities. Furthermore, libraries are becoming increasingly technology driven, for example,

7. Which sentence could be added to the paragraph to most effectively establish its main idea?

- A) Harris maintains active profiles on multiple social media networks to better connect with her students.
- B) The role of the school librarian has changed rapidly to meet the needs of students who are digital citizens.
- C) Librarians still perform many traditional tasks such as putting great literature in the hands of their students.
- D) In the future, many school libraries are unlikely to have books on the shelves because students prefer electronic media.

8. enabling access to collections of other libraries, offering remote access to databases, or they house video production studios. So, in Harris's opinion, librarians must be masters of the digital world.

Harris finishes her story time and heads across the library. A young student stops her and asks, "Ms. Harris, what's new in the library?"

8. A) NO CHANGE
 B) by enabling access to collections of other libraries, offering remote access to databases, or by housing video production studios.
 C) they enable access to collections of other libraries, offering remote access to databases, or they house video production studios.
 D) enabling access to collections of other libraries, offering remote access to databases, or housing video production studios.

9. Which sentence would provide evidence to effectively support the main idea of the paragraph?
- A) Harris sponsors a weekly "Fun Read" book discussion club that is well attended by many of the students at her school.
 B) Librarians continue to help students and teachers locate the perfect book in the library's collection.
 C) Teachers frequently ask Harris to recommend educational apps to support early literacy for their students.
 D) Many parents are concerned with online safety and digital citizenship due to the proliferation of social media.

10. She chuckles and thinks about the many collections, services, and programs their school library offers. "Have you seen the Trendy 10 list? You read the books on the list and blog 11 your ideas about them. I'll set you up with a password and username so you can blog," says Harris. In this library full of information, she's the gatekeeper.

Questions 12–22 are based on the following passage.

Unforeseen Consequences: The Dark Side of the Industrial Revolution

There is no doubt that the Industrial Revolution guided America through the nascent stages of independence 12 and into being a robust economic powerhouse. Inventions like the cotton gin revolutionized the textile industry, and the steam engine ushered in the advent of expeditious cross-country distribution.

The Industrial Revolution marked a shift from an agrarian to an industry-centered society. People eschewed farming in favor of 13 more lucrative enterprises in urban areas which put a strain on existing local resources. Necessary goods such as 14 food crops, vegetables, and meat products also had to be shipped in order to meet the dietary needs of a consolidated population. And because there were fewer people farming, food had to travel farther and in higher quantities to meet demand.

Issues like carbon dioxide emissions, therefore, arose not only as byproducts of industrial production but also from the delivery of these products. As a result, booming metropolises needed additional lumber, metal, and coal shipped from rural areas to sustain population and industrial growth.

10. A) NO CHANGE
B) He chuckles
C) Harris chuckles
D) They chuckle
11. A) NO CHANGE
B) they're
C) you're
D) their
12. A) NO CHANGE
B) and into the role of a robust economic powerhouse.
C) and turned into a robust economic powerhouse.
D) and then became a robust economic powerhouse.
13. A) NO CHANGE
B) more lucrative enterprises in urban areas, which put a strain on
C) more lucrative enterprises in urban areas; which put a strain on
D) more lucrative enterprises in urban areas. Which put a strain on
14. A) NO CHANGE
B) food
C) food crops
D) vegetables and meat products

15 [1] The negative effects of such expansion on humans were immediately apparent. Improper water sanitization led to cholera outbreaks in big cities. [2] Miners suffered from black lung after spending hours harvesting coal in dark caverns. [3] Combusted fossil fuels 16 released unprecedented amounts of human-made carbon dioxide into the air, resulting in respiratory ailments. [4] The fact remains that smog, now an internationally recognized buzzword, simply did not exist before the factories that produced it.

The critical impact on the environment must also 17 be taken into account. Proper regulations were either not in place or not enforced.

15. To effectively transition from paragraph 2, which sentence should begin paragraph 3?

- A) Sentence 1
- B) Sentence 2
- C) Sentence 3
- D) Sentence 4

16. Which graphic would best support the underlined claim?

- A) A line graph plotting an increase in atmospheric carbon dioxide over time
- B) A pie chart comparing the present percentages of carbon dioxide and other atmospheric gases
- C) A timeline tracking carbon dioxide emissions testing dates
- D) A bar graph showing levels of atmospheric carbon dioxide in different locations

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

- A) be taken into account, and proper regulations
- B) be taken into account since without proper regulations
- C) be taken into account, as proper regulations
- D) be taken into account; however, proper regulations

Industrial waste was often disposed of in the nearest river or buried in landfills, where it **18** polluted groundwater essential for wildlife to thrive. Deforestation across the United States served the dual purpose of providing inhabitable land and wood, but it also caused animals to migrate or die out completely.

Although the Industrial Revolution heralded an age of consumer ease and excess, it also invited a cyclical process of destruction and reduced resources. **19** Greenhouse gases were released into the atmosphere. Numerous health problems caused by **20** depressing working conditions prevented rural emigrants from thriving. And the environment that had cradled humankind since its inception was slowly being **21** degraded.

All in the name of progress. **22**

- 18. A) NO CHANGE
- B) disturbed
- C) drained
- D) enhanced

19. Which choice should be added to the end of the underlined sentence to better support the claim in the preceding sentence?

- A) NO CHANGE
- B) while carbon dioxide-consuming trees were cut down to make way for new living spaces.
- C) and caused an increase in global temperatures as well as a rise in coastal sea levels.
- D) faster than they could be absorbed by the atmosphere's shrinking ozone layer.

- 20. A) NO CHANGE
- B) urban
- C) substandard
- D) developing

- 21. A) NO CHANGE
- B) degraded; all
- C) degraded! All
- D) degraded—all

22. Which choice most effectively states the central idea of the essay on the previous page?

- A) The Industrial Revolution created a new consumer society that replaced the existing farming society.
- B) Politicians and historians today disagree about the true consequences of the Industrial Revolution.
- C) Although some analysts suggest that industrialization had many problems, its immense benefits outweigh these concerns.
- D) Unfortunately, progress came at the expense of environmental and ecological preservation and may well have ruined the future that once looked so bright.

Questions 23–33 are based on the following passage.

Remembering Freud

Psychology has grown momentarily over the past century, largely due to the influence of Sigmund Freud, a pioneer of the field. This Austrian-born neurologist founded the practice of psychoanalysis and **23** began scientific study of the unconscious mind. **24** Since his career which ended in the mid-twentieth century, Freud has remained a common cultural and scientific reference point.

- 23. A) NO CHANGE
- B) continued
- C) spearheaded
- D) led to
- 24. A) NO CHANGE
- B) Since his career, which ended in the mid-twentieth century, Freud has remained
- C) Since his career ending in the mid-twentieth century; Freud has remained
- D) Since his career (ending in the mid-twentieth century) Freud has remained



25. Even the abiding popularity of terms such as “id,” “ego,” or talking about a “Freudian slip” serves to indicate how this psychologist lingers powerfully in Western memory.

As neuroscience has progressed, many early practices and theories, including some of Freud’s, have been dismissed as outdated, unscientific, or even harmful. Much of Freud’s theory, clinical practice, and even lifestyle are now discredited. But when considered in his historical context, alongside the astounding progress catalyzed by his work, Freud’s contribution was significant indeed.

26. Because he is now widely referred to as the Father of Psychoanalysis, Freud was among the first to develop the now-commonplace psychological method of inviting patients to freely speak. For Freud, this was both study and treatment. It helped doctors to understand patients, but more importantly it helped patients to understand themselves. Freud employed the classic (now largely outdated) psychiatric style in which the patient lies face-up on a clinical bed, allegedly enabling access to deep 27. parts of the mind. These recesses, better known as the unconscious or subconscious, fascinated Freud.

25. A) NO CHANGE
 B) Even the abiding popularity of terms such as the “id,” “ego,” or a “Freudian slip”
 C) Even the abiding popularity of terms such as talking about an “id,” “ego,” or “Freudian slip”
 D) Even the abiding popularity of terms such as “id,” “ego,” or “Freudian slip”

26. A) NO CHANGE
 B) Widely remembered as the Father of Psychoanalysis, Freud was among the first to develop the now-commonplace psychological method of inviting patients to freely speak.
 C) Freud was among the first to develop the now-commonplace psychological method of inviting patients to freely speak, which is why he is now widely remembered as the Father of Psychoanalysis.
 D) Although he is widely remembered as the Father of Psychoanalysis, Freud was among the first to develop the now-commonplace psychological method of inviting patients to freely speak.

27. A) NO CHANGE
 B) recesses
 C) places
 D) components

28. He believed that uncovering repressed memories, was necessary for recovery. For Freud, understanding the activity of the innermost mind was essential. 29. In dealing with the conditions of patients, like neurosis or other psychological trauma, he suspected that there was a great deal going on beneath the "surface" of the psyche. He thought it was possible to reunite external, or conscious, thought with the internal,

- 28. A) NO CHANGE
- B) He believed that uncovering repressed memories, being necessary for recovery.
- C) He believed that uncovering repressed memories was necessary for recovery.
- D) He believed that uncovering, repressed memories was necessary for recovery.

- 29. A) NO CHANGE
- B) In dealing with patients' conditions, like neurosis or other psychological trauma, he suspected that
- C) In dealing with patients like neurosis or other psychological trauma conditions he suspected that
- D) He suspected that, in dealing with patients' conditions like neurosis or other psychological trauma,

or unconscious. **30** Moreover, the method of inviting patients to speak and process their thoughts aloud remains central to today's psychological practice.

Freud altered the course of twentieth-century medicine by initiating what would become a grand, global conversation about the **31** still vastly mysterious human mind before Freud, medicine had barely scratched the surface in understanding mental health. Patients were met with very few answers, let alone recovery protocols. **32** Through trial and error—scientific method in action—Freud's finding of a method that seemed to work.

30. Which detail would provide the best support for the ideas presented in this section?

- A) At the same time that Freud practiced, many people were interested in spiritualism.
- B) Freud lived and worked mostly in London although he had originally trained in Austria.
- C) While some of Freud's more unusual practices have been criticized or abandoned, his interest in the unconscious altered the trajectory of the field.
- D) Psychologists today employ many theories, not just those developed by Freud.

31. A) NO CHANGE

- B) still vastly mysterious human mind. Before Freud, medicine
- C) still vastly mysterious human mind, before Freud, medicine
- D) still vastly mysterious human mind before Freud. Medicine

32. A) NO CHANGE

- B) Through trial and error—scientific method in action—Freud's finding a method that seems to work.
- C) Through trial and error—scientific method in action—Freud finds a method that seemed to work.
- D) Through trial and error—scientific method in action—Freud found a method that seemed to work.

Since then, decades of ever-sharpening science have used his work as a launching pad. Therefore, as long as occasions arise to celebrate the progress of the field, Sigmund Freud will be remembered for groundbreaking work that enabled countless advances.

Questions 34–44 are based on the following passage and supplementary material.

Success in Montreal

The Montreal Protocol on Substances That Deplete the Ozone Layer is an international treaty that was created to ensure that steps would be taken to reverse damage to Earth's ozone layer and preventing future damage. It was signed in 1987. This document created restrictions on chemicals that were known to be dangerous to the protective barrier that the ozone layer offers Earth. Without the ozone layer, the sun's dangerous UV rays would alter our climate so drastically, life on land and in water would cease to exist.

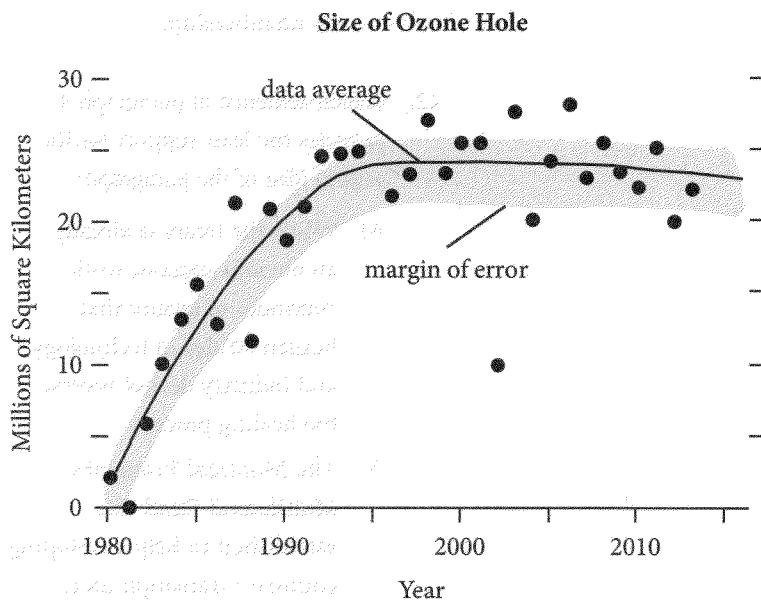
- 33. A) NO CHANGE
- B) the field; Sigmund Freud will be remembered for groundbreaking work that
- C) the field Sigmund Freud will be remembered for groundbreaking work that
- D) the field Sigmund Freud will be remembered for groundbreaking work, and that

- 34. A) NO CHANGE
- B) to prevent
- C) prevented
- D) was preventing

- 35. Which choice most effectively combines the sentences in the underlined portion?
- A) Signed in 1987, this document
- B) Because it was signed in 1987, this document
- C) It was signed in 1987, and this document
- D) It was signed in 1987 so this document

A hole in Earth's ozone layer was discovered over Antarctica **36** as long as two years prior to the signing of the treaty. The discovery brought the human impact on the environment to the forefront of **37** international conversation, the massive hole was evidence that a global response was necessary and that large-scale action was needed. The Montreal Protocol became effective January 1, 1989, and nearly 100 gases deemed dangerous to the ozone layer have been phased out. As a result, **38** the size of the ozone hole decreased significantly during the 1990s.

