3

3

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

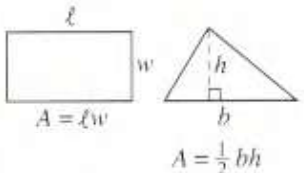
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

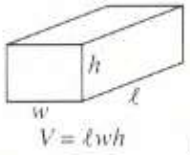
- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

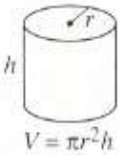
REFERENCE INFORMATION

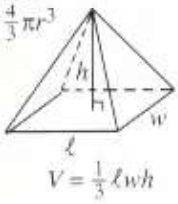
Area Facts



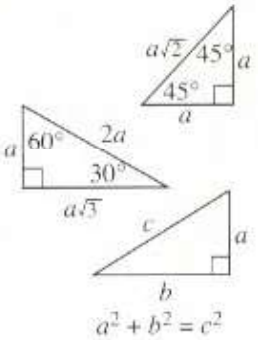
Volume Facts







Triangle Facts



The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

1. Which of the following is equal to –2 for some value of m?

   (A) $|m-2|-2$
   (B) $|m-2|+2$
   (C) $|2-m|+2$
   (D) $|2+m|+2$

2. If $f(x) = \sqrt{2x}-4$, what is $f(f^{-1}(-4))$?

   (A) –8
   (B) –6
   (C) –4
   (D) 0

GO ON TO THE NEXT PAGE

3. $2x - 3y = 24$
$x + 4.5y = -12$

In the system of equations above, what is the value of the product of x and y?

(A) 12
(B) 18
(C) −24
(D) −36

4. A shoe manufacturer wants to come up with a general rule to correlate the number of holes with the length of their shoelaces. The following table shows the number of holes in a shoe and the length, in inches, of its shoelace.

Holes	Length
4	12
6	18
8	24

If the table above represents a linear function, a hiking boot that has 18 holes should have shoelaces that are how long?

(A) 45 inches
(B) 48 inches
(C) 54 inches
(D) 63 inches

5. If $m = 2x^3 + 3x - 11$ and $n = 4x^2 + 5x - 7$, what is $3n - m$ in terms of x?

(A) $-2x^3 - 4x^2 - 2x - 18$
(B) $-(2x^3 + 3x^2 - 5x - 6)$
(C) $2x^3 - 12x^2 - 12x + 10$
(D) $-2x^3 + 12x^2 + 12x - 10$

6. If $\frac{1}{3x-1} = \frac{2}{x}$ then $x = ?$

(A) $\frac{2}{5}$
(B) 2
(C) $\frac{5}{2}$
(D) 3

7. Jenna needs to take a taxicab ride in Chicago to go to an important job interview. The taxi service she has selected provides the following fee schedule:

First $\frac{1}{4}$ mile: $2.00

Each $\frac{1}{4}$ mile after: $1.25

Excluding a tip, Jenna's fare was $15.75. How many miles did she travel?

(A) 2
(B) 2.5
(C) 2.75
(D) 3

8. $\frac{2}{3}x - \frac{5}{9}y = -7$
$bx - \frac{10}{3}y = 17$

In the system of equations above, b is a constant. If the system has no solution, what is the value of b?

(A) −3.75
(B) 3.75
(C) 4
(D) 4.4

9. $\sqrt{n-b} = n-2$

If $b = -4$, what is the solution set to the equation above?

(A) {−5}
(B) {0}
(C) {5}
(D) {0, 5}

GO ON TO THE NEXT PAGE

3

3

10. In a homecoming game, a girls' basketball team scored $\frac{1}{3}$ of its points during the first quarter, $\frac{1}{4}$ of its points during the second quarter, $\frac{1}{3}$ of its points in the third quarter, and 8 points in the fourth quarter. How many points did the team score in the game?

(A) 84
(B) 90
(C) 96
(D) 102

11. If $x^2 + y^2 = 12$ and $xy = -13$, what is the value of $2(x - y)^2$?

(A) −26
(B) 1
(C) 38
(D) 76

12. The number of bacteria in petri dish #1 is A. Petri dish #2 contains twice as many as dish #1 and is represented by the value B. Petri dish #3 has 17 more bacteria than the quantity in dish #2 and is represented by C. Which of the following expressions shows C in terms of A?

(A) C = 3A − 17
(B) C = 2A + 17
(C) C = 2A
(D) C = A + 17

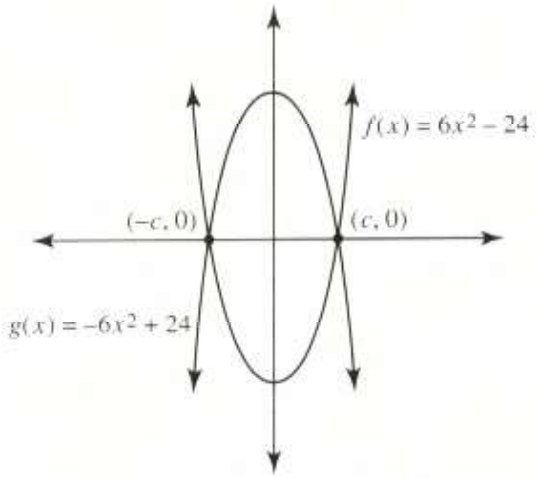


Figure Not Drawn to Scale

13. The functions f and g, defined by $f(x) = 6x^2 - 24$ and $g(x) = -6x^2 + 24$, are graphed in the xy-plane above. The graphs above intersect at the points $(c, 0)$ and $(-c, 0)$. What is the value of c?

(A) −2
(B) 0
(C) 2
(D) 4

14. Which of the following is an equivalent form of $\frac{7}{2-3i}$ (Note: $i = \sqrt{-1}$)?

(A) $3.5 + 4i$
(B) $\frac{14+21i}{13}$
(C) $1 + 3i$
(D) $-\frac{14+21i}{5}$

15. What are the solutions to $6x^2 + 12x - 15 = 0$?

(A) $2 \pm \sqrt{14}$
(B) $\frac{2 \pm \sqrt{14}}{2}$
(C) $\frac{-2 \pm \sqrt{14}}{2}$
(D) $-2 \pm 4\sqrt{2}$

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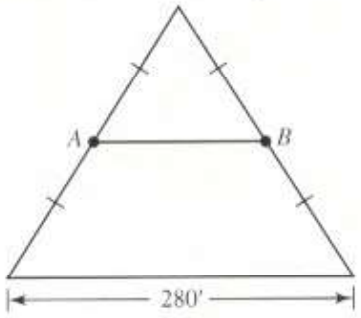
Floor Plan of Luxor Pyramid

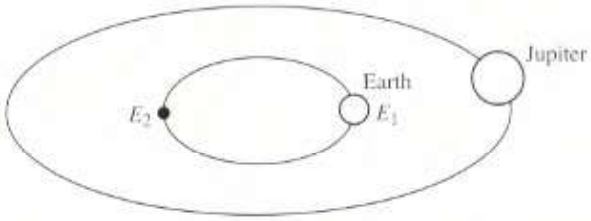


16. The Luxor pyramid in Egypt has a triangular base that is roughly equilateral; it served as the entrance to the Hall of the Pharaohs. A visitor was told that the measure of each side of the pyramid's triangular base was 280 feet long. He noticed that the corridor shown as $\overline{AB}$ in the diagram connected to the middle of each of the two sides it reached. How long is corridor $\overline{AB}$ (units are in feet)?

17. A farmer has 200 feet of fencing to surround a small plot of land. He wants to maximize the amount of space possible using a rectangular formation. The enclosed area will be against the side of a barn so he only needs one of the lengths of the rectangular area to be enclosed by fencing. What is the maximum area that can be enclosed by the fence (ignore the square unit label)?

18. $x^3 - 6x^2 + 2x - 12 = 0$
For what real value of x is the equation above true?

19. If $r = 3\sqrt{3}$ and $2r = \sqrt{3x}$ what is the value of x?



20. In the seventeenth century, the Danish astronomer Ole Roemer concluded that light takes longer to reach Earth from Jupiter when Earth is at E_2 than when Earth is at E_1. The modern figure for this time difference is 1,000 seconds. Modern estimates have the distance from Earth to Jupiter as 600 Gm and 900 Gm for E_1 and E_2, respectively. How long, in seconds, does it take light from Jupiter to reach the Earth at E_1? Give your answer in seconds. (Gm means gigameter, which is equal to 1,000,000,000 meters.)

STOP

If there is still time remaining, you may review your answers.

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- The **use of** a calculator on this section IS permitted.
- All variables and expressions represent real numbers unless indicated otherwise.
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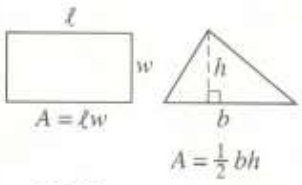
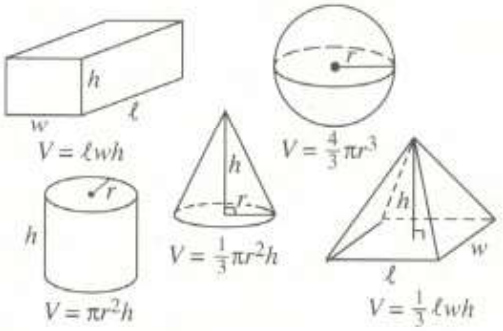
REFERENCE INFORMATION

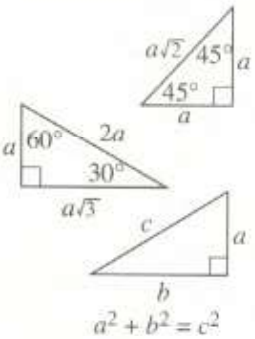
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

1. If $\frac{m-4}{3}=\frac{x}{9}$, what is x in terms of m?

   (A) $x=3m+6$

   (B) $x=\frac{1}{3}m-\frac{4}{3}$

   (C) $x=3(m-4)$

   (D) $x=3m-4$

GO ON TO THE NEXT PAGE

2. After researching the future cost of a four year college education, Sergio and Maria began saving for their daughter's tuition. After two years, they had accrued $2,870 for their college fund. After five years, the account balance was $7,150. If Sergio and Maria continue to save at the same rate as they have for the past five years, what will the savings be after 78 months?

   (A) $7,846.33
   (B) $8,413.17
   (C) $9,290.02
   (D) $9,291.07

3. The cube less the square of a number is twice the number. If x is a positive integer, what is its value?

   (A) 1
   (B) 2
   (C) 4
   (D) 8

4. Mr. Tessler, a biology teacher, uses pre-prepared slides of microorganisms to share with his class. Yesterday, one of Mr. Tessler's aides inadvertently mixed up the slides such that they no longer can be identified. Mr. Tessler knew he had the following slides:

   Slides of paramecia: 2
   Slides of amoebae: 5
   Slides of microbacteria: 3

   If Mr. Tessler selects two slides at random, what is the probability that he will select a slide of paramecia followed by a slide of amoebae?

   (A) $\frac{34}{45}$
   (B) $\frac{16}{45}$
   (C) $\frac{1}{9}$
   (D) $\frac{1}{10}$

5. A light year, the distance that light travels in one year, is 5.87×10^{12} miles. The Andromeda Galaxy is 1.3×10^{19} miles distant from Earth. How many light years distant is the Earth from the Andromeda Galaxy?

   (A) 2.2×10^5
   (B) 2.2×10^6
   (C) 3.4×10^8
   (D) 3.4×10^9

6. Conner needs to plan a production budget for a computer firm. In order to maximize profit, he needs to buy m computer frames at $18.75 and r keyboards at $13.25 each. If the cost of this transaction must be less than $139.00, which of the following inequalities represents Conner's model for profit maximization?

   (A) $18.75m + 13.25r < 139$
   (B) $18.75m + 13.25r \leq 139$
   (C) $18.75r + 13.25m < 139$
   (D) $18.75r + 13.25m \leq 139$

Day	Thursday	Friday	Saturday
Chance of rain	65%	74%	31%

7. The coach of the Denver High School baseball team will have to cancel an upcoming tournament if the weather conditions forecast rain. The table presents the probability of rain for the next three days. If it doesn't rain on Friday or Saturday, the coach can plan on holding the tournament at his high school. What is the probability that it will rain on Thursday but not Friday or Saturday?

   (A) 18.7%
   (B) 16.3%
   (C) 14.9%
   (D) 11.7%

GO ON TO THE NEXT PAGE

8. For what value of m does the system of equations have an infinite number of solutions?

$7x - 4y = 13$
$mx - 10y = 32.5$

(A) 14
(B) 17.5
(C) 21
(D) 32.5

9. Californians are very concerned about the continued drought conditions in their state. They are therefore curious about the price and quality of different water plans. A certain popular water plan charges a service fee of $31.50 per month. Each gallon of water used costs $.17 per gallon plus a local tax of 7.3% (the monthly service charge is tax exempt). Which of the following functions models the monthly cost of the plan?

(A) $f(x) = (.17x + .073)(31.5)$
(B) $f(x) = 31.5 + (.073x)(.17)$
(C) $f(x) = 31.5 + (1.073)(.17 + x)$
(D) $f(x) = 31.5 + (1.073)(.17x)$

Questions 10 and 11 refer to the table below.

The Environmental Protection Agency (EPA) has demonstrated that newer automobile emission standards have had a strong positive correlation with cleaner air in large metropolitan areas. Thus, it is the EPA's responsibility to get older cars off the road.

Cars in Operation in 1997

Age of Car	Millions of Cars
<3 years old	21.5
3 – 5 years old	29.9
6 – 8 years old	22.2
9 – 11 years old	16.7
≥12 years old	14.4

10. What percent of cars in operation in 1997 were between 6 and 11 years old?

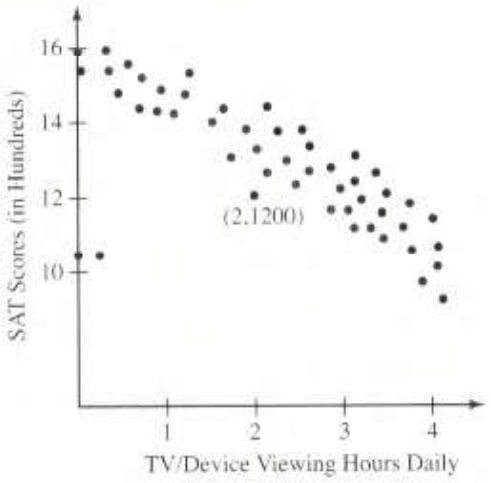
(A) 37.2
(B) 41.3
(C) 48.1
(D) 53.2

11. 1.3% of all cars were 20 years old and older. What percent of the 12 years and older category does this number represent?

(A) 8.3
(B) 9.4
(C) 11.3
(D) 14.8

GO ON TO THE NEXT PAGE

Questions 12 and 13 refer to the graph below.



The advent of television, iPhones, and tablets is vying for students' study time. Experts are concerned that the prolonged use of electronic devices adversely affects SAT scores. The graph demonstrates the correlation between hours spent viewing daily and their effect on SAT scores.

12. Which of the following can be inferred from the graph?

(A) The impact of viewing 3 versus 4 hours resulted in the same SAT score.
(B) All students who watched one hour or less of television/devices daily scored 1200 or higher on the SAT.
(C) SAT scores varied inversely with daily television/device viewing.
(D) SAT scores varied directly with daily television/device viewing.

13. Given the data in the graph, which equation could be the line of best fit?

(A) $y = 2.3x - 4.8$
(B) $y = .86x + .23$
(C) $y = -6.2x - 5.9$
(D) $y = -2.04x + 15.8$

Questions 14 and 15 refer to the information below.

Home values in America have increased since the 2008 slump in housing prices. Over the past six years, home prices have increased at an annual rate of 3.72%.

14. Which of the following functions models the increase in home values?

A = accumulated value of the home over time
P = the purchase price of the home
t = time in years

(A) $A = P(.0372)^t$
(B) $A = P(.9628)^t$
(C) $A = P(1.0372)^t$
(D) $A = P(3.72)^t$

15. A home costing $187,650 purchased in 2010 would be worth how much in 2013?

(A) $194,455
(B) $205,996
(C) $209,380
(D) $217,357

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16. A data set of five integers features a mean that is 5.5 times as large as the median. Why do these two measures of central tendency differ in size by such a large amount?

(A) The sample size is large.
(B) The mode of the data skews the data downward.
(C) There is an outlier that skews the mean higher.
(D) There is an outlier that skews the mean lower.

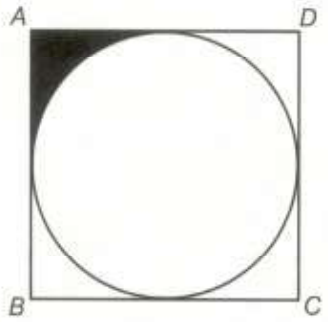
GO ON TO THE NEXT PAGE

17. A list of the weights of five, sixth-grade students is listed below:

x, 108, 112, 113, 119

If 112 is the median value of the weights, what is the greatest value of x (assume x is a positive integer)?

(A) 107
(B) 111
(C) 112
(D) 118

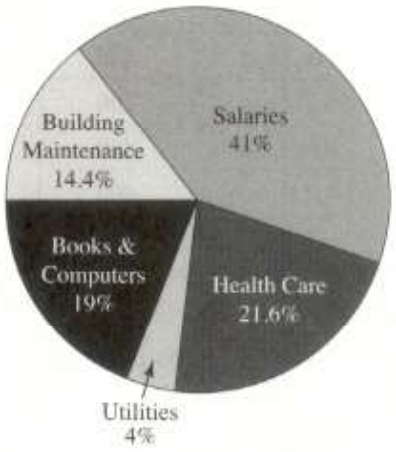


18. A coin toss board is shown above. If square *ABCD* has perimeter 64, what is the probability of a coin landing on the shaded portion of the board?

(A) .363
(B) .182
(C) .098
(D) .053

19. In 1990, the exchange rate of Mexican pesos was 3,120 per U.S. dollar. The next year, the Mexican government issued a super peso which traded at three to the U.S. dollar. Those who still possessed the old pesos could exchange them for super pesos or dollars, but a 4.8% transaction fee would be charged. How many U.S. dollars could be exchanged for 91,754 old pesos (round your answer to the nearest penny)?

(A) $17.43
(B) $28.06
(C) $29.14
(D) $37.43



Operating Costs Deerfield HS

20. The above pie chart represents the operating costs for Deerfield High School in 2014.

The cost for health care benefits in 2014 is $4,100,000. What is the cost for utilities?

(A) $586,113
(B) $637,431
(C) $759,259
(D) $817,437

GO ON TO THE NEXT PAGE

21. The tables below provide the distributions of majors of students at College A and College B.

College A

Major	Frequency
Psychology	300
Pre-Med	1,400
Nursing	200
Business	100
Art History	100

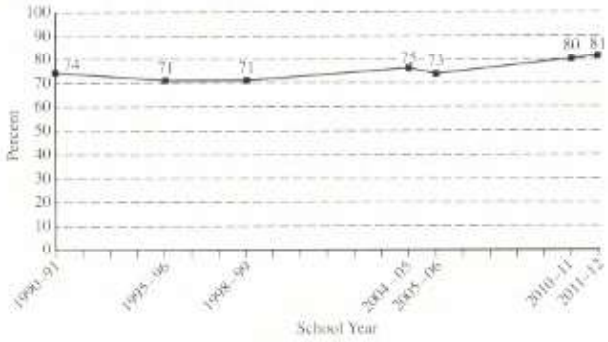
College B

Major	Frequency
Psychology	600
Pre-Med	300
Nursing	200
Business	400
Art History	600

Which of the following is true about the data shown for these two colleges?

(A) The standard deviation of majors at College A is larger.
(B) The standard deviation of majors at College B is larger.
(C) The standard deviation of majors at College A is the same as the standard deviation of College B.
(D) The standard deviation of both data sets cannot be calculated.

Question 22 refers to the graph below.



The graph above reflects the average percent of freshman high school students in America who graduate from high school within four years.

22. Which of the following can be inferred from the graph above?

(A) From 2006 to 2012 there was approximately an 11% increase in the percent of high school graduates.
(B) There was a steady increase in the number of high school graduates between 1991 and 2012.
(C) The number of high school graduates decreased from 2006 to 2012.
(D) The state of the national economy had a marked increase on the percent of high school graduates.

GO ON TO THE NEXT PAGE

23. $2{,}500\left[1+\frac{r}{1{,}200}\right]^{12}$

The expression shown above provides the sum of money, in dollars, that is earned in a year by an initial deposit of $2,500 in a savings institution that pays an annual rate r% compounded monthly. Which of the following expressions shows how much additional money is earned at an interest rate of 6% than at an interest rate of 3.2%?

(A) $2{,}500\left[1+\frac{6-3.2}{1{,}200}\right]^{12}$

(B) $2{,}500\left[1+\frac{6}{\frac{3.2}{1{,}200}}\right]^{12}$

(C) $\frac{2{,}500\left[1+\frac{6}{1{,}200}\right]^{12}}{2{,}500\left[1+\frac{3.2}{1{,}200}\right]^{12}}$

(D) $2{,}500\left[1+\frac{6}{1{,}200}\right]^{12}-2{,}500\left[1+\frac{3.2}{1{,}200}\right]^{12}$

24. The square root of x varies inversely with y. When $x = 196$, $y = -\frac{1}{2}$.

Find the value of x when $y = -3$.

(A) 3

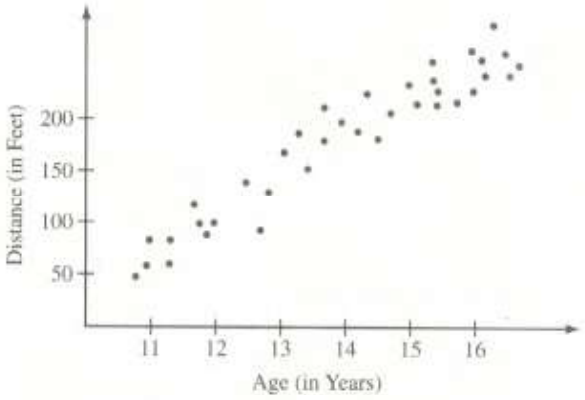
(B) $\frac{49}{9}$

(C) $\frac{49}{3}$

(D) 49

Questions 25–27 refer to the graph below.

A girls' softball coach was recruiting for Behrens High School's spring softball team. The coach wanted to see if age was a determining factor in gauging the distance each girl could throw a softball.



Softball Throws by Age and Distance

25. Which of the following statements can be concluded from the graph?

(A) There is a weak negative correlation between age and the distance thrown.
(B) There is a strong positive correlation between age and the distance thrown.
(C) There is no correlation between age and distance thrown.
(D) There is an inverse relationship between age and distance thrown.

26. Which of the following functions is a line of best fit for the graph?

(A) $y = 5.14x - 123.5$
(B) $y = -43.27x - 231.3$
(C) $y = 33.33x - 299.6$
(D) $y = 14.2 - 2.01x$

GO ON TO THE NEXT PAGE

4

4

27. Given the data in the graph, what would be the predicted distance of a throw from a person who is 18-years old?

(A) 247 feet
(B) 277 feet
(C) 300 feet
(D) 319 feet

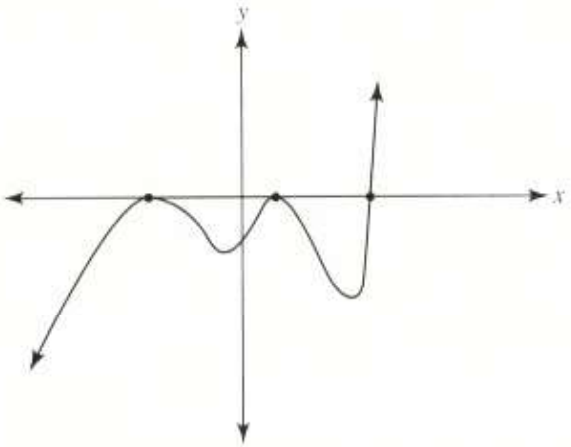
---

28. If $i = \sqrt{-1}$, what is the value of $3(2 - 4i)^2$?

(A) $-12 - 4i$
(B) $-12 - 16i$
(C) $-36 - 48i$
(D) -84

29. There are nine students in a statistics class. After a recent test, the average (arithmetic mean) score was 79%. What must a tenth student's score be to raise the class average to 81%?

(A) 87
(B) 89
(C) 94
(D) 99



30. All of the zeroes of the polynomial are shown in the graph above. Which of the following could be the equation of $f(x)$?

(A) $f(x) = -2x^2 + 3x - 5$
(B) $f(x) = 3x - 5x^2 + 4x - 2$
(C) $f(x) = x^5 - 2x^3 + 3x - 5$
(D) $f(x) = 2x^7 + 4x^4 - 2x^3 - 9$

GO ON TO THE NEXT PAGE

4

4

31. Steve and Iris drive exactly 5 miles from point A to point B. If Iris' average speed is 50 miles per hour and Steve's average speed is 60 miles per hour, how much longer, in seconds, will it take Iris than Steve to drive five miles?

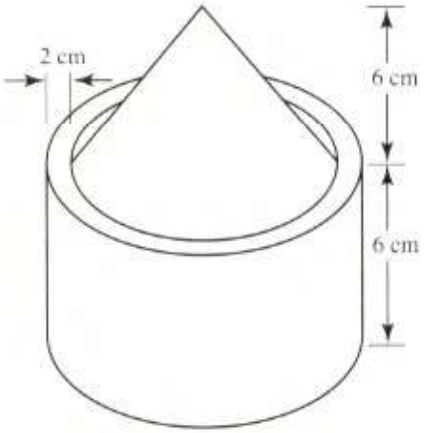
32. A manufacturer of surgical equipment measures its profit by using the following profit function:

$P(x) = 11{,}000x - 6750$, where x is the number of units the company sells in a three month period.

If the company's profit over a three month period was \$9,321,250, how many units did it sell?

33. Kari wants to buy a new service plan for a data and internet bundle. One plan offers a monthly fee of \$24.00 and \$.007 for each minute of use. Another plan offers a flat monthly fee of \$36.50. After how many minutes of use will the two plans charge the same monthly cost (round your answer to the nearest minute)?

34. A "standard candle" is a way for astronomers to calculate the distance to an object in space. The apparent brightness of an object varies directly with the square of the distance. For example a galaxy that is 1,000,000 times farther than another would appear to be 1,000 times dimmer. Similarly, a nebula that is 900 times more distant than another would appear 30 times as dim. If a star appeared to be 16 times dimmer than another star, how many times farther away is the more distant star?



35. A machine part, shown above, is in the shape of a cone on top of a cylinder. The width of the rim on top of the cylinder that surrounds the cone is 2 centimeters. The height of the cone and the cylinder are each 6 centimeters and the volume of the part is 102π cm^3. What is the radius of the cylinder (round your answer to the nearest tenth of a centimeter)?

GO ON TO THE NEXT PAGE



36. A central angle in a circle has a measure of 34.4° and the measure of its sector is 139.6 square units. To the nearest tenth of a unit, what is the measure of the circle's radius?

Questions 37 and 38 refer to the information provided below.

Because of refraction, an object 5 meters below the surface of a lake appears to be 4 meters below the surface.

37. If the apparent depth under water varies directly with the actual depth, what is the actual depth of a rock that appears to be 6 meters below the surface of a small lake?

38. A diver inadvertently left his keys in his shorts when he was swimming. The keys fell out of his shorts and went to the bottom of his swimming pool. The keys appeared to be 9 feet below the surface. What is the difference between the actual depth of the keys and the apparent depth?

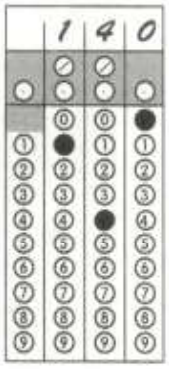
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 1

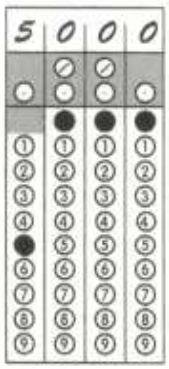
Section 3: Math (No Calculator)

1. **A**
2. **C**
3. **C**
4. **C**
5. **D**
6. **A**
7. **D**
8. **C**
9. **C**
10. **C**
11. **D**
12. **B**
13. **C**
14. **B**
15. **C**

16. **140**

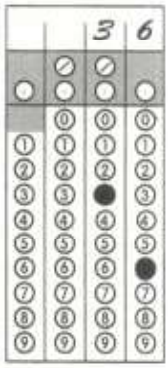


17. **5,000**

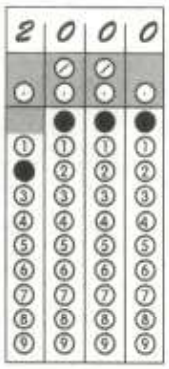


18. **6**

19. **36**



20. **2,000**



Number Correct _____

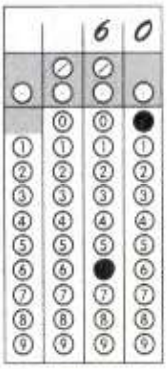
Number Incorrect _____

ANSWER KEY
Practice Test 1

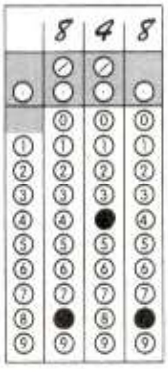
Section 4: Math (Calculator)

1. **C**	7. **D**	13. **D**	19. **B**	25. **B**
2. **C**	8. **B**	14. **C**	20. **C**	26. **C**
3. **B**	9. **D**	15. **C**	21. **A**	27. **C**
4. **C**	10. **A**	16. **C**	22. **A**	28. **C**
5. **B**	11. **B**	17. **B**	23. **D**	29. **D**
6. **A**	12. **C**	18. **D**	24. **B**	30. **C**

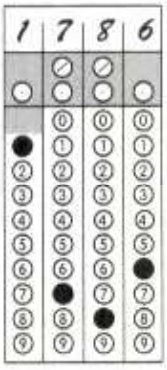
31. **60**



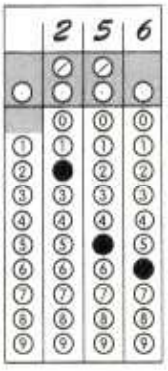
32. **848**



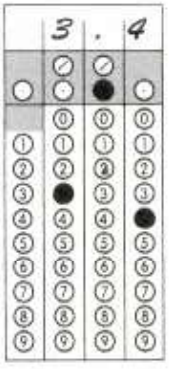
33. **1,786**



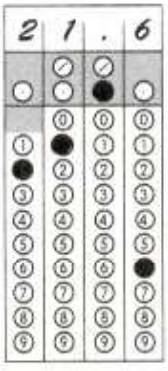
34. **256**



35. **3.4**

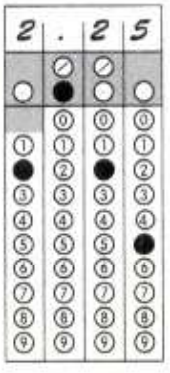


36. **21.6**



37. **7.5**

38. **2.25**



Number Correct _____

Number Incorrect _____

Section 3: Math Test (No Calculator)

1. **(A)** Although the absolute value of a number must be greater than or equal to 0, the entire expression, $|m-2|-2$ could equal -2. For example, suppose $m=2$, then:

$$|2-2|-2=0-2=-2$$

2. **(C)** Find $f^{-1}(f(x)=\sqrt{2x}-4)$.

$f(x)=\sqrt{2x}-4$ which means $y=\sqrt{2x}-4$

Find f^{-1} by reversing the positions of x and y

$$x=\sqrt{2y}-4$$
$$x+4=\sqrt{2y}$$
$$(x+4)^2=2y$$
$$\frac{1}{2}(x^2+8y+16)=y=f^{-1}(x)$$

Find $f^{-1}(-4)$ by replacing x with -4 in $\frac{1}{2}(x^2+8y+16)$.

$$f^{-1}(-4)=\frac{1}{2}((-4)^2+(8)(-4)+16)=0$$

Find $f(0)$ by replacing x with 0 in $f(x)=\sqrt{2x}-4$.

$$f(0)=\sqrt{2\times 0}-4=-4$$

3. **(C)** Multiply $x+4.5y=-12$ by -2. Attain the same coefficient of x but with different signs. Solve by elimination.

$$2x-3y=24$$
$$-2(x+4.5y=-12)$$

Solve by eliminating x.

$$\begin{array}{r} 2x-3y=24 \\ +\ -2x-9y=24 \\ \hline -12y=48 \\ y=-4 \end{array}$$

Replace y with -4 in $2x-3y=24$.

$$2x-3(-4)=24$$
$$2x+12=24$$
$$2x=12$$
$$x=6$$

The product of x and y is $(6)(-4)=-24$

This problem could also have been solved by using the substitution method.

$$x+4.5y=-12$$
$$x=-4.5y-12$$

$(-4.5y-12)$ would be substituted for x in $2x-3y=24$

4. **(C)** You may have noticed that the length of the shoelace is three times the number of holes. For example a 4-hole lace is 12 inches long and an 8-hole lace is 24 inches long. Therefore, the hiking boot will need shoelaces that are 54 inches long because $18 \times 3 = 54$.

5. **(D)** Substituting for m and n into $3n - m$ results in the following:

$$3(4x^2 + 5x - 7) - (2x^3 + 3x - 11) =$$
$$12x^2 + 15x - 21 - 2x^3 - 3x + 11 =$$

Combine like terms by adding and subtracting those terms with variables raised to the same power.

$$-2x^3 + 12x^2 + 12x - 10$$

6. **(A)** Cross-multiply the proportion and solve for x.

$$\frac{1}{3x-1} = \frac{2}{x}$$
$$(2)(3x - 1) = (1)(x)$$
$$6x - 2 = x$$
$$-2 = -5x$$
$$\frac{2}{5} = x$$

7. **(D)** Subtract \$2.00 from \$15.75 to count the first quarter mile.

$$\$15.75 - \$2.00 = \$13.75$$

Divide \$13.75 by \$1.25 to calculate the remaining quarter miles.

$$\$13.75 \div \$1.25 = 11$$

The taxi traveled a total of 12 quarter miles. Divide 12 by 4 to find the equivalent number of miles.

$$12 \div 4 = 3$$

8. **(C)** If the system of equations has no solution, each equation has the same slope and a different y-intercept, thus making the lines parallel. In this system of equations, the x's and y's must be multiples of one another.