Now that a substantial amount of time has passed since the treaty was put into place, the effects can begin to be **39** looked at. As a part of the treaty, the Montreal Protocol's Scientific Assessment Panel was created to gauge **40** their effect on the hole in the ozone layer.



Adapted from Ozone Hole Watch, NASA Goddard Space Flight Center.

36. A) NO CHANGE
 B) long ago, two years prior
 C) two years prior
 D) years prior
37. A) NO CHANGE
 B) international conversation, yet the massive hole
 C) international conversation. The massive hole
 D) international conversation, so the massive hole
38. Which choice completes the sentence with accurate data based on the graphic?
 A) NO CHANGE
 B) the average size of the ozone hole leveled off beginning in the 1990s.
 C) the average size of the ozone hole decreased beginning in the 2000s.
 D) the average size of the ozone hole increased beginning in the 1980s.
39. A) NO CHANGE
 B) controlled.
 C) measured.
 D) governed.
40. A) NO CHANGE
 B) its
 C) it's
 D) there

The Panel has since reported the results every four years. The Panel predicts that the ozone layer will return to its former state of health by 2060-2075. **11**

While the treaty is already an obvious success, work continues to ensure that human strides in technology and industry do not reverse the healing process. The Montreal Protocol's Multilateral Fund was established to help developing countries transition away from the consumption and production of harmful chemicals. So far, over \$3 billion has been invested by the Fund. The developing countries are referred to as "Article 5 countries." **12**

41. Which choice could be added to paragraph 3 to most effectively convey its central idea?

- A) It is the Panel's current estimation that the ozone layer is beginning to heal, but the rate of progress is slow.
- B) The Panel meets once a year to assess the increase or decrease of each gas that has been identified as dangerous.
- C) Of much concern to the Panel was the effect of ultraviolet radiation on the ozone layer.
- D) The Panel has recently updated procedures for the nomination and selection of its membership.

42. Which sentence in paragraph 4 provides the least support for the central idea of the paragraph?

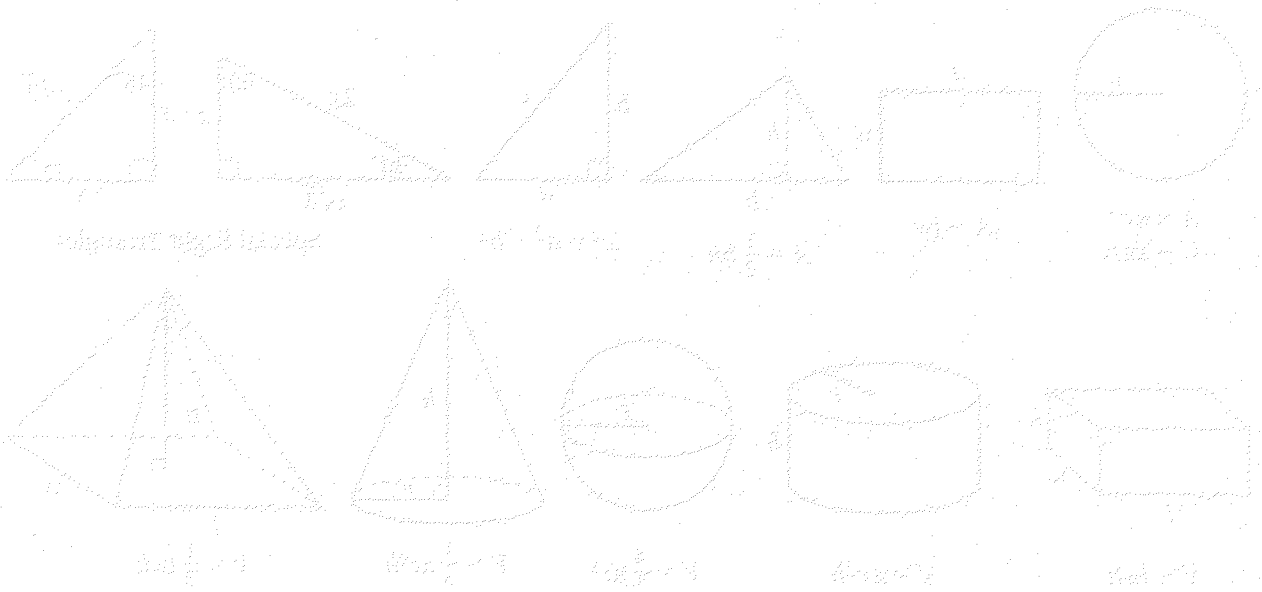
- A) While the treaty is already an obvious success, work continues to ensure that human strides in technology and industry do not reverse the healing process.
- B) The Montreal Protocol's Multilateral Fund was established to help developing countries transition away from the consumption and production of harmful chemicals.
- C) So far, over \$3 billion has been invested by the Fund.
- D) The developing countries are referred to as "Article 5 countries."

GO ON TO THE NEXT PAGE 

[1] The Montreal Protocol is a living document. [2] A current amendment proposition has been put forth by the United States, Mexico, and Canada jointly. [3] It aims to cut down on harmful gases that were put into use as an alternative to the gases specified in the original Montreal Protocol treaty. [4] It has been amended four times since its inception. [5] Combating the erosion of our ozone layer will take time and flexibility, but the research is clear: If humans stay conscious of what we emit into the atmosphere, we can not only stall the damage we have done in the past, but we can **43** change it. **44**

43. A) NO CHANGE
 B) switch
 C) invert
 D) reverse

44. For the sake of cohesion of this paragraph, sentence 4 should be placed
 A) where it is now.
 B) before sentence 1.
 C) after sentence 1.
 D) before sentence 3.



IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT TURN TO ANY OTHER SECTION IN THE TEST. **STOP**

MATH TEST

25 Minutes—20 Questions

NO-CALCULATOR SECTION

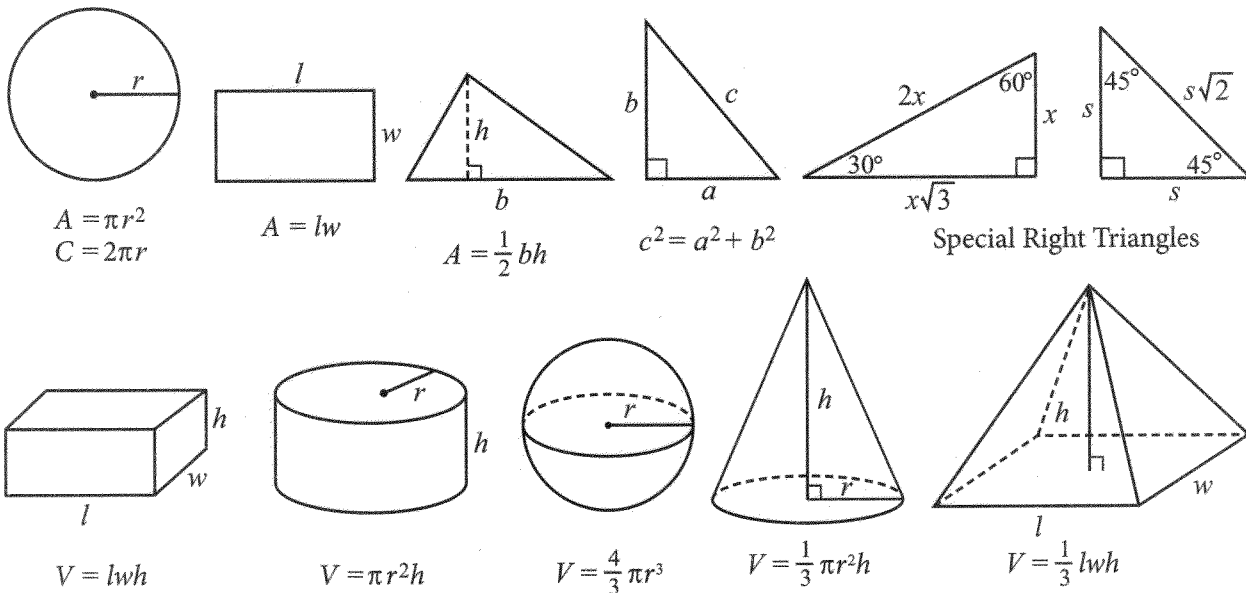
Turn to Section 3 of your answer sheet to answer the questions in this section.

Directions: For this section, solve each problem and decide which is the best of the choices given. Fill in the corresponding oval on the answer sheet. You may use any available space for scratch work.

Notes:

1. Calculator use is NOT permitted.
2. All numbers used are real numbers.
3. All figures used are necessary to solving the problems that they accompany. All figures are drawn to scale EXCEPT when it is stated that a specific figure is not drawn to scale.
4. Unless stated otherwise, the domain of any function f is assumed to be the set of all real numbers x , for which $f(x)$ is a real number.

Information:

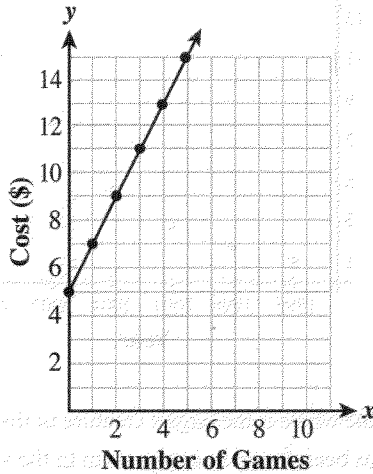


The sum of the degree measures of the angles in a triangle is 180.

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

The number of radians of arc in a circle is 2π .

GO ON TO THE NEXT PAGE



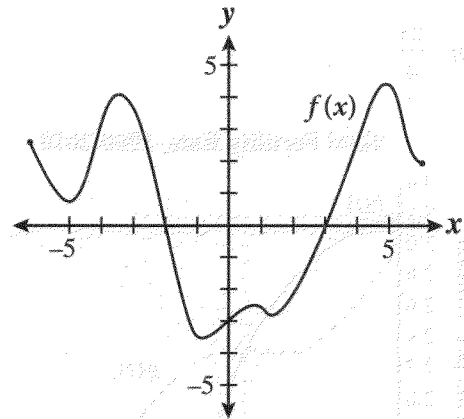
1. The graph above shows the amount that a new, high-tech video arcade charges its customers. What could the y -intercept of this graph represent?
- A) The cost of playing 5 games
 - B) The cost per game, which is \$5
 - C) The entrance fee to enter the arcade
 - D) The number of games that are played

$$\frac{3x}{x+5} \div \frac{6}{4x+20}$$

2. Which of the following is equivalent to the expression above, given that $x \neq -5$?
- A) $2x$
 - B) $\frac{x}{2}$
 - C) $\frac{9x}{2}$
 - D) $2x + 4$

$$(x+3)^2 + (y+1)^2 = 25$$

3. The graph of the equation above is a circle. What is the area, in square units, of the circle?
- A) 4π
 - B) 5π
 - C) 16π
 - D) 25π



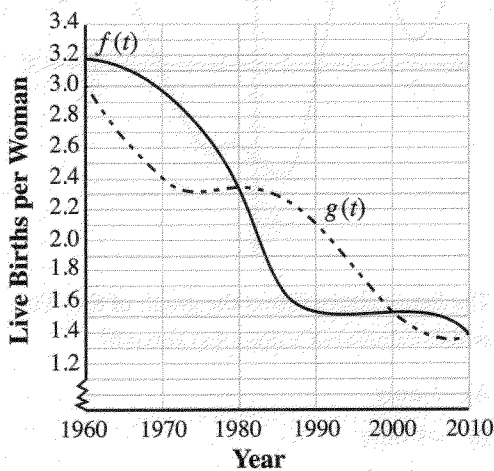
4. The figure above shows the graph of $f(x)$. For which value(s) of x does $f(x)$ equal 0?
- A) 3 only
 - B) -3 only
 - C) -2 and 3
 - D) -3, -2, and 3

$$\frac{4(d+3)-9}{8} = \frac{10-(2-d)}{6}$$

5. In the equation above, what is the value of d ?

- A) $\frac{23}{16}$
- B) $\frac{23}{8}$
- C) $\frac{25}{8}$
- D) $\frac{25}{4}$

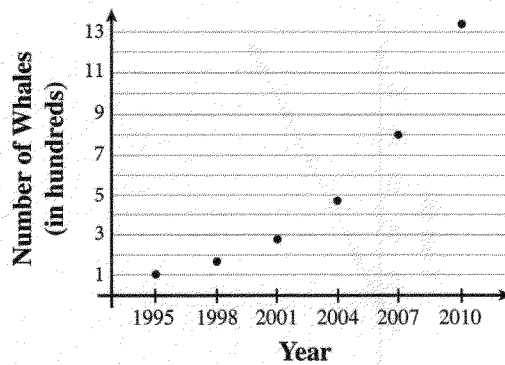
Total Fertility Rate, 1960-2010



Source: Data from Eurostat.