Find the multiple by dividing $-\frac{10}{3}y$ by $-\frac{5}{9}y$.

$$-\frac{10}{3}y \div -\frac{5}{9}y = 6$$

Multiply $\frac{2}{3}$ by 6 to find the value of b.

$$\frac{2}{3} \times 6 = 4$$

Make sure the constants are different to ensure the lines are parallel.
$-7(6)$ does not equal 17 because -42 does not equal 17.

9. **(C)** Square both sides of the equation to get rid of the radical.

$$\sqrt{n-(-4)} = n-2$$
$$(\sqrt{n--4})^2 = (n-2)^2$$
$$n+4 = n^2-4n+4$$
$$0 = n^2-5n$$
$$0 = n(n-5)$$

$n = 0$ or $n - 5 = 0$
$n = 0$ or $n = 5$

Check each solution in the original equation to ascertain any extraneous solutions.

Check 5:

$$\sqrt{5-(-4)} = 5-2$$
$$\sqrt{9} = 3$$
$$3 = 3$$

$$\sqrt{0-(-4)} = 0-2$$
$$\sqrt{4} = -2$$
$$2 \neq -2$$

We accept 5 as the solution and reject 0.

10. **(C)** Let x = the number of points scored in the game.

$$\frac{1}{3}x+\frac{1}{4}x+\frac{1}{3}x+8 = x$$
$$\frac{11}{12}x+8 = x$$
$$8 = \frac{1}{12}x$$
$$96 = x$$

11. **(D)** Expand $(x-y)^2$

$$(x-y)^2 = x^2 - 2xy + y^2$$

It was given that $x^2 + y^2 = 12$ and $xy = -13$. Therefore, $-2xy = 26$

$$(x-y)^2 = 12 + 26 = 38$$

Multiply the equation by 2.

$$2(x-y)^2 = (2)(38) = 76$$

12. **(B)** Dish #2 has B bacteria, which is twice the number in dish #1. Therefore, $2A = B$. Dish #3 has C bacteria, which is 17 more than B. Given that $B = 2A$ and $C = B + 17$, then $C = 2A + 17$.

13. **(C)** The two functions f and g intersect when their x values are the same. Set each of the functions equal and solve for x.

$$6x^2 - 24 = -6x^2 + 24$$

Add $6x^2$ and 24 to both sides to isolate x^2.

$$6x^2 - 24 + 6x^2 + 24 = -6x^2 + 24 + 6x^2 + 24$$
$$12x^2 = 48$$
$$x^2 = 4$$

Find the square root of each side of the equation.

$$x^2 = 4$$
$$x = \pm 2$$

Since we are looking for c rather than $-c$, its value is 2.

14. **(B)** Rationalize the denominator by multiplying the numerator and the denominator by $2 + 3i$, the conjugate of $2 - 3i$.

$$\frac{7}{2-3i} \times \frac{2+3i}{2+3i} =$$
$$\frac{7(2+3i)}{4-9i^2} =$$
$$\frac{14+21i}{4+9} = \frac{14+21i}{13}$$

Note that if $i = \sqrt{-1}$, then $i^2 = -1$.

15. **(C)** Solve the equation by first dividing all of the terms by 3.

$$(6x^2 + 12x - 15) \div 3 = 0 \div 3$$
$$2x^2 + 4x - 5 = 0$$

The equation cannot be factored so use the quadratic equation to solve.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

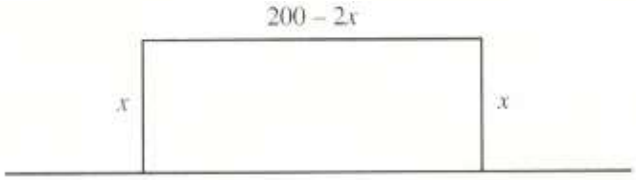
$$a = 2 \quad b = 4 \quad c = -5$$

$$\frac{-4 \pm \sqrt{(4)^2 - 4(2)(-5)}}{2(2)}$$
$$\frac{-4 \pm \sqrt{16+40}}{4} =$$
$$\frac{-4 \pm \sqrt{56}}{4} = \frac{-2 \pm \sqrt{14}}{2}$$

16. **140** If a segment connects the midpoints of two sides of a triangle, then the segment (in this case corridor $\overline{AB}$) is both parallel to the base and $\frac{1}{2}$ its length. Multiply one of the bases of the triangular floor by $\frac{1}{2}$.

$\frac{1}{2} \times 280 = 140$

17. **5,000**



The area of a rectangle is found by using the formula Area = (length)(width). Using the diagram we get

$$f(x) = (200 - 2x)(x) = -2x^2 + 200x$$

The lead term is negative and the function is quadratic, resulting in a parabola that opens down. Its vertex is a maximum of the function which provides the maximum enclosed area of the fence. Begin finding the vertex by using the formula $x = -\frac{b}{2a}$.

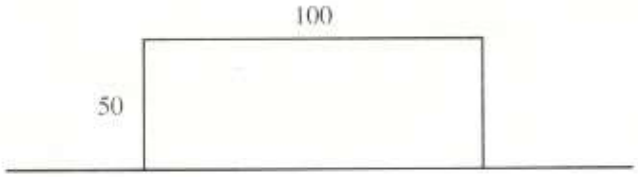
$$a = -2 \quad b = 200$$

$$-\frac{200}{2(-2)} = 50$$

Replace x with 50 in $f(x) = -2x^2 + 200x$

$$f(50) = -2(50)^2 + 200(50) = 5{,}000$$

This can be demonstrated with the diagram below.



The maximum area enclosed by the fencing is 5,000 square feet. Confirm the calculation by using the formula Area = (length)(width).

$$\text{Area} = 100 \times 50 = 5{,}000$$

18. **6** Begin factoring $x^3 - 6x^2 + 2x - 12 = 0$ by grouping.

$$(x^3 - 6x^2) + (2x - 12) = 0$$

Extract the largest common factor from each of the parentheses.

$$x^2(x - 6) + 2(x - 6) = 0$$

Place x^2 and 2 in its own parentheses.

$$(x^2 + 2)(x - 6) = 0$$

Set each of the parentheses equal to 0.

$$x^2 + 2 = 0 \text{ or } x - 6 = 0$$
$$x^2 = -2 \text{ or } x = 6$$

$x^2 = -2$ becomes $x = \pm 2i$, neither of which is a real number. Therefore, the real solution to $x^3 - 6x^2 + 2x - 12 = 0$ is $x = 6$.

19. **36** $r = 3\sqrt{3}$ and $2r = \sqrt{3x}$, therefore $2r$ also equals $(2)(3\sqrt{3})$ or $6\sqrt{3}$. Set $6\sqrt{3}$ equal to $\sqrt{3x}$ and solve for x.
Remove the radicals by squaring both sides.

$$6\sqrt{3} = \sqrt{3x}$$
$$(6\sqrt{3})^2 = (\sqrt{3x})^2$$
$$108 = 3x$$
$$36 = x$$

20. **2,000** Light travels according to the diagram in a relatively straight line. Thus, use a linear model in the form of $y = mx + b$ to find the time light travels to point E_1. Consider the point where Jupiter is located as the origin leading to $b = 0$.
Let x = distance
Let y = time
Using the information provided in the problem, we have point E_1 at (600, y) and E_2 at (900, $y + 1000$). Find the slope of the line connecting these two points.

$$\frac{(y+1000)-y}{900-600} = \frac{1000}{300} = \frac{10}{3}$$

The linear model is $y = \frac{10}{3}x$. Find the time light travels by replacing x with the distance from Jupiter to E_1, which is 600 GM.

$$y = \frac{10}{3}(600) = 2000$$

Light travels for 2,000 seconds to reach E_1 from Jupiter.

Section 4: Math Test (Calculator)

1. **(C)** Cross-multiply and solve for x.

$$\frac{m-4}{3} = \frac{x}{9}$$
$$3x = 9(m-4)$$
$$x = 3(m-4)$$

2. **(C)** The phrase ". . . at the same rate . . ." means use the linear model $y = mx + b$. Find the slope by using the ordered pairs (2, \$2870) and (5, \$7150).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7150-2870}{5-2} = \frac{4280}{3} = 1426.67$$

Replace m with 1426.67.

$$y = 1426.67x + b$$

Replace x and y with either point.

$$2870 = 2(1426.67) + b$$
$$16.67 = b$$
$$y = 1426.67x + 16.67$$

Replace x with 78 months, but remember to first convert it to years.

$$78 \text{ months} = 6.5 \text{ years}$$
$$y = 1426.67(6.5) + 16.66$$
$$y = 9{,}290.02$$

$9,290.02

3. **(B)** Let x = the positive integer

$$x^3 - x^2 = 2x$$
$$x^3 - x^2 - 2x = 0$$
$$x(x^2 - x - 2) = 0$$
$$x(x-2)(x+1) = 0$$
$$x = 0 \quad x - 2 = 0 \quad x + 1 = 0$$
$$x = 0 \quad x = 2 \quad x = -1$$

Since x is a positive integer, $x = 2$
If factoring is difficult, try a plug-and-check strategy.

$$(2)^3 - 2^2 = 2(2)$$
$$8 - 4 = 4$$
$$4 = 4$$

4. **(C)** Find the probability of Mr. Tessler choosing a slide of paramecia as his first selection.

$$P(\text{paramecia selected}) = \frac{2}{10} = \frac{1}{5}$$

Next, find the probability of selecting a slide of amoebae. Remember, there are now only 9 slides available since the first slide was removed.

$$P(\text{amoebae}) = \frac{5}{9}$$

Find the probability of selecting a slide of paramecia followed by a slide of amoebae by multiplying the probabilities.

$$\frac{1}{5} \times \frac{5}{9} = \frac{1}{9}$$

5. **(B)** Divide the miles to the Andromeda Galaxy by the miles in a light year to find the light years to the Andromeda Galaxy.

$$\frac{1.3 \times 10^{19}}{5.87 \times 10^{12}} = .22 \times 10^{7} = 2.2 \times 10^{6}$$

In scientific notation, the first number is expressed such that $1 \leq x < 10$ and the second number is 10 expressed to a power.

6. **(A)** The cost for m computers at \$18.75 each is \$18.75m. The cost for r keyboards at \$13.25 each is \$13.25r. The cost must be less than \$139, so we arrive at

$$18.75m + 13.25r < 139.$$

Choices (B) and (D) can automatically be eliminated because each features ≤ (less than or equal to). The problem stipulates the cost must be less than \$139.

7. **(D)** The probability of rain on Thursday is 65%. Since the probability of rain on Friday and Saturday is 74% and 31%, respectively, subtract each from 100% to find the probability of no rain on both days.
No rain on Friday: 100% – 74% = 26%
No rain on Saturday: 100% – 31% = 69%
Each day's forecast is independent of the others so multiply the three probabilities.

$$(.65)(.26)(.69) = .1166 = 11.7\%.$$

8. **(B)** A system of equations has an infinite number of equations when the lines are the same. For example,

$$x + y = 6$$
$$2x + 2y = 12$$

has infinite solutions because $2(x + y) = (6)(2)$. Both equations are multiples of one another.
Observe the following:

$$(32.5) \div 13 = 2.5$$
$$(-10) \div (-4) = 2.5$$

In order for the system of equations to have infinite solutions, m must be 2.5 times greater than 7.

$$7 \times 2.5 = m$$
$$17.5 = m$$

9. **(D)** The cost of x gallons of water at \$.17/gallon is $.17x$. The tax applied is found by $[.17x + (.073)(.17x)]$ which can be rewritten as $(1.073)(.17x)$. Add the monthly service charge to get

$$f(x) = 31.5 + (1.073)(.17x).$$

10. **(A)** Use the formula $\frac{\text{part}}{\text{whole}} = \frac{n}{100}$ to find the percent of those operating cars that were in the category 6 to 11 years old.

$$6 - 8: 22.2$$
$$9 - 11: 16.7$$

The number of cars (in millions) that are between 6 and 11 years old is 38.9 because $22.2 + 16.7 = 38.9$.
Total cars: 104.7

$$\frac{38.9}{104.7} = \frac{n}{100}$$

Cross-multiply and solve for n.

$$104.7n = 38{,}900$$
$$n = 37.2\%$$

11. **(B)** Find the number of cars that were 20 years old and older.

$$(.013)(104.7) = 1.36 \text{ million}$$

Use the formula $\frac{\text{part}}{\text{whole}} = \frac{n}{100}$ to find the percent of cars 12 years old and older that are 20 years old.

$$\frac{1.36}{14.4} = \frac{n}{100}$$

Cross-multiply and solve for n.

$$14.4n = 136$$
$$n = 9.4\%$$

12. **(C)** Inverse variation means one variable increases proportionally to the decrease in the other variable. SAT scores generally dropped as daily television/device watching increased.

13. **(D)** The data appear to descend to the right, indicating a negative slope. Therefore, choices (A) and (B) can be eliminated. Choose two points in the center of the data and derive the equation of the line that connects them.

(1, 14) (2, 12)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$m = \frac{12-14}{2-1}$$
$$m = -2$$
$$y = -2x + b$$

Substitute either point for x and y.

$$14 = -2(1) + b$$
$$16 = b$$

The equation of a line of best fit could be $y = -2x + 16$. Choice (D) is the closest to this equation.

14. **(C)** A = accumulated value of the home over time; P = the purchase price of the home; t = time in years. The formula for the growth of the home over time is the exponential equation $A = P(1.0372)^t$. The addition of 1 and .0372 insures growth in the calculations.

15. **(C)** Input the information provided in the question into the formula $A = P(1.0372)^t$. We substitute 3 for t because three years have elapsed from 2010 to 2013.

$$A = 187{,}650(1.0372)^3 = \$209{,}380$$

16. **(C)** A large outlier skews the value of the mean toward larger values. The following fulfills the description of the data set:

5 8 12 13 292

The mean is 66 but the median is 12. The large value, 292, skewed the mean much higher than any of the other numbers in the set.

17. **(B)** Arrange the values in ascending order but leave two blanks for x and 108.

____ ____ 112 113 119

Notice that x can be the smallest value

x 108 112 113 119

The variable x can also be the second smallest value.

$$108 \quad x \quad 112 \quad 113 \quad 110$$

The question requires the greatest integer that x can be so 111 would be that weight.

18. **(D)** Subtract the area of the square from the area of the circle.
Area of a square: side × side (s^2)

Divide the perimeter by 4 and square that value:

$$\left(\frac{64}{4}\right)^2 = 16^2 = 256$$

The area of the square is 256 square units.

$$\text{Area of a circle} = \pi r^2$$

The diameter of the circle is equal to the length of one of the sides of the square. Each side is 16 so the radius is 8 because the radius of a circle is one-half of the diameter.

$$\pi(8)^2 = 201.1$$

Subtract the area of the circle from the area of the square.

$$256 - 201.1 = 54.9$$

Divide the remaining area by 4 to find the shaded area.

$$54.9 \div 4 = 13.73$$

Divide the measure of the shaded area by the area of the square to find the probability of a coin landing in the shaded area.

$$13.73 \div 256 = .053$$

The diagram is assumed to be drawn to scale so choice (A), .363, would appear to be much too large.

19. **(B)** Multiply 3,120 by 1.048 to find the exchange rate of old pesos to the U.S. dollar that includes the 4.8% exchange fee.

$$3{,}120 \times 1.048 = 3{,}269.76$$

Divide 91,754 by 3,269.76 to calculate the dollar value.

$$91{,}754 \div 3{,}269.76 = \$28.06$$

20. **(C)** Find the percentage that is utility expense in 2015.

$$100\% - (14.4 + 41 + 21.6 + 19) = 4\%$$

Set up a proportion comparing an item's percentage of the budget to its dollar expenditure.

$$\frac{21.6}{4{,}100{,}000} = \frac{4}{x}$$

Cross-multiply and solve for x.

$$(21.6)(x) = (4)(4{,}100{,}000)$$
$$21.6x = 16{,}400{,}000$$
$$x = \$759{,}259$$

21. **(A)** The standard deviation is a measure of how far the data set values are from the mean. In the data set for College B, the large majority of the data are in three of the five possible values, which are the three values closest to the mean. In the data set for College A, the data are more spread out, with many values at the minimum and maximum values. Therefore, by observation, the data for College A have a larger standard deviation.

22. **(A)** The percent of high school graduates in 2006 was 73% and in 2012 the percent had increased to 81%. Divide 81 by 73 to find the percent increase.

$$81 \div 73 = 1.109$$

The increase was 10.9%; the closest answer to this figure is 11%.

23. **(D)** The formula indicates the amount of money earned at a savings institution on a $2,500 deposit, compounded monthly at r%. To find the additional dollars earned at 6% versus 3.2%, find the difference between the annual earnings at each rate.

$2{,}500\left[1+\frac{6}{1{,}200}\right]^{12}$ represents the amount earned each year at 6%.

$2{,}500\left[1+\frac{3.2}{1{,}200}\right]^{12}$ represents the amount earned at 3.2%.

Find their difference by subtracting the smaller expression from the larger.

$$2{,}500\left[1+\frac{6}{1{,}200}\right]^{12}-2{,}500\left[1+\frac{3.2}{1{,}200}\right]^{12}$$

24. **(B)** Inverse variation uses the model $xy = k$ where k is a constant. Since the question stipulates that the square root of x varies inversely with y, use the model $\sqrt{x}y = k$.

$$\sqrt{196} \times -\frac{1}{2} = k$$
$$-7 = k$$

Now input $y = -3$ into the equation.

$$\sqrt{x} \times -3 = -7$$
$$\sqrt{x} = \frac{7}{3}$$
$$(\sqrt{x})^2 = \left(\frac{7}{3}\right)^2$$
$$x = \frac{49}{9}$$

25. **(B)** The graph shows an unmistakable upward rise to the right; as the age increases, so, too, does the distance thrown. Choice (A), which indicates a weak negative correlation in the graph, can be discarded; the graph clearly moves vertically as age increases.

26. **(C)** Find the line of best fit by selecting two points that lie within the data.

$$(12, 100) \quad (15, 200)$$

Find the slope of a line that connects the two points.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{200-100}{15-12} = 33.33$$
$$y = 33.33x + b$$

Use either point to find b.

$$\begin{aligned} 100 &= 33.33(12) + b \\ -299.6 &= b \\ y &= 33.33x - 299.6 \end{aligned}$$

27. **(C)** Substitute 18 for x in the equation $y = 33.33x - 299.6$.

$$y = 33.33(18) - 299.6 = 300 \text{ feet.}$$

28. **(C)** Expand $(2 - 4i)^2$:

$$\begin{aligned} (2 - 4i)^2 &= 4 - 16i + 16i^2 \\ &= 4 - 16i - 16 \\ &= -12 - 16i \end{aligned}$$

Multiply $-12 - 16i$ by 3:

$$3(-12 - 16i) = -36 - 48i$$

29. **(D)** If nine students earned an average score of 79%, the class amassed 711 points because $9 \times 79 = 711$. In order for ten students to have an average score of 81, the class must collect 810 points because $10 \times 81 = 810$. Subtracting we get: $810 - 711 = 99$. The tenth student must earn a score of 99% to raise the class average to 81%.

30. **(C)** The graph touches the x-axis three times, suggesting a cubic polynomial. However, on two of the zeroes, the graph touches the x-axis but returns to go in the opposite direction; this indicates a double root. Points A and B represent double roots, but point C represents a single zero because the graph passes through the x-axis, continuing in the same direction. $f(x)$, therefore, shows the graph of a fifth-degree polynomial.

31. **60** Use the formula $d = rt$ (distance = rate × time) in the form of $t = \frac{d}{r}$.
We get:

Iris: $t = \frac{5 \text{ miles}}{50 \text{ miles per hour}} = \frac{1}{10}$ hour $= 6$ minutes

Steve: $\frac{5 \text{ miles}}{60 \text{ miles per hour}} = \frac{1}{12}$ hour $= 5$ minutes

The difference in time is 1 minute or 60 seconds.

32. **848** Replace $P(x)$ with \$9,321,250, the company's profit.

$$\begin{aligned} 9{,}321{,}250 &= 11{,}000x - 6{,}750 \\ 9{,}328{,}000 &= 11{,}000x \\ 848 &= x \end{aligned}$$

33. **1,786** Kari needs to set the plans equal to each other while leaving the number of minutes as a variable.
Let x = the number of minutes at \$.007 per minute
Plan 1: $24 + .007x$
Plan 2: 36.50

$$\begin{aligned} 24 + .007x &= 36.50 \\ .007x &= 12.50 \\ x &= 1{,}786 \end{aligned}$$

At 1,786 minutes, the two data plans have equal monthly costs.

34. **256** The way to calculate the distance of a star is to square the apparent dimness to find the distance. For example, the galaxy that is 1000 times dimmer is 1,000,000 times farther away ($1000^2 = 1{,}000{,}000$). The nebula that is 30 times as dim is 900 times further away ($30^2 = 900$). Therefore a star that is 16 times dimmer than another would be 256 times distant than the brighter star because $16^2 = 256$.

35. **3.4** Let r represent the radius of the cone and $r + 2$ represent the radius of the cylinder. Use the formulas for the volume of a cone and a cylinder and set the sum equal to 102π.

$$6\pi(r+2)^2 + \frac{1}{3}\pi r^2(6) = 102\pi$$

$$6\pi(r^2 + 4r + 4) + \frac{1}{3}\pi r^2(6) = 102\pi$$

$$6\pi\,(r^2 + 4r + 4) + 2\pi r^2 = 102\pi$$

Divide both sides of the equation by 2π.

$$3r^2 + 12r + 12 + r^2 = 102$$

$$4r^2 + 12r - 90 = 0$$

Using the quadratic formula we arrive at answers of 3.4 and –6.4. We discard the negative answer.

36. **21.6** The area of a sector is found by using the formula

$$A = \frac{m}{360}\pi r^2$$

where m = measure of the central angle and r = length of the radius.
Input the known data and solve for r.

$$139.6 = \frac{34.4}{360}\pi r^2$$

$$465.33 = r^2$$

$$21.6 = r$$

37. **7.5** Direct variation calculations can be found by using the model $\frac{y_1}{x_1} = \frac{y_2}{x_2}$. In the situation with the refracted images, use the model $\frac{\text{actual depth}}{\text{apparent depth}} = \frac{\text{actual depth}}{\text{apparent depth}}$.

$$\frac{5}{4} = \frac{n}{6}$$

$$30 = 4n$$

$$7.5 = n$$

38. **2.25** Use the model $\frac{\text{actual depth}}{\text{apparent depth}} = \frac{\text{actual depth}}{\text{apparent depth}}$ to find the actual depth of the keys.

$$\frac{n}{9} = \frac{5}{4}$$

$$45 = 4n$$

$$11.25 = n$$

The question asks for the difference between the actual depth and the apparent depth, so subtract 9 from 11.25.

$$11.25 - 9 = 2.25$$

3

3

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

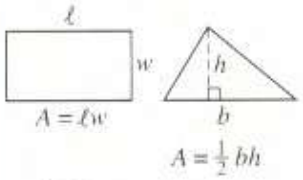
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

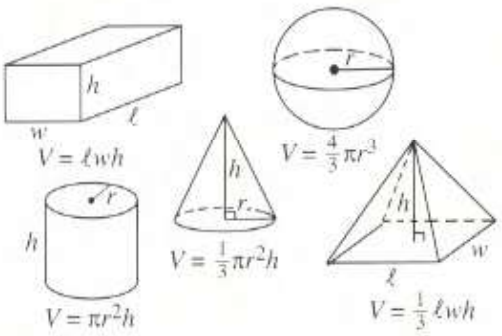
- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

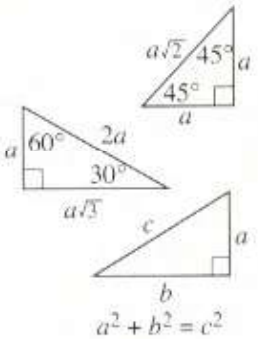
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

1. If $\frac{r-2}{6} = n$ and $n = 5$, what is the value of r?

   (A) 28
   (B) 30
   (C) 32
   (D) 42

2. If $i = \sqrt{-1}$, what is the value of $(5 + 3i) + (-4 + 7i)$?

   (A) $1 + 10i$
   (B) $9 + 10i$
   (C) $-41 + 2i$
   (D) $-1 - 5i$

GO ON TO THE NEXT PAGE

3. Ted needs to purchase shirts and belts for the costumes in his school's play. He can buy s shirts and b belts but the quantity may not exceed 100 items. Which of the following inequalities represents the conditions of Ted's purchases?

(A) $s + b > 100$
(B) $s + b < 100$
(C) $s + b \leq 100$
(D) $sb \leq 100$

4. $\frac{1}{x} + \frac{3}{x} = \frac{1}{7}$

Jill has employed two painters to paint the outside of her rental apartment. One of the workers paints three times as quickly as the other. Together they paint the apartment in 7 hours. If the equation above models the situation, what does $\frac{3}{x}$ represent?

(A) The entire job if it were done by the faster painter only.
(B) The entire job if it were done by the slower painter only.
(C) The fraction of the job the slower painter completes in one hour.
(D) The fraction of the job the faster painter completes in one hour.

5. What is the result when $3x^2 - 4x + 5$ is subtracted from $3x^3 - 13x + 4$?

(A) $3x^3 - 3x^2 - 9x - 1$
(B) $x^3 - 6x - 1$
(C) $5x - 4x^2 - 11$
(D) $3x^3 - 2x^2 - 6x - 9$

6. For what value(s) of x is the following expression undefined?

$$\frac{-5x^2y - 4xy}{6x^2 - 13x - 5}$$

(A) $-1, 5$
(B) 5
(C) $-\frac{1}{3}, \frac{5}{2}$
(D) $\frac{1}{3}, \frac{3}{2}$

7. Which of the following equations has the same x- and y-coordinates of the vertex as $y = 3(x - 4)(x + 6)$?

(A) $y = x^2 - 8x + 15$
(B) $y = 3(x^2 + 4x - 6)$
(C) $y = 3(x + 1)^2 - 75$
(D) $y = 3x^2 + 6x - 10$

8. A square photograph is surrounded by a square frame that is 2 inches wide on each side. If the diagonal of the photograph is 12 inches, what is the area of the frame (in square inches)?

(A) $72 + 48\sqrt{2}$
(B) $16 + 48\sqrt{2}$
(C) 72
(D) $48\sqrt{2}$

9. Which of the following equations represents a line that is parallel to the line with equation $y = \frac{3}{2}x - \frac{7}{4}$?

(A) $6x + 4y = 8$
(B) $-6x + 4y = 11$
(C) $x - 2y = -4$
(D) $3x + 2y = 7$

GO ON TO THE NEXT PAGE

10. $n = 3.65 + .35x$
$m = 4.25 + .15x$

In the equations above, m and n represent the heights of bamboo plants, in feet, x weeks after September 15. What was the height of the two plants when their heights were equal?

(A) 1.5
(B) 3.0
(C) 4.7
(D) 4.8

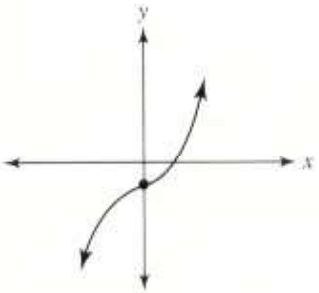
11. $\frac{3i}{2-i}$

If the expression above is written in the form $a + bi$, where a and b are real numbers, what is the value of a? (Note $i^2 = \sqrt{-1}$)

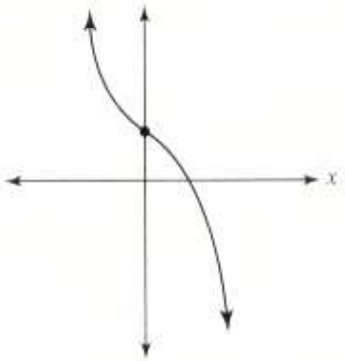
(A) -6
(B) $\frac{6}{5}$
(C) $-\frac{3}{5}$
(D) $\frac{5}{3}$

12. If n is a positive rational number, which of the following could be the graph of $y = x^3 + \frac{1}{5}n^n$?

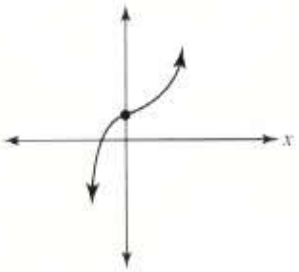
(A)



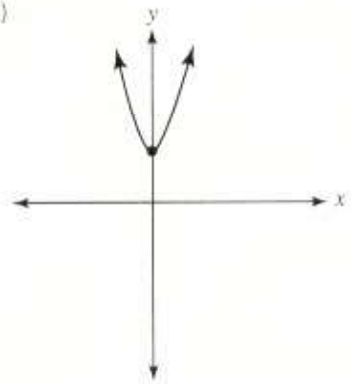
(B)



(C)



(D)



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13. $h(x) = bx^2 + 30$

For the function h defined above, b is a constant and $h(6) = 138$. What is the value of $h(-4)$?

(A) 24
(B) 64
(C) 78
(D) 86

14. A college currently has 600 students enrolled full time. Of these students, 400 are science majors while 200 are liberal arts majors. If 350 of the students are male, and 250 of the males are science majors, how many female students are liberal arts majors?

(A) 200
(B) 150
(C) 100
(D) 50

15. $P = -1.6x^2 + 2.6xy - 11.4$

The equation above represents a profit function used by an event coordinator at a city museum. In the equation, P represents profit earned, x represents paid admissions ($x > 0$), and y is any rental discount that is offered. Which of the following represents y in terms of x and P?

(A) $y = \frac{1.6xP + 11.4}{2.6x}$

(B) $y = \frac{P + 1.6x^2 + 11.4}{2.6x}$

(C) $y = \frac{1.6x^2 - 11.4}{2.6x}$

(D) $y = \frac{P \pm \sqrt{2.6x}}{11.4}$

GO ON TO THE NEXT PAGE

16. A 2002 Loyola University of Chicago study showed a marked decrease in blue-eyed Americans. About one-half of Americans were born in 1900 with blue eyes. By 1950 that number had dropped to one-third. The 2000 Census states that only about 1 of every 6 Americans had blue eyes. If the rate of decrease continues at the same rate as the prior 50 years (1950–2000), what fraction of people will be born with blue eyes by the year 2050?

17. Jerry has joined a gymnasium for which he pays dues of $75 each month, plus a daily rate of $10 for each day that he uses the facilities. The function shown below can be used to determine the cost in dollars per month for being a member of this club.

    $f(d) = 75 + 10d$, where d is the number of days.

    Jerry spent $155 in January, $195 in February, and $225 in March. If he spent a total of $850 for the months of January, February, March, and April, what was the total number of days that he spent at the club for those four months?

18. Two sides of a triangle are 7 and 11 inches. If a third side of the triangle is also an integer, what is the product of the smallest and largest values that the side could be?

19. In triangle ABC, the measure of angle B is 90°, $BC = 80$ and $AC = 100$. Triangle DEF is similar to triangle ABC where vertices D, E, and F correspond with vertices A, B, and C. The scale factor of triangle DEF to triangle ABC is $\frac{1}{10}$. What is the value of cos D?

20. A customer at the produce section of a food store bought cucumbers and heads of lettuce. The quantity she purchased of the heads of lettuce was 6 fewer than 5 times the number of cucumbers. If cucumbers cost $.30 each and a head of lettuce costs $.70 and her cost was $7.20, how many cucumbers did she buy?

If there is still time remaining, you may review your answers.

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- The **use of** a calculator on this section IS permitted.
- All variables and expressions represent real numbers unless indicated otherwise.
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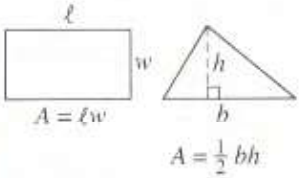
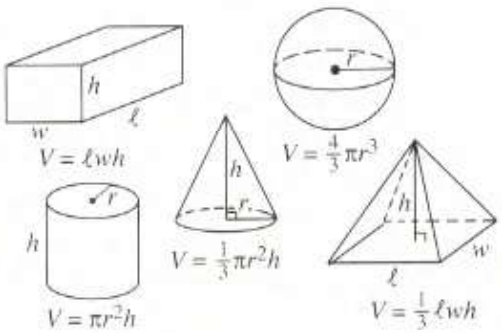
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

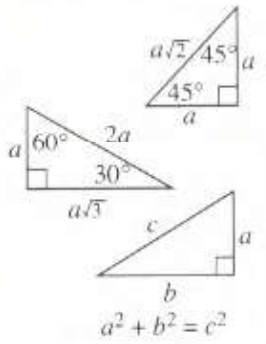
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

Questions 1 and 2 refer to the following information.

A graphic novelist earns income directly proportional to the number of books she sells. Her income at a recent book signing was $1,320 when 800 books were sold.

1. What would be the income for the novelist at a show in which she sold 12,000 books?

   (A) $1,140
   (B) $1,980
   (C) $19,800
   (D) $21,080

GO ON TO THE NEXT PAGE

2. The graphic novelist has to pay certain expenses, called overhead, on all of her sales. The amount of the overhead costs is 32% of the income she earns from book sales. After she pays her overhead costs, what would be her income on sales of 5,000 books?