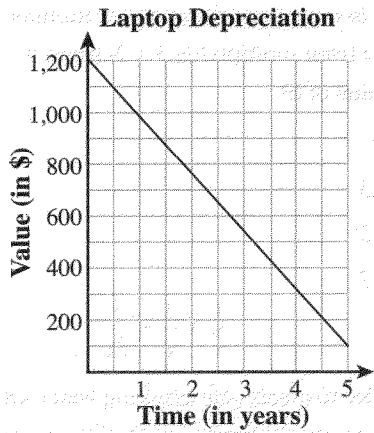
6. One indicator of a declining economy is a continued decline in birth rates. In 2010, birth rates in Europe were at an all-time low, with the average number of children that a woman has in her lifetime at well below two. In the figure above, $f(t)$ represents birth rates for Portugal between 1960 and 2010, and $g(t)$ represents birth rates in Slovakia for the same time period. For which value(s) of t is $f(t) > g(t)$?

- A) $1960 < t < 1980$ only
- B) $1980 < t < 2000$ only
- C) $1960 < t < 1980$ and $1990 < t < 2000$
- D) $1960 < t < 1980$ and $2000 < t < 2010$



7. The blue whale is the largest creature in the world and has been found in every ocean in the world. A marine biologist surveyed the blue whale population in Monterey Bay, off the coast of California, every three years between 1995 and 2010. The figure above shows her results. If w is the number of blue whales present in Monterey Bay and t is the number of years since the study began in 1995, which of the following equations best represents the blue whale population of Monterey Bay?

- A) $w = 100 + 2t$
- B) $w = 100 + \frac{t^2}{4}$
- C) $w = 100 \times 2^t$
- D) $w = 100 \times 2^{\frac{t}{4}}$

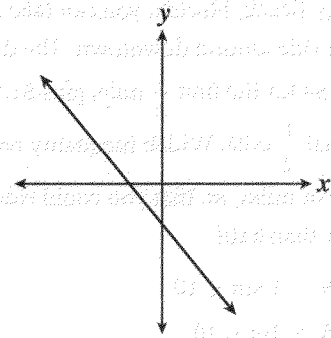


8. The figure above shows the straight-line depreciation of a laptop computer over the first five years of its use. According to the figure, what is the average rate of change in dollars per year of the value of the computer over the five-year period?

- A) -1,100
- B) -220
- C) -100
- D) 100

9. What is the coefficient of x^2 when $6x^2 - \frac{2}{5}x + 1$ is multiplied by $10x + \frac{1}{3}$?

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



10. The graph above could represent which of the following equations?

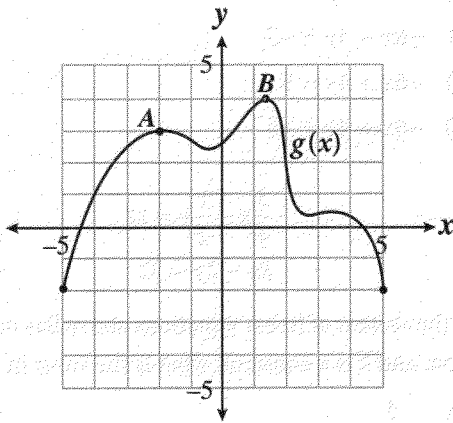
- A) $-6x - 4y = 5$
- B) $-6x - 4y = -5$
- C) $-6x + 4y = 5$
- D) $-6x + 4y = -5$

$$\begin{aligned} \frac{3}{4}x - \frac{1}{2}y &= 12 \\ kx - 2y &= 22 \end{aligned}$$

11. If the system of linear equations above has no solution, and k is a constant, what is the value of k ?

- A) $-\frac{4}{3}$
- B) $-\frac{3}{4}$
- C) 3
- D) 4

12. In Delray Beach, Florida, you can take a luxury golf cart ride around downtown. The driver charges \$4 for the first $\frac{1}{4}$ mile, plus \$1.50 for each additional $\frac{1}{2}$ mile. Which inequality represents the number of miles, m , that you could ride and pay no more than \$10?
- A) $3.25 + 1.5m \leq 10$
 B) $3.25 + 3m \leq 10$
 C) $4 + 1.5m \leq 10$
 D) $4 + 3m \leq 10$



13. The graph of $g(x)$ is shown in the figure above. If $h(x) = -g(x) + 1$, which of the following statements is true?
- A) The range of $h(x)$ is $-3 \leq y \leq 3$.
 B) The minimum value of $h(x)$ is -4 .
 C) The coordinates of point A on the function $h(x)$ are $(2, 4)$.
 D) The graph of $h(x)$ is increasing between $x = -5$ and $x = -2$.

14. If $a + bi$ represents the complex number that results from multiplying $3 + 2i$ times $5 - i$, what is the value of a ?

- A) 2
 B) 13
 C) 15
 D) 17

$$\frac{1}{x} + \frac{4}{x} = \frac{1}{72}$$

15. In order to create safe drinking water, cities and towns use water treatment facilities to remove contaminants from surface water and groundwater. Suppose a town has a treatment plant but decides to build a second, more efficient facility. The new treatment plant can filter the water in the reservoir four times as quickly as the older facility. Working together, the two facilities can filter all the water in the reservoir in 72 hours. The equation above represents the scenario. Which of the following describes what the term $\frac{1}{x}$ represents?

- A) The portion of the water the older treatment plant can filter in 1 hour
 B) The time it takes the older treatment plant to filter the water in the reservoir
 C) The time it takes the older treatment plant to filter $\frac{1}{72}$ of the water in the reservoir
 D) The portion of the water the new treatment plant can filter in 4 hours

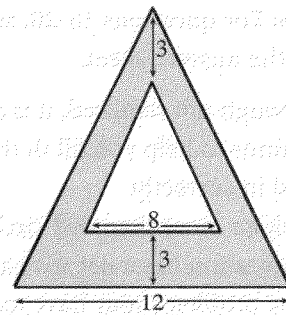
16. If $\frac{1}{4}x = 5 - \frac{1}{2}y$, what is the value of $x + 2y$?

$$\begin{aligned} x + 3y &\leq 18 \\ 2x - 3y &\leq 9 \end{aligned}$$

17. If (a, b) is a point in the solution region for the system of inequalities shown above and $a = 6$, what is the minimum possible value for b ?

$$\frac{\sqrt{x} \cdot x^{\frac{5}{6}} \cdot x}{\sqrt[3]{x}}$$

18. If x^n is the simplified form of the expression above, what is the value of n ?



Note: Figure not drawn to scale.

19. In the figure above, the area of the shaded region is 52 square units. What is the height of the larger triangle?

20. If $y = ax^2 + bx + c$ passes through the points $(-3, 10)$, $(0, 1)$, and $(2, 15)$, what is the value of $a + b + c$?

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT TURN TO ANY OTHER SECTION IN THE TEST.

STOP

MATH TEST

55 Minutes—38 Questions

CALCULATOR SECTION

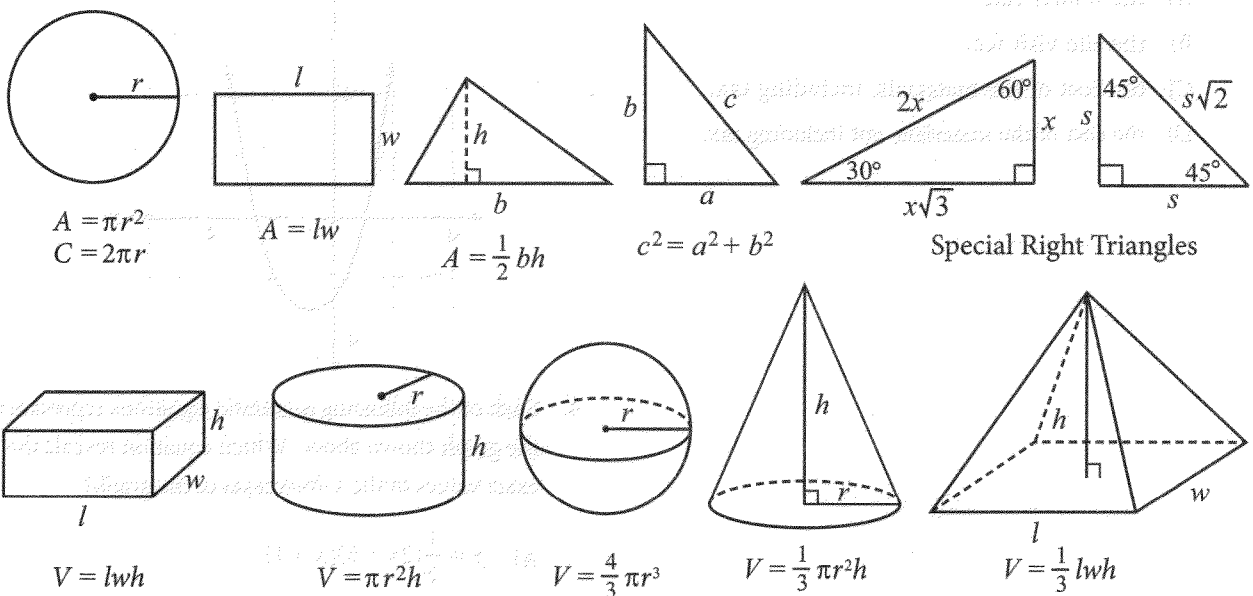
Turn to Section 4 of your answer sheet to answer the questions in this section.

Directions: For this section, solve each problem and decide which is the best of the choices given. Fill in the corresponding oval on the answer sheet. You may use any available space for scratch work.

Notes:

1. Calculator use is permitted.
2. All numbers used are real numbers.
3. All figures used are necessary to solving the problems that they accompany. All figures are drawn to scale EXCEPT when it is stated that a specific figure is not drawn to scale.
4. Unless stated otherwise, the domain of any function f is assumed to be the set of all real numbers x , for which $f(x)$ is a real number.

Information:



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

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

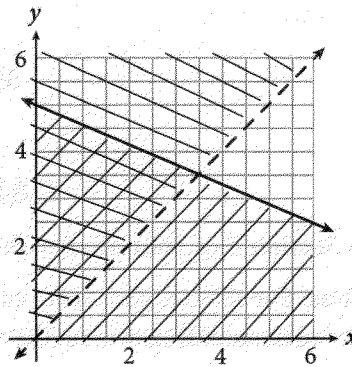
The number of radians of arc in a circle is 2π .

1. Oceans, seas, and bays represent about 96.5% of Earth's water, including the water found in our atmosphere. If the volume of the water contained in oceans, seas, and bays is about 321,000,000 cubic miles, which of the following best represents the approximate volume, in cubic miles, of all the world's water?

- A) 308,160,000
- B) 309,765,000
- C) 332,642,000
- D) 334,375,000

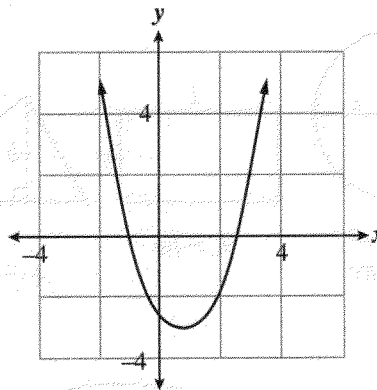
2. An electrician charges a one-time site visit fee to evaluate a potential job. If the electrician accepts the job, he charges an hourly rate plus the cost of any materials needed to complete the job. The electrician also charges for tax, but only on the cost of the materials. If the total cost of completing a job that takes h hours is given by the function $C(h) = 45h + 1.06(82.5) + 75$, then the term $1.06(82.5)$ represents

- A) the hourly rate.
- B) the site visit fee.
- C) the cost of the materials, including tax.
- D) the cost of the materials, not including tax.



3. The figure above shows the solution set for the system $y > x$ and $y \leq -\frac{3}{7}x + 5$. Which of the following is not a solution to the system?