(A) $2,640
(B) $5,610
(C) $7,610
(D) $7,620

---

3. In a linear function $f(4) = 6$ and $f(-2) = 14$. What is the value of $f(9)$?

(A) $\frac{20}{3}$
(B) $\frac{2}{3}$
(C) $-\frac{2}{3}$
(D) -3

4. The average (arithmetic mean) of $2x - 4$, $x + 4$, and $3x - 6$ is $x + 4$. What is the value of $-2x + 3$?

(A) -9
(B) -6
(C) 6
(D) 12

5. Shelley is a salesperson for a local furniture store. She receives a $24.00 commission for every recliner she sells and $63.00 for every dinette set. If Shelley sells r dinette sets and d recliners during a work shift, which expression represents her pay for that day?

(A) $63r + 24d$
(B) $24r + 63d$
(C) $24r - 63d$
(D) $63r - 24d$

6. The following price sheet indicates the cost of purchasing bottled water.

Quantity	Price
24-pack	$9.95
12-pack	$5.95
Individual Bottle	$1.15

A field trip to the outdoor petting zoo requires that each student have a bottle of water to avoid dehydration. What is the lowest price available for 39 bottles of water?

(A) $19.35
(B) $21.30
(C) $27.20
(D) $44.85

7. If $n > 0$ then n^2 is

(A) greater than n
(B) equal to n
(C) less than n
(D) there is not enough information to solve this problem.

8. $f(x) = x^2 + 6x - 4$

If the parabola described above is shifted m units to the right and n units up, the new vertex is $(5, -6)$. What is the value of mn^{-1}?

(A) -56
(B) $-\frac{8}{7}$
(C) $\frac{8}{7}$
(D) 56

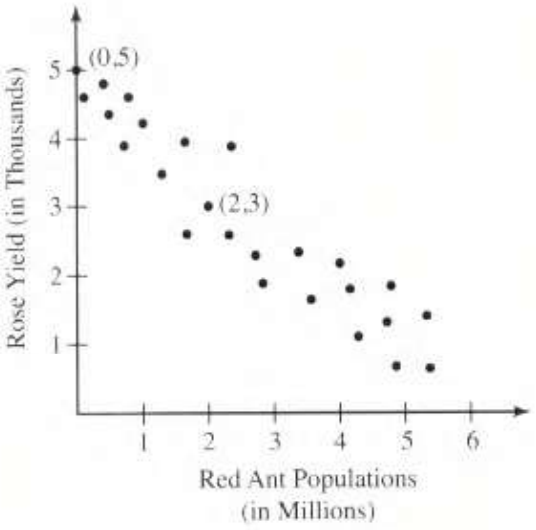
GO ON TO THE NEXT PAGE

9. A fabric warehouse manager has found that for every 500 square yards of fabric in stock, 13 square yards cannot be sold due to defects. If a recent shipment contained 273 square yards of defective fabric, how many square yards were in the entire shipment?

(A) 10,000
(B) 10,500
(C) 11,000
(D) 23,500

Questions 10 and 11 refer to the graph below.

A botanist was exploring the impact a local red ant population had on local nurseries. An experiment was devised to investigate any correlation between red ant populations and the annual yield of white roses. A scatter plot of the data is shown below.



10. A line of best fit is constructed within the data. Which of the following functions best models the data?

(A) $f(x) = -4.88x + 4.66$
(B) $f(x) = 1.15x + 7.88$
(C) $f(x) = 1.27x + 4.88$
(D) $f(x) = -1.14x + 4.88$

11. A grower has an annual yield of 1,100 roses. If the grower uses a pesticide that reduces ant populations by 60%, how many more roses can be expected to grow per year?

(A) 3,200
(B) 2,100
(C) 1,800
(D) 1,400

Questions 12 and 13 refer to the table below.

Table of the Seven Lightest Chemical Elements (by atomic mass)

Atomic Mass	Name Chemical Element	Symbol	Atomic number
1.0079	Hydrogen	H	1
4.0026	Helium	He	2
6.941	Lithium	Li	3
9.0122	Beryllium	Be	4
10.811	Boron	B	5
12.0107	Carbon	C	6
14.0067	Nitrogen	N	7

12. Which element is approximately equal to the sum of the weights of Helium and Lithium?

(A) Nitrogen
(B) Boron
(C) Beryllium
(D) Lithium

13. Which element is about 30% more massive than Lithium?

(A) Nitrogen
(B) Boron
(C) Beryllium
(D) Hydrogen

GO ON TO THE NEXT PAGE

14. The equation of a circle is shown below.

$x^2 + y^2 - 6y + 4x = 36$

What is the circumference of this circle?

(A) 49π
(B) 36π
(C) 14π
(D) 12π

15. Sammie has done a survey of one hundred 16-year-old Florida students and found that 84% favored including an internship in their schools' curricula. She finds, however, that the margin of error in her survey is 6.9%. What can she do to reduce the margin of error?

(A) check similar surveys in other states
(B) reduce the survey size
(C) increase the survey size
(D) survey other age groups as well

16. The function g is defined by $g(x) = 2x^3 - 8x^2 - bx + 140$. In the xy plane, the graph of g intersects the x-axis at $(2, 0)$, $(-5, 0)$, and $(m, 0)$. What is the value of b?

(A) -44
(B) 4
(C) 31
(D) 62

17. A car travels h hours at a rate of m miles per hour. If the car can travel g miles for each gallon of gasoline used, which equation shows the number of gallons used?

(A) $x = \frac{hm}{g}$

(B) $x = \frac{g}{hm}$

(C) $x = \frac{gh}{m}$

(D) $x = \frac{mg}{h}$

18. Even though she is only twenty-seven years old, Cheryl is interested in beginning a retirement plan. The graph above shows the value of a market fund investment compared to a Certificate of Deposit (CD). Which of the following **cannot** be concluded by Cheryl from the graph?

(A) At one year, the market fund is worth more than the CD.
(B) The market fund shows exponential growth and the CD shows linear growth.
(C) At 20 months, the two funds have the same value.
(D) The initial investment in each account was the same.

19. Which of the following is a step in solving the equation $\sqrt{x-7} = x-7$?

(A) $x - 7 = x - 7$
(B) $2x = 14$
(C) $(x - 8)(x - 7) = 0$
(D) $(x + 7)(x - 6) = 0$

GO ON TO THE NEXT PAGE

20. A game spinner has four colors equally spaced: red, green, blue, and yellow. What is the probability that a single, six-sided die will land on a prime number followed by a spin of yellow or blue?

(A) $\frac{1}{4}$

(B) $\frac{1}{9}$

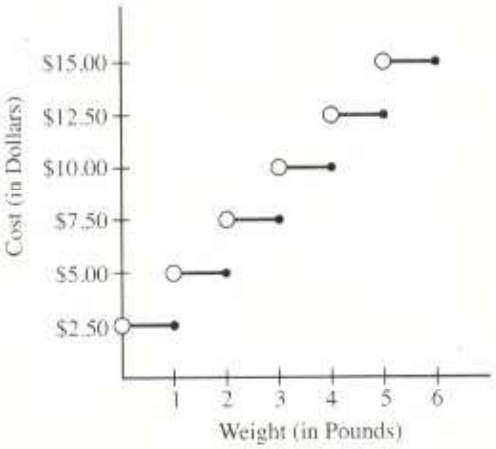
(C) $\frac{1}{12}$

(D) $\frac{1}{36}$

21. Gold has always been coveted for its aesthetic qualities. However, due to its malleability, it also has many industrial and electronic applications. Gold can be stretched so thinly that a single ounce can cover 100 square yards of surface. How many square feet can be covered with 2.5 ounces of gold?

(A) 2,250 square feet
(B) 1,125 square feet
(C) 750 square feet
(D) 150 square feet

22. A start-up delivery service in Gainesville offers a fee schedule that is indicated in the table below. Each pound (or fraction thereof) costs $2.50 to deliver within a 20-mile radius of downtown Gainesville. A local business owner in the downtown section finds the service cost effective to deliver to suburban clientele at the outskirts of town.



A recent delivery had items that weighed the following (in pounds):

2.68 3.11 5.28 4.0

What was the cost to deliver this order?

(A) $37.50
(B) $42.50
(C) $45.00
(D) $52.50

GO ON TO THE NEXT PAGE

23. A learning therapist has shown that students can increase reading levels by increasing required summer reading. She models the increase using the formula $y = 1.09x + .17$, where x represents the current grade reading level and y represents the improvement after the program. Which of the following represents the meaning of 1.09 in the equation?

(A) The difference between the students who use the program and those who do not.
(B) The increase in the number of students using the reading program.
(C) The increase in the reading level plus a constant of .17.
(D) A 17% increase in reading level.

Questions 24 and 25 refer to the information provided in the table below.

Rank	Country	GDP–per capita (US$)
1	Liechtenstein	141,100
2	Qatar	104,300
3	Luxembourg	81,100
4	Bermuda	69,900
5	Monaco	63,400
6	Singapore	60,500
7	Jersey	57,000
8	Falkland Islands (Islas Malvinas)	55,400
9	Norway	54,200
10	Brunei	50,000

The Gross Domestic Product (GDP) is a measure of a country's wealth. The per-capita income for a country is found by dividing the sum of all of the goods and services that a country produces by the country's population.

24. Which country exceeded the GDP of Singapore by approximately 4.8%?

(A) Qatar
(B) Monaco
(C) Bermuda
(D) Norway

25. In 2014, the GDP of Singapore was $298,000,000,000. Which of the following is the best approximation of the size of Singapore's population?

(A) 493,000
(B) 874,000
(C) 4,900,000
(D) 6,100,000

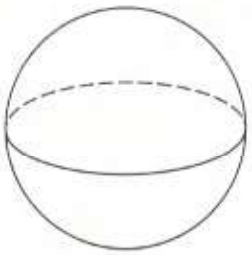
	10th	11th
Female	17	18
Male	18	20

26. One lucky student at Bristol High School will be selected to attend a College for Kids camp at Johns Hopkins University. The table above represents the number of students in the 10th and 11th grades at the school. If a student is selected at random, what is the probability that the student will be in 10th grade or a male?

(A) .753
(B) .521
(C) .479
(D) .472

GO ON TO THE NEXT PAGE

27. A great circle of a sphere contains the sphere's center. If the volume of a sphere is 374 cubic inches, what is the circumference of a great circle on that sphere? (Use $\pi = 3.14$)



(A) 4.47
(B) 28.07
(C) 56.14
(D) 62.74

Question 28 refers to the information below.

The half-life of an element is the amount of time that elapses until a certain mass of an element or compound decays to one-half its initial amount.

$$A = R_0\left(\frac{1}{2}\right)^x$$

28. A certain compound's half-life can be approximated using the equation above where

R_0 = the initial amount of the compound
A = the amount remaining after x years
x = the time elapsed in years

If 125 grams of the compound is left to decay over 2.3 years, how many grams will remain?

(A) 16.7
(B) 25.4
(C) 29.6
(D) 41.1

29. Twenty-one students entered into a foul shooting contest in basketball. Each student was given five foul shots to attempt. The table below lists the number of foul shots made and the number of students who made that many foul shots.

Successful Foul Shots	Frequency
0	2
1	4
2	4
3	7
4	3
5	1

If a student who successfully shot at least two foul shots was chosen at random, what is the probability that he/she successfully shot exactly 4 foul shots?

(A) $\frac{1}{7}$
(B) $\frac{1}{5}$
(C) $\frac{2}{5}$
(D) $\frac{3}{5}$

Question 30 refers to the system of equations below.

30. $4a + n = 2a - 3$
$4b + m = 2b - 3$

If n is m plus 1, which of the following is true?

(A) a is b minus $\frac{1}{2}$
(B) a is b plus $\frac{1}{2}$
(C) a is b plus 1
(D) a is b minus 2

GO ON TO THE NEXT PAGE

31. It's the end of the school year and a tenth grade civics class is planning a barbecue to celebrate. The class has drinks and desserts but needs to plan the number of hamburgers it needs to buy. Hamburger patties are sold in packages of six hamburgers. Hamburger rolls come in packages of eight rolls. What is the smallest number of hamburgers that should be purchased to have no rolls left over from a package?

32. A World History class recently took its mid-term exam. The following table represents the array of scores.

		x	x	
		x	x	
x		x	x	
x	x	x	x	x
20%	**40%**	**60%**	**80%**	**100%**

If a thirteenth student took the exam the next day, what must that score be to arrive at a class mean score of 60%?

33. If $x^3 - 15 = (x - 3)(x^2 + 3x + 9) + m$, what is the value of m?

34. In a circle with center P, central angle MPN has a measure of $\frac{3\pi}{4}$ radians. The area of the sector formed by the central angle MPN is what fraction of the circle?

35. Cindy owns a candy store and sells individual candies as well as mixes. Her most popular mixture is the chocolate and mint collection. The ratio of chocolates to mints in this candy mix is 3 to 5. If she is mixing 7 pounds of the mix, how many pounds are chocolates?

36. $y \leq -12x + 2400$
$y \leq 6x$

In the xy-plane, if a point with coordinates (x, y) lies in the solution set of the system of inequalities above, what is the maximum value of y?

GO ON TO THE NEXT PAGE

Questions 37 and 38 refer to the information provided below.

A merchant is experimenting with discounting prices for men's slacks to raise additional revenue for his business.

37. A merchant sells a pair of slacks called Model 1, for $50 a pair. He is able to sell 40 pairs per month at this price. In order to get capital to purchase newer models, the merchant plans to discount this model of slacks by 10%. If the discount yields the sale of 10 additional pairs, how much capital will he have gained at the end of the month by discounting this model of slacks?

38. The merchant determined that the additional working capital gained from discounting his first model of slacks by 10% was insufficient. He now wants to discount an additional pair of slacks, Model 2, in order to gain a total of $750. In a normal month the Model 2 slacks sell for $65 at 25 pairs per month. If he discounts Model 2 slacks by 25%, how many pairs of this second model must he sell, in addition to the discounted Model 1 slacks, in order to arrive at a $750 gain?

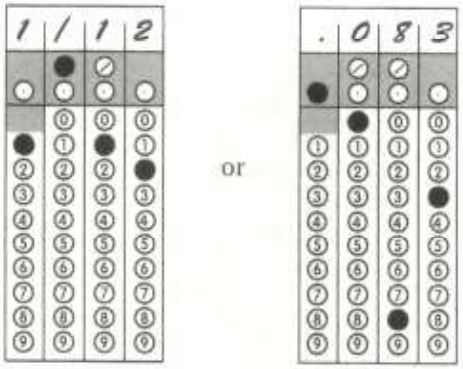
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 2

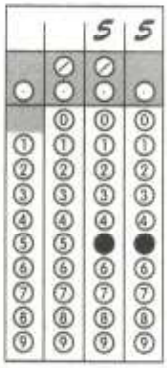
Section 3: Math (No Calculator)

1. **C**
2. **A**
3. **C**
4. **D**
5. **A**
6. **C**
7. **C**
8. **B**
9. **B**
10. **C**
11. **C**
12. **C**
13. **C**
14. **C**
15. **B**

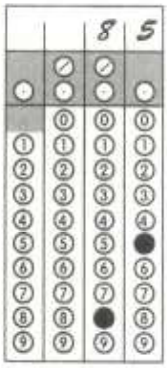
16. **1/12** or **.083**



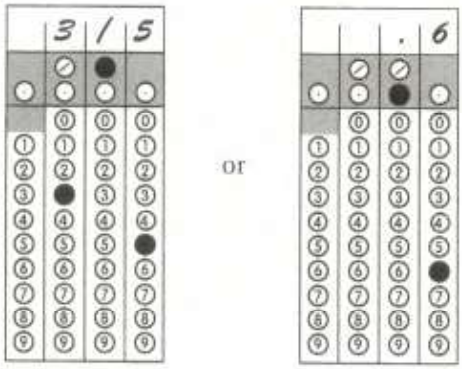
17. **55**



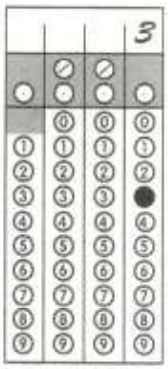
18. **85**



19. **3/5** or **.6**



20. **3**



Number Correct _____

Number Incorrect _____

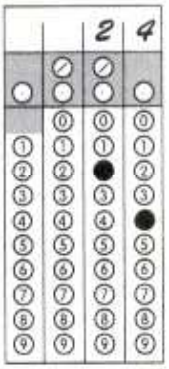
PRACTICE TEST 2

ANSWER KEY
Practice Test 2

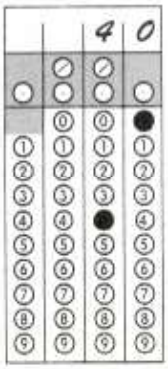
Section 4: Math (Calculator)

1. **C**	7. **D**	13. **C**	19. **C**	25. **C**
2. **B**	8. **C**	14. **C**	20. **A**	26. **A**
3. **B**	9. **B**	15. **C**	21. **A**	27. **B**
4. **A**	10. **D**	16. **D**	22. **B**	28. **B**
5. **A**	11. **B**	17. **A**	23. **C**	29. **B**
6. **A**	12. **B**	18. **A**	24. **B**	30. **A**

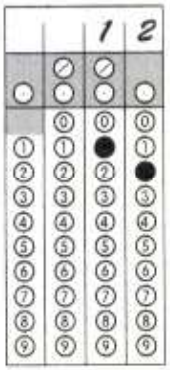
31. **24**



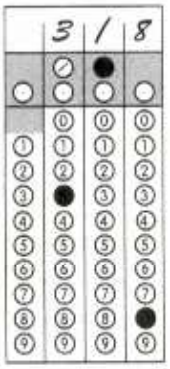
32. **40**



33. **12**



34. **3/8** or **.375**



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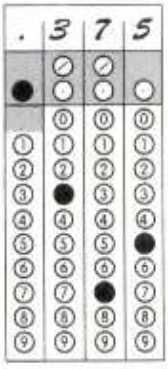
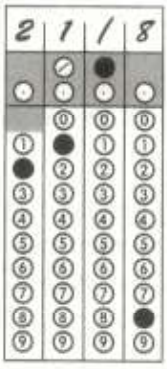
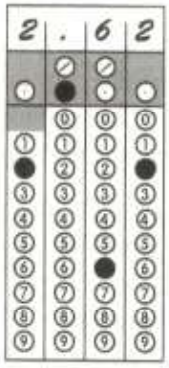


ANSWER KEY
Practice Test 2

35. **21/8** or **2.62** or **2.63**



or



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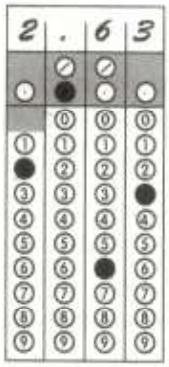
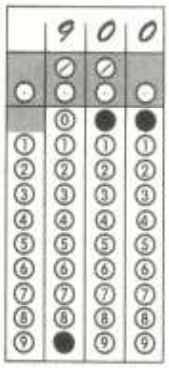
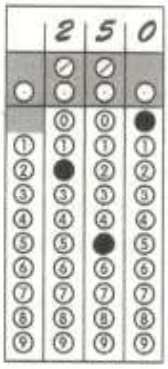


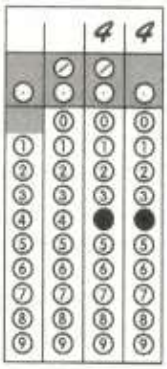
36. **900**



37. **250**



38. **44**



Number Correct _____

Number Incorrect _____

PRACTICE TEST 2

43. **(C)** This is the only choice that makes good sense and is grammatical. The adverb clause "when they began to treat each other civilly," together with the phrase "that is," is set off by dashes. The material set off by dashes amplifies what has just been said. Note that this use of dashes is often effective, but dashes should be used sparingly in formal writing.

44. **(B)** This aptly expresses the main point of the paragraph.

Section 3: Math Test (No Calculator)

1. **(C)** Substitute 5 for n as provided in the original equation.

$$\frac{r-2}{6}=5$$

Next, multiply both sides of the equation by 6 to isolate $r-2$.

$$(6)\frac{r-2}{6}=5(6)$$

$$r-2=30$$

Add 2 to both sides of the equation.

$$r-2+2=30+2$$

$$r=32$$

2. **(A)** Simplify $(5+3i)+(-4+7i)$ by combining the real components of the expression first.

$$5+-4=1$$

Next, combine the imaginary components.

$$3i+7i=10i$$

Add the two components with the real number followed by the imaginary.

$$1+10i$$

3. **(C)** The number of shirts (s) and belts (b) cannot exceed 100 items, but they can be equal to that sum. We therefore, add the two quantities and ensure that they could not exceed 100 items.

$$s+b\leq 100$$

Choices (A) and (B) can be eliminated at once. The question suggests that the number of items cannot exceed 100 items. That implies the number of items could be equal to 100 but not more. Therefore, the symbol "≤" is needed, but using "<" would be incorrect.

4. **(D)**

$$\frac{1}{x}+\frac{3}{x}=\frac{1}{7}$$

The model above shows the portion of the work completed in one hour because $\frac{1}{7}$ is 1 hour of the 7 needed to complete the job. Since one worker can work 3 times more quickly than the other, her time is represented by $\frac{3}{x}$. The slower worker would accomplish solely $\frac{1}{x}$ of the entire job in 1 hour.

5. **(A)** When adding or subtracting algebraic expressions, combine only like terms. Like terms are those that have the same variables raised to the same power.

$$(3x^3 - 13x + 4) - (3x^2 - 4x + 5) =$$
$$3x^3 - 3x^2 + (-13x + 4x) + (4 - 5) =$$
$$3x^3 - 3x^2 - 9x - 1$$

When adding and subtracting polynomials, we only combine like terms; we do not add exponents unless we are multiplying. Thus, choice (C) with an exponent of 5 should be immediately eliminated.

6. **(C)** Division by 0 is undefined. Set $6x^2 - 13x - 5$ equal to 0 and solve.

$$6x^2 - 13x - 5 = 0$$

Solve by factoring.

$$(3x + 1)(2x - 5) = 0$$

Set each of the parentheses equal to 0 and solve for the variable.

$$3x + 1 = 0 \text{ or } 2x - 5 = 0$$
$$3x = -1 \text{ or } 2x = 5$$
$$x = -\frac{1}{3} \quad x = \frac{5}{2}$$

$\frac{-5x^2y - 4xy}{6x^2 - 13x - 5}$ is undefined when $x = -\frac{1}{3} \quad x = \frac{5}{2}$

7. **(C)** Find the coordinates of the vertex of $3(x - 4)(x + 6)$ by multiplying.

$$y = 3(x - 4)(x + 6)$$
$$y = 3(x^2 + 2x - 24)$$

Begin to transform the equation from standard form to graphing form. First, move -24 to the right of the parentheses, remembering to first multiply it by 3.

$$y = 3(x^2 + 2x) - (24)(3)$$
$$y = 3(x^2 + 2x) - 72$$

Complete the square by squaring $\frac{b}{2}$. Remember to multiply that value by 3.

$$y = 3(x^2 + 2x + 1) - 72 - (3 \times -1)$$
$$y = 3(x^2 + 2x + 1) - 72 - 3$$
$$y = 3(x + 1)^2 - 75$$

The equation is now in graphing form. The vertex is $(-1, -75)$.

8. **(B)** The diagonal of a square creates two isosceles right triangles. Use the Pythagorean theorem to find the length of a side of the square.

$$x^2 + x^2 = 12^2$$
$$2x^2 = 144$$
$$x^2 = 72$$

The area of the square photograph is 72 square inches because the formula for area requires us to multiply adjacent sides. However, we need to find the length of a side to find the frame's dimensions.

$$x^2 = 72$$
$$x = 6\sqrt{2}$$

Each side of the square photograph is $6\sqrt{2}$. Add 4 to $6\sqrt{2}$ because there is a 2 inch border on each side of the photograph. We now know that each side of the frame is $6\sqrt{2} + 4$. Multiply that value by itself to find the area surrounded by the frame.

$$(6\sqrt{2} + 4)^2 = 88 + 48\sqrt{2}$$

Find the area of the frame by subtracting the area of the square photograph from the area surrounded by the frame.

$$88 + 48\sqrt{2} - 72 = 16 + 48\sqrt{2}$$

9. **(B)** Parallel lines have the same slope but distinct y-intercepts. The equation $y = \frac{3}{2}x - \frac{7}{4}$ has slope $\frac{3}{2}$ and y-intercept $-\frac{7}{4}$. Transform each of the equations to slope-intercept form, $y = mx + b$, to compare slopes and y-intercepts. Choice B offers the following:

$$-6x + 4y = 11$$

Transform to slope-intercept form by isolating y:

$$-6x + 6x + 4y = 6x + 11$$
$$4y = 6x + 11$$

Divide both sides of the equation by 4.

$$\frac{4}{4}y = \frac{6}{4}x + \frac{11}{4}$$
$$y = \frac{3}{2}x + \frac{11}{4}$$
$$m = \frac{3}{2} \quad b = \frac{11}{4}$$

$y = \frac{3}{2}x + \frac{11}{4}$ and $y = \frac{3}{2}x - \frac{7}{4}$ have the same slope but different y-intercepts so the two lines are parallel.

10. **(C)**

$$n = 3.65 + .35x$$
$$m = 4.25 + .15x$$

Setting $m = n$ will provide the number of weeks that passed when the two plants were the same height.

$$3.65 + .35x = 4.25 + .15x$$

Solve for x.

$$3.65 + .35x = 4.25 + .15x$$
$$.2x = .6$$
$$x = 3$$

After 3 weeks passed, the two plants were identical heights. Replace x with 3 in either equation to find the height when they were the same.

$$3.65 + .35(3) = 4.7$$

The two plants were both 4.7 feet three weeks after September 15.

11. **(C)** Rationalize the denominator by multiplying the numerator and the denominator by $2 + i$.

$$\frac{3i}{2-i} \times \frac{2+i}{2+i} =$$

$$\frac{6i+3i^2}{4-i^2}$$

Substitute -1 for i^2 into the expression.

$$\frac{6i+3(-1)}{4-(-1)} = \frac{6i-3}{5}$$

$\frac{6i-3}{5}$ can be rewritten in the form of $a + bi$ as $-\frac{3}{5} + \frac{6i}{5}$. Therefore, $a = -\frac{3}{5}$.

12. **(C)** The parent graph of $y = x^3$ is an S-shaped curve. Its end behavior approaches $-\infty$ as x assumes smaller values and ∞ for larger values. Its y-intercept is 0 because when $x = 0$, $y = 0$. Adding a positive rational number shifts the parent graph vertically; its y-intercept will be greater than 0. Choice (C) illustrates such a graph.

13. **(C)** Replace $h(x)$ with 138 and x with 6 in order to find b.

$$138 = b(6)^2 + 30$$
$$138 = 36b + 30$$
$$108 = 36b$$
$$3 = b$$

Replace b with 3 to find $h(-4)$.

$$h(-4) = 3(-4)^2 + 30$$
$$h(-4) = 78$$

14. **(C)** Since 350 of the students are males, 250 are females (600 – 350 = 250). Given that 250 of the males are science majors, the remaining science majors, 150, must be female (400 – 250 = 150). Thus, if 150 of the 250 females are science majors, the remaining 100 must be liberal arts majors.

15. **(B)** Use the basic steps of algebra to isolate y.

STEP 1 Add $1.6x^2$ and 11.4 to both sides of the equation.

$$P = -1.6x^2 + 2.6xy - 11.4$$
$$P + 1.6x^2 + 11.4 = -1.6x^2 + 2.6xy - 11.4 + 1.6x^2 + 11.4$$
$$P + 1.6x^2 + 11.4 = 2.6xy$$

STEP 2 Divide both sides of the equation by $2.6x$

$$\frac{P + 1.6x^2 + 11.4}{2.6x} = \frac{2.6xy}{2.6x}$$

$$\frac{P + 1.6x^2 + 11.4}{2.6x} = y$$

16. **$\frac{1}{12}$ or .083** The question provides data for the past 100 years but only asks for conclusions about the past 50. With the data from the past 50 years, we will predict the future reduction in blue-eyed individuals. In 1950, one-third of Americans had blue eyes. That number was reduced to one-sixth by 2000. Over that 50-year time span, the number of blue-eyed individuals was halved. Using that information, we halve one-sixth.

$$\left(\frac{1}{6}\right)\left(\frac{1}{2}\right) = \frac{1}{12}$$

We could also grid in .083.

17. **55** The dollar amount in April was \$850 − \$155 − \$195 − \$225 = \$275. The number of days for January can be found by solving the equation $155 = 75 + 10d$. Subtract 75 from each side to get $80 = 10d$. Then $d = 8$. In a similar manner, the number of days for each of February, March, and April can be determined by solving the equations $195 = 75 + 10d$, $225 = 75 + 10d$, and $275 = 75 + 10d$, respectively. We find that Jerry spent 12 days in February, 15 days in March, and 20 days in April. Thus, the total number of days spent at the club was $8 + 12 + 15 + 20 = 55$.

18. **85** The sum of two sides of a triangle is always larger than the length of the third side. Suppose that 11 is the measure of the longest side. Then $7 + x > 11$ and $x > 4$. The smallest integer that satisfies this inequality is 5.
Suppose the largest side is unknown, then $7 + 11 > x$ and $18 > x$. The largest value that satisfies this inequality is 17. Therefore the product of the smallest value, 5, and the largest value, 17, is $5 \times 17 = 85$.

19. **$\frac{3}{5}$ or .6** The scale factor of triangle DEF to triangle ABC is $\frac{1}{10}$, so multiply the sides of triangle ABC by $\frac{1}{10}$.

$$(100)\left(\frac{1}{10}\right) = 10 = DF$$

$$(80)\left(\frac{1}{10}\right) = 8 = EF$$

Use the Pythagorean theorem to calculate the length of DE.

$$a^2 + 8^2 = 10^2$$
$$a^2 = 36$$
$$a = 6$$

The cosine function is found by using the ratio $\cos x = \frac{\text{adjacent side}}{\text{hypotenuse}}$. The side adjacent to angle D is 6 and the hypotenuse is 10 so $\frac{\text{adjacent side}}{\text{hypotenuse}} = \frac{3}{5} = .6$.

20. **3** This question can be answered by using a system of equations. "The quantity she purchased of the heads of lettuce was 6 fewer than 5 times the number of cucumbers" can be translated as $h + 6 = 5c$. Each head of lettuce costs \$.70 and each cucumber costs \$.30, so the cost for the vegetables, in terms of c and h, is $.3c + .7h$. Given that the cost of the purchase was \$7.20, we get the second equation in the system of equations.

$$.3c + .7h = 7.2$$

Transform $h + 6 = 5c$ to $h = 5c - 6$, and replace that value for h in $.3c + .7h = 7.2$.

$$\begin{aligned} .3c + .7(5c - 6) &= 7.2 \\ .3c + 3.5c - 4.2 &= 7.2 \\ 3.8c &= 11.4 \\ c &= 3 \end{aligned}$$

Section 4: Math Test (Calculator)

1. **(C)** Use the ratio of books sold to income earned to create a proportion.

$$\frac{800}{1320} = \frac{12{,}000}{x}$$

Cross-multiply and solve for x.

$$\begin{aligned} (800)(x) &= (1{,}320)(12{,}000) \\ 800x &= 15{,}840{,}000 \\ x &= \$19{,}800 \end{aligned}$$

The graphic novelist would earn \$19,800 on sales of 12,000 books.
Choices (A) and (B) can be eliminated immediately. Each is much too close to the initial \$1,320 earned when 800 books were sold. Clearly, selling 12,000 books should yield a significantly higher figure as offered in choices (C) and (D).

2. **(B)** Use the ratio of books sold: income earned once again.

$$\frac{800}{1320} = \frac{5000}{x}$$

Cross-multiply and solve for x.

$$\begin{aligned} (1320)(5000) &= (800)(x) \\ 6{,}600{,}000 &= 800x \\ 8250 &= x \end{aligned}$$

The income earned before overhead costs are subtracted is \$8,250. Subtract 32% of that amount to find the novelist's net income.
\$8250 – (8250)(.32) = \$5,610. Note that choice (A) is incorrect because it represents the expenses, not the net income.

3. **(B)** A linear function that contains $f(4) = 6$ and $f(-2) = 14$ indicates that the points (4, 6) and (–2, 14) satisfy the function. Use these points to find the slope of the function.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{14 - 6}{-2 - 4} = -\frac{4}{3}$$

Use the point-slope form of a line to create the linear function.

$$y - y_1 = m(x - x_1)$$

Substitute either point for x and y.

$$y-6=-\frac{4}{3}(x-4)$$

Substitute 9 for x to find $f(9)$.

$$y-6=-\frac{4}{3}(9-4)$$

$$y-6=-\frac{20}{3}$$

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

Therefore $f(9)=\frac{2}{3}$

4. **(A)** Add the three terms and divide the sum by 3. Set this value equal to $x + 4$, the average.

$$\frac{2x-4+x+4+3x-6}{3}=x+4$$

$$\frac{6x-6}{3}=x+4$$

$$6x-6=3x+12$$

$$3x=18$$

$$x=6$$

Replace x with 6 in $-2x + 3$.

$$-2(6)+3=-9.$$

5. **(A)** If Shelley sold 10 recliners and 10 dinette sets, her commission would be $10(24) + 10(63) = 870$. In other words, multiply each commission by the number of units sold of a particular item. If she sold r dinette sets and d recliners, her commission would be $63r + 24d$.

6. **(A)** Calculate the cost per bottle of a 24-pack and a 12-pack.

$\$9.95 \div 24 = \$.41$ per bottle
$\$5.95 \div 12 = \$.50$ per bottle

Minimize the cost by purchasing one 24-pack, one 12-pack, and three individual bottles.

$$\$9.95 + \$5.95 + (3 \times \$1.15) = \$19.35$$

Choice (D) can be eliminated at once. It is the cost of 39 bottles of water sold at the most expensive price, $1.15 per bottle.

7. **(D)** Consider the three conditions that each satisfy $n > 0$:
(a) Let $n = 2$, then $n^2 = 4$

$$n^2 > n$$

(b) Let $n = 1$, then $n^2 = 1$

$$n^2 = n$$

(c) let $n=\frac{1}{2}$, then $n^2=\frac{1}{4}$

$$n^2 < n$$

Without more information about n, we cannot make a conclusion about n^2.

8. **(C)** Assess the vertex of $f(x) = x^2 + 6x - 4$ by transforming to graphing form.

$$f(x) = x^2 + 6x - 4$$
$$f(x) = x^2 + 6x + 9 - 4 - 9$$
$$f(x) = (x + 3)^2 - 13$$

The vertex of the parabola is (–3, –13). A shift to a vertex located at (5, –6) means the graph shifted 8 units to the right (m) and 7 units up (n). If $m = 8$ and $n = 7$, then

$$mn^{-1} = (8)\left(\frac{1}{7}\right) = \frac{8}{7}$$

9. **(B)** Form a proportion using the ratio $\frac{\text{defects}}{\text{total shipment}}$

$$\frac{13}{500} = \frac{273}{n}$$

Cross-multiply and solve for n.

$$13n = (273)(500)$$
$$13n = 136{,}500$$
$$n = 10{,}500$$

A shipment of 10,500 square yards of fabric would produce 273 square yards of defective fabric.

10. **(D)** The data roughly correspond to a line with a negative slope, so only choices (A) and (D) should be considered. Using the points (0, 5) and (2, 3) we can get a sense of the slope:

$$\frac{\text{rise}}{\text{run}} = \frac{5-3}{0-2} = -1$$

Choice (D) is more closely aligned with slope –1. Choices (B) and (C) can be eliminated at once. The data appear to descend to the right as the number of ants increase, thus indicating a negative slope. Choices (B) and (C) incorrectly show positive slopes.

11. **(B)** The grower that has a yield of 1,100 roses has approximately 5,000,000 red ants. Reducing the ant population by 60% brings the ant population to 2,000,000. Ant populations of 2,000,000 permit a rose yield of 3,200. Subtract 1,100 from 3,200 to yield 2,100 more roses.

12. **(B)** The combined weights of Helium and Lithium are 4.0026 + 6.941 = 10.9436. The weight of Boron is 10.811. That value is the closest to the combined weights of Helium and Lithium among the answer choices.

13. **(C)** The atomic weight of Lithium is 6.941. Multiply that number by .30 and add it to the weight of Lithium.

$$6.941 + (.30)(6.941) = 9.023$$

Of the elements listed in the table, Beryllium, with a weight of 9.0122, is approximately 30% heavier than Lithium.

14. **(C)** Change the equation of the circle to graphing form by completing the square for x and y. The general form of a circle in graphing form is $(x-h)^2+(y-k)^2=r^2$, where (h, k) is the circle's center, and r is its radius.

$$x^2+y^2-6y+4x=36$$
$$(x^2+4x+4)+(y^2-6y+9)=49$$
$$(x+2)^2+(y-3)^2=49$$

The radius squared, r^2, is 49 so r is 7. Replace the measure of the radius, r, in the circumference formula.

$$C=2\pi r$$
$$C=(2)(\pi)(7)=14\pi$$

Choice (A) can be eliminated as it represents the area, not the circumference, of the circle.

15. **(C)** If Sammie interviewed every 16-year-old in Florida, she would have no margin of error: she would have all of the data! Thus, the larger the sample size, the smaller the margin of error. Sammie ought to interview additional students to reduce the margin of error in the sample.

16. **(D)** Use any of the given zeroes to solve for b. In the zero $(2, 0)$, $x=2$ and $y=0$. Substitute both in $g(x)=2x^3-8x^2-bx+140$.

$$0=2(2)^3-8(2)^2-b(2)+140$$
$$0=124-2b$$
$$2b=124$$
$$b=62$$

17. **(A)** Imagine the following:

$h=4$ hours
$m=60$ miles per hour
$g=20$ miles per gallon

The number of gallons used would be:

[(4 hours)(60 miles per hour)]/20 miles per gallon =
240 miles/20 miles per gallon = 12 gallons

Thus, $x=\frac{hm}{g}$, which represents the number of gallons used.

18. **(A)** At one year, the market fund was worth \$600 and the CD was valued at \$1,600. Thus, choice (A) cannot be concluded because it states incorrectly that the market fund is worth more than the CD.

19. **(C)** Square both sides of the equation to remove the radical.

$$(\sqrt{x-7})^2=(x-7)^2$$
$$x-7=x^2-14x+49$$
$$x=x^2-14x+56$$
$$x^2-15x+56=0$$
$$(x-7)(x-8)=0$$

This last step reflects answer choice (C).

20. **(A)** Find the probability that a single, six-sided die will land on a prime number:

$$p\,(\text{prime number}) = \frac{2,3,5}{1,2,3,4,5,6} = \frac{1}{2}$$

Remember, 1 is not a prime number.
Find the probability that the spinner will land on yellow or blue.

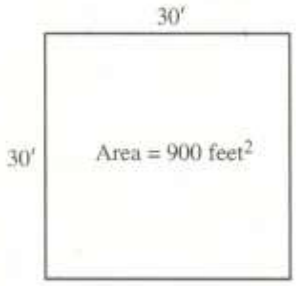
$$\frac{\text{yellow,blue}}{\text{red,green,blue,yellow}} = \frac{1}{2}$$

The two events, landing on a prime number and spinning yellow or blue, are independent so multiply the probabilities.

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

21. **(A)** An ounce of gold covers 100 square yards of surface but the question requires the answer to be in square feet.

1 yard = 3 feet



100 square yards is equivalent to 900 square feet, so one ounce of gold covers 900 square feet. Multiply 900 by 2.5 to find the area covered by 2.5 ounces of gold.

$$2.5 \times 900 = 2,250 \text{ square feet.}$$

22. **(B)** Based on the fee schedule outlined in the graph, the business owner incurs the following delivery fees:

2.68 pounds cost $7.50
3.11 pounds cost $10.00
5.28 pounds cost $15.00
4.0 pounds cost $10.00

Adding the different costs, the sum of the costs of the delivery is $42.50

23. **(C)** The learning therapist has demonstrated that her program increases students' reading levels. 1.09 in the equation ensures growth. For example, if a student is in the second grade and uses the program, we get the following:

$$x = 2$$
$$y = 1.09(2) + .17$$
$$y = 2.35$$

This means a student in second grade would read at a level more than 3 months in advance (assuming a 10-month school year) of students who are not in the reading program.

24. **(B)** The GDP of Singapore is $60,500. The GDP of Monaco is 63,400. Find the percent increase by using the formula

$$\frac{\text{increase}}{\text{original}} = \frac{n}{100}$$

$$\frac{2{,}900}{60{,}500} = \frac{n}{100}$$

Cross-multiply and solve for n.

$$(2900)(100) = 60{,}500n$$
$$290{,}000 = 60{,}500n$$
$$n = 4.8\%$$

25. **(C)** The GDP is found by multiplying the total value of goods and services that a country produces. Use the formula GDP = (per capita income)(population).
Let x = the population size

$$298{,}000{,}000{,}000 = 60{,}500\ (x)$$
$$x = 4{,}925{,}619.$$

Choice (C), 4,900,000 is the closest to this value.

26. **(A)** Use the probability formula:

$$P(x) = \frac{\text{desired outcomes}}{\text{all outcomes}}$$

There are 35 tenth graders and 38 boys. However, some of the tenth graders are boys and should not be counted twice. Thus:

P(10th grader or boy) = [(number of 10th graders) + (number of boys) − (number of 10th grade boys)] ÷ (total number of students)

$$P(\text{10th grader or boy}) = (35 + 38 - 18) \div (73)$$

$$P(\text{10th grader or boy}) = 55 \div 73 = .753$$

27. **(B)** Find the radius of the sphere by using the formula $V = \frac{4}{3}\pi r^3$.

$$374 = \frac{4}{3}(3.14)r^3$$
$$374 = 4.19r^3$$
$$89.26 = r^3$$
$$4.47 = r$$

The circumference of a circle is found by using the formula $C = 2\pi r$.

$$C = (2)(4.47)(3.14) = 28.07$$

Once you have calculated the length of the radius of the sphere, choice (A) can be eliminated. 4.47 is the radius of the circle, not its circumference.

28. **(B)**

$$A = R_0\left(\frac{1}{2}\right)^x$$

Input 2.3 for the number of years, x, and 125 for R_0 the initial amount of the compound.

$$A = 125\left(\frac{1}{2}\right)^{2.3}$$
$$A = 25.4$$

After 2.3 years, 125 grams of the compound will be reduced to 25.4 grams.

29. **(B)** Find the probability of selecting a student who successfully shot four foul shots by using the formula $\frac{\text{favored outcomes}}{\text{all outcomes}}$.

There are a total of 15 students who successfully shot two or more foul shots. Of those 15 students, 3 made exactly 4 baskets. Therefore $\frac{3}{15}$, or $\frac{1}{5}$, of the students in the sample made exactly 4 baskets.

30. **(A)** Subtract the two equations and combine like terms.

$$\begin{array}{r} 4a + n = 2a - 3 \\ -4b + m = 2b - 3 \\ \hline 4a - 4b + n - m = 2a - 2b \end{array}$$
$$2a - 2b + n - m = 0$$

Substitute $m + 1$ for n.

$$2a - 2b + m + 1 - m = 0$$
$$2a - 2b + 1 = 0$$
$$2a - 2b = -1$$
$$a - b = -\frac{1}{2}$$
$$a = b - \frac{1}{2}$$

31. **24** The least number of hamburgers and rolls to buy is the least common multiple (LCM) of 6 and 8. Multiply 6 and 8 by 1, 2, 3, and so on to find the least common multiple.

6: 6, 12, 18, **24**, 30
8: 8, 16, **24**, 32

24 is the LCM of 6 and 8

In order to buy hamburger patties and rolls without any left over, 24 of each should be purchased.

32. **40** Add the scores of all twelve of the students.

$$(2 \times 20) + (1 \times 40) + (4 \times 60) + (4 \times 80) + (1 \times 100) = 740$$

In order for 13 students to average 60%, the class must amass 780 points because $13 \times 60 = 780$.

Since the first 12 students accumulated 740 points, then the thirteenth student must score a 40% on his/her test because $780 - 740 = 40$.

33. **12** Use the model for factoring the difference of cubes:

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2).$$

$(x - 3)(x^2 + 3x + 9)$ is the factored form of $x^3 - 27$.
Substituting $x^3 - 27$ for $(x - 3)(x^2 + 3x + 9)$ gets $x^3 - 15 = x^3 - 27 + m$

$$12 = m$$

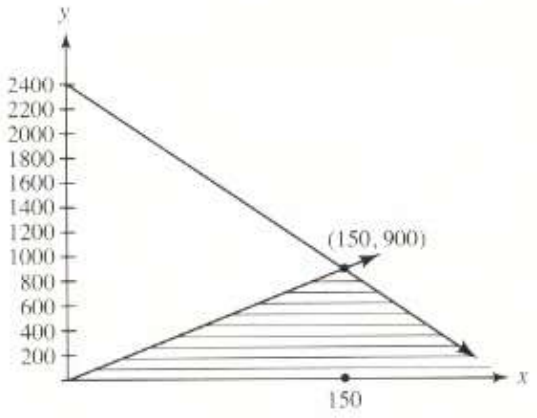
34. **$\frac{3}{8}$ or .375** The area of a circle is surrounded by an angle of measure 2π radians. Find the ratio of the central angle, $\frac{3\pi}{4}$, to the entire circle.

$$\frac{\frac{3\pi}{4}}{\frac{2\pi}{1}} = \frac{3\pi}{4} \times \frac{1}{2\pi} = \frac{3}{8} \text{ or } .375$$

35. **$\frac{21}{8}$ or 2.62 or 2.63** Since the ratio of chocolates to mints is 3 to 5, the ratio of chocolates to the mix is $\frac{3}{3+5} = \frac{3}{8}$. Remember, there are 8 parts to the mix: 3 parts chocolate and 5 parts mints. Multiply 7 pounds by $\frac{3}{8}$ to find the number of pounds of chocolates in a 7-pound mix.

$$\frac{3}{8} \times 7 = \frac{21}{8} \text{ or } 2.62 \text{ or } 2.63$$

36. **900** A graph of the system of inequalities is shown below.



There are two shaded areas bounded by the lines $y = 6x$ and $y = -12x + 2{,}400$. The point where these lines intersect is the maximum value of y. Set the x-components equal and find x.

$$6x = -12x + 2{,}400$$
$$18x = 2{,}400$$
$$x = 150$$

Substitute 150 for x in either equation to find y.

$$y = 6x$$
$$y = 6(150) = 900.$$

37. **250** Normally the merchant sells 40 pairs of slacks at \$50 a pair, so find the revenue from selling 40 pairs.

$$\$50 \times 40 = \$2{,}000$$

Next determine the price of the slacks with the 10% applied.

$$\$50 - (.10)(50) = \$45$$

Since 50 pairs of slacks were sold at the new discounted price of \$45, multiply these together to get the total earnings for that month.

$$50 \times \$45 = \$2{,}250$$

The last step is to subtract this value from the earnings in a normal month.

$$\$2{,}250 - \$2{,}000 = \$250$$

38. **44** The first step is to determine how much additional capital is needed from the sale of Model 2 slacks. Model 1 slacks give additional capital of \$250. Subtracting \$250 from \$750, we arrive at \$500 as the amount needed. Next find out how much money is normally received from the Model 2 slacks.

$$\$65 \times 25 \text{ pairs of slacks} = \$1{,}625$$

\$1,625 + \$500 = \$2,125 is the amount of money needed from the sale of Model 2 slacks. Find the price of Model 2 slacks after the discount of 25%.

$$\$65 \times 75\% = \$48.75$$

Let n = number of slacks needed to sell

$$\$48.75n = \$2{,}125$$
$$n = 43.58$$

Round up to 44 pairs of slacks. 44 pairs of Model 2 slacks must be sold so the merchant can earn a total of \$750 extra from the sale of Model 1 and Model 2 slacks.

3

3

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

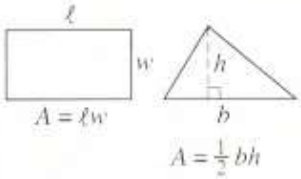
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

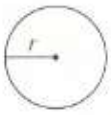
REFERENCE INFORMATION

Area Facts



$A = \ell w$

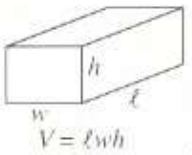
$A = \frac{1}{2}bh$



$A = \pi r^2$

$C = 2\pi r$

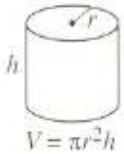
Volume Facts



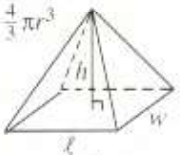
$V = \ell wh$

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

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

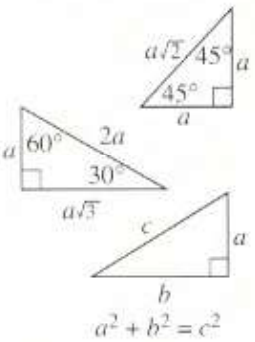


$V = \pi r^2 h$



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

Triangle Facts



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

The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

GO ON TO THE NEXT PAGE

3

3

1. Charles is conducting a survey regarding a proposed recreational center in his town. He finds the cost of the survey is expensive and must find a way to reduce the cost. Which of the following is the best way to reduce his costs?

   (A) Interview more people to get more detailed information
   (B) Accept a wider margin of error in the survey
   (C) Interview people about topics other than the proposed recreational center
   (D) Accept a narrower margin of error in the survey

2. Simplify $-2\left(\frac{x^2-8x-180}{x+10}\right)$ if $x \neq -10$

   (A) $x-18$
   (B) $-2x+36$
   (C) $-2x^2+x$
   (D) $x+10$

3. If $(x+n)^2 = x^2 + 19x + n^2$, what is the value of n^2?

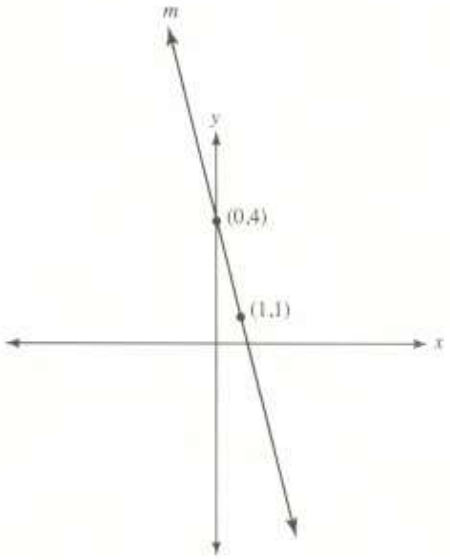
   (A) 361
   (B) $\frac{361}{2}$
   (C) $\frac{361}{4}$
   (D) 38

4. Brian and Richard stand back-to-back. Each boy takes 5 equally spaced steps, in opposite directions from the starting location. At this point, Richard walks to where Brian is now and does so in 9 steps. How many times bigger are Richard's steps than Brian's steps?

   (A) $\frac{4}{5}$
   (B) $\frac{5}{4}$
   (C) $\frac{7}{4}$
   (D) 2

5. If M represents the number of prime numbers less than 25 and r is their range, what is $2M - r$?

   (A) –3
   (B) 3
   (C) 8.9
   (D) 27



6. If line m (see diagram above) is translated down 4 units and right 5 units, what is the slope of the new line?

   (A) –3
   (B) $-\frac{15}{7}$
   (C) $-\frac{3}{8}$
   (D) $-\frac{5}{7}$

7. If $f(x) = x^3 - 7$ and $g(x) = 2x + 5$, what is $g(f^{-1}(20))$?

   (A) –4
   (B) –3
   (C) 11
   (D) 13

GO ON TO THE NEXT PAGE

3

3

8. If $2x + 3y = 17$ and $5x - 7y = 31$, what is the value of $\frac{7x-4y}{8}$?

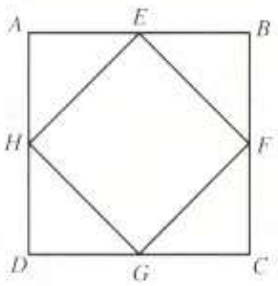
(A) 6
(B) 7
(C) 8
(D) 12

9. If the area of a rectangle is shown by the expression $16x^2 - 9y^2$ and the width is $4x - 3y$, what is the perimeter of the rectangle?

(A) $4(x + y)$
(B) $16x$
(C) $64x^2 - 36y^2$
(D) $2(x + y)$

10. In the xy-plane, the parabola with equation $y = (x - 6)^2$ intersects the line with equation $y = 36$ at two points, A and B. What is the length of AB?

(A) 12
(B) 16
(C) 24
(D) 48



11. Square $EHGF$ lies within square $ABCD$ with E, F, G, and H all being midpoints. If the area of square $EHGF$ is 64 units squared, what is the area of square $ABCD$ (in square units)?

(A) 36
(B) 64
(C) $96\sqrt{2}$
(D) 128

12. In a 10-question true/false test, what is the probability of guessing correctly on questions 6 through 8 exactly 2 times?

(A) $\frac{1}{3}$
(B) $\frac{3}{8}$
(C) $\frac{2}{3}$
(D) $\frac{7}{8}$

13. $2x^2 + y^2 = 360$
$y = 4x$

What is the value of x^2?

(A) 12
(B) 15
(C) 18
(D) 20

14. What are the solutions to $2x^2 + 8x - 12 = 0$?

(A) $x = -4 \pm 3\sqrt{10}$
(B) $x = -3 + \frac{\sqrt{10}}{10}$
(C) $x = -2 \pm \sqrt{10}$
(D) $x = 2 \pm \sqrt{10}$

15. $(ax - 7)(bx + 5) = 6x^2 + cx - 35$. If $ab = 6$ and $a - b = -1$ what are two possible values of c?

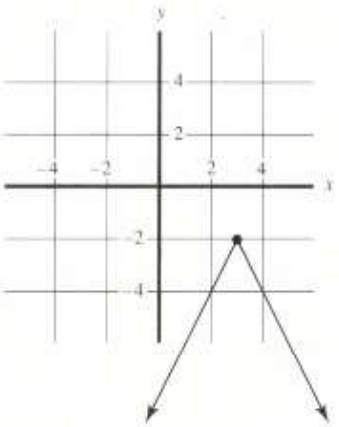
(A) $c = 2$ or $c = -4$
(B) $c = 11$ or $c = -11$
(C) $c = -2$ or $c = 4$
(D) $c = 12$ or $c = -5$

GO ON TO THE NEXT PAGE

3

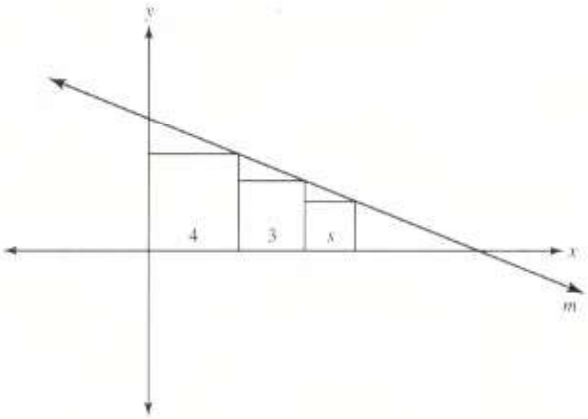
3

16. Jamie is considering two different companies to rent him a mobile home trailer for one day. One service offers \$30 per day and \$0.25 per mile. The other service offers \$40 per day and \$0.20 per mile. At what number of miles is the cost for the two services equal?



17. The graph of $f(x) = -2|x - m| + n$ is shown. What is the value of $-mn^{-1}$?

18. In a right triangle one angle measures $x°$, where $\sin x° = \frac{5}{8}$. What is the value of $\cos(90° - x°)$?



19. In the figure above, one side of the largest square lies on the y-axis, one side of each of the three squares lies on the x-axis, and one vertex of each square is on line m. If the length of the sides of the three squares is 4, 3, and s, respectively, what is the value of s?

20. A function, r, is defined as $r(n) = (n - 7)|(n + 1) - 7|[(n + 2) - 7] \ldots$ where n is an integer. What is the value of $r(1)$?

If there is still time remaining, you may review your answers.

4

4

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

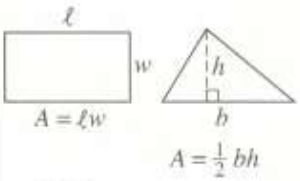
Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

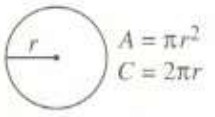
Notes:

- The use of a calculator on this section IS permitted.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

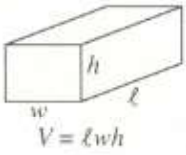
REFERENCE INFORMATION

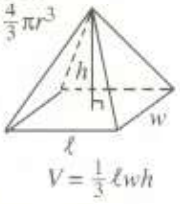
Area Facts



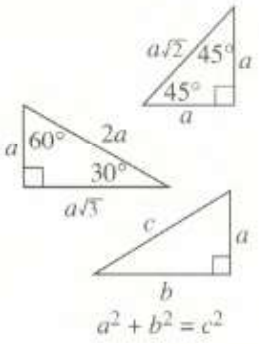


Volume Facts





Triangle Facts



The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

GO ON TO THE NEXT PAGE

4

4

1. Warren has a streaming video account with an online movie channel. His cost for each movie he rents is $2.25 and his monthly membership fee is $4.00. If his invoice for the past month was $24.25, how many movies did Warren rent?

   (A) 6
   (B) 7
   (C) 8
   (D) 9

2. The legend on a map shows that 1 inch = 80 miles. The distance on a map shows that Hartford, Connecticut and Roanoke, Virginia are 5.05 inches apart. What is the actual distance between the two cities?

   (A) 80 miles
   (B) 205 miles
   (C) 395 miles
   (D) 404 miles

3. The density of an object is found by dividing the mass of the object by its volume. What is the volume, in milliliters, of an object with a mass of 48 grams and density of 4 grams per milliliter?

   (A) 12
   (B) 14
   (C) 16
   (D) 24

4. A customer service call center for a credit card company asks 1 in 8 of the callers to take a survey at the conclusion of the call. Approximately 20% of those solicited consent to the survey. If 400 callers were serviced between 2:00 and 3:00 one afternoon and 20% of the callers consented to the survey, how many callers did **not** consent to the survey?

   (A) 20
   (B) 30
   (C) 35
   (D) 40

5. The formula for the area of a trapezoid is

   $$A = \frac{1}{2}(h)(b_1 + b_2)$$

   Which of the following equations represents the area as a function of b_1?

   (A) $\frac{2A}{h} - b_2$

   (B) $\frac{h}{2A} - b_2$

   (C) $b_2 + 2Ah$

   (D) $\left(\frac{A}{2h}\right) - b_2$

6. A student is taking a series of classes at the recreational center in his neighborhood. Each class has a monthly fee of $5.75 plus a monthly membership cost of $11.50. If the total cost for March was $51.75, how many classes were taken?

   (A) 5
   (B) 6
   (C) 7
   (D) 8

GO ON TO THE NEXT PAGE

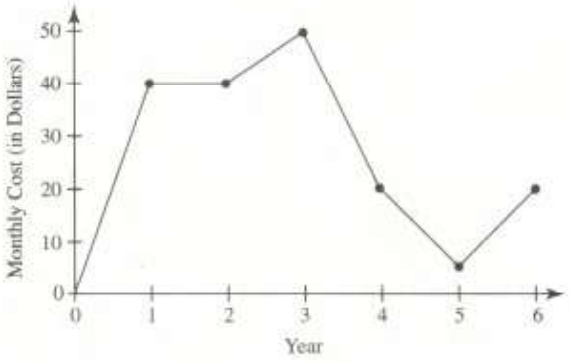
7. If $2p - 4 \geq 6$, what is the least possible value of $2p + 4$?

(A) 7
(B) 14
(C) 21
(D) 28

8. Circle P has center (4, –2). The point A (7, 3) lies on the circle. What is the area of circle P?

(A) 24π
(B) 34π
(C) 54π
(D) 64π

Questions 9 and 10 refer to the graph below.



The monthly costs of certain internet plans have varied greatly over the six year period as illustrated in the graph.

9. What was the largest percent drop in price from one year to another?

(A) 25
(B) 50
(C) 75
(D) 85

10. What was the greatest decrease in internet plan price in the graph?

(A) $40
(B) $30
(C) $25
(D) $10

---

11. The mean weight of a class of sixth graders is 103 pounds with a standard deviation of 6.3 pounds. If a student's weight is in the lowest 2.5% of the class, what would be his or her approximate weight?

(A) 115.6
(B) 108.4
(C) 96.7
(D) 90.4

12. Friendly Car Service charges a flat rate of $1.50 and $.55 per mile. Mustafa has only $11 to spend on his ride. Write an inequality that represents the maximum distance that Mustafa can travel.

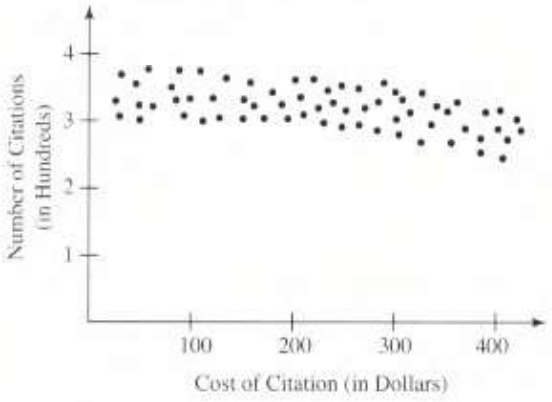
(A) $.55m - 1.50 \leq 11$
(B) $.55m + 1.50 \leq 11$
(C) $1.50m + .55 \geq 11$
(D) $.55m + 1.50 \geq 11$

13. Pham is interested in starting a 4H Club at her high school. She randomly sampled a group of 75 students and found that 31.5% of the students in her sample thought that starting a club was a good idea. If her high school has 1,145 students enrolled, approximately how many will consider that starting the 4H club was a good idea?

(A) 360
(B) 340
(C) 280
(D) 225

GO ON TO THE NEXT PAGE

Questions 14 and 15 refer to the graph below.



14. The graph shows the number of drivers who have been caught texting while driving and the fines that were levied against them. Which of the following can be concluded from the graph?

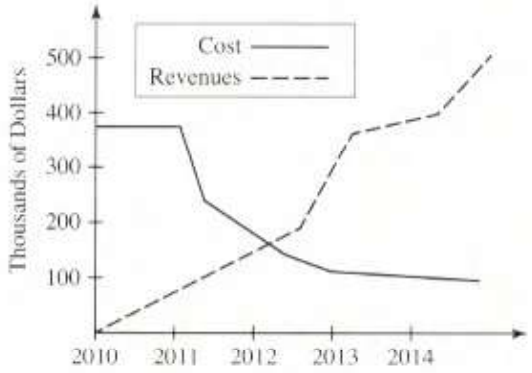
(A) There is a strong negative correlation between higher fines and the number of students cited for texting while driving.
(B) There is a weak negative correlation between higher fines and the number of students cited for texting while driving.
(C) There is a strong positive correlation between higher fines and the number of students cited for texting while driving.
(D) There is no correlation between higher fines and the number of students cited for texting while driving.

15. Based on the data from the graph, which of the following would be useful in reducing texting while driving?

(A) Reduce the fines for citations
(B) Increase the fines for citations
(C) Launch a series of commercials illustrating the dangers of texting while driving
(D) Maintain the fine amount for a period of 18 months

Questions 16 and 17 refer to the information below.

The D'Amico family had plans to open a third Italian restaurant on the outskirts of Milwaukee. Their grand opening was in 2010 and the graph below shows the five year history of the restaurant's costs and revenues.



16. Between what two years was the difference between costs and revenues the least?

(A) 2010–2011
(B) 2011–2012
(C) 2012–2013
(D) 2013–2014

17. Which of the following is the best estimate of the percent growth in the two years when the restaurant became profitable?

(A) 3.7%
(B) 17.2%
(C) 35.7%
(D) 111.1%

GO ON TO THE NEXT PAGE

Questions 18 and 19 refer to the table below.

A recent marathon featured runners of many different ages. The table below shows a listing of the participants as categorized by age and place in the race.

Age	Under 20	20–29	30–39	40–49	50–69	70 and Over	Total
Top 10 Finisher	2	6	1	1	0	0	10
Finished in place 11 to 40	11	11	5	3	0	0	30
Finished after 40th Place	5	8	23	31	43	12	122
Total	18	25	29	35	43	12	162

18. What percent of the top forty finishers came from the 30 to 39 age group?

(A) 8%
(B) 10%
(C) 15%
(D) 18%

19. What is the difference between the percent of runners under 20 years of age who finished in places 11 to 40 and the percent of runners age 40 to 49 who also finished in places 11 through 40?

(A) 52.5%
(B) 46.4%
(C) 34.2%
(D) 31.1%

X	1	2	3
$g(x)$	3	5	7

X	3	4	5
$h(x)$	8	16	24

20. Values for $g(x)$ and $h(x)$ are listed above. What is the value for the $h(g(2))$?

(A) 24
(B) 36
(C) 48
(D) 72

21. $|m - 3| = 12$
$|n + 7| = 22$

In the equations above, $m < 0$ and $n < 0$. What is the value of $m - n$?

(A) 14
(B) 18
(C) 20
(D) 24

GO ON TO THE NEXT PAGE

Questions 22 and 23 refer to the table below.

A mariner wants to purchase a sailboat and needs to finance some of the cost. The chart below provides the monthly payments per $1000 borrowed.

Monthly payment per $1000 borrowed

Annual Interest Rate	Number of Payments		
	36	48	60
5%	$29.97	$23.03	$18.87
8%	$31.34	$24.41	$20.28
10%	$32.27	$25.36	$21.24
12%	$33.22	$26.34	$22.24

22. The boat the mariner is interested in purchasing costs $8,795. The mariner wants to borrow $6,500 and pay for the balance in cash. What would the monthly payment be if a financing plan at 10%, paid off in 36 monthly payments is selected?

(A) $167.32
(B) $179.33
(C) $209.76
(D) $318.43

23. A boat vendor is offering a 5% rate for 36, 48, or 60 months. If the mariner can afford a $300 monthly payment, what is the maximum price that can be paid for a sailboat?

(A) $10,000
(B) $13,000
(C) $14,000
(D) $15,000

24. Homeowners want to create a circular rock garden of 20 feet in diameter. Reference materials state that the space for the garden needs to be 3" deep. The rocks they wish to buy cost $80 per cubic yard and must be purchased in whole cubic yards. How much will they have to spend on rocks?

(A) $480
(B) $400
(C) $320
(D) $240

25. A Boy Scout troop in Des Moines is practicing its marching order in the upcoming Memorial Day parade. The troop leader wants the boys to march in neat rows, the same number in each row. When the leader tries four in a row, the last row has three. When he tries five boys in a row, the last row has four. In desperation, he tries to line up six boys in a row, only to find five in the last row. What is the least number of boys that could be in the troop?

(A) 11
(B) 14
(C) 59
(D) 119

26. Seven students draw numbered cards, each with a value that is a positive integer. The mean of their selections is 14. What is the largest number any student could have drawn?

(A) 92
(B) 70
(C) 28
(D) 14

GO ON TO THE NEXT PAGE

27. The golden ratio compares dimensions that are appealing to the eye. Sometimes the golden ratio appears in nature but more frequently in painting and architecture. The ratio has been defined as $\frac{1+\sqrt{5}}{2}:1$.

A new downtown cultural center is being planned for construction in 2017. The city planners hope to construct the main amphitheater using the golden ratio. If the proposed width of the amphitheater is to be 87 meters, what will be its length? (Round your answer to the nearest meter.)