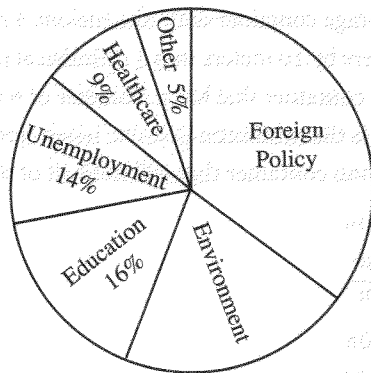
- A) (0, 3)
- B) (1, 2)
- C) (2, 4)
- D) (3, 3)



4. Each of the following quadratic equations represents the graph shown above. Which equation reveals the exact values of the x -intercepts of the graph?

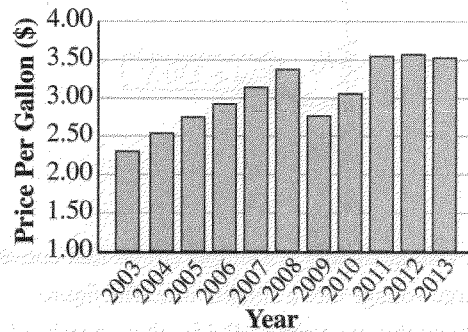
- A) $y = \frac{1}{2}(2x - 5)(x + 1)$
- B) $y = x^2 - \frac{3}{2}x - \frac{5}{2}$
- C) $y + \frac{49}{16} = x - \frac{3}{4}$
- D) $y = x - \frac{3}{4} - \frac{49}{16}$

National Government Concerns



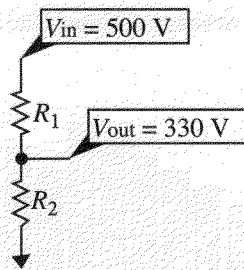
5. Margo surveyed all the students in the government classes at her school to see what they thought should be the most important concern of a national government. The results of the survey are shown in the figure above. If the ratio of students who answered "Foreign Policy" to those who answered "Environment" was 5:3, what percentage of the students answered "Environment"?
- A) 16%
 B) 21%
 C) 24%
 D) 35%
6. Marco needs to buy several white dress shirts for his new job. He finds one he likes for \$35 that is on sale for 40% off. He also likes a black tie that costs \$21. Which of the following represents the total cost, not including tax, if Marco buys x of the white shirts that are on sale and two of the black ties?
- A) $C = 14x + 42$
 B) $C = 21x + 21$
 C) $C = 21x + 42$
 D) $C = 35x + 42$

Average Annual Gas Prices



Data from U.S. Energy Information Administration.

7. The figure above shows the average annual gas prices in the United States from 2003 to 2013. Based on the information shown, which of the following conclusions is valid?
- A) A gallon of gas cost more in 2008 than in 2013.
 B) The price more than doubled between 2003 and 2013.
 C) The drop in price from 2008 to 2009 was more than \$1.00 per gallon.
 D) The overall change in price was greater between 2003 and 2008 than it was between 2008 and 2013.
8. If (x, y) is a solution to the system of equations above, what is the sum of x and y ?
- A) $-\frac{137}{30}$
 B) -4
 C) $-\frac{10}{3}$
 D) -3



9. A voltage divider is a simple circuit that converts a large voltage into a smaller one. The figure above shows a voltage divider that consists of two resistors that together have a total resistance of 294 ohms. To produce the desired voltage of 330 volts, R_2 must be 6 ohms less than twice R_1 . Solving which of the following systems of equations gives the individual resistance for R_1 and R_2 ?

- A) $R_2 = 2R_1 - 6$
 $R_1 + R_2 = 294$
- B) $R_1 = 2R_2 + 6$
 $R_1 + R_2 = 294$
- C) $R_2 = 2R_1 - 6$
 $R_1 + R_2 = \frac{294}{330}$
- D) $R_1 = 2R_2 + 6$
 $R_1 + R_2 = 330(294)$

10. If $\frac{2}{5}(5x) + 2(x-1) = 4(x+1) - 2$, what is the value of x ?

- A) $x = -2$
- B) $x = 2$
- C) There is no value of x for which the equation is true.
- D) There are infinitely many values of x for which the equation is true.

11. Crude oil is being transferred from a full rectangular storage container with dimensions 4 meters by 9 meters by 10 meters into a cylindrical transportation container that has a diameter of 6 meters. What is the minimum possible length for a transportation container that will hold all of the oil?

- A) 40π
- B) $\frac{40}{\pi}$
- C) 60π
- D) $\frac{120}{\pi}$



12. The percent increase from 5 to 12 is equal to the percent increase from 12 to what number?

- A) 16.8
- B) 19.0
- C) 26.6
- D) 28.8

$$b = \frac{L}{4\pi d^2}$$

13. The brightness of a celestial body, like a star, decreases as you move away from it. In contrast, the luminosity of a celestial body is a constant number that represents its intrinsic brightness. The inverse square law, shown above, is used to find the brightness, b , of a celestial body when you know its luminosity, L , and the distance, d , in meters to the body. Which equation shows the distance to a celestial body, given its brightness and luminosity?

- A) $d = \frac{1}{2}\sqrt{\frac{L}{\pi b}}$
- B) $d = \sqrt{\frac{L}{2\pi b}}$
- C) $d = \frac{\sqrt{L}}{2\pi b}$
- D) $d = \frac{L}{2\sqrt{\pi b}}$

Questions 14 and 15 refer to the following information.

Each month, the Bureau of Labor Statistics conducts a survey called the Current Population Survey (CPS) to measure unemployment in the United States. Across the country, about 60,000 households are included in the survey sample. These households are grouped by geographic region. A summary of the January 2014 survey results for male respondents in one geographic region is shown in the table below.

Age Group	Employed	Unemployed	Not in the Labor Force	Total
16 to 19	8	5	10	23
20 to 24	26	7	23	56
25 to 34	142	11	28	157
35 to 44	144	8	32	164
45 to 54	66	6	26	98
Over 54	65	7	36	152
Total	451	44	155	650

14. According to the data in the table, for which age group did the smallest percentage of men report that they were unemployed in January 2014?
- A) 20 to 24 years
 B) 35 to 44 years
 C) 45 to 54 years
 D) Over 54 years
15. If one unemployed man from this sample is chosen at random for a follow-up survey, what is the probability that he will be between the ages of 45 and 54?
- A) 6.0%
 B) 13.6%
 C) 15.1%
 D) 44.9%

16. Which of the following are solutions to the quadratic equation $(x-1)^2 = \frac{4}{9}$?
- A) $x = -\frac{5}{3}, x = \frac{5}{3}$
- B) $x = \frac{1}{3}, x = \frac{5}{3}$
- C) $x = \frac{5}{9}, x = \frac{13}{9}$
- D) $x = 1 \pm \sqrt{\frac{2}{3}}$
17. Damien is throwing darts. He has a total of 6 darts to throw. He gets 5 points for each dart that lands in a blue ring and 10 points for each dart that lands in a red ring. If x of his darts land in a blue ring and the rest land in a red ring, which expression represents his total score?
- A) $10x$
- B) $10x + 5$
- C) $5x + 30$
- D) $60 - 5x$
18. Red tide is a form of harmful algae that releases toxins as it breaks down in the environment. A marine biologist is testing a new spray, composed of clay and water, hoping to kill the red tide that almost completely covers a beach in southern Florida. He applies the spray to a representative sample of 200 square feet of the beach. By the end of the week, 184 square feet of the beach is free of the red tide. Based on these results, and assuming the same general conditions, how much of the 10,000-square-foot beach would still be covered by red tide if the spray had been used on the entire area?
- A) 800 sq ft
- B) 920 sq ft
- C) 8,000 sq ft
- D) 9,200 sq ft
19. If (a, b) is a solution to the system of equations above, which of the following could be the value of b ?
- A) -3
- B) -2
- C) 1
- D) 2
20. Given the function $g(x) = \frac{2}{3}x + 7$, what domain value corresponds to the range value of 3?
- A) -6
- B) -2
- C) 6
- D) 9
21. A landscaper buys a new commercial-grade lawn mower that costs \$2,800. Based on past experience, he expects it to last about 8 years, and then he can sell it for scrap metal with a salvage value of about \$240. Assuming the value of the lawn mower depreciates at a constant rate, which equation could be used to find its approximate value after x years, given that $x < 8$?
- A) $y = -8x + 2,560$
- B) $y = -240x + 2,800$
- C) $y = -320x + 2,800$
- D) $y = 240x - 2,560$

22. A microbiologist is studying the effects of a new antibiotic on a culture of 20,000 bacteria. When the antibiotic is added to the culture, the number of bacteria is reduced by half every hour. What kind of function best models the number of bacteria remaining in the culture after the antibiotic is added?

- A) A linear function
- B) A quadratic function
- C) A polynomial function
- D) An exponential function

23. An airline company purchased two new airplanes. One can travel at speeds of up to 600 miles per hour and the other at speeds of up to 720 miles per hour. How many more miles can the faster airplane travel in 12 seconds than the slower airplane?

- A) $\frac{1}{30}$
- B) $\frac{2}{5}$
- C) 2
- D) 30

State	Minimum Wage per Hour
Idaho	\$7.25
Montana	\$7.90
Oregon	\$9.10
Washington	\$9.32

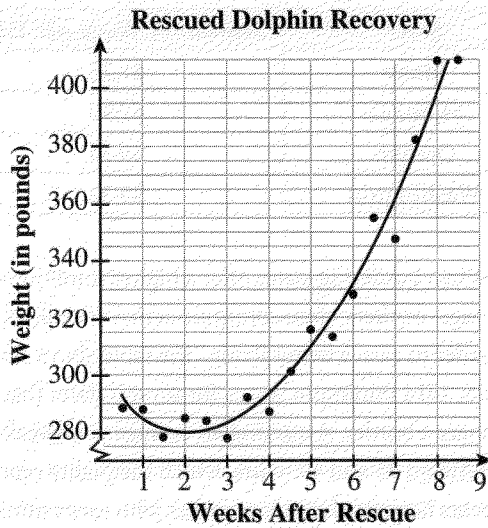
24. When bordering states offer a higher minimum wage, workers often commute across state lines in order to earn a better living. The table above shows the 2014 minimum wages for several states that share a border. Assuming an average workweek of between 35 and 40 hours, which inequality represents how much more a worker who earns minimum wage can earn per week in Oregon than in Idaho?

- A) $x \geq 1.85$
- B) $7.25 \leq x \leq 9.10$
- C) $64.75 \leq x \leq 74$
- D) $253.75 \leq x \leq 364$

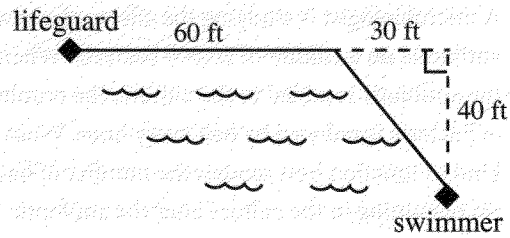
25. In the United States, the maintenance and construction of airports, transit systems, and major roads is largely funded through a federal excise tax on gasoline. Based on the 2011 statistics given below, how much did the average household pay per year in federal gasoline taxes?

- The federal gasoline tax rate was 18.4 cents per gallon.
- The average motor vehicle was driven approximately 11,340 miles per year.
- The national average fuel economy for noncommercial vehicles was 21.4 miles per gallon.
- The average American household owned 1.75 vehicles.