(A) 211
(B) 176
(C) 143
(D) 141

Questions 28 and 29 refer to the data below.

	BMI
Underweight	Below 18.5
Normal	18.5–24.9
Overweight	25.0–29.9
Obesity	30.0 and Above

Body Mass Index is a calculation that measures obesity and the potential for serious health risks such as strokes and heart attacks. The BMI can be found by using the following formula:

$$\frac{\text{weight (pounds)}}{\text{height}^2\text{ (inches)}} \times 703$$

28. What is the category of BMI of a patient who weighs 182 pounds and is 5'10"?

(A) Underweight
(B) Normal
(C) Overweight
(D) Obesity

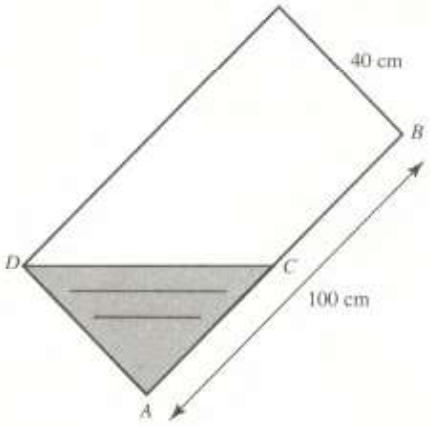
29. What is the weight of a patient who is 6 feet tall and has the lowest BMI that is categorized as obese?

(A) 194
(B) 221
(C) 231
(D) 241

---

30. Sam was babysitting his three-year-old brother Josh. When Sam wasn't watching, Josh had taken the aquarium and tipped it on its side so the water level was as shown below. When Sam found Josh, he quickly grabbed the tank and returned it to a horizontal position. What was the height of the water in the aquarium when it was in a horizontal position if the dimensions of the tank are 100 cm long, 60 cm wide, and 40 cm high?

(C is the midpoint of AB)



(A) 10
(B) 20
(C) 30
(D) 40

GO ON TO THE NEXT PAGE

$$6x-7y=\frac{37}{2}$$
$$ax-\frac{21}{2}y=\frac{111}{4}$$

31. In the above system of equations a is a constant. What value for a gives the system of equations infinite solutions?

	7th grade	8th grade	9th grade
Girls	191	215	174
Boys	162	219	181

32. The data above represents students categorized by gender and grade at a local middle school. If a student is selected at random, what is the probability the student is not an eighth-grade girl (round your answer to the nearest hundredth)?

33. A furniture manufacturer of office chairs uses the following profit function:

$P(x) = -.08x^2 + 23.1x + 500$, where x represents the number of chairs that are manufactured and $P(x)$ is profit in dollars. What is the most profitable number of chairs to manufacture (round your answer to the nearest whole number)?

$$\left(\frac{1}{3}\right)^{x-2} = (27)^{3-x}$$

34. Given the equation above, what is the value of $2x + 11$?

35. A small wooden bridge has a maximum carrying capacity of 15,000 pounds. Three cars are currently crossing the bridge, each with a mean weight of 3,250 pounds. What is the greatest weight a fourth car or truck can have and still cross the bridge safely?

36. Students at a local art school wish to create a Styrofoam pyramid. The pyramid will have a rectangular base that measures 6 feet by 8 feet and will have a height that measures 12 feet. If each cubic foot weighs 4 ounces and the cost per pound of Styrofoam is $.50 per pound, what will be the cost to create the pyramid? (Note: 16 ounces = 1 pound) (Ignore the $ sign)

GO ON TO THE NEXT PAGE

4

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Questions 37 and 38 refer to the information below.

Objects above the Earth's surface weigh less than objects on the Earth's surface due to the effects of gravity. Scientists use the following formula when considering the weight of satellites orbiting Earth.

$$W(h) = m\left(\frac{4000}{4000+h}\right)^2$$

where m equals the weight of an object at sea level and h is its height in miles above sea level.

37. A NOAH weather satellite is in a decaying orbit around Earth. In anticipation of this development, the engineers that built the satellite created the vehicle to be light enough to completely disintegrate as it descended to Earth. Thus the scientists created the weather satellite to weigh 50 pounds when it orbited at 22,000 miles. What was the weight of the satellite on Earth before it was launched into space (round your answer to the nearest pound)?

38. Susan is flying in a military test jet that can fly several miles higher than a passenger jet. At sea level, she weighs 120 pounds. At what height will she weigh 119.95 pounds (round your answer to the nearest hundredth of a mile)?

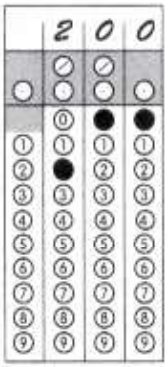
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 3

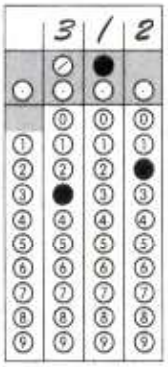
Section 3: Math (No Calculator)

1. **B**
2. **B**
3. **C**
4. **B**
5. **A**
6. **A**
7. **C**
8. **A**
9. **B**
10. **A**
11. **D**
12. **B**
13. **D**
14. **C**
15. **B**

16. **200**



17. **3/2** or **1.5**



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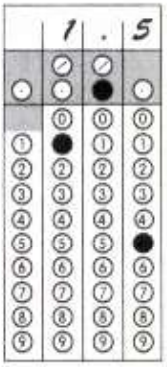
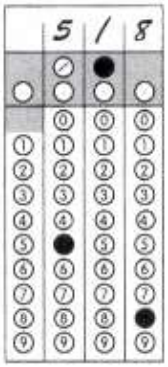


18. **5/8** or **.625**



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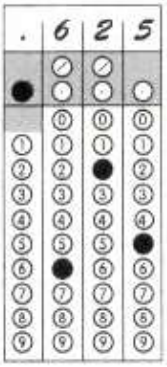
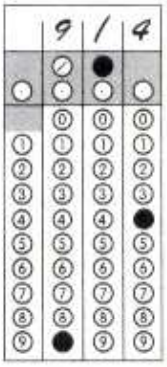


19. **9/4** or **2.25**



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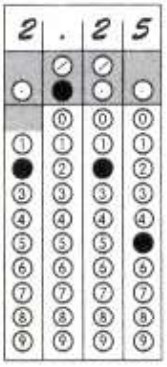


ANSWER KEY
Practice Test 3

20. **0**

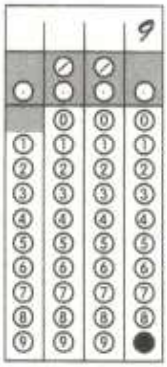
Number Correct _____

Number Incorrect _____

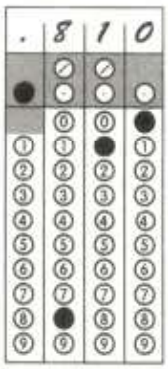
Section 4: Math (Calculator)

1. **D**	7. **B**	13. **A**	19. **A**	25. **C**
2. **D**	8. **B**	14. **B**	20. **A**	26. **A**
3. **A**	9. **C**	15. **C**	21. **C**	27. **D**
4. **D**	10. **B**	16. **C**	22. **C**	28. **C**
5. **A**	11. **D**	17. **D**	23. **D**	29. **B**
6. **C**	12. **B**	18. **C**	24. **D**	30. **A**

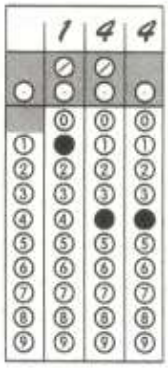
31. **9**



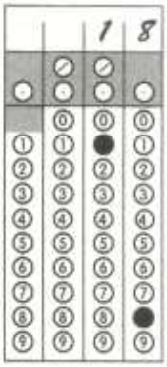
32. **.810**



33. **144**

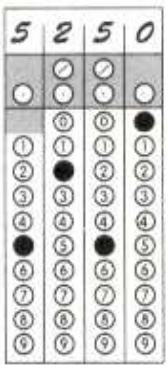


34. **18**

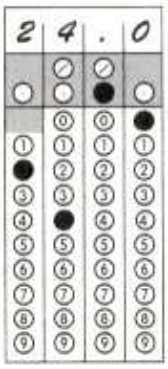


ANSWER KEY
Practice Test 3

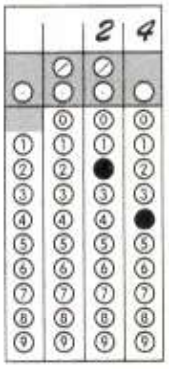
35. **5,250**



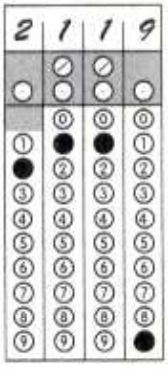
36. **24.0** or **24**



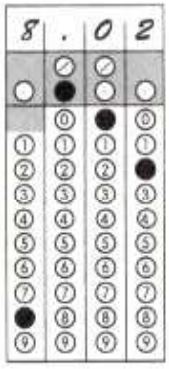
or



37. **2,119**



38. **8.02**



Number Correct _____

Number Incorrect _____

Section 3: Math Test (No Calculator)

1. **(B)** If Charles interviewed everyone in town, there would be no margin of error—he would have all of the data! Therefore accepting a wider margin of error reduces the number of surveys and the costs as well.

2. **(B)** Factor and cancel as needed.

$$-2\left(\frac{x^2-8x-180}{x+10}\right)=$$

$$-2\left(\frac{(x+10)(x-18)}{x+10}\right)=$$

$$-2(x-18)=-2x+36$$

3. **(C)** Find the value of n^2 by completing the square in $x^2+19x+n^2$.

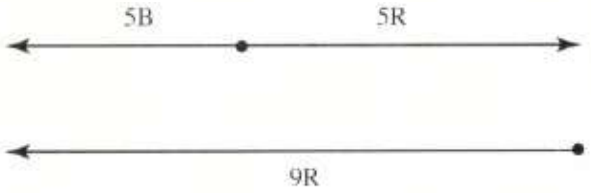
Multiply 19 by $\frac{1}{2}$ and square the product.

$$x^2+19x+n^2=x^2+19x+\left(\frac{19}{2}\right)^2=x^2+19x+\frac{361}{4}$$

$$n^2=\frac{361}{4}$$

Choice (B) can be eliminated at once since the denominator, 2, is not a perfect square.

4. **(B)** Brian and Richard take 5 steps apart and then Richard walks to Brian in 9 steps. The diagram below illustrates these events.



We conclude the following:

$$5R+5B=9R$$
$$5B=4R$$
$$\frac{5}{4}B=R$$

Each of Richard's steps is $\frac{5}{4}$ the size of Brian's.

5. **(A)** The prime numbers less than 25 are: 2, 3, 5, 7, 11, 13, 17, 19, 23. There are nine prime numbers less than 25, so $M = 9$. Find the range of this set of numbers by subtracting the lowest value from the highest.

$$23-2=21$$

The range of the numbers is 21, so $r = 21$

$$2M-r=2(9)-21=-3$$

6. **(A)** The slope of a line is found by using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$.

$$(0, 4) \quad (1, 1)$$

$$\frac{1-4}{1-0} = -3$$

The line in the diagram has a slope that measures –3. Translating the line moves all the points in the same direction creating a parallel line. Parallel lines have the same slope so the translated line will also have a slope of –3.

7. **(C)** Find $f^{-1}(x)$

$$f(x) = x^3 - 7$$
$$y = x^3 - 7$$

Reverse the positions of x and y to find $f^{-1}(x)$. Then begin to solve for y.

$$x = y^3 - 7$$
$$x + 7 = y^3$$
$$\sqrt[3]{x+7} = y = f^{-1}(x)$$

Replace x with 20 in $f^{-1}(x)$.

$$f^{-1}(20) = \sqrt[3]{20+7} = 3$$

Replace x with 3 in $g(x)$.

$$g(3) = 2(3) + 5 = 11$$

8. **(A)** Although this system of equations can be solved via the substitution or elimination method, it is much easier to add the two equations together.

$$\begin{array}{r} 2x + 3y = 17 \\ +\ 5x - 7y = 31 \\ \hline 7x - 4y = 48 \end{array}$$

$$\frac{7x-4y}{8} = \frac{48}{8} = 6$$

9. **(B)** Factoring $16x^2 - 9y^2$ gives $(4x + 3y)(4x - 3y)$. The area of a rectangle is given by the formula Area = (length) (width) or $A = lw$. Since $4x - 3y$ is the width, $4x + 3y$ is the length. The perimeter of a rectangle is found by using perimeter = $2l + 2w$.

$$2(4x + 3y) + 2(4x - 3y) = 8x + 6y + 8x - 6y = 16x$$

10. **(A)** The intersections of two lines, parabolas, etc. are those points that satisfy both equations. In this case, the parabola $y = (x - 6)^2$ intersects the horizontal line $y = 36$. Since both equations are equal to y, set each of them equal to one another.

$$36 = (x - 6)^2$$

Solve this equation by finding the square root of each side of the equation.

$$36 = (x-6)^2$$
$$\sqrt{36} = \sqrt{(x-6)^2}$$
$$\pm 6 = x - 6$$
$$x = 12 \quad \text{or} \quad x = 0$$

The points of intersection are (12, 36) and (0, 36). Although we can use the distance formula to find the distance between these two points, intuitively, they lie along the line $y = 36$. Subtract the x-coordinates to find the distance between the two points.

$$12 - 0 = 12$$

The length of AB, then, is 12.

11. **(D)** Square $EFGH$ has an area that measures 64 square units which means each side is 8 units. All four of the triangles are isosceles right triangles with hypotenuse 8. Using the formula for a 45-45-90 triangle, both legs of each right triangle are therefore $4\sqrt{2}$ units. Each side of square $ABCD$, then, is $8\sqrt{2}$ units long. The formula for the area of a square is Area = s^2, where s is the measure of a side.

$$\text{Area} = s^2$$
$$\text{Area} = (8\sqrt{2})^2 = 128$$

The figures can be assumed to be to scale as there is no note indicating otherwise. We therefore can deduce square $ABCD$ is larger than square $EFGH$. Thus, choices (A) 36, and (B) 64 can be immediately eliminated.

12. **(B)** A total of 8 outcomes are possible when guessing among 3 questions:
Let C = the answers guessed correctly
Let I = the answers guessed incorrectly

CCC, CCI, CIC, CII, ICC, ICI, IIC, and III

Of the 8 possible outcomes, 3 contain exactly two correct guesses (and therefore one incorrect guess). Therefore, the probability of guessing correctly on exactly two of the three questions among questions 6 through 8 is $\frac{3}{8}$.

13. **(D)** Substitute $4x$ for y in $2x^2 + y^2 = 360$.

$$2x^2 + (4x)^2 = 360$$
$$2x^2 + 16x^2 = 360$$
$$18x^2 = 360$$
$$x^2 = 20$$

14. **(C)** Divide both sides of the equation by 2, the *GCF* of $2x^2 + 8x - 12$.

$$(2x^2 + 8x - 12) \div 2 = 0 \div 2$$
$$x^2 + 4x - 6 = 0$$

The equation does not factor so solve by using the quadratic equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a = 1 \quad b = 4 \quad c = -6$$

$$x = \frac{-4 \pm \sqrt{(4)^2 - 4(1)(-6)}}{2(1)}$$
$$x = \frac{-4 \pm \sqrt{40}}{2}$$
$$x = \frac{-4 \pm 2\sqrt{10}}{2}$$
$$x = -2 \pm \sqrt{10}$$

15. **(B)** Solve for a or b in $a - b = -1$ and create a system of equations.

$$a - b = -1 \text{ so } a = b - 1$$

Substitute $b - 1$ for a in $ab = 6$.

$$\begin{aligned}(b-1)b &= 6\\ b^2 - b &= 6\\ b^2 - b - 6 &= 0\end{aligned}$$

Factor and solve for b.

$$\begin{aligned}(b+2)(b-3) &= 0\\ b+2 = 0 \text{ or } b-3 &= 0\\ b = -2 \text{ or } b &= 3\end{aligned}$$

Find a when $b = 3$ or $b = -2$.

$$\begin{aligned}ab &= 6\\ 3a &= 6\\ a &= 2\\ ab &= 6\\ -2a &= 6\\ a &= -3\end{aligned}$$

Solve for c when a and b are 2 and 3, respectively.

$$\begin{aligned}(2x-7)(3x+5) &= 6x^2 - 11x - 35\\ c &= -11\end{aligned}$$

Solve for c when a and b are -3 and -2, respectively.

$$\begin{aligned}(-2x-7)(-3x+5) &= 6x^2 + 11x - 35\\ c &= 11\end{aligned}$$

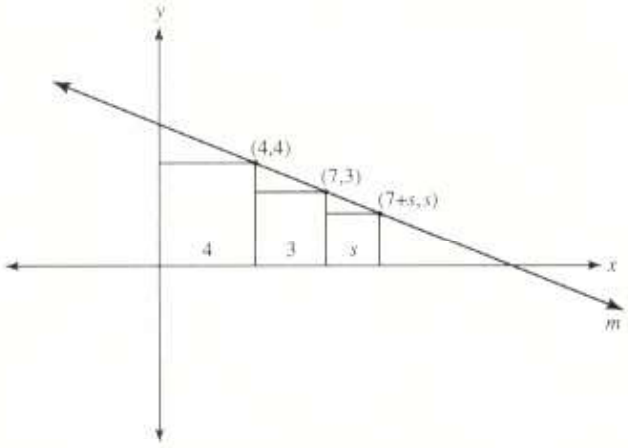
16. **200** Let x = the number of miles for the two trailer rental costs to be equal.

$$\begin{aligned}40 + 0.20x &= 30 + 0.25x\\ 40 + 0.20x - 0.20x &= 30 + 0.25x - 0.20x\\ 40 &= 30 + 0.05x\\ 10 &= 0.05x\\ 200 &= x\end{aligned}$$

17. **$\frac{3}{2}$ or 1.5** The graph of an absolute value function is in the form $f(x) = a|x - h| + k$ where (h, k) is the vertex. In the function $f(x) = -2|x - m| + n$, $m = h$ and $n = k$. The graph shows the vertex is $(3, -2)$ so $m = 3$ and $n = -2$. Therefore, $-mn^{-1} = -(3)\left(-\frac{1}{2}\right) = \frac{3}{2}$.

18. **$\frac{5}{8}$ or .625** By the complementary angle relationship for sine and cosine, $\sin(x°) = \cos(90° - x°)$. Therefore, $\cos(90° - x°) = \frac{5}{8}$.

Either the fraction $\frac{5}{8}$ or its decimal equivalent, .625 may be gridded in as the correct answer.



19. **$\frac{9}{4}$ or 2.25** Using the first two points of line m, we get the slope is $\frac{3-4}{7-4}=-\frac{1}{3}$. Using the second and third points we get the slope as $\frac{s-3}{(7+s)-7}=\frac{s-3}{s}$. Since $\frac{s-3}{s}=-\frac{1}{3}$, cross-multiply and solve for s.

$$\frac{s-3}{s}=-\frac{1}{3}$$
$$s(-1)=(3)(s-3)$$
$$-s=3s-9$$
$$4s=9$$
$$s=\frac{9}{4} \text{ or } 2.25$$

20. **0** Replace n with 1 in $r(n)$.

$$(1-7)(2-7)(3-7)(4-7)(5-7)(6-7)(7-7)\ldots$$

The function progresses to 7 – 7, which equals 0. The product of 0 and any other number is 0.

Section 4: Math Test (Calculator)

1. **(D)** Let x equal the number of movies rented by Warren in the past month.

$$2.25x+4=24.25$$
$$2.25x=20.25$$

Divide both sides of the equation by 2.25.

$$\frac{2.25x}{2.25}=\frac{20.25}{2.25}$$
$$x=9$$

2. **(D)** Use the proportion $\frac{\text{map distance}}{\text{actual distance}} = \frac{\text{map distance}}{\text{actual distance}}$ to answer the question.

$$\frac{1}{80} = \frac{5.05}{d}$$
$$1 \times d = 80 \times 5.05$$
$$d = 404$$

The distance between Hartford and Roanoke is 404 miles.
Choice (A) can be immediately eliminated; 1 inch = 80 miles and the map shows 5.05 inches.

3. **(A)** The density of an object is equal to the mass of the object divided by the volume of the object, which can be expressed as density = mass/volume. Thus, if an object has a density of 4 grams per milliliter and a mass of 48 grams, the equation becomes:

$$4 = \frac{48}{V}$$
$$4V = 48$$
$$V = 12$$

The volume, then, is 12 milliliters/gram.

4. **(D)** If 1 in 8 callers were solicited for the survey, then one-eighth of the callers were asked to participate. Thus, one-eighth of 400 callers is 50 callers. Since 20% of the callers consented to the survey, then 80% did not want to take part. Find 80% of 50 by multiplying 50 by .8.

$$50 \times .8 = 40$$

5. **(A)** Begin to isolate b_1 by multiplying the area formula by 2.

$$A = \frac{1}{2}(h)(b_1 + b_2)$$
$$(2)A = \frac{1}{2}(h)(b_1 + b_2)(2)$$
$$2A = (h)(b_1 + b_2)$$

Divide both sides of the equation by h, the height of the trapezoid.

$$\frac{2A}{h} = \frac{(h)(b_1 + b_2)}{h}$$
$$\frac{2A}{h} = b_1 + b_2$$

Subtract b_2 from both sides of the equation.

$$\frac{2A}{h} - b_2 = b_1$$

6. **(C)** Since the number of classes the student took is unknown, let x equal that value. Adding the monthly cost we get the following equation:

$$5.75x + 11.50 = 51.75$$

Subtract 11.50 from both sides.

$$5.75x + 11.50 - 11.50 = 51.75 - 11.50$$
$$5.75x = 40.25$$

Divide each side of the equation by 5.75 to isolate x.

$$5.75x \div 5.75 = 40.25 \div 5.75$$
$$x = 7$$

7. **(B)** Solve $2p - 4 \geq 6$ and assess its least value.

$$2p - 4 + 4 \geq 6 + 4$$
$$2p \geq 10$$
$$p \geq 5$$

Substitute 5 into the expression $2p + 4$ to calculate its least value.

$$2(5) + 4 = 14$$

8. **(B)** Use the distance formula to find the distance from the center to point A.

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$d = \sqrt{(4-7)^2 + (-2-3)^2} = \sqrt{34}$$

The formula for the area of a circle is $A = \pi r^2$. Replace r with $\sqrt{34}$ to find the area of the circle.

$$A = \pi(\sqrt{34})^2 = 34\pi$$

9. **(C)** The greatest drop, as a percentage, occurred between years 4 and 5.

Year 4: \$20
Year 5: \$5

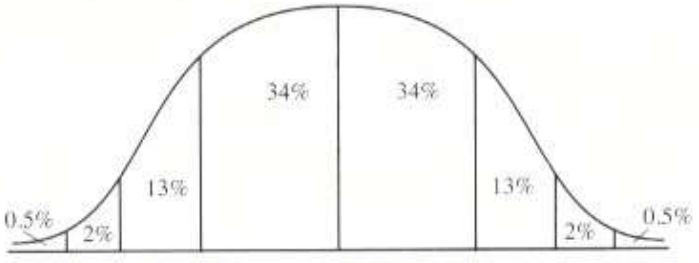
Use the formula $\frac{\text{decrease}}{\text{original}} = \frac{n}{100}$ to find the percent decrease.

$$\frac{15}{20} = \frac{n}{100}$$
$$20n = 1{,}500$$
$$n = 75\%$$

10. **(B)** In year 3, the internet plan price was \$50. In year 4, the plan price decreased to \$20.

$$50 - 20 = 30$$

11. **(D)** A standard deviation is a statistical measure of the dispersion of data around its mean. A student whose weight is in the lowest 2.5% of the class means that this student is two standard deviations separated from the mean.



Each standard deviation is 6.3 pounds from the mean. Given the student is in the lowest 2.5% of the data, this weight falls two standard deviations from 103 pounds, the mean. Multiply 6.3 by 2 and subtract that value from 103.

$$103 - (2)(6.3) = 90.4$$

Choices (A) and (B) can immediately be eliminated. Since the student's weight is in the lowest 2.5% of the class' weights, his weight must be lower than the mean, 103 pounds.

12. **(B)** Let m equal the number of miles. Multiply m by the cost per mile, and add the fixed charge of $1.50 per transaction.

$$.55m + 1.50$$

This amount can be no more than $11 since that is all the money that Mustafa has.

$$.55m + 1.50 \leq 11$$

Choices (C) and (D) can immediately be eliminated as they express inequalities permitting costs no lower than $11. Mustafa has only $11 to spend.

13. **(A)** Because Pham surveyed a random sample of the students in her school, her sample was representative of the entire high school. Thus, the percent of students in the entire high school expected to prefer starting a 4H Club is appropriately estimated by the percent of students who preferred it in the sample, 31.5%. Thus, of the 1,145 students in the high school, approximately $1{,}145 \times 0.315 = 360.7$ students would be expected to prefer starting the 4H Club. Of the choices given, this is closest to 360.

14. **(B)** Although the number of students cited for texting while driving is reduced slightly as higher fees are levied, a line of best fit would show only a mild negative slope. Thus, there is a weak negative correlation between higher fines and the number of students cited for texting while driving.

15. **(C)** It has been shown that increasing the cost of a texting citation has only a modest impact on the number of citations issued. Some other plan is needed to decrease the number of offenders. Perhaps a series of commercials showing the traffic fatalities caused by texters would enhance the program to reduce texting while driving.

16. **(C)** Sometime just after the beginning of 2012 the restaurant had reached its break-even point, the time when revenues and costs are the same. It can therefore be reasoned that between 2012 and 2013 was the time when the difference between costs and revenues was the least dollar amount.

17. **(D)** The break-even point occurred in late 2012 when revenues and expenses were about $180,000. After two years, the revenues had increased to about $380,000. Find the percent increase by using the formula

$$\frac{\text{increase}}{\text{original amount}} = \frac{n}{100}$$

$$\frac{200}{180} = \frac{n}{100}$$

Cross-multiply and solve for n.

$$180n = 20{,}000$$
$$n = 111.1$$

18. **(C)** Of the runners who placed in the top 40, 6 were in the age group of 30 to 39. One runner in that age group finished in the top 10 and 5 others finished somewhere in places between 11 and 40. Divide 6 by 40 to get .15 which, when expressed as a percent, is 15%.

19. **(A)** The number of runners under 20 years of age who placed in positions 11 through 40 was 11. Given that the total number of runners in that age group was 18, the percent who finished in places 11 through 40 is 61.1%. The number of runners between the ages of 40 and 49 who also finished in places 11 through 40 was 3. Given that a total of 35 runners were in this category, the percent of those runners who finished in places 11 through 40 was 8.6%. The difference between 61.1% and 8.6% is 52.5%.

20. **(A)** Using the values chart, note that when $x = 2$, $g(2) = 5$. Now, check the $h(x)$ values chart for $x = 5$. We find $h(5) = 24$. Therefore, $h(g(2)) = 24$.

21. **(C)** Solve each absolute value equation:

$$|m - 3| = 12$$

Therefore:

$$m - 3 = 12 \text{ or } m - 3 = -12$$
$$m = 15 \text{ or } m = -9$$

Therefore:

$$|n + 7| = 22$$
$$n + 7 = 22 \text{ or } n + 7 = -22$$
$$n = 15 \text{ or } n = -29$$

Since m and n are both less than 0, select –9 and –29 for m and n, respectively.

$$m - n = -9 - (-29) = 20$$

22. **(C)** The mariner is borrowing \$6,500, which is 6.5 increments of \$1,000. At 36 payments with a rate of 10%, the cost is \$32.27 per \$1,000. Multiply 6.5 by \$32.27 to find the monthly payment.

$$\$32.27 \times 6.5 = \$209.76$$

23. **(D)** In order to maximize the amount that can be spent on a boat, the mariner must find the lowest payment per \$1,000 loaned. At a rate of 5% for 60 months, the cost per \$1,000 is \$18.87. Divide \$300 by \$18.87 to find the most that can be spent on a sailboat.

$$\$300 \div \$18.87 = \$15.898$$
$$15.898 \times \$1{,}000 = \$15{,}898$$

The closest answer is D, \$15,000.

24. **(D)** Convert everything into yards.

$$3 \text{ inches} = .08 \text{ yards}$$
$$10 \text{ foot radius} = 3.33 \text{ yards}$$
$$\pi = 3.14$$

Use the formula $V = \pi r^2 h$, the volume of a cylinder, to determine how much rock is needed if 3.33 yards is the radius and .08 yards is the height.

$$3.14 \times 3.33^2 \times .08 = 3.14 \times 11.09 \times .08 = 2.79 \text{ cubic yards}$$

Rounding to the nearest cubic yard, the homeowners must purchase 3 cubic yards of rock.

$$3 \text{ cubic yards} \times \$80 = \$240$$

25. **(C)** Whether the rows contained 4, 5, or 6 boys, the last row was always one short. Suppose the number of boys in the group is r, then $r + 1$ would be the quantity that is divisible by 4, 5, and 6. Find the least common multiple of 4, 5, and 6 and set the value equal to $r + 1$.
The least common multiple of 4, 5, and 6 is 60, so $r + 1 = 60$. Therefore, r must be 59, the smallest number of boys that could be in the Boy Scout troop.

26. **(A)** Find the sum of the cards by multiplying the mean by the number of cards:

$$7 \times 14 = 98$$

To maximize the value of a single card, minimize the value of the other cards by assigning each a value of 1:

$$1 + 1 + 1 + 1 + 1 + 1 + 92 = 98$$

27. **(D)** Use a proportion to find the length of the proposed amphitheater in the downtown cultural center. This operation can be facilitated by approximating the length in decimal form.
$\frac{1+\sqrt{5}}{2}:1$ is approximately equal to 1.62 : 1. Use this ratio substituting 87 for the width.

$$\frac{1.62}{1} = \frac{x}{87}$$

Cross-multiply and solve for x.

$$x = (1.62)(87) = 140.94$$

140.94 rounded to the nearest meter is 141.
Choice (A) can be eliminated quickly (and possibly B as well). Once it is determined that the golden ratio is about 1.62:1, 211 would surely seem more than twice as large as 87.

28. **(C)** Use the BMI formula with the provided data to assess the patient's BMI number. Remember to convert the height to inches: 5 feet 10 inches equals 70 inches.

$$\frac{182}{70^2} \times 703 = 26.11$$

A patient with a BMI of 26.11 is classified as overweight.

29. **(B)** Use the BMI formula using the provided data to assess the patient's BMI weight. Remember to convert the height to inches: 6 feet equals 72 inches. The lowest BMI categorized as obese is 30.0.
Let x = the patient's weight.

$$\frac{x}{72^2} \times 703 = 30$$
$$.136x = 30$$
$$x = 221$$

30. **(A)** Find the volume of the tank by multiplying its length by its width and depth.

$$100 \times 60 \times 40 = 240{,}000 \text{ cm}^3$$

The tilted tank in the diagram demonstrates that the water in the aquarium represents $\frac{1}{4}$ of the tank's volume. Therefore the volume of the water is $\left(\frac{1}{4}\right)(240{,}000) = 60{,}000$ cm^3. Once the tank is replaced on its horizontal axis we find the width is still 60 cm, the length is still 100 cm but the water's height is unknown. Let x = the height of the water in the tank and replace the volume with 60,000.

$$(100)(60)(x) = 60{,}000$$
$$6{,}000x = 60{,}000$$
$$x = 10$$

31. **9** A system of equations yields an infinite number of solutions when the equations are equivalent. For example:

$$x + y = 6$$
$$2x + 2y = 12$$

has infinite solutions because

$$(2x + 2y = 12) \div 2 = x + y = 6$$

Dividing, we get:

$$-\frac{21}{2}y \div -7y = 1.5$$
$$\frac{111}{4} \div \frac{37}{2} = 1.5$$

Each term in the second equation is 1.5 times the corresponding term in the first equation. The value of a is 9 because $6 \times 1.5 = 9$.

32. **.810** Find the probability that the student selected is an eighth-grade girl and subtract that value from 1.0.

$$\frac{\text{eighth grader}}{\text{all students}} = \frac{215}{1142} = .188$$

Subtract .188 from 1.0 to find the probability that the student selected is not an eighth-grade girl.

$$1.0 - .188 = .812$$

The answer, .812, rounds to .810.