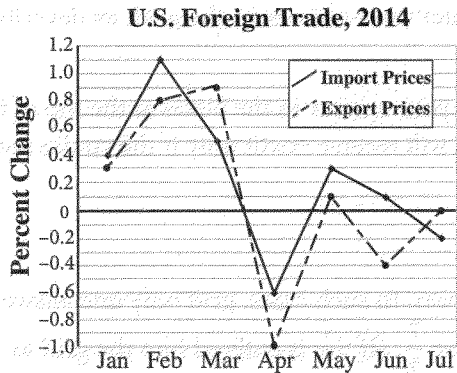
- A) \$55.73
- B) \$68.91
- C) \$97.52
- D) \$170.63



26. Following the catastrophic oil spill in the Gulf of Mexico in April of 2010, more than 900 bottlenose dolphins were found dead or stranded in the oil spill area. The figure above shows the weight of a rescued dolphin during its recovery. Based on the quadratic model fit to the data shown, which of the following is the closest to the average rate of change in the dolphin's weight between week 2 and week 8 of its recovery?
- A) 4 pounds per week
 - B) 16 pounds per week
 - C) 20 pounds per week
 - D) 40 pounds per week



27. As shown in the figure above, a lifeguard sees a struggling swimmer who is 40 feet from the beach. The lifeguard runs 60 feet along the edge of the water at a speed of 12 feet per second. He pauses for 1 second to locate the swimmer again, and then dives into the water and swims along a diagonal path to the swimmer at a speed of 5 feet per second. How many seconds go by between the time the lifeguard sees the struggling swimmer and the time he reaches the swimmer?
- A) 16
 - B) 22
 - C) 50
 - D) 56
28. What was the initial amount of gasoline in a fuel trailer, in gallons, if there are now x gallons, y gallons were pumped into a storage tank, and then 50 gallons were added to the trailer?
- A) $x + y + 50$
 - B) $x + y - 50$
 - C) $y - x + 50$
 - D) $x - y - 50$



29. The figure above shows the net change, as a percentage, for U.S. import and export prices from January to July 2014 as reported by the Bureau of Labor Statistics. For example, U.S. import prices declined 0.2 percent in July while export prices remained unchanged for that month. Based on this information, which of the following statements is true for the time period shown in the figure?
- A) On average, export prices increased more than import prices.
 - B) Import prices showed an increase more often than export prices.
 - C) Import prices showed the greatest change between two consecutive months.
 - D) From January to July, import prices showed a greater overall decrease than export prices.

$$\frac{3.86}{x} + \frac{180.2}{10x} + \frac{42.2}{5x}$$

30. The Ironman Triathlon originated in Hawaii in 1978. The format of the Ironman has not changed since then: it consists of a 3.86-km swim, a 180.2-km bicycle ride, and a 42.2-km run, all raced in that order and without a break. Suppose an athlete bikes 10 times as fast as he swims and runs 5 times as fast as he swims. The variable x in the expression above represents the rate at which the athlete swims, and the whole expression represents the number of hours that it takes him to complete the race. If it takes him 16.2 hours to complete the race, how many kilometers did he swim in 1 hour?
- A) 0.85
 - B) 1.01
 - C) 1.17
 - D) 1.87

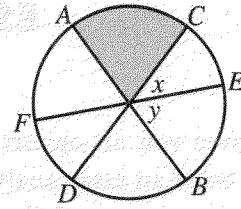
31. What value of x satisfies the equation

$$\frac{2}{3}(5x + 7) = 8x?$$

32. Some doctors base the dosage of a drug to be given to a patient on the patient's body surface area (BSA). The most commonly used formula for

calculating BSA is $BSA = \sqrt{\frac{wh}{3,600}}$, where w is the patient's weight (in kg), h is the patient's height (in cm), and BSA is measured in square meters. How tall (in cm) is a patient who weighs 150 kg and has a BSA of $2\sqrt{2}$ m²?

33. If $-\frac{3}{2} < -2m + 1 < -\frac{7}{5}$, what is one possible value of $10m - 5$?



34. In the figure above, \overline{AB} , \overline{CD} , and \overline{EF} are diameters of the circle. If $y = 2x - 12$, and the shaded area is $\frac{1}{5}$ of the circle, what is the value of x ?

35. If the slope of a line is $-\frac{7}{4}$ and a point on the line is $(4, 7)$, what is the y -intercept of the line?

36. Rory left home and drove straight to the airport at an average speed of 45 miles per hour. He returned home along the same route, but traffic slowed him down and he only averaged 30 miles per hour on the return trip. If his total travel time was 2 hours and 30 minutes, how far is it, in miles, from Rory's house to the airport?

Questions 37 and 38 refer to the following information.

Chemical Makeup of One Mole of Chloroform

Element	Number of Moles	Mass per Mole (grams)
Carbon	1	12.011
Hydrogen	1	1.008
Chlorine	3	35.453

A chemical solvent is a substance that dissolves another to form a solution. For example, water is a solvent for sugar. Unfortunately, many chemical solvents are hazardous to the environment. One eco-friendly chemical solvent is chloroform, also known as trichloromethane (CHCl_3). The table above shows the chemical makeup of one mole of chloroform.

37. Carbon makes up what percent of the mass of one mole of chloroform? Round your answer to the nearest whole percent and ignore the percent sign when entering your answer.

38. If a chemist starts with 1,000 grams of chloroform and uses 522.5 grams, how many moles of chlorine are left?

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT TURN TO ANY OTHER SECTION IN THE TEST.

STOP

MATH—NO CALCULATOR

- | | | | |
|------|-------|-------|--------|
| 1. C | 6. D | 11. C | 16. 20 |
| 2. A | 7. D | 12. B | 17. 1 |
| 3. D | 8. B | 13. A | 18. 2 |
| 4. C | 9. B | 14. D | 19. 14 |
| 5. B | 10. A | 15. A | 20. 6 |

MATH—CALCULATOR

- | | | | |
|-------|-------|-------|-------------------|
| 1. C | 11. B | 21. C | 31. 1 |
| 2. C | 12. D | 22. D | 32. 192 |
| 3. D | 13. A | 23. B | 33. $7 < x < 7.5$ |
| 4. A | 14. D | 24. C | 34. 40 |
| 5. B | 15. B | 25. D | 35. 14 |
| 6. C | 16. B | 26. C | 36. 45 |
| 7. D | 17. D | 27. A | 37. 10 |
| 8. B | 18. A | 28. B | 38. 12 |
| 9. A | 19. A | 29. B | |
| 10. C | 20. A | 30. D | |

44. C

Difficulty: Hard**Category:** Writing & Language / Organization

Strategic Advice: Examine the entire paragraph. Decide whether the sentence provides more information about a topic mentioned in one of the other sentences.

Getting to the Answer: This sentence provides more information related to sentence 1, "The Montreal Protocol is a living document"; it describes how the document is "living." Choice (C) is the correct answer.

MATH TEST: NO-CALCULATOR SECTION

1. C

Difficulty: Easy**Category:** Heart of Algebra / Linear Equations

Strategic Advice: To determine what the y -intercept could mean in the context of a word problem, examine the labels on the graph and note what each axis represents.

Getting to the Answer: According to the labels, the y -axis represents cost, and the x -axis represents the number of games played. The y -intercept, $(0, 5)$, has an x -value of 0, which means zero games were played, yet there is still a cost of \$5. The cost must represent a flat fee that is charged before any games are played, such as an entrance fee to enter the arcade.

2. A

Difficulty: Easy**Category:** Passport to Advanced Math / Exponents

Strategic Advice: To divide one rational expression by another, multiply the first expression by the reciprocal (the flip) of the second expression.

Getting to the Answer: Rewrite the division as multiplication, factor any factorable expressions, and then simplify if possible.

$$\begin{aligned}\frac{3x}{x+5} \div \frac{6}{4x+20} &= \frac{3x}{x+5} \cdot \frac{4x+20}{6} \\ &= \frac{3x}{x+5} \cdot \frac{4(x+5)}{6} \\ &= \frac{12x}{6} \\ &= 2x\end{aligned}$$

Note that the question also states that $x \neq -5$. This doesn't affect your answer—it is simply stated because the denominators of rational expressions cannot equal 0.

3. D

Difficulty: Easy**Category:** Additional Topics in Math / Geometry

Strategic Advice: When the equation of a circle is written in the form $(x - h)^2 + (y - k)^2 = r^2$, the point (h, k) represents the center of the circle on a coordinate plane, and r represents the length of the radius.

Getting to the Answer: To find the area of a circle, use the formula, $A = \pi r^2$. In the equation given in the question, r^2 is the constant on the right-hand side (25)—you don't even need to solve for r because the area formula involves r^2 , not r . So, the area is $\pi(25)$ or 25π .

4. C

Difficulty: Easy**Category:** Passport to Advanced Math / Functions

Strategic Advice: When using function notation, $f(x)$ is simply another way of saying y , so this question is asking you to find the values of x for which $y = 0$, or in other words, where the graph crosses the x -axis.

Getting to the Answer: The graph crosses the x -axis at the points $(-2, 0)$ and $(3, 0)$, so the values of x for which $f(x) = 0$ are -2 and 3 .

5. B

Difficulty: Medium**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Choose the best strategy to answer the question. You could start by cross-multiplying to get rid of the denominators, but simplifying the numerators first will make the calculations easier.

Getting to the Answer:

$$\frac{4(d+3)-9}{8} = \frac{10-(2-d)}{6}$$

$$\frac{4d+12-9}{8} = \frac{10-2+d}{6}$$

$$\frac{4d+3}{8} = \frac{8+d}{6}$$

$$6(4d+3) = 8(8+d)$$

$$24d+18 = 64+8d$$

$$16d = 46$$

$$d = \frac{46}{16} = \frac{23}{8}$$

6. D

Difficulty: Medium**Category:** Passport to Advanced Math / Functions

Strategic Advice: This is a crossover question, so quickly skim the first couple of sentences. Then look for the relevant information in the last couple of sentences. It may also help to circle the portions of the graph that meet the given requirement.

Getting to the Answer: Because *greater* means *higher* on a graph, the statement $f(t) > g(t)$ translates to "Where is $f(t)$ above $g(t)$?" The solid curve represents f and the dashed curve represents g , so $f > g$ between the years 1960 and 1980 and again between the years 2000 and 2010. Look for these time intervals in the answer choices: $1960 < t < 1980$ and $2000 < t < 2010$.

7. D

Difficulty: Medium**Category:** Passport to Advanced Math / Scatterplots

Strategic Advice: Use the shape of the data to predict the type of equation that might be used as a model. Then, use specific values from the graph to choose the correct equation.

Getting to the Answer: According to the graph, the population of the whales grew slowly at first and then more quickly. This means that an exponential model is probably the best fit, so you can eliminate A (linear) and B (quadratic). The remaining equations are both exponential, so choose a data point and see which equation is the closest fit. Be careful—the vertical axis represents *hundreds* of whales, and the question states that t represents the number of years since the study began, so $t = 0$ for 1995, $t = 3$ for 1998, and so on. If you use the data for 1995, which is the point (0, 100), the results are the same for both equations, so choose a different point. Using the data for 2007, $t = 2007 - 1995 = 12$, and the number of whales was 800. Substitute these values into C and D to see which one is true. Choice C is not true because $800 \neq 100 \times 2^{12}$. Choice (D) is correct because $800 = 100 \times 2^{\frac{12}{4}} = 100 \times 2^3 = 100 \times 8$ is true.

8. B

Difficulty: Medium**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Average rate of change is the same as slope, so use the slope formula.

Getting to the Answer: To find the average rate of change over the 5-year period, find the slope between the starting point (0, 1,200) and the ending point (5, 100).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{100 - 1,200}{5 - 0} = \frac{-1,100}{5} = -220$$

The average rate of change is negative because the laptop decreases in value over time.

Note: Because the question involves *straight-line* depreciation, you could have used any two points on the graph to find the slope. As a general rule, however, you should use the endpoints of the given time interval.

9. B

Difficulty: Medium

Category: Passport to Advanced Math / Exponents

Strategic Advice: When multiplying polynomials, carefully multiply each term in the first factor by each term in the second factor. This question doesn't ask for the entire product, so check to make sure you answered the right question (the coefficient of x^2).

Getting to the Answer:

$$\begin{aligned} & (6x^2 - \frac{2}{5}x + 1)(10x + \frac{1}{3}) \\ &= 6x^2 \cdot 10x + \frac{1}{3} \cdot \frac{2}{5}x \cdot 10x + \frac{1}{3} \cdot 1 \cdot 10x + \frac{1}{3} \\ &= 60x^3 + \frac{2x^2}{15} - 4x^2 + 10x + \frac{1}{3} \end{aligned}$$

The coefficient of x^2 is $2 + (-4) = -2$.

10. A

Difficulty: Medium

Category: Heart of Algebra / Linear Equations

Strategic Advice: Notice that there are no grid lines and no numbers on the axes. This is a great clue that the numbers in the equations don't actually matter.

Getting to the Answer: The line is decreasing, so the slope (m) is negative. The line crosses the y -axis below 0, so the y -intercept (b) is also negative. Put each answer choice in slope-intercept form, one at a time, and examine the signs of m and b . Begin with A:

$$-6x - 4y = 5$$

$$-4y = 6x + 5$$

$$y = \frac{6x}{-4} + \frac{5}{-4}$$

$$y = -\frac{3}{2}x - \frac{5}{4}$$

You don't need to check any of the other equations. Choice (A) has a negative slope and a negative y -intercept, so it is the correct equation.

11. C

Difficulty: Hard

Category: Heart of Algebra / Systems of Linear Equations

Strategic Advice: Graphically, a system of linear equations that has no solution indicates two parallel lines or, in other words, two lines that have the same slope. So, write each of the equations in slope-intercept form ($y = mx + b$) and set their slopes (m) equal to each other to solve for k . Before finding the slopes, multiply the top equation by 4 to make it easier to manipulate.

Getting to the Answer:

$$4 \left(\frac{3}{4}x - \frac{1}{2}y \right) = 12 \rightarrow 3x - 2y = 48 \rightarrow y = \frac{3}{2}x - 24$$

$$kx - 2y = 22 \rightarrow -2y = -kx + 22 \rightarrow y = \frac{k}{2}x - 11$$

The slope of the first line is $\frac{3}{2}$, and the slope of the second line is $\frac{k}{2}$. Set them equal and solve for k .

$$\frac{3}{2} = \frac{k}{2}$$

$$2(3) = 2(k)$$

$$6 = 2k$$

$$3 = k$$

12. B

Difficulty: Hard**Category:** Heart of Algebra / Inequalities

Strategic Advice: Pay careful attention to units, particularly when a question involves rates. The \$4.00 for the first $\frac{1}{4}$ mile is a flat fee. Before you write the inequality, you need to find the per-mile rate for the remaining miles.