33. **144** The profit function, $P(x) = -.08x^2 + 23.1x + 500$, is a parabola that opens down. The vertex is a maximum with the x-coordinate representing the most profitable number of chairs to manufacture. Find the x-coordinate by using the formula for finding the axis of symmetry, $x = -\frac{b}{2a}$.

$$a = -.08 \quad b = 23.1$$

$$x = -\frac{23.1}{2(-.08)} = 144.375 \approx 144$$

34. **18** Solve for x by changing each base to 3.

$$\left(\frac{1}{3}\right)^{x-2} = (27)^{3-x}$$
$$(3^{-1})^{x-2} = (3^3)^{3-x}$$
$$-x + 2 = 9 - 3x$$
$$-7 = -2x$$
$$\frac{7}{2} = x$$
or
$$3.5 = x$$

Substitute 3.5 for x in $2x+11$.

$$(2)(3.5) + 11 = 18$$

35. **5,250 pounds** Find the weight of the three cars currently crossing the bridge. Subtract that sum from 15,000, the carrying capacity of the bridge. Since the average weight of the three cars is 3,250 pounds, multiply that value by 3 to find the weight of all three.

$$3 \times 3{,}250 = 9{,}750$$

Subtract 9,750 from 15,000 to find the maximum allowable weight for a fourth car or truck.

$$15{,}000 - 9{,}750 = 5{,}250$$

36. **24.00** or **24** Find the volume of the pyramid using the formula $V = \frac{1}{3}Bh$, where B is the base area of the pyramid and h is its height.
Use the formula Area = (length)(width) to find the base area.

$$\text{Area} = 6 \times 8 = 48 \text{ square feet}$$

Replace B with 48 in the volume formula.

$$V = \left(\frac{1}{3}\right)(48)(12) = 192$$

The pyramid has a volume that measures 192 cubic feet. Since each cubic foot weighs 4 ounces, multiply 192 by 4 to find its weight in ounces.

$$192 \times 4 = 768.$$

Divide 768 by 16, the number of ounces in a pound, to find the weight of the pyramid in pounds.

$$768 \div 16 = 48$$

Multiply 48 by .50 to find the cost for the Styrofoam to make the pyramid.

$$48 \times \$.50 = \$24.00$$

37. **2,119** Replace $W(h)$ with 50 and h with 22,000 in $W(h) = m\left(\frac{4000}{4000+h}\right)^2$

$$50 = m\left(\frac{4000}{4000+22000}\right)^2$$
$$50 = m\,(.0236)$$
$$2{,}119 = m$$

38. **8.02** Substitute Susan's sea level weight, 120 pounds, for m and her weight in the jet, $W(h)$ with 119.5.

$$119.5 = 120\left(\frac{4000}{4000+h}\right)^2$$

Divide both sides of the equation by 120.

$$.996 = \left(\frac{4000}{4000+h}\right)^2$$

Find the square root of both sides of the equation.

$$.998 = \frac{4000}{4000+h}$$

Begin to solve for h.

$$.998(4000 + h) = 4{,}000$$
$$3{,}992 + .998h = 4{,}000$$
$$.998h = 8$$
$$h = 8.02$$

3

3

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

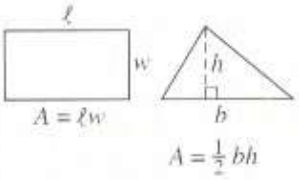
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

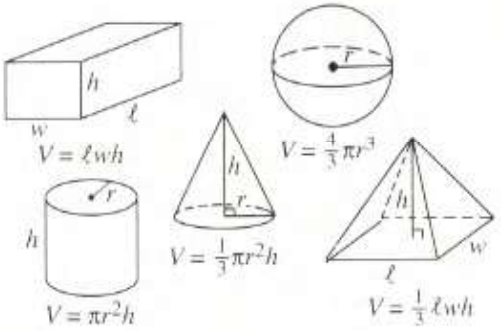
- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

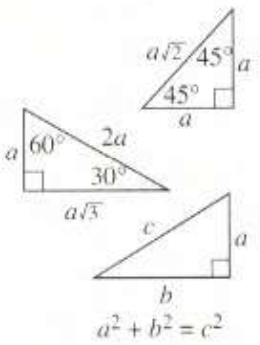
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

1. The product of an integer, n, and 5, increased by 12 is −13. What is the value of n?

   (A) 25
   (B) 5
   (C) $\frac{1}{5}$
   (D) −5

2. If $i = \sqrt{-1}$, what is the value of $(7 - 2i) + (4 - 5i)$?

   (A) $4i$
   (B) $11 - 7i$
   (C) $7 - 11i$
   (D) $-77i^2$

GO ON TO THE NEXT PAGE

3

3. Alan had a big day catching 17 fish. He is concerned, however, about the weight of all of the fish. The average weight of the 17 fish he caught is f pounds. What would be the weight of the 17 fish if they were placed in a single container?

(A) $\frac{17}{f}$

(B) $\frac{f}{17}$

(C) $17f$

(D) $f + 17$

4. Jorge earns a weekly allowance of $10, and he gets $8 for every chore he does at his home. Recently Jorge was paid $106 for his allowance and chores. How many chores did he do?

(A) 12
(B) 11
(C) 9
(D) 7

5. $-4xy^2 - 2xy + xy - 8mn + mn$

Which of the following is equivalent to the expression above?

(A) $-5x^3y^3 - 8m^2n^2$
(B) $-5x^3y - 7m^2n^2$
(C) $32y - 8$
(D) $-4xy^2 - xy - 7mn$

6. A small city was incorporated in the year Y. Every 15 years, the town doubled in size. How many times larger was the town in year $Y + 90$ than it was in year Y?

(A) 16
(B) 32
(C) 64
(D) It cannot be determined because the initial population is unknown.

7. If $\frac{m}{n} = 7$, what is the value of $\frac{2n}{m}$?

(A) 14
(B) $\frac{7}{2}$
(C) $\frac{2}{7}$
(D) $\frac{1}{7}$

8. $$y = \frac{2}{5}x - 3$$
$$2x - 5y = 7$$

The linear equations above form lines that are

(A) parallel
(B) perpendicular
(C) parallel and perpendicular
(D) neither parallel nor perpendicular

9. Which of the following is true about the graph of the equation $y = 4(x - 3)^2 + 13$?

(A) The graph is wider than the graph of $y = (x - 3)^2 + 13$.
(B) It has no real roots.
(C) Its minimum value is -3.
(D) Its roots are $x = 3$ and $x = -13$.

GO ON TO THE NEXT PAGE

10. $V = 7.5 + .75x$
$C = 1.25x$

Sarah is an art teacher who wants to purchase calligraphy pens for her students. Visionary Arts (V) charges a delivery fee of \$7.50 plus \$.75 for each pen. Cramer's Art Supply charges \$1.25 per pen with free delivery. What number of pens would need to be purchased such that the two deals are equivalent?

(A) 8
(B) 10
(C) 15
(D) 20

11. A line in the xy-plane passes through the origin and has a slope of $\frac{1}{9}$. Which of the following points lies on the line?

(A) $(-6, 12)$
(B) $(-4, 36)$
(C) $\left(3, \frac{1}{3}\right)$
(D) $\left(-\frac{1}{3}, 3\right)$

12. Which of the following is equivalent to $\dfrac{1}{\frac{1}{x+4}+\frac{1}{x+6}}$?

(A) $x^2 + 10x + 24$
(B) $\dfrac{1}{\frac{1}{x+12}}$
(C) $\dfrac{x^2+10x+24}{2x+10}$
(D) $\dfrac{x+4}{x+6}$

13. If $12x - 3y = 5$, what is the value of $\dfrac{16^{3x}}{8^{y}}$?

(A) 4
(B) 16
(C) 32
(D) 64

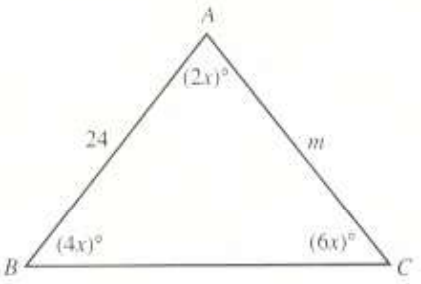


Figure Not Drawn to Scale

14. In $\triangle ABC$, what is the value of m?

(A) 12
(B) $12\sqrt{3}$
(C) $12\sqrt{2}$
(D) $3\sqrt{6}$

15. The circles $(x-\sqrt{3})^2 + (y-\sqrt{3})^2 = 1$ and $x^2 + y^2 = 1$ are tangent to one another. What is the measure of the segment that contains their centers?

(A) $\left(\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}\right)$
(B) $\sqrt{6}$
(C) $2\sqrt{3}$
(D) .6

GO ON TO THE NEXT PAGE

16. Kareem has purchased a hybrid automobile that has an average fuel efficiency of 40 miles per gallon. He recently filled his 12-gallon tank yesterday but it now registers $\frac{3}{4}$ full. How many miles did Kareem drive if his mileage reflected his average fuel efficiency?

17. A gymnast has a routine in which he sways back and forth on a high bar, making an arc that measures 135°. As he swings, the bottom of his shoes create an arc that measures 9 feet. At the conclusion of his routine, he swings completely around for one full circle around the bar. What is the circumference of that circle (answer in feet)?

18. If $\frac{1}{5}x + \frac{5}{8}y = 2$, then $8x + 25y = ?$

19. In a right triangle, one angle measures $n°$ where $\sin(n°) = \frac{7}{9}$. What is $\cos(90 - n)°$?

20. New drivers must learn that braking distance is dependent on speed. If you travel x miles per hour, your stopping distance in feet can be approximated by $f(x) = x + \frac{x^2}{20}$. What is the difference in braking distance between a driver traveling at 60 miles per hour and a driver traveling at 40 miles per hour?

If there is still time remaining, you may review your answers.

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

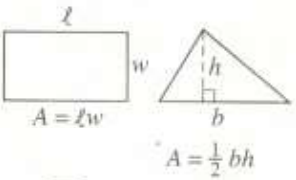
Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- The use of a calculator on this section IS permitted.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

Area Facts



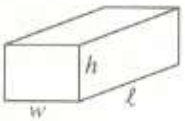
$A = \ell w$

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

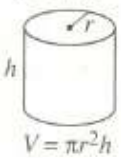
$A = \pi r^2$

$C = 2\pi r$

Volume Facts



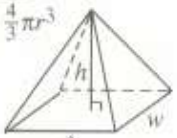
$V = \ell wh$



$V = \pi r^2 h$

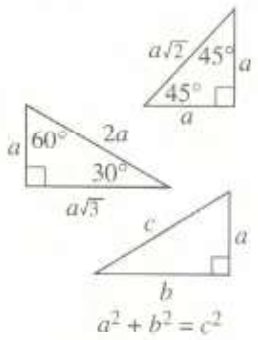
$V = \frac{1}{3}\pi r^2 h$

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



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

Triangle Facts



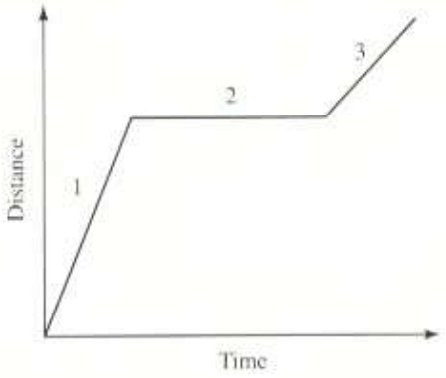
$a^2 + b^2 = c^2$

The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

GO ON TO THE NEXT PAGE

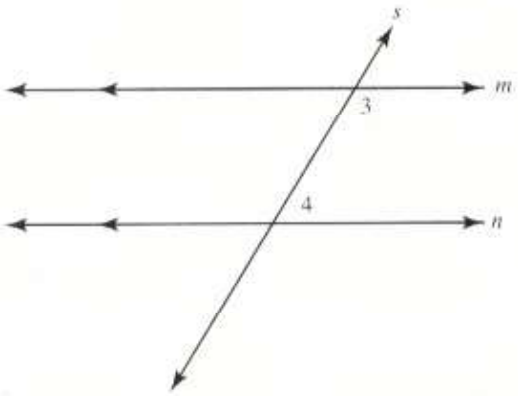


1. Thomas rides his bike to the park and then sits down on a bench to rest. After his rest, he jogs several miles. Which part(s) of the graph represents the time he spent sitting on the bench?

   (A) 1 and 2
   (B) 2 only
   (C) 2 and 3
   (D) 3 only

2. If $xy = k$, where k is a constant, when x equals 8 and y equals 10, what is the value of y when $x = 5$?

   (A) 80
   (B) 16
   (C) 8
   (D) 4



3. In the figure above, lines m and n are parallel. If $m\angle 3 = (3x)°$ and $m\angle 4 = (2x)°$, what is the measure of $m\angle 4$?

   (A) 36°
   (B) 48°
   (C) 72°
   (D) 108°

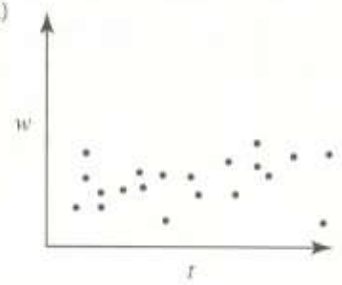
4. If one-half of a number is 5 more than 6, what is the value when the number is tripled?

   (A) 11
   (B) 22
   (C) 33
   (D) 66

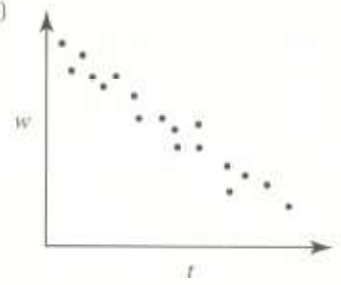
GO ON TO THE NEXT PAGE

5. Which of the following graphs shows a strong positive association between t and w?

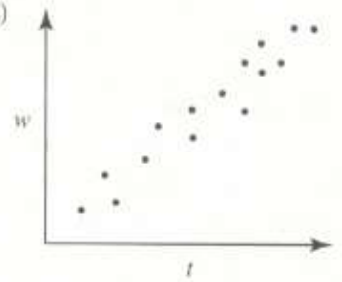
(A)



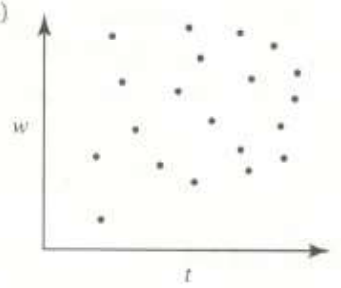
(B)



(C)



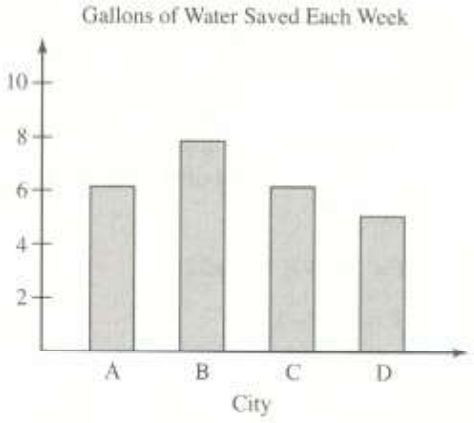
(D)



1 hectogram = 100 grams 100 centigrams = 1 gram

6. A popular snack is packaged in 2 hectogram containers. If a customer ate $\frac{1}{4}$ of one of these containers, how many centigrams did he/she consume?

(A) 50
(B) 100
(C) 1,000
(D) 5,000



7. Certain cities in the southwestern United States are experimenting with water-saving plumbing. If the total gallons saved as expressed in the graph above equal 25,000 gallons, what is an appropriate label for the vertical axis?

(A) Gallons saved (in tens)
(B) Gallons saved (in hundreds)
(C) Gallons saved (in thousands)
(D) Gallons saved (in hundred thousands)

GO ON TO THE NEXT PAGE

8. What value(s) of n satisfies $|n + 11| \geq -12$?

   (A) $-1 \leq n \leq 1$
   (B) $n \geq 11$ or $n \leq -23$
   (C) there is no value n
   (D) all real numbers

Questions 9 and 10 refer to the following information.

An enclosed volume of a certain gas is shown by the following equation:

$$V = \frac{.7T}{P} + 3.77$$

where
V = volume of the gas (in cubic centimeters)
P = pressure (in kilograms per square centimeter)
T = temperature (in degrees Kelvin)

9. Which of the following expresses temperature in terms of volume and pressure?

   (A) $T = (P - V)(.7) - 3.77$
   (B) $T = \frac{P}{.7}(V - 3.77)$
   (C) $T = \frac{(V + 3.77)}{P}$
   (D) $T = \frac{P}{V - 3.77}$

10. Find the temperature (in degrees Kelvin) when the volume of the gas is 8,000 cubic centimeters and the pressure is 1.2 kg/cm^2.

    (A) 7,407
    (B) 8,176
    (C) 13,708
    (D) 16,511

11. Brittany was packing bags for shipping. She had packed 42 bags before she realized that one of her earrings was missing. She asked Todd to help her open up the bags and find her earring. What was the likelihood that she and Todd would only have to open 7 bags apiece in order to recover the lost earring?

    (A) 33%
    (B) 17%
    (C) 50%
    (D) 18%

12. Which of the following is **not** a solution of the inequality $-7x + 4 \leq 4x - 5$?

    (A) 0
    (B) 1
    (C) 3
    (D) 4

13. Two friends are returning home from Vacaville, CA to Carlsbad, CA, a round trip of 984 miles. They would like to stop over in Bakersfield to go to the Museum of Art, free admission on Fridays. They would also like to eat lunch within walking distance of the museum, spending $8 each. This side trip would add 54 miles to the trip. They have designated a budget of $90 for the return trip to Carlsbad. Each gallon of gas costs $3.64 and their car gets 26 miles per gallon. Do they have enough money to take this extra stop?

    (A) Yes, they will have $7.43 extra after the side trip.
    (B) Yes, they will have $4.32 extra after the side trip.
    (C) No, they will need an additional $2.44.
    (D) No, they will need an additional $8.73.

GO ON TO THE NEXT PAGE

Presidential Candidate	Vice Presidential Candidate	Political Party	Popular Vote		Electoral Vote	
Barack H. Obama	Joseph R. Biden, Jr.	Democratic	65,918,507	51.01%	332	61.7%
Willard Mitt Romney	Paul Ryan	Republican	60,934,407	47.15%	206	38.3%
Gary Johnson	James P. Gray	Libertarian	1,275,923	0.99%	0	0.0%
Jill Stein	Cheri Honkala	Green	469,015	0.36%	0	0.0%
Other (+)	—	—	637,706	0.49%	0	0.0%
Total			129,235,558		538	

14. The results of the 2012 presidential election are listed above. If all of the Libertarian, Green, and Other votes were cast for former governor Romney, what would have been true about the vote difference between Obama and Romney?

(A) Romney would have earned the presidency by a total of 2,601,456 votes.
(B) Obama's margin of victory would have been cut by 2,382,646 votes.
(C) Obama would have won the election by 3,135,721 votes.
(D) The difference between the candidates' vote totals would have been so slim that a recount would have been in order as had happened in 2000.

15. A plumbing service charges a fixed fee for a house call in addition to its hourly rate. A 2-hour call costs $114 and a call for 4.5 hours costs $194. What is the cost of the hourly rate?

(A) $80
(B) $75.50
(C) $65
(D) $32

GO ON TO THE NEXT PAGE

Questions 16–18 refer to the table below.

Daily Statistics for June 2015												
Day	Hits		Files		Pages		Visits		Sites		KBytes	
1	**327**	6.35%	**274**	6.62%	**250**	7.29%	**85**	7.58%	**60**	8.97%	**2203**	4.87%
2	**432**	8.39%	**383**	9.25%	**349**	10.17%	**64**	5.71%	**57**	8.52%	**2506**	5.54%
3	**283**	5.49%	**235**	5.68%	**181**	5.28%	**56**	5.00%	**50**	7.47%	**2332**	5.15%
4	**249**	4.83%	**208**	5.03%	**143**	4.17%	**47**	4.19%	**56**	8.37%	**2816**	6.22%
5	**265**	5.14%	**164**	3.96%	**134**	3.91%	**39**	3.48%	**44**	6.58%	**1644**	3.63%
6	**165**	3.20%	**142**	3.43%	**114**	3.32%	**45**	4.01%	**42**	6.28%	**1425**	3.15%
7	**250**	4.85%	**155**	3.74%	**134**	3.91%	**50**	4.46%	**51**	7.62%	**1621**	3.58%

The table above is a statistics page for an educational website. The visits, files, and other data are shown for the first week of June 2015. The owner of the educational site is wondering how to effectively reach more viewers.

16. Which of the following can be concluded from the table?

(A) The number of visits exceeds the number of sites each day.
(B) On day 7, the ratio of hits to files is greater than the ratio of files to pages.
(C) The ratio of KBytes to sites is greater on day 6 than on day 1.
(D) The ratio of pages to visits is never less than 3 : 1.

17. What is the median number of visits in the first seven days of June 2015?

(A) 85
(B) 47
(C) 56
(D) 50

18. If R is the range of the File category and r is the range of the KByte category, what is the value of $2r - R$?

(A) 3,126
(B) 2,541
(C) 254
(D) −249

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19. Two brothers remembered their first high school job. In their first week, Rick earned $4.50 per hour while Jay earned $5.25 per hour. They worked a total of 44 hours and their combined wage was $202.50. How many hours did Rick work that week?

(A) 10
(B) 17
(C) 34
(D) 38

GO ON TO THE NEXT PAGE

20. Briana bought a pair of running shoes at a 25% discount off of the original price. The total she paid the cashier was r dollars, which includes an 8% sales tax on the discounted price. Which of the following represents the original price of the running shoes in terms of r?

(A) $.81r$

(B) $\frac{r}{.75}$

(C) $(.75)(1.08)r$

(D) $\frac{r}{(1.08)(.75)}$

Questions 21 and 22 refer to the information provided below.

The metabolic rate r (in kilocalories per day) of any mammal can be modeled by using the formula $r = km^{\frac{3}{4}}$ where k is a constant and m is the mass in kilograms of the mammal. The formula $s = \frac{km^{\frac{3}{4}}}{m}$ is used to find the specific metabolic rate which measures the rate per unit of mass.

21. If the weight of a great walrus is 1,000 kilograms, and its metabolic rate is 18,500 kilocalories per day, what is the value of k in the metabolic rate formula?

(A) 134.74
(B) 104.03
(C) 94.42
(D) 41.53

22. Using the k value from question 21, find the specific metabolic rate of the great walrus.

(A) 4.47
(B) 4.03
(C) 18.50
(D) 23.47

23. A central angle in a circle has a measure of 34.4° and the measure of the area of its sector is 139.6 square units. To the nearest tenth of a unit, what is the measure of the circle's radius?

(A) 19.4
(B) 21.6
(C) 27.3
(D) 29.7

Questions 24 and 25 refer to the information below.

$$h = -4.9t^2 + 32t$$

The equation above shows the height of a ball thrown upward from ground level with an initial velocity of 32 meters per second.

24. After approximately how many seconds will the ball hit the ground?

(A) 5.6
(B) 6.5
(C) 7.4
(D) 8.2

25. After how many seconds will the ball be 18 meters in the air?

(A) 2.2
(B) 4.3
(C) .6 and 5.9
(D) .6 or 5.9

---

26. The mean of seven numbers is x. What must be added to the sum of the numbers to increase the mean by $\frac{4}{7}$?

(A) $\frac{19}{7}$
(B) 4
(C) $\frac{29}{7}$
(D) 8

GO ON TO THE NEXT PAGE

27. A combination lock uses three two-digit numbers. The following conditions apply.

- one number is prime
- one number is a day of the month
- one number is a multiple of 3

If each number in the combination satisfies exactly one of the conditions, which of the following could be the combination?

(A) 15 – 23 – 29
(B) 26 – 17 – 18
(C) 51 – 42 – 27
(D) 14 – 19 – 16

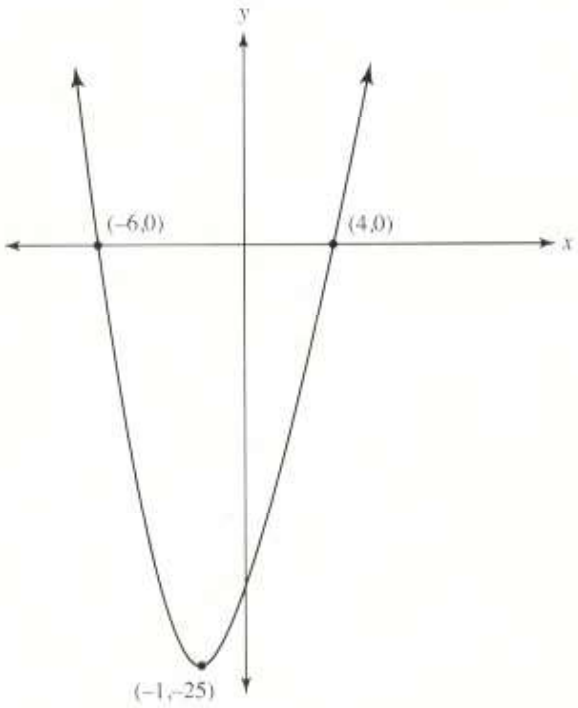
28. Which of the following is an equivalent form of the function h, such that the minimum value of h appears as a constant or coefficient?

$h(x) = (x - 8)(x + 2)$

(A) $h(x) = x^2 - 6x - 16$
(B) $h(x) = x^2 + 6x - 16$
(C) $h(x) = (x - 3)^2 - 25$
(D) $h(x) = (x + 3)^2 - 25$

29. If $x^3 - 20 = (x + 5)(x^3 - 5x + 25) + m$, what is the value of m?

(A) 65
(B) 10
(C) 5
(D) –145



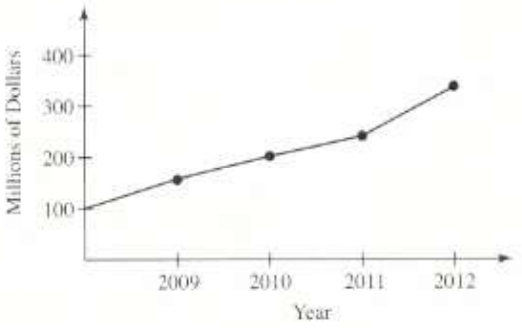
30. Which of the following equations is equivalent to the parabola with equation $y = (x - 4)(x + 6)$?

(A) $y = (x + 1)^2 - 25$
(B) $y = (x - 1)^2 + 25$
(C) $y = (x + 3)(x - 8)$
(D) $y = (x + 12)(x - 2)$

GO ON TO THE NEXT PAGE

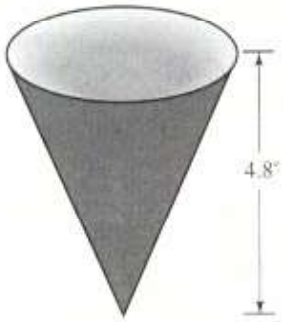
31. A pair of hiking boots sells for $80.00. After one week, the vendor reduced the cost of the boots by 20%. After two weeks, he raised the current price by 20%. What is the cost of the hiking boots after two weeks?

32. On July 15, 2015 the New Horizon planet orbiter transmitted its first pictures of minor planet Pluto. Pluto is approximately 3 billion miles distant from Earth. If the transmission of the photographs traveled at light-speed, to the nearest hundredth, how many hours did it take for the Pluto photographs to reach Earth from Pluto? (Note: light travels 186,000 miles per second)



33. The County Education Budget is shown in the graph above. According to the line graph, the budget in 2010 is what fraction of the budget in 2012?

34. If $g(x) = 2(x^2 - 6)$ and $f(x) = x^2 - 5$, what does $g(f(5)) - f(g(-3))$ equal?



35. A waffle-flavored ice cream cone is pictured above. If the volume of the cone is 14.4π cubic inches, what is the diameter of the cone (in inches)?

36. $$f(x) = \frac{1}{2(x-3)^2 + 4(x-3) + 2}$$

For what value of x is the function f undefined?

PRACTICE TEST 4

GO ON TO THE NEXT PAGE

Questions 37 and 38 refer to the information below.

An annuity is a fixed income stream paid out over an agreed upon period of time. A $1,000,000 insurance payment is an annuity if it is paid out over a period of time in fixed installments. The insurance company may offer the payee a lump sum payout called the present value of the annuity. The formula to calculate the present value of an annuity is as follows.

$$P = A(1+\frac{r}{n})^{-nt}$$

P = the present value of the payout
A = the dollars that would have been received over time
t = time in years
r = the interest rate
n = compounding periods each year

37. Jorge and his brothers have inherited a pension plan from their grandfather. The plan will pay each grandchild $10,000 over the course of a ten-year period. Jorge chooses to accept the present value of the inheritance at 8% compounded monthly. How much should he expect his payout to be? (Round your answer to the nearest dollar.)

38. Samantha received a cash annuity as a gift for college graduation. The annuity would pay an interest rate of 3.5% over a 5-year period compounded quarterly. Samantha elected to receive the present value of the annuity, which totaled $1,621. To the nearest dollar, what would have been the payout of the annuity if she chose to accept the 5-year payout terms?

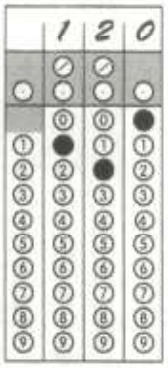
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 4

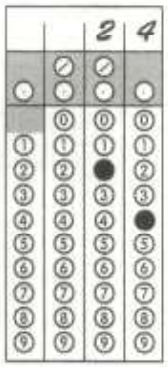
Section 3: Math (No Calculator)

1. **D**
2. **B**
3. **C**
4. **A**
5. **D**
6. **C**
7. **C**
8. **A**
9. **B**
10. **C**
11. **C**
12. **C**
13. **C**
14. **B**
15. **B**

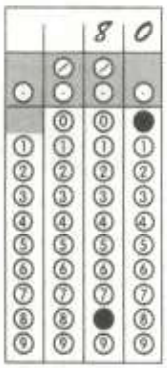
16. **120**



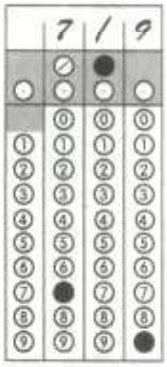
17. **24**



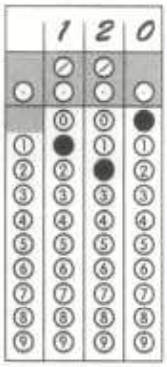
18. **80**



19. **7/9**



20. **120**



Number Correct _____

Number Incorrect _____

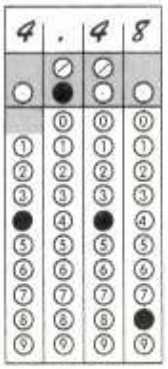
ANSWER KEY
Practice Test 4

Section 4: Math (Calculator)

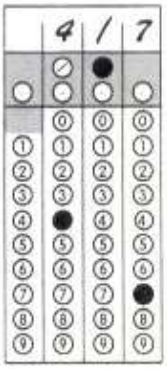
1. **B**	7. **C**	13. **C**	19. **D**	25. **C**
2. **B**	8. **D**	14. **B**	20. **D**	26. **B**
3. **C**	9. **B**	15. **D**	21. **B**	27. **B**
4. **D**	10. **C**	16. **B**	22. **C**	28. **C**
5. **C**	11. **A**	17. **D**	23. **B**	29. **D**
6. **D**	12. **A**	18. **B**	24. **B**	30. **A**

31. **76.8**

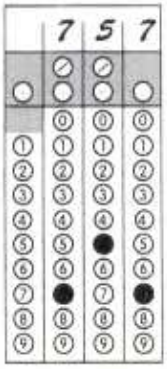
32. **4.48**



33. **4/7**

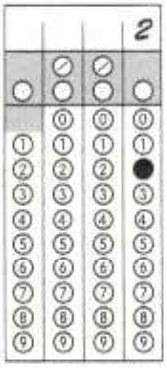


34. **757**

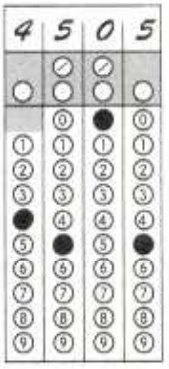


35. **6**

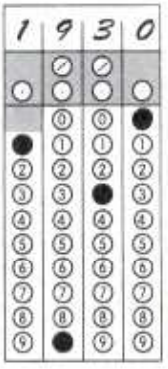
36. **2**



37. **4,505**



38. **1,930**



Number Correct _____

Number Incorrect _____

Section 3: Math Test (No Calculator)

1. **(D)** The product of two values is the result of multiplying them. "Increased by" means use addition. We therefore arrive at the equation:

$$5n + 12 = -13$$

Begin isolating the variable by subtracting 12 from both sides of the equation.

$$5n + 12 - 12 = -13 - 12$$
$$5n = -25$$

Complete the problem by dividing both sides of the equation by 5.

$$\frac{5n}{5} = -\frac{25}{5}$$

$$n = -5$$

Check your solution by replacing n with -5 in the equation we have created.

$$5(-5) + 12 = -13$$
$$-25 + 12 = -13$$
$$-13 = -13$$

2. **(B)** Each complex number is expressed in the form $a + bi$ where a is the real component and bi is the imaginary. Add the real components together and then add the imaginary components.

$$(7 - 2i) + (4 - 5i)$$
$$(7 + 4) + (-2i - 5i)$$
$$11 - 7i$$

3. **(C)** Although it is possible that no single fish weighs f pounds, on average each one weighs that amount. To find the total weight of 17 fish, each with a weight of f pounds, multiply the number of fish, 17, by its average weight, f.

$$17 \times f = 17f$$

4. **(A)** Let n represent the number of chores Jorge performed in the week in which he earned $106. Including Jorge's weekly allowance we come up with the following equation:

$$10 + 8n = 106$$
$$8n = 96$$
$$n = 12$$

Jorge performed 12 chores the week he was paid $106.

5. **(D)** Combine like terms by adding and subtracting the coefficients. Like terms are those that contain the same variable(s) raised to the same power(s). In this example, the following are the like terms:

$-2xy$, xy and $-8mn$ and mn

$$-4xy^2 - 2xy + xy - 8mn + mn = -4xy^2 - xy - 7mn$$

Remember, a term such as mn is understood to have a coefficient of 1.

6. **(C)** The year $Y+90$ means 90 years had elapsed since year Y. The town doubled in size every 15 years so it doubled a total of 6 times because $90 \div 15 = 6$. Given that doubling means multiply by 2, the town was 2^6 as large as it was in year Y. $2^6 = 64$, so the town was 64 times larger than it was in year Y. Choice (D) suggests we need to know the original size of the population, but that fact is irrelevant. Whatever its size was in year Y, we only need to know how many times larger it became in year $Y+90$.

7. **(C)** If $\frac{m}{n} = 7$ then $\frac{n}{m} = \frac{1}{7}$. $\frac{2n}{m}$ can be interpreted as $(2)\left(\frac{n}{m}\right)$. Since $\frac{n}{m} = \frac{1}{7}$, then double that value, $\frac{2n}{m}$, must equal $\frac{2}{7}$.

8. **(A)** Parallel lines have the same slope.

$$y = \frac{2}{5}x - 3$$
$$2x - 5y = 7$$

Convert the second equation to slope-intercept form to compare the slopes of the equations.

$$\begin{aligned} 2x - 5y &= 7 \\ -5y &= -2x + 7 \\ \frac{-5}{-5}y &= \frac{-2}{-5}x + \frac{7}{-5} \\ y &= \frac{2}{5}x - \frac{7}{5} \end{aligned}$$

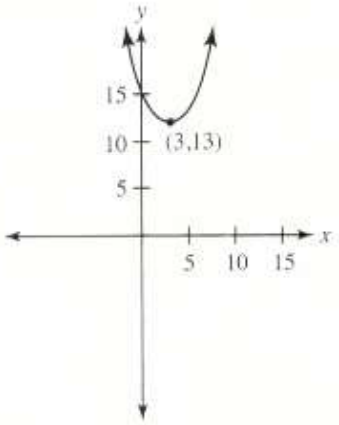
The slope of both lines is $\frac{2}{5}$, so the lines are parallel.

Choice (C) can automatically be eliminated; a line cannot be both parallel and perpendicular.

9. **(B)** One way to solve this problem is to let $y = 0$. Doing so will let us find the roots of the equation.

$$\begin{aligned} 0 &= 4(x-3)^2 + 13 \\ -13 &= 4(x-3)^2 \\ -\frac{13}{4} &= (x-3)^2 \\ \pm\sqrt{-\frac{13}{4}} &= x - 3 \\ 3 \pm \frac{i\sqrt{13}}{2} &= x \end{aligned}$$

The equation has no real roots, solely imaginary ones. Another way to solve this question is to quickly sketch the graph.



The entire parabola is above the x-axis so its roots are imaginary.

10. **(C)** Set both purchase plans equal to one another to calculate the number of pens which make both deals equal in cost.

$$7.5 + .75x = 1.25x$$

$$7.5 = .5x$$

$$15 = x$$

Purchasing 15 pens gives the same price at Visionary Arts and Cramer's Art Supply. Check your answer.

$$\$7.50 + \$.75(15) = \$18.75$$
$$\$1.25(15) = \$18.75$$

11. **(C)** A line that passes through the origin with a slope of $\frac{1}{9}$ has an equation of $y = \frac{1}{9}x + 0$, or more simply $y = \frac{1}{9}x$. The point $\left(3, \frac{1}{3}\right)$ satisfies the equation.

$$y = \frac{1}{9}x$$

$$\frac{1}{3} = \left(\frac{1}{9}\right)(3)$$

$$\frac{1}{3} = \frac{1}{3}$$

12. **(C)** Multiply $\frac{1}{x+4}$ by $\frac{x+6}{x+6}$ and $\frac{1}{x+6}$ by $\frac{x+4}{x+4}$.

$$\frac{1}{\frac{1}{x+4}\times\frac{(x+6)}{(x+6)}+\frac{1}{x+6}\times\frac{(x+4)}{(x+4)}}=$$

$$\frac{1}{\frac{x+6+x+4}{(x+4)(x+6)}}=$$

$$\frac{1}{\frac{2x+10}{(x+4)(x+6)}}=$$

$$\frac{x^2+10x+24}{2x+10}$$

13. **(C)** Convert the numerator and the denominator to base 2.

$$\frac{16^{3x}}{8^y}=\frac{(2^4)^{3x}}{(2^3)^y}=\frac{2^{12x}}{2^{3y}}$$

When dividing terms with the same base, subtract the exponents.

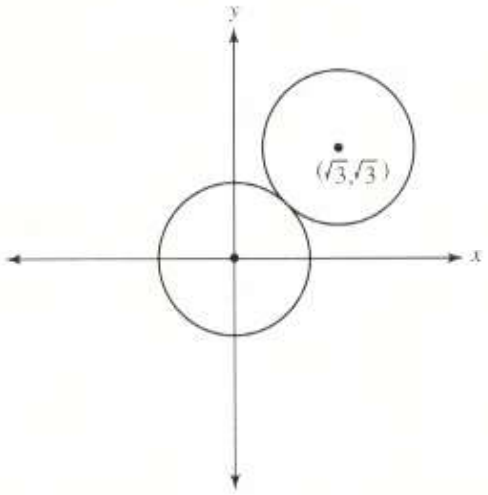
$$\frac{2^{12x}}{2^{3y}}=2^{12x-3y}$$

Since $12x-3y=5$, then $2^{12x-3y}=2^5=32$

14. **(B)** Find the measure of each angle by solving for x.

$$\begin{aligned}6x+4x+2x&=180\\12x&=180\\x&=15\\2x&=30\\4x&=60\\6x&=90\end{aligned}$$

$\triangle ABC$ is a 30-60-90 triangle. The hypotenuse measures 24 so m measures $12\sqrt{3}$ because it is opposite the 60° angle.



15. **(B)** The center of $x^2 + y^2 = 1$ is (0, 0). The center of the circle $(x-\sqrt{3})^2+(y-\sqrt{3})^2=1$ is $(\sqrt{3},\sqrt{3})$. Use the distance formula to find the length of the segment that connects the centers.

$$\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}=d$$
$$\sqrt{(\sqrt{3}-0)^2+(\sqrt{3}-0)^2}=d$$
$$\sqrt{6}=d$$

Choice (A) can be eliminated immediately because it is a set of coordinates, not a distance.

16. **120** Kareem's gas tank registered $\frac{3}{4}$ full, which means he has used $\frac{1}{4}$ of his full tank, which has a capacity of 12 gallons. Multiply $\frac{1}{4}$ by 12 to find how many gallons Kareem used.

$$\frac{1}{4}\times 12=3$$

Kareem used 3 gallons of gas and each gallon provided him 40 miles, so he drove a total of 120 miles.

17. **24** A circle measures 360°. Find what portion a 135° arc is of a circle and then use that information to create a proportion. It will be useful to reduce $\frac{135}{360}$ to $\frac{3}{8}$.

$$\frac{3}{8}=\frac{9}{x}$$
$$3x=72$$
$$x=24$$

18. **80** Multiply $\frac{1}{5}x+\frac{5}{8}y=2$ by 40, the least common multiple (LCM) of 5 and 8.

$$(40)\left(\frac{1}{5}x+\frac{5}{8}y=2\right)$$
$$8x+25y=80$$

19. **$\frac{7}{9}$** The acute angles in a right triangle are complementary. The complementary theorem states that $\sin x = \cos(90 - x)$. Since $\sin n^\circ = \frac{7}{9}$ then $\cos(90 - n^\circ)$ also equals $\frac{7}{9}$.

20. **120** Input 60 and 40 for x in the braking distance formula, then find their difference.

$$f(x) = x + \frac{x^2}{20}$$
$$f(60) = 60 + \frac{60^2}{20} = 240$$
$$f(40) = 40 + \frac{40^2}{20} = 120$$
$$240 - 120 = 120$$

Section 4: Math Test (Calculator)

1. **(B)** Part 2 of the graph is flat, indicating that time passed but no additional distance was covered. Sections 1 and 3 show both time and distance were covered over each interval as evidenced by the upward behavior of the graph.

2. **(B)** Input the known data for x and y to find k.

$$(8)(10) = k$$
$$80 = k$$

Replace x with 5 and k with 80 and solve for y.

$$5y = 80$$
$$y = 16$$

3. **(C)** $\angle 3$ and $\angle 4$ are consecutive interior angles. When lines are parallel, consecutive interior angles are supplementary. Find their sum and set that value equal to 180°.

$$3x + 2x = 180$$
$$5x = 180$$
$$x = 36$$

The measure of $\angle 4$ is $(2x)^\circ$, so replace x with 36 and solve.

$$(2)(36) = 72$$

The figure is drawn to scale and angle 4 seems to be acute, so choice (D), 108°, can be eliminated at once.

4. **(D)** Let n = the number
"... one-half of a number is 5 more than 6" translates into the following equation:

$$\frac{1}{2}n = 5 + 6$$

Solve for n as you normally would.

$$\frac{1}{2}n = 11$$

$$2\left(\frac{1}{2}n = 11\right)2$$

$$n = 22$$

The question requires tripling the value of n so multiply 22 by 3.

$$3 \times 22 = 66$$

5. **(C)** A strong positive association means when t values increase, w values increase. Choice (C) shows this relationship while choice (B) shows a strong negative association. The other two graphs show a weak association and no association.

6. **(D)** One hectogram equals 100 grams, so 2 hectograms equal 200 grams. The customer consumed $\frac{1}{4}$ of one container, so 50 grams of the snack was consumed $\left(\frac{1}{4} \times 200 = 50\right)$. Each gram equals 100 centigrams, so multiply 50 by 100 to find the amount consumed expressed as centigrams.

$$50 \times 100 = 5{,}000$$

7. **(C)** The sum of the measures of the bars in the graph is 25 units. Given that the four cities saved 25,000 gallons of water, the vertical axis should read *Gallons saved (in thousands)* because $25{,}000 \div 25 = 1{,}000$.

8. **(D)** The absolute value of a quantity is greater than or equal to 0. Therefore, any value of n satisfies $|n + 11| \geq -12$. The solution set to the inequality, then, is all real numbers.

9. **(B)** Isolate T by subtracting 3.77 from each side of $V = \frac{.7T}{P} + 3.77$.

$$V = \frac{.7T}{P} + 3.77$$

$$V - 3.77 = \frac{.7T}{P}$$

Multiply both sides of the equation by $\frac{P}{.7}$, the reciprocal of $\frac{.7}{P}$.

$$\left(\frac{P}{.7}\right)(V - 3.77) = \frac{.7T}{P}\left(\frac{P}{.7}\right)$$

$$\left(\frac{P}{.7}\right)(V - 3.77) = T$$

10. **(C)** Use the formula $V = \frac{.7T}{P} + 3.77$ and input 8,000 for V and 1.2 for P.

$$8000 = \frac{.7T}{1.2} + 3.77$$

$$7996.23 = \frac{.7T}{1.2}$$

Multiply each side of the equation by $\frac{1.2}{.7}$, the reciprocal of $\frac{.7}{1.2}$.

$$\frac{1.2}{.7}\left(7996.23=\frac{.7T}{1.2}\right)\frac{1.2}{.7}$$
$$13{,}708=T$$

11. **(A)** Using the probability event formula, divide the number of events by the total number of outcomes. Todd and Brittany each have a $\frac{7}{42}$ chance to recover the lost earring.

$$\frac{7}{42}+\frac{7}{42}=\frac{14}{42}=\frac{1}{3}$$

A $\frac{1}{3}$ probability of success translates to approximately 33%.

12. **(A)** Simplify by subtracting $4x$ from both sides of the inequality.

$$-7x+4\le 4x-5$$
$$-11x+4\le -5$$

Subtract 4 from both sides of the inequality.

$$-11x\le -9$$

Divide both sides of the inequality by –11 remembering to reverse the direction of the inequality sign.

$$\frac{-11x}{-11}\le\frac{-9}{-11}$$
$$x\ge\frac{9}{11}$$

The answer choice (A) 0, does not satisfy the inequality.

13. **(C)** The return trip from Vacaville to Carlsbad is 492 miles. Add 54 miles to get a total of 546 miles. Divide this number by 26 miles to the gallon which comes out to 21 units. Multiply 21 by $3.64 which comes to $76.44. Add $16 for the two lunches to $76.44 which brings the cost to $92.44. The friends had allocated $90 for the cost of the return trip, so the side trip and the two lunches will exceed their budget by $2.44

14. **(B)** President Obama's margin of victory over former governor Romney was a total of 4,984,100 votes (65,918,507 – 60,934,407 = 4,984,100). However, if all of the other votes, other than those cast for Obama, went to Romney, Romney's new vote total would have been 63,317,051. With this new total, Romney would have earned 2,601,456 fewer votes than the victor. Had Romney accumulated all of the Green, Libertarian, and Other votes, his margin of loss would have been reduced by 2,382,646 because 4,984,100 – 2,601,454 = 2,382,646.

15. **(D)** Use a linear model in the form of $y = mx + b$ to solve this question.

Let x = number of hours
y = the cost of the visit
b = fee for the house call
$114 = 2x + b \Rightarrow 114 - 2x = b$
$194 = 4.5x + b \Rightarrow 194 - 4.5x = b$

Since both equations are expressed as a function of b, set the two values equal.

$$114 - 2x = 194 - 4.5x$$
$$2.5x = 80$$
$$x = 32$$

16. **(B)** On day 7, the ratio of hits to files is greater than the ratio of files to pages. Note the ratio of hits to files:

$$\frac{250}{155} = 1.61$$

The ratio of files to pages is $\frac{155}{134} = 1.16$.

$$1.61 > 1.16$$

Choices (A), (C), and (D) cannot be supported by the data in the table.

17. **(D)** The median is the middle value when the numbers are arranged in order. The numbers are arranged in order below.

39 45 47 50 56 64 85

The value in the middle, 50, is the median.

18. **(B)** The range of a group of numbers is found by finding the difference between the greatest and least values.
The range of the Files is 383 – 142 = 241

$$R = 241$$

The range of the KBytes is 2,816 – 1,425 = 1,391

$$r = 1{,}391$$

Find $2r - R$ by substituting 241 and 1,381 for R and r, respectively.

$$(2)(1{,}391) - 241 = 2{,}541$$

19. **(D)** Use a system of equations to answer this question.
Let r = Rick's number of hours worked
Let j = Jay's number of hours worked
They worked a total of 44 hours, so $r + j = 44$. Assign the monetary value of each boy's work to get the second equation, $4.5r + 5.25j = 202.5$. Our system of equations, then, is

$$r + j = 44$$
$$4.5r + 5.25j = 202.5$$

Use substitution or elimination to solve for r, Rick's hours worked. Transform $r + j = 44$ to $j = 44 - r$ and substitute the value into the second equation.

$$4.5r + 5.25(44 - r) = 202.5$$
$$4.5r + 231 - 5.25r = 202.5$$
$$-.75r + 231 = 202.5$$
$$-.75r = -28.5$$
$$r = 38$$

20. **(D)** Let x be the original price of the running shoes, in dollars. The discounted price is 25 percent off the original price, so $x - 0.25x = 0.75x$ is the discounted price, in dollars. The tax is 8 percent of the discounted price, so $0.08(0.75x)$ is the tax on the purchase, in dollars. The price r, in dollars, that Briana paid the cashier is the sum of the discounted price and the tax:

$$r = 0.75x + (0.08)(0.75x)$$

which can be rewritten as $r = 1.08(0.75x)$. Therefore, the original price, x, of the running shoes, in dollars, can be written as $\frac{r}{(1.08)(.75)}$.

21. **(B)** Input the known data and solve for k.

$$r = km^{\frac{3}{4}}$$

$$18{,}500 = k(1000)^{\frac{3}{4}}$$

$$18{,}500 = k(177.83)$$

$$104.03 = k$$

22. **(C)** Input the known data, including the value of k from question 21, and solve for s, the specific metabolic rate.

$$s = \frac{km^{\frac{3}{4}}}{m}$$

$$s = \frac{104.03(1000)^{\frac{3}{4}}}{1000} = 18.50$$

23. **(B)** The area of a sector is found by using the formula $A = \frac{m}{360}\pi r^2$ where m = measure of the central angle and r = length of the radius. Input the known data and solve for r.

$$139.6 = \frac{34.4}{360}\pi r^2$$

$$465.33 \approx r^2$$

$$21.6 = r$$

24. **(B)** The ball hits the ground when the height is 0 feet. Let h equal 0 and solve for t.

$$0 = -4.9t^2 + 32t$$

$$0 = t(-4.9t + 32)$$

$$t = 0 \text{ or } -4.9t + 32 = 0$$

$$t = 0 \text{ or } t = 6.5$$

The initial value of $t = 0$ represents the time before the ball was thrown.

25. **(C)** Replace h with 18 as the height the ball attains. Use the formula $h = -4.9t^2 + 32t$.

$$18 = -4.9t^2 + 32t$$

Set the equation equal to 0 and solve for t.

$$-4.9t^2 + 32t - 18 = 0$$

The equation does not factor, so use the quadratic formula $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Let $a = -4.9 \quad b = 32 \quad c = -18$

After using the quadratic formula, we arrive at two different answers, .6 and 5.9. We get two different answers because after .6 seconds the ball attains a height of 18 meters and rises higher. As the ball returns to earth, it reaches 18 meters high again, 5.9 seconds after it was thrown into the air.

26. **(B)** Let $x = 1$ (or any easy number). Therefore, the sum of the seven numbers must be $7 \times 1 = 7$.

Since $x = 1$, then $x + \frac{4}{7} = 1\frac{4}{7}$. The sum of the seven numbers with mean $1\frac{4}{7}$ is $7 \times 1\frac{4}{7} = 11$.

In order to increase the mean of the seven numbers by $\frac{4}{7}$, the sum of the numbers must be increased by 4.

27. **(B)** 26 – 17 – 18 satisfies all of the conditions set forth in the problem.
26 is the day of the month.
17 is the prime number.
18 is the multiple of 3.
Although each number can be a day of the month, 26, 17, and 18 can only satisfy one condition.

28. **(C)** Transform $h(x) = (x - 8)(x + 2)$ to graphing form by multiplying the parentheses.

$$h(x) = (x - 8)(x + 2) = x^2 - 6x - 16$$

Move –16 to the far right of the equation as you complete the square. Remember as you add a value to complete the square, that same value must be subtracted from –16.

$$h(x) = x^2 - 6x - 16$$
$$h(x) = x^2 - 6x + 9 - 16 - 9$$
$$h(x) = (x - 3)^2 - 25$$

The vertex of the parabola is (3, –25) and the minimum value is –25.

29. **(D)** $(x + 5)(x^2 - 5x + 25)$ is the factored form of $x^3 + 125$. Replace $(x + 5)(x^2 - 5x + 25)$ with $x^3 + 125$ and solve for m.

$$x^3 - 20 = x^3 + 125 + m$$
$$-145 = m$$

30. **(A)** Transform the equation to graphing form $y = (x - h)^2 + k$, where (h, k) represent the parabola's vertex.

$$y = (x - 4)(x + 6)$$
$$y = x^2 + 2x - 24$$

Move –24 to the far right of the equation.

$$y = x^2 + 2x - 24$$

Complete the square by dividing b by 2 and squaring that quantity.

$$b = 2 \text{ so } \left(\frac{2}{2}\right)^2 = 1$$

Add 1 to $2x$, remembering to subtract 1 from -24.

$$y = (x^2 + 2x + 1) - 24 - 1$$

Factor and combine like terms.

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

Looking at the graph, we could also have identified the vertex as $(-1, -25)$, which confirms that (A) is the correct answer.

31. **76.80** Find the cost of the boots after one week:

$$\$80.00 - (.20)(\$80.00) = \$64.00$$

Add 20% to $64.00 to find the cost after two weeks.

$$\$64.00 + (.20)(\$64.00) = \$76.80$$

32. **4.48** Find the quotient of 3 billion and 186,000 to find the number of seconds elapsed between the transmission and reception of the photos (these are known as "light seconds").

$$3{,}000{,}000{,}000 \div 186{,}000 = 16{,}129 \text{ seconds}$$

There are 60 seconds in a minute and 60 minutes in an hour so there are 3,600 seconds in one hour ($60 \times 60 = 3{,}600$). Divide 16,129 by 3,600 to find the number of hours needed to successfully transmit photographs from Pluto to Earth.

$$16{,}129 \div 3{,}600 = 4.48 \text{ hours.}$$

33. **$\frac{4}{7}$** The County Education Budget for 2010 was $200,000,000. By 2012, the budget had increased to $350,000,000. Divide $200,000,000 by $350,000,000 to find what fraction 2010's figure is of 2012's. $\frac{200{,}000{,}000}{350{,}000{,}000} = \frac{4}{7}$

34. **757** Find $g(f(5))$ by first finding $f(5)$.

$$f(5) = (5^2) - 5 = 20$$

Next find $g(20)$.

$$g(20) = 2(20^2 - 6) = 788$$

We find that $g(f(5)) = 788$
Repeat the process with $f(g(-3))$.
Find $g(-3)$.

$$2[(-3)^2 - 6] = 6$$

Next, find $f(6)$.

$$6^2 - 5 = 31$$

We find $f(g(-3)) = 31$. Find the difference between $g(f(5))$ and $f(g(-3))$.

$$788 - 31 = 757$$

35. **6** The volume of a cone is found by using the formula $V = \frac{1}{3}\pi r^2 h$, where r is the radius of the circular base and h is the height. Input the known data and solve for r.

$$14.4\pi = \frac{1}{3}\pi r^2(4.8)$$
$$14.4 = 1.6r^2$$
$$9 = r^2$$
$$3 = r$$

The question asks for the diameter, so multiply the radius, 3, by 2.

$$2 \times 3 = 6$$

36. **2** Simplify the denominator.

$$f(x) = \frac{1}{2(x-3)^2 + 4(x-3) + 2}$$
$$f(x) = \frac{1}{2x^2 - 12x + 18 + 4x - 12 + 2}$$
$$f(x) = \frac{1}{2x^2 - 8x + 8}$$
$$f(x) = \frac{1}{2(x - 4x + 4)}$$
$$f(x) = \frac{1}{2(x-2)^2}$$

Division by 0 is not allowed. Set $x - 2$ equal to 0 to find the restriction on

$$f(x) = \frac{1}{2(x-3)^2 + 4(x-3) + 2}$$
$$x - 2 = 0$$
$$x = 2$$

37. **4,505** Use the present value formula and input the known information.

$$P = A\left(1 + \frac{r}{n}\right)^{-nt}$$
$$P = 10{,}000\left(1 + \frac{.08}{12}\right)^{(-12)(10)} = 4{,}505$$

Jorge can expect to receive $4,505 as the present value of his $10,000 ten-year annuity.

38. **1,930** Input the known information into the present value formula and solve for A.

$$P = A\left(1 + \frac{r}{n}\right)^{-nt}$$
$$1{,}621 = A\left(1 + \frac{.035}{4}\right)^{-(4)(5)}$$
$$1{,}621 = .84A$$
$$1{,}930 = A$$

Samantha would have earned $1,930 if she had elected to receive her gift as an annuity.

3

3

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

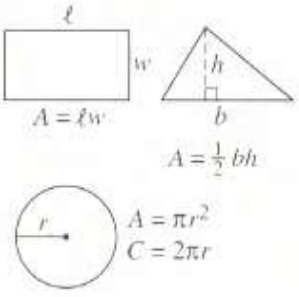
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

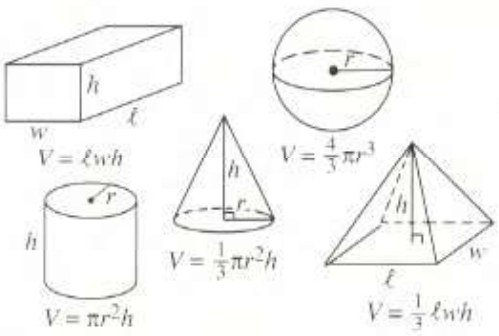
- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

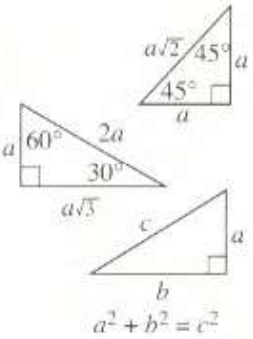
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

1. If $7n = 42$, what is the value of $4n - 11$?

   (A) 13
   (B) 16
   (C) 17
   (D) 19

2. Which of the following is equal to $(m^{\frac{1}{3}})^2$?

   (A) $\sqrt{m^6}$
   (B) $\sqrt[3]{m^2}$
   (C) $\sqrt{m^3}$
   (D) $m\sqrt{m}$

GO ON TO THE NEXT PAGE

3

3. A marathon runner can run m miles at d miles per hour in h hours. The formula for the distance she runs is $hd = m$. If m is a constant, which of the following conclusions is correct?

(A) when d increases, h increases
(B) when d decreases, h decreases
(C) as h increases, d decreases
(D) d will never increase but m can increase or decrease

4. If the area of a square is doubled, how many times longer is a side of the larger square than is the length of the smaller square?

(A) 4
(B) 2
(C) $\sqrt{3}$
(D) $\sqrt{2}$

5. If $\frac{6}{n} = \frac{18}{n+24}$, what is the value of $\frac{n}{12}$?

(A) 1
(B) 1.5
(C) 2
(D) 4.5

$$3x + 6y = 14$$
$$2x + 5y = -11$$

6. If (x, y) is a solution to the system of equations above, what is the value of $x + y$?

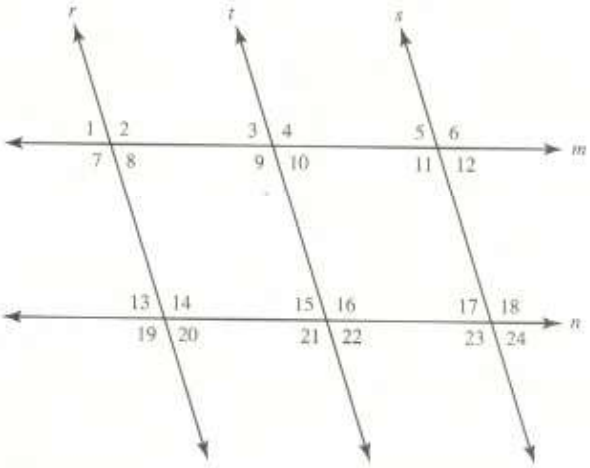
(A) 3
(B) 17.5
(C) 24
(D) 25

3

x	$f(x)$
0	5
2	3
4	1
5	0
8	−2

7. The function f is defined by a polynomial. Some values of x and $f(x)$ are shown in the table above. Which of the following must be a factor of $f(x)$?

(A) x
(B) $x - 3$
(C) $x - 5$
(D) $x - 8$



8. In the diagram above, $r \parallel t \parallel s$ and $m \parallel n$. If the measure of $\angle 3 = (2m + 18)°$ and the measure of $\angle 2 = (4m + 42)°$, what is the measure of $\angle 18$?

(A) 122°
(B) 61°
(C) 58°
(D) 20°

GO ON TO THE NEXT PAGE

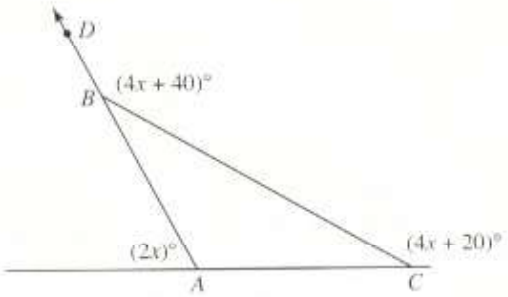
3

3

$$5x + 3y = -10$$
$$bx - 4.5y = 13.5$$

9. In the system of equations above, b is a constant and x and y are variables. For what value of b will the system of equations have no solution?

(A) -10
(B) -7.5
(C) 2.5
(D) 4



10. What is the measure of $\angle ABC$?

(A) 20
(B) 40
(C) 65
(D) 70

$$y = m(x + 3)(x - 5)$$

11. In the quadratic function above, m is a non-zero constant. The graph of the equation in the xy-plane has vertex (e, f). Which of the following is the value of f?

(A) $16m$
(B) $4m$
(C) $-4m$
(D) $-16m$

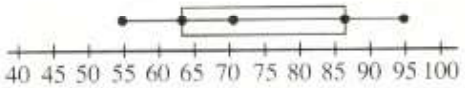
12. What is the value of x if $x = \dfrac{\frac{w^2 + 2w + 1}{w + 1}}{3}$?

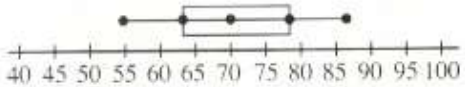
(A) $\dfrac{3}{w+1}$
(B) $3(w+1)$
(C) $\dfrac{1}{3w+1}$
(D) $\dfrac{\frac{1}{w}}{3+w}$

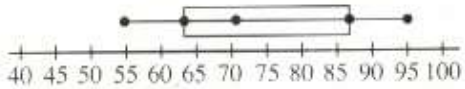
13. Mr. Klein posted the following quiz scores:

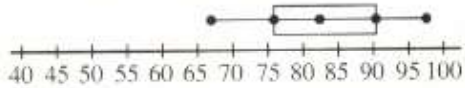
80 75 67 97 85 95 89 76 78 90

He wanted to create a box-and-whisker plot to show the median, the range, and the inter-quartile range. Which box-and-whisker plot represents this data?

(A)


(B)


(C)


(D)


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3

$$F = \frac{9}{5}C + 32$$

14. The equation above shows how a temperature, C, measured in degrees Celsius, relates to a temperature, F, in degrees Fahrenheit. Based on the equation, which of the following must be true?

I. An increase in temperature of 1 degree Celsius is equivalent to an increase of 1.8 degrees Fahrenheit.

II. A temperature of 5° F is equivalent to –15°C.

III. A temperature of 20°C is equivalent to 62°F.

(A) I only
(B) I and II
(C) I and III
(D) III only

15. The expression $\frac{4n+6}{n-4}$ is equivalent to which of the following?

(A) $-\frac{4+6}{4}$

(B) $4-\frac{6}{4}$

(C) $4+\frac{6}{n-4}$

(D) $4+\frac{22}{n-4}$

GO ON TO THE NEXT PAGE

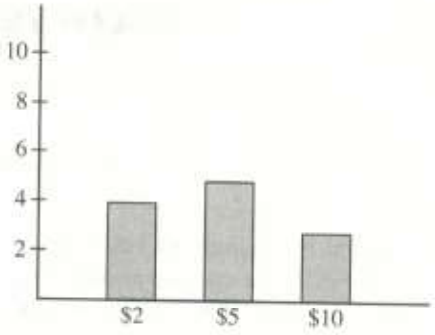
3

3

16. If $m^2 - 6m + 8 = 0$, what is *one* possible value of $\frac{1}{m}$?

17. What is the radius of $x^2 + 6y + y^2 - 4x = 12$?

18. What is *one* possible value for the compound inequality $-8 \leq 2x - 8 < 8$?



19. The bar graph above represents the fishing lures sold in a sales competition sponsored by the seller.

    What is the median cost of the lures sold?

20. An academic quiz show features local high school students. Each correctly answered question nets the team one point and an incorrectly answered question results in a two-point deduction. If a team scored 38 points on a fifty-question quiz, how many questions did it answer incorrectly?

If there is still time remaining, you may review your answers.

4

4

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- The use of a calculator on this section IS permitted.
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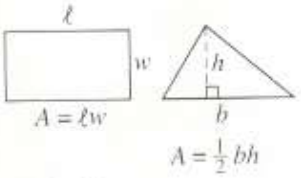
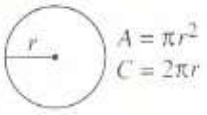
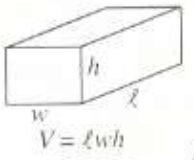
REFERENCE INFORMATION

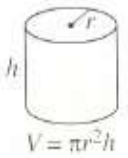
Area Facts

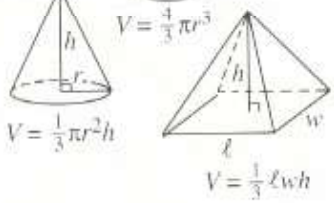




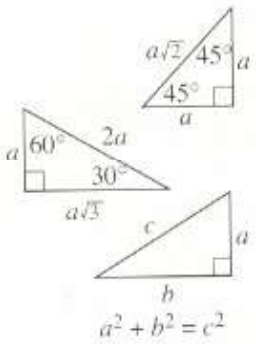
Volume Facts







Triangle Facts



The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

GO ON TO THE NEXT PAGE

1. Anita climbed 5 flights of stairs because the elevator was in disrepair. If each staircase had 16 stairs and she reached the top stair of the 5th flight in 5 minutes and 20 seconds, what was the mean time spent climbing each stair?

   (A) 3 seconds
   (B) 4 seconds
   (C) 5 seconds
   (D) 6 seconds

	Boy	Girl	Total
Swim	12	14	26
Water Polo	16	15	31
Total	28	29	57

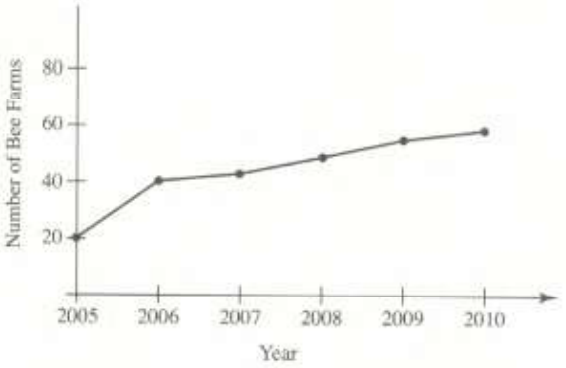
2. The above chart represents the students who are members of a high school's swim and water polo teams.

   The water polo and swim teams are having a Spring Banquet. One of the team members will be chosen as athlete of the year. What is the probability the person chosen will be a member of the water polo team or a boy but not both?

   (A) $\frac{31}{57}$
   (B) $\frac{43}{57}$
   (C) $\frac{52}{57}$
   (D) $\frac{55}{57}$

Questions 3 and 4 refer to the information below.

The graph below shows the number of domestic bee farms in the metropolitan Atlanta area from 2005 to 2010.



3. Based on the graph, which of the following describes the trend in the number of domestic bee farms in the Atlanta area?