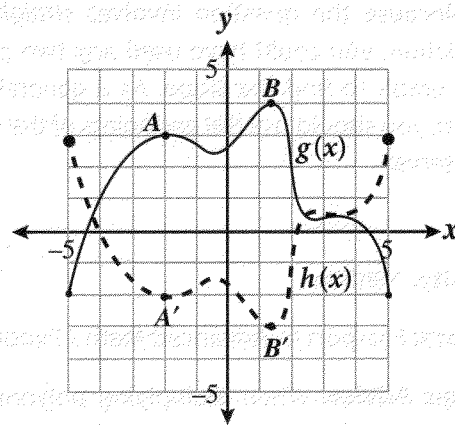
Getting to the Answer: The driver charges \$4.00 for the first $\frac{1}{4}$ mile, which is a flat fee, so write 4. The additional charge is \$1.50 per $\frac{1}{2}$ mile, or 1.50 times 2 = \$3.00 per mile. The number of miles after the first $\frac{1}{4}$ mile is $m - \frac{1}{4}$, so the cost of the trip, not including the first $\frac{1}{4}$ mile, is $3m - \frac{3}{4}$. This means the cost of the whole trip is $4 + 3m - \frac{3}{4}$. The clue "no more than \$10" means that much or less, so use the symbol \leq . The inequality is $4 + 3m - \frac{3}{4} \leq 10$, which simplifies to $3.25 + 3m \leq 10$.

13. A

Difficulty: Hard**Category:** Passport to Advanced Math / Functions

Strategic Advice: Think about how the transformations affect the graph of $g(x)$ and draw a sketch of $h(x)$ on the same grid. Compare the new graph to each of the answer choices until you find one that is true.

Getting to the Answer: The graph of $h(x) = -g(x) + 1$ is a vertical reflection of $g(x)$, over the x -axis, that is then shifted up 1 unit. The graph looks like the dashed line in the following graph:



Now, compare the dashed line to each of the answer choices: the range of $h(x)$ is the set of y -values from lowest to highest (based on the dashed line). The lowest point occurs at point B' and has a y -value of -3 ; the highest value occurs at both ends of the graph and is 3 , so the range is $-3 \leq y \leq 3$. This means (A) is correct and you can move on to the next question. Don't waste valuable time checking the other answer choices unless you are not sure about the range. (Choice B: The minimum value of $h(x)$ is -3 , not -4 . Choice C: The coordinates of point A on $h(x)$ are $(-2, -2)$, not $(2, 4)$. Choice D: the graph of $h(x)$ is decreasing, not increasing, between $x = -5$ and $x = -2$.)

14. D

Difficulty: Medium**Category:** Additional Topics in Math / Imaginary Numbers

Strategic Advice: Multiply the two complex numbers just as you would two binomials (using FOIL). Then, combine like terms and use the definition $i^2 = -1$ to simplify the result.

Getting to the Answer:

$$\begin{aligned}(3+2i)(5-i) &= 3(5-i) + 2i(5-i) \\ &= 15 - 3i + 10i - 2i^2 \\ &= 15 + 7i - 2(-1) \\ &= 15 + 7i + 2 \\ &= 17 + 7i\end{aligned}$$

The question asks for a in $a + bi$, so the correct answer is 17.

15. A**Difficulty:** Hard**Category:** Passport to Advanced Math / Exponents

Strategic Advice: Think of the rate given in the question in terms of the constant term you see on the right-hand side of the equation. Working together, the two treatment plants can filter the water in 72 hours. This is equivalent to saying that they can filter $\frac{1}{72}$ of the water in 1 hour.

Getting to the Answer: If $\frac{1}{72}$ is the portion of the water the two treatment plants can filter *together*, then each term on the left side of the equation represents the portion that each plant can filter *individually* in 1 hour. Because the new facility is 4 times as fast as the older facility, $\frac{4}{x}$ represents the portion of the water the new plant can filter in 1 hour, and $\frac{1}{x}$ represents the portion of the water the older plant can filter in 1 hour.

16. 20**Difficulty:** Medium**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Only one equation is given, and it has two variables. This means that you don't have enough information to solve for either variable. Instead, look for the relationship between the variable terms in the equation and those in the expression that you are trying to find, $x + 2y$.

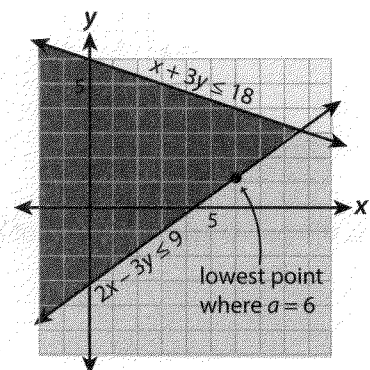
Getting to the Answer: First, move the y -term to the left side of the equation to make it look more like the expression you are trying to find. The expression doesn't have fractions, so clear the fractions in the equation by multiplying both sides by 4. This yields the expression that you are looking for, $x + 2y$, so no further work is required—just read the value on the right-hand side of the equation. The answer is 20.

$$\begin{aligned}\frac{1}{4}x &= 5 - \frac{1}{2}y \\ \frac{1}{4}x + \frac{1}{2}y &= 5 \\ 4\left(\frac{1}{4}x + \frac{1}{2}y\right) &= 4(5) \\ x + 2y &= 20\end{aligned}$$

17. 1**Difficulty:** Medium**Category:** Heart of Algebra / Inequalities

Strategic Advice: This question is extremely difficult to answer unless you draw a sketch. It doesn't have to be perfect—you just need to get an idea of where the solution region is. Don't forget to flip the inequality symbol when you graph the second equation.

Getting to the Answer: Sketch the system.



If (a, b) is a solution to the system, then a is the x -coordinate of any point in the darkest shaded region and b is the corresponding y -coordinate. When $a = 6$, the minimum possible value for b lies

on the lower boundary line, $2x - 3y \leq 9$. It looks like the y -coordinate is 1, but to be sure, substitute $x = 6$ into the equation and solve for y . You can use $=$ in the equation, instead of the inequality symbol, because you are finding a point on the boundary line.

$$2x - 3y = 9$$

$$2(6) - 3y = 9$$

$$12 - 3y = 9$$

$$-3y = -3$$

$$y = 1$$

18. 2

Difficulty: Hard

Category: Passport to Advanced Math / Exponents

Strategic Advice: Rewrite the radicals as fraction exponents: $\sqrt{x} = x^{\frac{1}{2}}$ and $\sqrt[3]{x} = x^{\frac{1}{3}}$.

Getting to the Answer: Write each factor in the expression in exponential form. Then use the rules of exponents to simplify the expression. Add the exponents of the factors that are being multiplied and subtract the exponent of the factor that is being divided:

$$\begin{aligned} \frac{\sqrt{x} \cdot x^5 \cdot x}{\sqrt[3]{x}} &= \frac{x^{\frac{1}{2}} \cdot x^5 \cdot x^1}{x^{\frac{1}{3}}} \\ &= x^{\frac{1}{2} + 5 + 1 - \frac{1}{3}} \\ &= x^{\frac{3}{6} + \frac{5}{6} + \frac{6}{6} - \frac{2}{6}} \\ &= x^{\frac{12}{6}} = x^2 \end{aligned}$$

Because n is the power of x , the value of n is 2.

19. 14

Difficulty: Hard

Category: Additional Topics in Math / Geometry

Strategic Advice: The shaded region is the area of the larger triangle minus the area of the smaller triangle. Set up and solve an equation using the information from the figure. Before you grid in your answer, check that you answered the right question (height of larger triangle).

Getting to the Answer: You don't know the height of the smaller triangle, so call it h . You do know the area of the shaded region—it's 52 square units.

Larger triangle: base = 12; height = $h + 3 + 3$

Smaller triangle: base = 8; height = h

Shaded area = large area – small area

$$52 = \frac{1}{2}(12)(h+6) - \frac{1}{2}(8)(h)$$

$$52 = 6(h+6) - 4h$$

$$52 = 6h + 36 - 4h$$

$$52 = 2h + 36$$

$$16 = 2h$$

$$8 = h$$

The question asks for the height of the *larger* triangle, so the correct answer is $8 + 3 + 3 = 14$.

20. 6

Difficulty: Hard

Category: Passport to Advanced Math / Quadratics

Strategic Advice: The highest power of x in the equation is 2, so the function is quadratic. Writing quadratic equations can be tricky and time-consuming. If you know the roots, you can use factors to write the equation. If you don't know the roots, you need to create a system of equations to find the coefficients of the variable terms.

Getting to the Answer: You don't know the roots of this equation, so start with the point that has the easiest values to work with, (0, 1), and substitute them into the equation $y = ax^2 + bx + c$.

$$1 = a(0)^2 + b(0) + c$$

$$1 = c$$

Now your equation looks like $y = ax^2 + bx + 1$. Next, use the other two points to create a system of two equations in two variables.

$$(-3, 10) \rightarrow 10 = a(-3)^2 + b(-3) + 1 \rightarrow 9 = 9a - 3b$$

$$(2, 15) \rightarrow 15 = a(2)^2 + b(2) + 1 \rightarrow 14 = 4a + 2b$$

You now have a system of equations to solve. None of the variables has a coefficient of 1, so use elimination to solve the system. If you multiply the top equation by 2 and the bottom equation by 3, the b -terms will eliminate each other.

$$2[9a - 3b = 9] \rightarrow 18a - 6b = 18$$

$$3[4a + 2b = 14] \rightarrow 12a + 6b = 42$$

$$30a = 60$$

$$a = 2$$

Now, find b by substituting $a = 2$ into either of the original equations. Using the top equation, you get:

$$9(2) - 3b = 9$$

$$18 - 3b = 9$$

$$-3b = -9$$

$$b = 3$$

The value of $a + b + c$ is $2 + 3 + 1 = 6$.

MATH TEST: CALCULATOR SECTION

1. C

Difficulty: Easy

Category: Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: You can use the formula $\text{Percent} = \frac{\text{Part}}{\text{Whole}} \times 100\%$ whenever you know two out of the three quantities.

Getting to the Answer: The clue "all" tells you that the "whole" is what you don't know. The percent is 96.5, and the part is 321,000,000.

$$96.5 = \frac{321,000,000}{w} \times 100\%$$

$$96.5w = 32,100,000,000$$

$$w = \frac{32,100,000,000}{96.5}$$

$$w = 332,642,487$$

The answer choices are rounded to the nearest thousand, so the answer is 332,642,000.

2. C

Difficulty: Easy

Category: Heart of Algebra / Linear Equations

Strategic Advice: A *one-time* fee does not depend on the variable and is therefore a constant. A unit rate, however, is always multiplied by the independent variable.

Getting to the Answer: The total cost consists of the site visit fee (a constant), an hourly cost (which depends on the number of hours), and the cost of the materials (which are taxed). The constant in the equation is 75 and is therefore the site visit fee; 45 is being multiplied by h (the number of hours), so \$45 must be the hourly rate. That leaves the remaining term, $1.06(82.5)$, which must be the cost of the materials (\$82.50) plus a 6% tax.

3. D**Difficulty:** Easy**Category:** Heart of Algebra / Inequalities

Strategic Advice: The intersection (overlap) of the two shaded regions is the solution to the system of inequalities. Check each point to see whether it lies in the region with the darkest shading. Don't forget to check that you answered the right question—you are looking for the point that is *not* a solution to the system.

Getting to the Answer: Each of the first three points clearly lies in the overlap. The point (3, 3) looks like it lies on the dashed line, which means it is *not* included in the solution. To check this, plug (3, 3) into the easier inequality: $3 \not> 3$ (3 is equal to itself, not greater than itself), so (D) is correct.

4. A**Difficulty:** Easy**Category:** Passport to Advanced Math / Quadratics

Strategic Advice: Quadratic equations can be written in several forms, each of which reveals something special about the graph. For example, the vertex form of a quadratic equation gives the minimum or maximum value of the function, while the standard form reveals the y-intercept.

Getting to the Answer: The factored form of a quadratic equation reveals the solutions to the equation, which graphically represent the x-intercepts. Choice (A) is the only equation written in this form and therefore must be correct. You can set each factor equal to 0 and solve to find that the x-intercepts of the graph are $x = \frac{5}{2}$ and $x = -1$.

5. B**Difficulty:** Easy**Category:** Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: Break the question into steps. Before you can use the ratio, you need to find the percent of the students who answered either "Foreign Policy" or "Environment."

Getting to the Answer: The ratio given in the question is 5:3, so write this as 5 parts "Foreign Policy" and 3 parts "Environment." You don't know how big a *part* is, so call it x . This means that $5x + 3x =$ the percent of the students who answered either "Foreign Policy" or "Environment," which is 100% – all the other answers:

$$100 - (16 + 14 + 9 + 5) = 100 - 44 = 56$$

$$5x + 3x = 56$$

$$8x = 56$$

$$x = 7$$

Each part has a value of 7, and 3 parts answered "Environment," so the correct percentage is $3(7) = 21\%$.

6. C**Difficulty:** Easy**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Don't peek at the answers. They may confuse you because the numbers look different from the ones given in the question. Instead, write your own equation in words first and then translate from English to math.

Getting to the Answer: Keep in mind that the shirts are on sale but the tie is not. The shirts are 40% off, which means that Marco only pays $100 - 40 = 60\%$ of the price, or $0.6(35)$.

Cost = (Shirt price times how many) plus (Tie price times how many)

$$C = 0.6(35)x + 21(2)$$

This is not one of the answer choices, so simplify to get $C = 21x + 42$.

There are variables in the answer choices, so you could also use the Picking Numbers strategy to answer this question.

7. D

Difficulty: Easy**Category:** Problem Solving and Data Analysis / Statistics and Probability

Strategic Advice: Your only choice for this question is to compare each statement to the figure. Don't waste time trying to figure out the exact value for each bar—an estimate is good enough to determine whether each statement is true.

Getting to the Answer: Choice A is incorrect because the price in 2008 was slightly less (not more) than \$3.50, while the price in 2013 was right around \$3.50. Choice B is incorrect because the price in 2003 was more than \$2.00, and the price in 2013 was not more than twice that (\$4.00). Choice C is incorrect because the price in 2008 was about \$3.25 and the price in 2009 was about \$2.75—this is not a difference of more than \$1.00. This means (D) must be correct. You don't have to check it—just move on. (Between 2003 and 2008, the change in price was about $\$3.40 - \$2.30 = \$1.10$; between 2008 and 2013, the change in price was only about $\$3.50 - \$3.40 = \$0.10$; the change in price was greater between 2003 and 2008.)

8. B

Difficulty: Medium**Category:** Heart of Algebra / Systems of Linear Equations

Strategic Advice: Because none of the variable terms has a coefficient of 1, solve the system of equations using elimination by addition (combining the equations). Before you choose an answer, check that you answered the right question (the sum of x and y).

Getting to the Answer: Multiply the top equation by 2 to eliminate the terms that have y 's in them.

$$\begin{array}{r} 2[-2x + 5y = 1] \rightarrow -4x + 10y = 2 \\ 7x - 10y = -11 \rightarrow 7x - 10y = -11 \\ \hline 3x = -9 \\ x = -3 \end{array}$$

Now, substitute the result into either of the original equations and simplify to find y :

$$\begin{array}{r} -2x + 5y = 1 \\ -2(-3) + 5y = 1 \\ 6 + 5y = 1 \\ 5y = -5 \\ y = -1 \end{array}$$

The question asks for the *sum*, so add x and y to get $-3 + (-1) = -4$.

9. A

Difficulty: Medium**Category:** Heart of Algebra / Systems of Linear Equations

Strategic Advice: Take a quick peek at the answers just to see what variables are being used, but don't study the equations. Instead, write your own system using the same variables as given in the answer choices.

Getting to the Answer: One of the equations in the system should represent the sum of the two resistors ($R_1 + R_2$), which is equal to 294. This means you can eliminate C and D. The second equation needs to satisfy the condition that R_2 is 6 less than twice R_1 , or $R_2 = 2R_1 - 6$. This means (A) is correct.

10. C

Difficulty: Medium**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Use the distributive property to simplify each of the terms that contains parentheses. Then use inverse operations to solve for x .

Getting to the Answer:

$$\begin{aligned}\frac{2}{3}(3x) + 2(x-1) &= 4(x+1) - 2 \\ 2x + 2x - 2 &= 4x + 4 - 2 \\ 4x - 2 &= 4x + 2 \\ -2 &\neq 2\end{aligned}$$

All of the variable terms cancel out, and the resulting numerical statement is false (because negative 2 does not equal positive 2), so there is no solution to the equation. Put another way, there is no value of x for which the equation is true.

11. B**Difficulty:** Medium**Category:** Additional Topics in Math / Geometry

Strategic Advice: Think about this question logically before you start writing things down—after it's transferred, the volume of the oil in the cylindrical container will be the same volume as the rectangular container, so you need to set the two volumes equal and solve for h .

Getting to the Answer: The volume of the rectangular container is $4 \times 9 \times 10$, or 360 cubic meters. The volume of a cylinder equals the area of its base times its height, or $\pi r^2 h$. Because the diameter is 6 meters, the radius, r , is half that, or 3 meters. Now we're ready to set up an equation and solve for h (which is the height of the cylinder, or in this case, the length of the transportation container):

Volume of oil = Volume of rectangular container

$$\pi(3)^2 h = 360$$

$$9\pi h = 360$$

$$h = \frac{360}{9\pi} = \frac{40}{\pi}$$

12. D**Difficulty:** Medium**Category:** Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: Even though this question uses the word *percent*, you are never asked to find the actual percent itself. Set this question up as a proportion to get the answer more quickly. Remember, percent change equals amount of change divided by the original amount.

Getting to the Answer:

$$\frac{12-5}{5} = \frac{x-12}{12}$$

$$\frac{7}{5} = \frac{x-12}{12}$$

$$12(7) = 5(x-12)$$

$$84 = 5x - 60$$

$$144 = 5x$$

$$28.8 = x$$

13. A**Difficulty:** Medium**Category:** Passport to Advanced Math / Exponents

Strategic Advice: Don't spend too much time reading the scientific explanation of the equation. Focus on the question at the very end—it's just asking you to solve the equation for d .

Getting to the Answer: First, cross-multiply to get rid of the denominator. Then, divide both sides of the equation by $4\pi b$ to isolate d^2 . Finally, take the square root of both sides to find d .

$$b(4\pi d^2) = L$$

$$\frac{b(4\pi d^2)}{4\pi b} = \frac{L}{4\pi b}$$

$$d^2 = \frac{L}{4\pi b}$$

$$\sqrt{d^2} = \sqrt{\frac{L}{4\pi b}}$$

$$d = \sqrt{\frac{L}{4\pi b}}$$

Unfortunately, this is not one of the answer choices, so you'll need to simplify further. You can take the square root of 4 (it's 2), but be careful—it's in the denominator of the fraction, so it comes out of the square root as $\frac{1}{2}$.

The simplified equation is $d = \frac{1}{2}\sqrt{\frac{L}{\pi b}}$.

14. D

Difficulty: Easy

Category: Problem Solving and Data Analysis / Statistics and Probability

Strategic Advice: You do not need to use all of the information presented in the table to find the answer. Read the question carefully to make sure you use only what you need.

Getting to the Answer: To calculate the percentage of men in each age group who reported being unemployed in January 2014, divide the number in *that* age group who were unemployed by the total number in *that* age group. There are six age groups but only four answer choices, so don't waste time on the age groups that aren't represented. Choice (D) is correct because $7 \div 152 \approx 0.046 = 4.6\%$, which is a lower percentage than that for any other age group (20 to 24 = 12.5%; 35 to 44 = 4.9%; 45 to 54 = 6.1%).

15. B

Difficulty: Medium

Category: Problem Solving and Data Analysis / Statistics and Probability

Strategic Advice: The follow-up survey targets only those respondents who said they were unemployed, so focus on that column in the table.

Getting to the Answer: There were 6 respondents out of 44 unemployed males who were between the ages of 45 and 54, so the probability is $\frac{6}{44} = 0.136$, or about 13.6%.

16. B

Difficulty: Medium

Category: Passport to Advanced Math / Quadratics

Strategic Advice: Taking the square root is the inverse operation of squaring, and both sides of the equation are already perfect squares, so take their square roots. Then solve the resulting equations. Remember, there will be two equations to solve.

Getting to the Answer:

$$(x-1)^2 = \frac{4}{9}$$

$$\sqrt{(x-1)^2} = \sqrt{\frac{4}{9}}$$

$$x-1 = \pm \frac{\sqrt{4}}{\sqrt{9}}$$

$$x = 1 \pm \frac{2}{3}$$

Now, simplify each equation: $x = 1 + \frac{2}{3} = \frac{3}{3} + \frac{2}{3} = \frac{5}{3}$

and $x = 1 - \frac{2}{3} = \frac{3}{3} - \frac{2}{3} = \frac{1}{3}$.

17. D

Difficulty: Medium

Category: Heart of Algebra / Linear Equations

Strategic Advice: The key to answering this question is to determine how many darts land in each color ring. If there are 6 darts total and x land in a blue ring, the rest, or $6 - x$, must land in a red ring.

Getting to the Answer: Write the expression in words first: points per blue ring (5) times number of darts in blue ring (x), plus points per red ring (10) times number of darts in red ring ($6 - x$). Now, translate the words into numbers, variables, and operations: $5x + 10(6 - x)$. This is not one of the answer choices, so simplify the expression by distributing the 10 and then combining like terms: $5x + 10(6 - x) = 5x + 60 - 10x = 60 - 5x$.

18. A

Difficulty: Medium

Category: Problem Solving and Data Analysis / Statistics and Probability

Strategic Advice: This is a science crossover question. Read the first two sentences quickly—they are simply describing the context of the question. The last two sentences pose the question, so read those more carefully.

Getting to the Answer: In the sample, 184 out of 200 square feet were free of red tide after applying the spray. This is $\frac{184}{200} = 0.92 = 92\%$ of the area. For the whole beach, $0.92(10,000) = 9,200$ square feet should be free of the red tide. Be careful—this is *not* the answer. The question asks how much of the beach would still be covered by red tide, so subtract to get $10,000 - 9,200 = 800$ square feet.

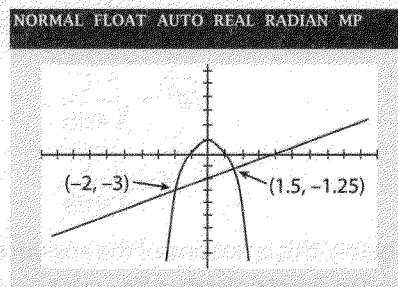
19. A

Difficulty: Medium

Category: Passport to Advanced Math / Quadratics

Strategic Advice: The solution to a system of equations is the point(s) where their graphs intersect. You can solve the system algebraically by setting the equations equal to each other, or you can solve it graphically using your calculator. Use whichever method gets you to the answer more quickly.

Getting to the Answer: Both equations are given in calculator-friendly format ($y = \dots$), so graphing them is probably the more efficient approach. The graph looks like:



The solution point in the question is given as (a, b) , so b represents the y -coordinate of the solution. The y -coordinates of the points of intersection are -3 and -1.25 , so choice (A) is correct.

20. A

Difficulty: Medium

Category: Passport to Advanced Math / Functions

Strategic Advice: Don't answer this question too quickly—you may be tempted to substitute 3 for x , but 3 is the output (range), not the input (domain).

Getting to the Answer: The given range value is an output value, so substitute 3 for $g(x)$ and use inverse operations to solve for x , which is the corresponding domain value.

$$g(x) = \frac{2}{3}x + 7$$

$$3 = \frac{2}{3}x + 7$$

$$-4 = \frac{2}{3}x$$

$$-12 = 2x$$

$$-6 = x$$

You could also graph the function and find the value of x (the domain value) for which the value of y (the range value) is 3. The point on the graph is $(-6, 3)$.

21. C**Difficulty:** Medium**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Don't peek at the answers. Write your own equation using the initial cost and the rate of change in the value of the lawn mower. Remember—when something changes at a constant rate, it can be represented by a linear equation.

Getting to the Answer: When a linear equation in the form $y = mx + b$ is used to model a real-world scenario, m represents the constant rate of change, and b represents the starting amount. Here, the starting amount is easy—it's the purchase price, \$2,800. To find the rate of change, think of the initial cost as the value at 0 years, or the point (0, 2,800), and the salvage amount as the value at 8 years, or the point (8, 240). Substitute these points into the slope formula to find that $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{240 - 2,800}{8 - 0} = \frac{-2,560}{8} = -320$, so the equation is $y = -320x + 2,800$.

22. D**Difficulty:** Medium**Category:** Problem Solving and Data Analysis / Functions

Strategic Advice: Determine whether the change in the number of bacteria is a common difference (linear function) or a common ratio (exponential function) or if the number of bacteria changes direction (quadratic or polynomial function).

Getting to the Answer: The question tells you that the number of bacteria is reduced by half every hour after the antibiotic is applied. The microbiologist started with 20,000, so after one hour, there are 10,000 left, or $20,000 \times \frac{1}{2}$. After 2 hours, there are 5,000 left, or $20,000 \times \frac{1}{2} \times \frac{1}{2}$, and so on. The change in the number of bacteria is a common ratio $\frac{1}{2}$,

so the best model is an exponential function of the form $y = a \left(\frac{1}{2}\right)^x$. In this scenario, a is 20,000.

23. B**Difficulty:** Medium**Category:** Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: Let the units in this question guide you to the solution. The speeds of the airplanes are given in miles per hour, but the question asks about the number of miles each airplane can travel in 12 seconds, so convert miles per hour to miles per second.

Getting to the Answer:*Slower airplane:*

$$\frac{600 \text{ mi}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times 12 \text{ sec} = 2 \text{ mi}$$

Faster airplane:

$$\frac{720 \text{ mi}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times 12 \text{ sec} = 2.4 \text{ mi}$$

The faster plane can travel $2.4 - 2 = 0.4$ miles farther, which is the same as $\frac{2}{5}$ miles.

24. C**Difficulty:** Medium**Category:** Heart of Algebra / Inequalities

Strategic Advice: The best way to answer this question is to pretend you are the worker. How much more would you earn for one hour in Oregon than in Idaho? If you worked 35 hours per week, how much more would this be? If you worked 40 hours per week, how much more would this be?

Getting to the Answer: Based on the data in the table, a worker would earn $\$9.10 - \$7.25 = \$1.85$ more for one hour of work in Oregon than in Idaho.

If he worked 35 hours per week, he would earn $35(1.85) = \$64.75$ more. If he worked 40 hours per week, he would earn $40(1.85) = \$74$ more. So, the worker would earn somewhere between \$64.75 and \$74 more per week, which can be expressed as the compound inequality $64.75 \leq x \leq 74$.

25. D**Difficulty:** Medium**Category:** Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: This is another question where the units can help you find the answer. Use the number of vehicles owned to find the total number of miles driven to find the total number of gallons of gas used to find the total tax paid. Phew!

Getting to the Answer:

$$1.75 \text{ vehicles} \times \frac{11,340 \text{ miles}}{\text{vehicle}} = 19,845 \text{ miles}$$

$$19,845 \text{ miles} \times \frac{1 \text{ gallon of gas}}{21.4 \text{ miles}} = 927.336 \text{ gallons}$$

$$927.336 \text{ gallons} \times \frac{\$0.184}{\text{gallon}} = \$170.63$$

26. C**Difficulty:** Medium**Category:** Problem Solving and Data Analysis / Scatterplots

Strategic Advice: The average rate of change of a function over a given interval, from a to b , compares the change in the outputs, $f(b) - f(a)$, to the change in the inputs, $b - a$. In other words, it is the slope of the line that connects the endpoints of the interval, so you can use the slope formula.

Getting to the Answer: Look at the quadratic model, not the data points, to find that the endpoints of the given interval, week 2 to week 8, are (2, 280) and (8, 400). The average rate of change is $\frac{400 - 280}{8 - 2} = \frac{120}{6} = 20$.

On average, the dolphin's weight increased by 20 pounds per week.

27. A**Difficulty:** Hard**Category:** Additional Topics in Math / Geometry

Strategic Advice: In this question, information is given in both the diagram and the text. You need to relate the text to the diagram, one piece of information at a time, to calculate how long the lifeguard ran along the beach and how long he swam. Before you find the swim time, you need to know how far he swam.

Getting to the Answer: Whenever you see a right triangle symbol in a diagram, you should think Pythagorean theorem or, in this question, special right triangles. All multiples of 3-4-5 triangles are right triangles, so the length of the lifeguard's swim is the hypotenuse of a 30-40-50 triangle, or 50 feet. Add this number to the diagram. Now calculate the times using the distances and the speeds given. Don't forget the 1 second that the lifeguard paused.

$$\text{Run time} = 60 \text{ ft} \times \frac{1 \text{ sec}}{12 \text{ ft}} = \frac{60}{12} = 5 \text{ sec}$$

Pause time = 1 sec

$$\text{Swim time} = 50 \text{ ft} \times \frac{1 \text{ sec}}{5 \text{ ft}} = \frac{50}{5} = 10 \text{ sec}$$

Total time = 5 + 1 + 10 = 16 seconds

28. B**Difficulty:** Hard**Category:** Heart of Algebra / Linear Equations

Strategic Advice: Write an equation in words first and then translate from English to math. Finally, rearrange your equation to find what you're interested in, which is the initial amount of gasoline.

Getting to the Answer: Call the initial amount A . After you've written your equation, solve for A .

Amount now (x) = Initial amount (A) minus y , plus 50

$$x = A - y + 50$$

$$x + y - 50 = A$$

The initial amount was $x + y - 50$ gallons. Note that you could also use Picking Numbers to answer this question.

29. B

Difficulty: Hard

Category: Problem Solving and Data Analysis / Statistics and Probability

Strategic Advice: When a question involves reading data from a graph, it is sometimes better to skip an answer choice if it involves long calculations. Skim the answer choices for this question—A involves finding two averages, each of which is composed of 7 data values. Skip this choice for now.

Getting to the Answer: Start with (B). Be careful—you are not looking for places where the line segments are increasing. The y -axis already represents the change in prices, so you are simply counting the number of positive values for the imports (5) and for the exports (4). There are more for the imports, so (B) is correct and you don't need to check any of the other statements. Move on to the next question.

30. D

Difficulty: Hard

Category: Passport to Advanced Math / Exponents

Strategic Advice: The key to answering this question is deciding what you're trying to find. The question tells you that x represents the athlete's swim rate and you are looking for the number of kilometers he swam in one hour—these are the same thing. If you find x (in kilometers per hour), you will know how many kilometers he swam in one hour.

Getting to the Answer: Set the equation equal to the total time, 16.2, and solve for x . To do this, write the variable terms over a common denominator, $10x$, and combine them into a single term. Then cross-multiply and go from there.

$$16.2 = \frac{10}{10} \frac{3.86}{x} + \frac{180.2}{10x} + \frac{2}{2} \frac{42.2}{5x}$$

$$16.2 = \frac{38.6}{10x} + \frac{180.2}{10x} + \frac{84.4}{10x}$$

$$16.2 = \frac{303.2}{10x}$$

$$10x(16.2) = 303.2$$

$$162x = 303.2$$

$$x = \frac{303.2}{162} \approx 1.87$$

31. 1

Difficulty: Easy

Category: Heart of Algebra / Linear Equations

Strategic Advice: Choose the best strategy to answer the question. If you distribute the $\frac{2}{3}$, it creates messy calculations. Instead, clear the fraction by multiplying both sides of the equation by 3. Then use the distributive property and inverse operations to solve for x .

Getting to the Answer:

$$\frac{2}{3}(5x + 7) = 8x$$

$$3 \cdot \frac{2}{3}(5x + 7) = 3 \cdot 8x$$

$$2(5x + 7) = 24x$$

$$10x + 14 = 24x$$

$$14 = 14x$$

$$1 = x$$

32. 192

Difficulty: Medium

Category: Passport to Advanced Math / Exponents

Strategic Advice: This looks like a word problem, but don't let it intimidate you. Once you read it, you'll see that it boils down to substituting a few given values for the variables and solving the equation.

Getting to the Answer: Before you start substituting values, quickly check that the units given match the units required to use the equation—they

do, so proceed. The patient's weight (w) is 150 and the patient's BSA is $2\sqrt{2}$, so the equation becomes $2\sqrt{2} = \sqrt{\frac{150h}{3,600}}$. The only variable left in the equation is h , and you are trying to find the patient's height, so you're ready to solve the equation. To do this, square both sides of the equation and then continue using inverse operations. Be careful when you square the left side—you must square both the 2 and the root 2.

$$\begin{aligned} 2\sqrt{2} &= \sqrt{\frac{150h}{3,600}} \\ (2\sqrt{2})^2 &= \left(\sqrt{\frac{150h}{3,600}}\right)^2 \\ 2^2(\sqrt{2})^2 &= \frac{150h}{3,600} \\ 4(2) &= \frac{150h}{3,600} \\ 28,800 &= 150h \\ 192 &= h \end{aligned}$$

33. Any value greater than 7 and less than 7.5

Difficulty: Medium

Category: Heart of Algebra / Inequalities

Strategic Advice: You could solve the compound inequality for m and substitute the result into the expression $10m - 5$, but there is a quicker way to answer this question. Look for a relationship between what you're given, the possible values of $-2m + 1$, and what you're looking for, the possible values of $10m - 5$.

Getting to the Answer: Notice that $10m - 5$ is -5 times the expression $-2m + 1$. This means you can answer the question by multiplying all three pieces of the inequality by -5 . (Don't forget to flip the inequality symbols because you are multiplying by a negative number.) Then write the inequality with increasing values from left to right.

$$\begin{aligned} -5 \left(-\frac{3}{2}\right) &< -5(-2m + 1) < -5 \left(-\frac{7}{5}\right) \\ \frac{15}{2} &> 10m - 5 > 7 \\ 7 &< 10m - 5 < 7.5 \end{aligned}$$

You can enter any value between (but not including) 7 and 7.5, such as 7.1 or 7.2.

34. 40

Difficulty: Hard

Category: Additional Topics in Math / Geometry

Strategic Advice: Since \overline{AB} , \overline{CD} , and \overline{EF} are diameters, the sum of x , y , and the interior angle of the shaded region is 180 degrees. The question tells you that the shaded region is $\frac{1}{5}$ of the circle, so the interior angle must equal $\frac{1}{5}$ of the degrees in the whole circle, or $\frac{1}{5}$ of 360.

Getting to the Answer: Use what you know about y (that it is equal to $2x - 12$) and what you know about the shaded region (that it is $\frac{1}{5}$ of 360 degrees) to write and solve an equation.

$$x + y + \frac{1}{5}(360) = 180$$

$$x + (2x - 12) + 72 = 180$$

$$3x + 60 = 180$$

$$3x = 120$$

$$x = 40$$

35. 14

Difficulty: Hard

Category: Heart of Algebra / Linear Equations

Strategic Advice: When you know the slope and one point on a line, you can use $y = mx + b$ to write the equation. Substitute the slope for m and the coordinates of the point for x and y and then solve for b , the y -intercept of the line.

Getting to the Answer: The slope is given as $-\frac{7}{4}$, so substitute this for m . The point is given as $(4, 7)$, so $x = 4$ and $y = 7$. Now, find b .

$$y = mx + b$$

$$7 = -\frac{7}{4}(4) + b$$

$$7 = -7 + b$$

$$14 = b$$

The y-intercept of the line is 14.

You could also very carefully graph the line using the given point and the slope. Start at (4, 7) and move toward the y-axis by rising 7 and running to the left 4 (because the slope is negative). You should land at the point (0, 14).

36. 45

Difficulty: Hard

Category: Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: Make a chart that represents rate, time, and distance and fill in what you know. Then use your table to solve for distance. If it took Rory t hours to get to the airport, and the total trip took 2 hours and 30 minutes (or 2.5 hours), how long (in terms of t) did the return trip take?

Getting to the Answer:

	Rate	Time	Distance
To airport	45 mph	t	d
Back to home	30 mph	$2.5 - t$	d

Now use the formula $d = r \times t$ for both parts of the trip: $d = 45t$ and $d = 30(2.5 - t)$. Because both are equal to d , you can set them equal to each other and solve for t :

$$45t = 30(2.5 - t)$$

$$45t = 75 - 30t$$

$$75t = 75$$

$$t = 1$$

Now plug back in to solve for d :

$$d = 45t$$

$$d = 45(1)$$

$$d = 45$$

37. 10

Difficulty: Medium

Category: Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: You don't need to know chemistry to answer this question. All the information you need is in the table. Use the formula

$$\text{Percent} = \frac{\text{Part}}{\text{Whole}} \times 100\%$$

Getting to the Answer: To use the formula, find the part of the mass represented by the carbon; there is 1 mole of carbon, and it has a mass of 12.011 grams. Next, find the whole mass of the mole of chloroform; 1 mole carbon (12.011 g) + 1 mole hydrogen (1.008 g) + 3 moles chlorine ($3 \times 35.453 = 106.359$ g) = $12.011 + 1.008 + 106.359 = 119.378$. Now use the formula:

$$\begin{aligned} \text{Percent} &= \frac{12.011}{119.378} \times 100\% \\ &= 0.10053 \times 100\% \\ &= 10.053\% \end{aligned}$$

Before you grid in your answer, make sure you follow the directions—round to the nearest whole percent, which is 10.

38. 12

Difficulty: Hard

Category: Problem Solving and Data Analysis / Rates, Ratios, Proportions, and Percentages

Strategic Advice: This part of the question contains several steps. Think about the units given in the question and how you can use what you know to find what you need.

Getting to the Answer: Start with grams of chloroform; the chemist starts with 1,000 and uses 522.5, so there are $1,000 - 522.5 = 477.5$ grams left. From the previous question you know that 1 mole of chloroform has a mass of 119.378 grams, so there are $477.5 \div 119.378 = 3.999$, or about 4 moles of chloroform left. Be careful—you're not finished yet. The question asks for the number of moles of chlorine, not chloroform. According to the table, each mole of chloroform contains 3 moles of chlorine, so there are $4 \times 3 = 12$ moles of chlorine left.