   (A) exponential growth between 2005 and 2010
   (B) continued but modest growth after 2006
   (C) an increase until 2007 followed by a gradual decline after that year
   (D) a dramatic decrease after 2008

4. What was the average increase in domestic bee farms from 2005 to 2010?

   (A) 5%
   (B) 20%
   (C) 40%
   (D) 60%

GO ON TO THE NEXT PAGE

4

4

n	1	2	3	4
$r(n)$	−1	1	3	5

5. The table above shows some values of the linear function r. Which of the following defines r?

(A) $r(n) = 2n + 3$
(B) $r(n) = 3n - 5$
(C) $r(n) = n - 3$
(D) $r(n) = 2n - 3$

$$4x^2 + 5x - 6$$
$$3x^2 + x - 11$$

6. Which of the following is the sum of the polynomials above?

(A) $x^2 + 4x + 5$
(B) $x^2 + 6x - 17$
(C) $7x^2 + 6x - 17$
(D) $7x^4 + 6x^2 - 17$

7. If $\frac{5}{9}n = \frac{7}{20}$, what is the value of n?

(A) $\frac{16}{25}$
(B) $\frac{27}{50}$
(C) $\frac{17}{25}$
(D) $\frac{63}{100}$

8. A swearing-in ceremony for new American citizens is scheduled for early 2017. Although tickets are free, seating is scarce. The event planners use the following formula to ration the distribution of tickets.

$T(x) = -.4x^2 + 9x + 11$ where x represents the number of days that tickets are available for distribution.

How many days after the tickets are made available will the peak number of tickets be distributed and what will be the number of tickets distributed on that day?

(A) 11 days, 62 tickets
(B) 12 days, 11 tickets
(C) 19 days, 38 tickets
(D) 38 days, 19 tickets

9. Gina runs 28 meters in 4.7 seconds. If she continues to run at this rate, which of the following is the closest to the distance (in meters) she will run in 2.4 minutes?

(A) 269 meters
(B) 542 meters
(C) 653 meters
(D) 858 meters

GO ON TO THE NEXT PAGE

Questions 10 and 11 refer to the information below.

The following table represents federal spending for NASA for the years 1958 through 1963.

NASA spending since 1958

Year	NASA fed outlay, $ in millions	Total US fed spending, $ in millions	NASA as % of US spending	President	Party
1958	89	71,936	0.1	Dwight D. Eisenhower	Rep
1959	145	80,697	0.2	Dwight D. Eisenhower	Rep
1960	401	76,539	0.5	Dwight D. Eisenhower	Rep
1961	744	81,515	0.9	John F. Kennedy	Dem
1962	1,257	106,821	1.18	John F. Kennedy	Dem
1963	2,552	111,316	2.28	Lyndon B. Johnson	Dem

10. Which of the following can be concluded about the information portrayed in the table?

(A) From 1958 until 1963, spending on NASA as a percentage of the US budget increased nearly 2,200%.
(B) Between 1962 and 1963 spending on NASA virtually tripled.
(C) In 1963, real spending on NASA exceeded the $1 billion mark for the first time.
(D) The total dollars spent each year from 1958 to 1963 decreased.

11. Total US spending in 1962 was about how many times larger than the NASA budget in 1958?

(A) 77 times
(B) 88 times
(C) 650 times
(D) 1,200 times

GO ON TO THE NEXT PAGE

4

4

Questions 12 and 13 refer to the following information.

An investment of $7,500 in a certain piece of artwork has depreciated in value. The investor uses the following formula to calculate the value of her investment.

$A = P(1 - r)^t$

where
A = the accumulated value over time
P = the initial price of the artwork
r = rate of decrease expressed as a decimal
t = time in years

12. Which of the following equations models the value of the artwork if it has devalued at 4.6% annually for 3.5 years?

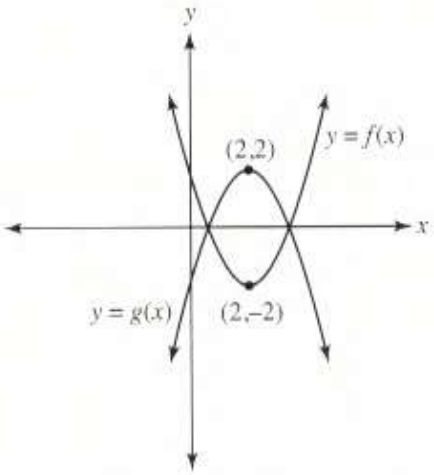
(A) $A = 7{,}500(.965)^{3.5}$
(B) $A = 7{,}500(1.035)^{3.5}$
(C) $A = 7{,}500(1.046)^{3.5}$
(D) $A = 7{,}500(.954)^{3.5}$

13. Three years after the purchase date, the value of the artwork had declined to $6,511.88. If the depreciation has occurred at a 4.6% annual rate, what was its value five years later?

(A) $5,145.75
(B) $5,337.62
(C) $5,476.39
(D) $6,126.63

14. A clinical study was devised to see if a new procedure was an effective early detector of skin cancer. A group of 500 patients participated but only 250, group A, received the treatment. The other 250 participants, group B, received the standard procedure which is 45% effective. Group A was treated with the new procedure, resulting in 79% effectiveness. Based on the design and results of the study, which of the following is an appropriate conclusion?

(A) The study size was too small to make a conclusion.
(B) The new early detection program is better than any other available program.
(C) The new early detection program was more effective than the current standard procedure.
(D) The new procedure will help all patients in danger of skin cancer.



15. Graphs of the functions f and g are shown in the xy-plane. For which of the following x-values does $f(x) + g(x) = 0$?

(A) 0
(B) 1
(C) 2
(D) 3

GO ON TO THE NEXT PAGE

Questions 16 and 17 refer to the information below.

The term light-year refers to the distance light travels in one year.

16. If light travels 186,000 miles per second, which of the following is closest to the distance from Earth to Sirius, 8 light-years distant?

(A) 47 billion miles
(B) 198 billion miles
(C) 9 trillion miles
(D) 50 trillion miles

17. If light travels 186,000 miles per second, how far does light travel in one-billionth of a second (note: 1 mile = 5,280 feet)?

(A) 10 miles
(B) 1 mile
(C) 1 foot
(D) 0.01 feet

---

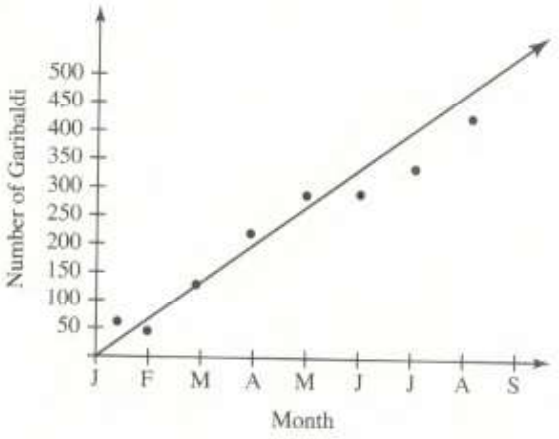
18. An airline company is calculating its passenger cost for a trans-Atlantic flight. The plane flies approximately 3,000 miles at an average air speed of 500 miles per hour. The cost is given by the following function.

$$C(x) = 100 + \frac{x}{10} + \frac{36{,}000}{x}$$

where x is the ground speed. Ground speed is defined as air speed ± wind speed.

What is the airline's cost if there is no wind during the flight?

(A) $176
(B) $222
(C) $358
(D) $422



19. Garibaldi are bright orange fish that are closely related to goldfish. They are frequently found in the waters of the western Pacific Ocean. In different coastal California lagoons, researchers counted the number of Garibaldi found per cubic mile of ocean. The graph of that study is shown above along with a line of best fit.

In August, what was the difference between the number predicted by the line of best fit and the actual number of Garibaldi that were counted?

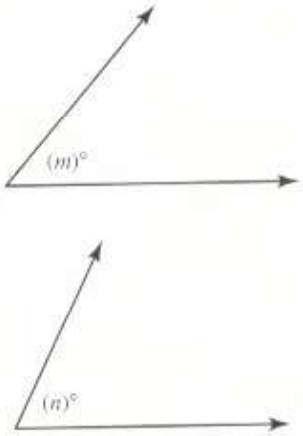
(A) 120
(B) 100
(C) 60
(D) 50

20. The sum of three numbers is 780. One of the numbers, n, is 50% more than the sum of the other two numbers. What is the value of n?

(A) 144
(B) 312
(C) 424
(D) 468

GO ON TO THE NEXT PAGE

4



Note: Figures not drawn to scale

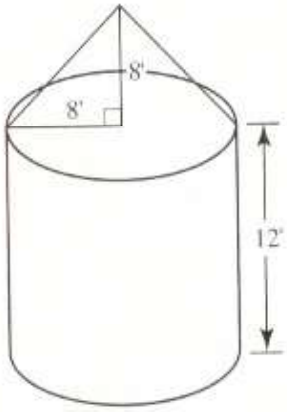
21. The angles shown above are complementary and $\sin(m°) = \cos(n°)$. If $m = (3x - 12)°$ and $n = (6x - 18)°$, what is the value of x?

(A) $13.\overline{3}$
(B) 20.6
(C) 30.25
(D) 40.3

22. Ms. Garcia has a jar containing m milliliters of a solution for her chemistry class. If she gives 8 milliliters to each student, she will have 6 milliliters left over. If she provides 10 milliliters to each student, she will need an additional 16 milliliters. How many students are in her class?

(A) 10
(B) 11
(C) 17
(D) 22

4



Height of Cylinder: 12'

Radius of Cylinder: 8'

Radius of Cone: 8'

Height of Cone: 8'

23. The diagram above represents a grain silo with a right cylindrical base and a top in the shape of a right cone. The owner believes he needs a new silo which will store 10% more grain than his existing silo. Which of the following represents the volume of the new silo (in cubic feet)?

(A) 2,123
(B) 2,678
(C) 2,948
(D) 3,243

24. In the xy-plane, the line determined by $(6, m)$ and $(m, 54)$ passes through the origin. Which of the following could be the value of m?

(A) 2
(B) 18
(C) 36
(D) 48

GO ON TO THE NEXT PAGE

25. The length of a rectangle was reduced by 10% and the width by x%. If the resulting dimensions reduced the area by 32.5%, what is the value of x?

(A) 25
(B) 21
(C) 18
(D) 13

26. A collectible vinyl record made in 1948 has appreciated in value about 12% every five years. If the record was worth $7,000 in 1980, which of the following expressions represents its value in 2005?

(A) $7{,}000(.12)^5$
(B) $7{,}000(.12)^{25}$
(C) $7{,}000(1.12)^{25}$
(D) $7{,}000(1.12)^5$

27. Alice loves rope licorice. She is offered the three following deals:

Deal 1: She can buy licorice ropes at a rate of $5.40 per yard.
Deal 2: She can buy licorice ropes for $1.92 per foot.
Deal 3: She can buy licorice ropes for $.14 per inch.

Alice wants to buy 1.5 yards of licorice rope at the lowest price. What deal should she select?

(Note: 1 yard = 3 feet; 1 foot = 12 inches)

(A) Deal 1
(B) Deal 2
(C) Deal 3
(D) Deals 1 and 3 provide equal prices for the licorice

$$2x^{\frac{2}{3}} = 6^{\frac{1}{2}}$$

28. In the equation above, what is the value of x?

(A) $\frac{27}{8}$
(B) $\left(\frac{27}{8}\right)^{\frac{1}{4}}$
(C) $\left(\frac{8}{27}\right)^{\frac{1}{4}}$
(D) $\frac{16}{27}$

29. Let $g(x) = \frac{\sqrt{x^2-4}}{x^2-3}$. For how many integers, x, is $g(x)$ not defined?

(A) none
(B) 1
(C) 2
(D) 3

30. The value p varies directly with q^{-1}. If $p = \frac{1}{6}$ when $q = \frac{5}{8}$, what is the value of p when $q = 18$?

(A) $\frac{864}{5}$
(B) $\frac{7}{24}$
(C) $\frac{5}{864}$
(D) $-\frac{8}{135}$

GO ON TO THE NEXT PAGE

31. Belts cost \$11 and blouses cost \$18. If Kara spends at least \$51 but no more than \$62 for x belts and one blouse, what is *one* possible value of x?

$$(-8x^2 + 15x - 2) - 3(2x^2 + 4x - 2)$$

32. If the expression above is written in the form of $ax^2 + bx + c$, where a, b, and c are constants, what is the value of b?

33. OSHA has determined that an entrance ramp to a store used by those with disabilities cannot exceed a certain grade. The diagram shows an example of a ramp that is at the highest degree of elevation and is still code-compliant. What is the highest degree of elevation for an OSHA code entrance ramp to a store (round your answer to the nearest hundredth of a degree)?

34. A new movie recently scored an average rating of 4.3 stars out of 5 from its first 12 reviewers. If the next two reviewers each give the movie a 5-star review, what will the new average rating be?

$$A = 25m + 275$$

35. Terrence has made an initial deposit into his bank account. Each month after his initial deposit he has deposited a fixed amount into the account. The equation above represents the amount, A, he has in dollars after he has made m monthly deposits. According to this equation, what was the initial deposit Terrence made into his account?

36. The points (2, 7) and (–3, 37) lie on the graph of $y = ax^2 - 4x + 7$. What is the value of a?

GO ON TO THE NEXT PAGE

Questions 37 and 38 refer to the following information.

The theory of special relativity suggests that an observer moving at great speed experiences the flow of time much more slowly than an observer on Earth. The following formula is used to calculate what is known as time dilation.

$$F(t) = \frac{t}{\sqrt{1-v^2}}$$

In the formula, t represents some unit of time and v represents velocity as some fraction of light-speed. For example, an observer counts one second in a rocket ship traveling at 60% of the speed of light while an observer on Earth measures 1.25 seconds.

37. If an observer traveling at 80% the speed of light counts off one second, how many seconds will be counted by an observer on Earth?

38. An observer on Earth measures 2 seconds, while an observer traveling at a fraction of light-speed measures 1 second. What fraction of light-speed was the moving observer traveling?

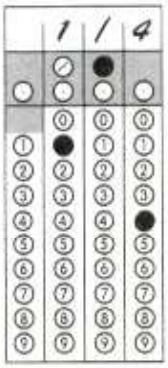
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 5

Section 3: Math (No Calculator)

1. **A**
2. **B**
3. **C**
4. **D**
5. **A**
6. **D**
7. **C**
8. **A**
9. **B**
10. **A**
11. **D**
12. **B**
13. **D**
14. **B**
15. **D**

16. **1/4** or **1/2**



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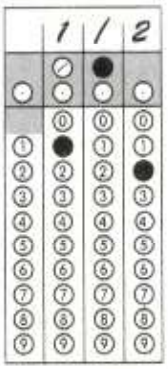
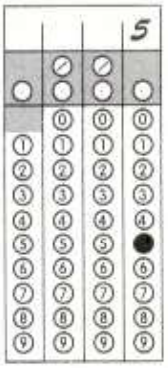
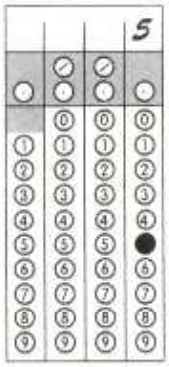


17. **5**

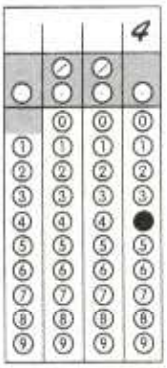


18. Answers may vary.
$0 \leq x < 8$

19. **5**



20. **4**



Number Correct _____

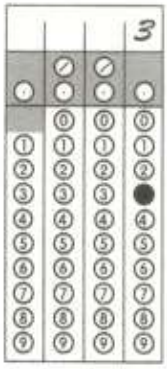
Number Incorrect _____

ANSWER KEY
Practice Test 5

Section 4: Math (Calculator)

1. **B**	7. **D**	13. **A**	19. **D**	25. **A**
2. **B**	8. **A**	14. **C**	20. **D**	26. **D**
3. **B**	9. **D**	15. **A**	21. **A**	27. **C**
4. **C**	10. **A**	16. **D**	22. **B**	28. **B**
5. **D**	11. **D**	17. **C**	23. **D**	29. **D**
6. **C**	12. **D**	18. **B**	24. **B**	30. **C**

31. **3** or **4**



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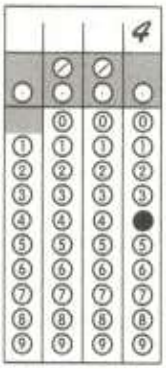
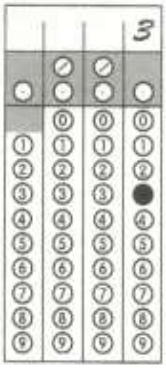
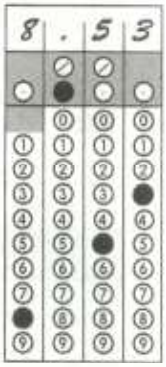


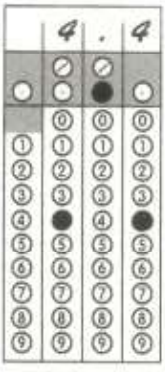
32. **3**



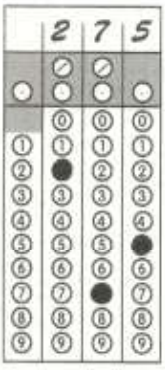
33. **8.53**



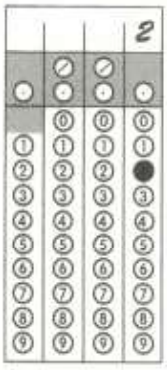
34. **4.4**



35. **275**

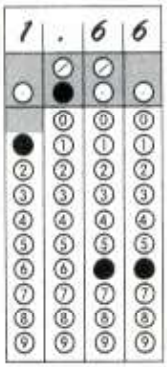


36. **2**



ANSWER KEY
Practice Test 5

37. **1.66** or **1.67** or **5/3**



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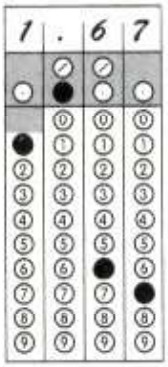

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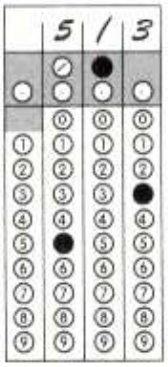
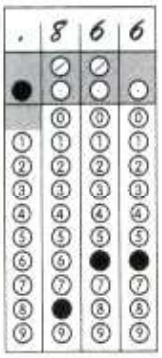


38. **.866**



Number Correct _____

Number Incorrect _____

39. **(C)** Choice (A) makes little sense. Choice (C) is the best choice in context. Although choice (B) and choice (D) each create a grammatical sentence that makes sense, choice (C) is best because the sentence now beginning "Before . . ." expresses a new idea rather than one closely related to the previous sentence.

40. **(D)** This is the only choice that makes good sense in context and is grammatical. In this context *anticipate* means "act in advance so as to mitigate."

41. **(C)** This is the only choice that creates a grammatical sentence. "Sea storms and strong winds" becomes the object of the verbs "adapt" and "entertain," creating a grammatical sentence.

42. **(B)** Choices (A), (C), and (D) are not grammatical. Choice (B) corrects the error by creating a participial phrase beginning with "cutting."

43. **(A)** Choices (B), (C), and (D) are not grammatical. Choice (A) creates a sentence that is grammatical and makes good sense.

44. **(B)** This is the focus of the paragraph. The other choices are mentioned in relation to this main topic.

Section 3: Math Test (No Calculator)

1. **(A)** Solve for n in $7n = 42$ and replace that value in $4n - 11$.

$$7n = 42$$
$$n = 6$$
$$4(6) - 11 = 13$$

2. **(B)** When raising an exponent to another, multiply the exponents.

$$(m^{\frac{1}{3}})^2 = m^{\frac{2}{3}}$$

Rational exponents can be expressed as radicals by finding the exponent that is the numerator and the root that is the denominator.

$$m^{\frac{2}{3}} = \sqrt[3]{m^2}$$

The root, 3, exceeds the exponent, 2, so $\sqrt[3]{m^2}$ is simplified to its lowest term.

3. **(C)** Use simple values for m, d, and h to find the correct conclusion.
Let $m = 12$
$hd = m$

h	d
1	12
2	6
3	4
4	3
6	2
12	1

As h increases, d decreases.

4. **(D)** Imagine a square that has an area of 4 square units. Since the area of a square is found by using the formula $A = s^2$ (where s is the length of a side), then each side of the square is 2 because $\sqrt{4} = 2$. If the area of the larger square is double the smaller, then its area must be 8. Find the square root of 8 to find the length of a side.

$$\sqrt{8} = 2\sqrt{2}$$

When the area of a square is doubled, each side length increases by a factor of $\sqrt{2}$.

5. **(A)** Cross-multiply and solve for n.

$$\frac{6}{n} = \frac{18}{n+24}$$
$$6(n+24) = (18)(n)$$
$$6n + 144 = 18n$$
$$144 = 12n$$
$$12 = n$$

Find the value of $\frac{n}{12}$ by substituting 12 for n.

$$\frac{12}{12} = 1$$

6. **(D)** Although the system of equations can be solved by using elimination or substitution, it is easier to subtract the equations.

$$\begin{array}{r} 3x + 6y = 14 \\ -(2x + 5y = -11) \\ \hline x + y = 25 \end{array}$$

7. **(C)** A polynomial has a factor x if $f(x) = 0$. The chart indicates (5, 0) satisfies the function which means 5 is a zero of $f(x)$. In other words, $f(5) = 0$, so $x = 5$. Subtracting 5 from both sides of the equation we get $x - 5 = 0$. Therefore, $x - 5$ is a factor of $f(x)$.

8. **(A)** Angle 2 and $\angle 3$ are consecutive interior angles, so their sum is 180°. Solve for m by setting their sum equal to 180.

$$(2m + 18) + (4m + 42) = 180$$
$$6m + 60 = 180$$
$$6m = 120$$
$$m = 20$$

Substitute 20 for m and find the measure of $\angle 2$.

$$(4)(20) + 42 = 122$$

Angle 2 and $\angle 6$ are corresponding angles so their measures are equal. Angle 6 and $\angle 18$ are corresponding angles so their measures are also the same. Using the transitive property, we find that the measure of $\angle 2$ equals the measure of $\angle 6$, which equals the measure of $\angle 18$, which all equal 122°.

There are several alternate ways to solve this problem but the easiest way is visually. The diagram is drawn to scale and $\angle 18$ appears to be obtuse. Solely choice (A), 122°, appears to have a measure greater than 90°.

9. **(B)** Systems of equations have no solution when the equations are parallel lines. Parallel lines have the same slope but different y-intercepts. Convert $5x + 3y = -10$ to slope-intercept form to inspect the slope and y-intercept.

$$\begin{aligned} 5x + 3y &= -10 \\ 3y &= -5x - 10 \\ y &= -\frac{5}{3}x - \frac{10}{3} \end{aligned}$$

Substitute -7.5 for b and convert to slope-intercept form.

$$\begin{aligned} -7.5x - 4.5y &= 13.5 \\ -4.5y &= 7.5x + 13.5 \\ y &= -\frac{5}{3}x - 3 \end{aligned}$$

The equations $y = -\frac{5}{3}x - \frac{10}{3}$ and $y = -\frac{5}{3}x - 3$ are parallel lines because their slopes are the same but the y-intercepts are different. When $b = -7.5$, the system of equations has no solution.

10. **(A)** The sum of the measures of the exterior angles of a polygon is 360°. Add the exterior angles of $\triangle ABC$ and set them equal to 360 to find x.

$$\begin{aligned} (4x + 40) + (4x + 20) + 2x &= 360 \\ 10x + 60 &= 360 \\ 10x &= 300 \\ x &= 30 \end{aligned}$$

$\angle DBC$ and $\angle ABC$ are supplementary angles; their sum is 180°.

$$\angle DBC = 4x + 40 = 4(30) + 40 = 160$$

Therefore, $m\angle ABC + 160 = 180$ and $m\angle ABC = 20$

11. **(D)** Use FOIL to expand the quantities in the parentheses.

$$y = m(x + 3)(x - 5) = m(x^2 - 2x - 15)$$

Multiply each term in the parentheses by m.

$$m(x^2 - 2x - 15) = mx^2 - 2xm - 15m$$

Find the value of e by using the formula $e = -\frac{b}{2a}$ (this is also the formula for finding the axis of symmetry of a parabola).

$$e = -\frac{b}{2a} = -\frac{(-2m)}{2m} = 1$$

Find f by replacing x with 1 in $mx^2 - 2xm - 15m$.

$$m(1)^2 - 2(1)m - 15m = -16m$$

The value of f in the vertex is $-16m$.

12. **(B)** Factor the numerator of the complex fraction.

$$\frac{\frac{w^2 + 2w + 1}{w + 1}}{3} = \frac{\frac{(w + 1)(w + 1)}{w + 1}}{3}$$

When dividing a complex fraction, invert the denominator and multiply that quantity with the numerator.

$$\frac{(w+1)(w+1)}{\frac{w+1}{3}} = (w+1)(w+1)\left(\frac{3}{w+1}\right)$$

Cross-divide as needed.

$$(w+1)(w+1)\left(\frac{3}{w+1}\right) = 3(w+1)$$

13. **(D)** Arrange the data in ascending order.

67 75 76 78 80 85 89 90 95 97

First, find the median of the scores:

67 75 76 78 80 85 89 90 95 97

There are two values in the middle, 80 and 85, so find their mean.

$$(80 + 85) \div 2 = 82.5$$

67 75 76 78 82.5 89 90 95 97

Next, find the median of the numbers to the left of the median:

67 75 76 78 80 (median = 82.5) 85 89 90 95 97

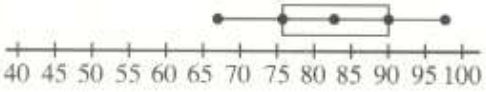
The median of this data set is 76

Next, find the median of the numbers to the right of the median:

67 75 76 78 80 (median = 82.5) 85 89 90 95 97

The median of this data set is 90.

The minimum is 67 and the maximum is 97. Use these numbers to construct the box-and-whisker plot



14. **(B)** Verify the accuracy of the statements.

I. An increase in temperature Celsius is equivalent to an increase of 1.8 degrees Fahrenheit.

Use $C = 1$ and $C = 2$

$$\frac{9}{5}(1) + 32 = 33.8$$

$$\frac{9}{5}(2) + 32 = 35.6$$

$$35.6 - 33.8 = 1.8$$

Statement I is true.

II. A temperature of 5°F is equivalent to −15°C.

$$5=\frac{9}{5}C+32$$
$$-27=\frac{9}{5}C$$
$$-15=C$$

Statement II is correct.

III. A temperature of 20°C is equivalent to 62°F

$$\frac{9}{5}(20)+32=68$$

Statement III is incorrect. Statements I and II are correct and statement III is incorrect.

15. **(D)** Use long division to assess the equivalent statement.

$$\begin{array}{r} 4+\frac{22}{n-4} \\ n-4\overline{)\ 4n+6} \\ \underline{4n-16} \\ 22 \end{array}$$

$4+\frac{22}{n-4}$ is equivalent to $\frac{4n+6}{n-4}$.

16. **$\frac{1}{4}$ or $\frac{1}{2}$**

Solve for m.

$$m^2-6m+8=0$$
$$(m-4)(m-2)=0$$
$$m-4=0 \text{ or } m-2=0$$
$$m=4 \text{ or } m=2$$

$\frac{1}{m}$ equals $\frac{1}{4}$ *or* $\frac{1}{2}$

17. **5** Complete the square for both x and y:

$$x^2+6y+y^2-4x=12$$
$$x^2-4x+y^2+6y=12$$
$$x^2-4x+4+y^2+6y+9=12+4+9$$
$$(x-2)^2+(y+3)^2=25$$

The graphing form of a circle is $(x-h)^2+(y-k)^2=r^2$. Since $r^2=25$, $r=5$.

18. **Answers may vary. $0 \le x < 8$**

Solve the compound inequality by writing it as two separate inequalities.

$-8 \le 2x-8$	*and*	$2x-8<8$
$0 \le 2x$		$2x<16$
$0 \le x$		$x<8$

$$0 \le x < 8$$

19. **5** The median of a data set is the middle value when data are arranged in order. Array the number of lures sold; there are four \$2 lures, five \$5 lures, and three \$10 lures.

2 2 2 2 5 5 5 5 5 10 10 10

The middle numbers are both 5's, so find their mean.

$$(5 + 5) \div 2 = 5$$

20. **4** There are two ways this question can be solved.

Method 1: System of equations.

Let x = questions answered correctly
Let y = questions answered incorrectly

There are 50 questions, so the first equation is $x + y = 50$. Since two points are deducted for each incorrect answer, we get $x - 2y = 38$. Solve by subtracting the equations.

$$\begin{array}{r} x + y = 50 \\ -\ x - 2y = 38 \\ \hline 3y = 12 \\ y = 4 \end{array}$$

There were 4 incorrectly answered questions.

An alternate method to solve the problem is by using trial and error. Suppose 40 questions were answered correctly and 10 questions were answered incorrectly.

$40(1) - 10(2) = 20$; Too many incorrect answers.

Try 48 questions answered correctly and 2 questions answered incorrectly.

$48(1) - 2(2) = 44$; Too few questions answered incorrectly.

Try the correct answer 46 questions answered correctly and 4 questions answered incorrectly.

$$46(1) - 4(2) = 38$$

Section 4: Math Test (Calculator)

1. **(B)** Anita climbed 5 flights of stairs, each flight containing 16 steps. The total number of stairs she climbed is 80 stairs. Her effort used five minutes and 20 seconds, which is a total of 320 seconds. Divide the number of seconds by the number of stairs to find the mean time spent climbing a single stair.

$$320 \div 80 = 4 \text{ seconds per stair}$$

2. **(B)** Find the probability that the athlete will be a boy or a water polo member. Avoid double counting by subtracting the boys who are on the water polo team.

$$\text{boys: } \frac{28}{57} \qquad \text{water polo members: } \frac{31}{57}$$

$$\text{boys on the water polo team: } \frac{16}{57}$$

$$\frac{28}{57} + \frac{31}{57} - \frac{16}{57} = \frac{43}{57}$$

3. **(B)** From 2005 to 2006, there was a 100% growth (from 20 to 40). After 2007, however, the graph shows about a 5% increase per year.

4. **(C)** In 2005, there were 20 bee farms in the metropolitan Atlanta area. By 2010, that number gradually increased to 60, an increase of 40 additional farms. Find the total increase as a percentage by using the formula $\frac{\text{increase}}{\text{original}} = \frac{n}{100}$.

$$\frac{40}{20} = \frac{n}{100}$$
$$20n = 4{,}000$$
$$n = 200$$

The increase as a percentage from 2005 to 2010 is 200%. Divide that number by 5 to find the annual increase:

$$200 \div 5 = 40$$

5. **(D)** Use the formula $\frac{\text{rise}}{\text{run}}$ to find the slope of the linear function. As n increases by 1, $r(n)$ increases by 2. Thus, $r(n) = 2n + b$ with b representing the y-intercept. Input any of the points to calculate b.

$$(4, 5)$$
$$5 = 2(4) + b$$
$$5 = 8 + b$$
$$-3 = b$$
$$r(n) = 2n - 3$$

6. **(C)** Polynomials are added by combining like terms. Like terms have the same variable(s) raised to equivalent exponents.

$$\begin{array}{r} 4x^2 + 5x - 6 \\ +\ 3x^2 + x - 11 \\ \hline 7x^2 + 6x - 17 \end{array}$$

Note that when like terms are added, coefficients are combined but the exponents remain the same.

7. **(D)** Isolate n by multiplying both sides of the equation by $\frac{9}{5}$.

$$\frac{9}{5}\left(\frac{5}{9}n\right) = \left(\frac{7}{20}\right)\frac{9}{5}$$
$$n = \frac{63}{100}$$

8. **(A)** Use the formula for the axis of symmetry of a parabola to find which day will result in the greatest distribution of tickets.

$$x = -\frac{b}{2a}$$
$$x = -\frac{9}{2(-.4)} = 11$$

Input 11 for x in $T(x) = -.4x^2 + 9x + 11$ to find the number of tickets distributed on day 11.

$$T(11) = -.4(11)^2 + 9(11) + 11 = 62 \text{ tickets.}$$

9. **(D)** Use the proportion $\frac{\text{distance}}{\text{time}} = \frac{\text{distance}}{\text{time}}$ to find how far Gina will run in 2.4 minutes.

Since the original ratio is stated in seconds, convert 2.4 minutes into seconds.
2.4 minutes = 2.4(60) = 144 seconds.

$$\frac{28}{4.7} = \frac{n}{144}$$
$$4.7n = (144)(28)$$
$$4.7n = 4{,}032$$
$$n = 858$$

10. **(A)** The percent of the U.S. budget was .1% in 1958. By 1963, the percentage of the U.S. budget rose to 2.28%. Use the formula $\frac{\text{increase}}{\text{original}} = \frac{n}{100}$ to find the percent increase.

Increase = 2.28 −.1 = 2.18

$$\frac{2.18}{.1} = \frac{n}{100}$$
$$218 = .1n$$
$$n = 2{,}180\%$$

Choice (A), 2,200%, was the closest to this figure.

11. **(D)** U.S. spending in 1962 was $106,821,000. The NASA budget in 1958 was $89,000,000. Divide 106,821,000 by 89,000,000 to calculate how many times larger the 1962 U.S. spending was than the 1958 NASA budget.

$$106{,}821{,}000 \div 89{,}000{,}000 = 1{,}200.23.$$

Choice (D), 1,200, was the closest.

12. **(D)** Use $7500(.954)^{3.5}$ to represent the depreciated value of the artwork. Each year the piece loses 4.6% of its value, so place 1 − .046 in the parentheses which simplifies to .954. Show 3.5 years of compounding decline by placing 3.5 in the exponential position. Choices (B) and (C) can be eliminated immediately because each demonstrates growth, not depreciation.

13. **(A)** Five years after the three-year value is a total of eight years beyond the purchase date. Let $t = 8$

$$A = 7500(.954)^8 = \$5{,}145.75$$

14. **(C)** The study size, 250 per group, is large enough to conclude that the new early detection program is more effective than the standard procedure. However, since the new procedure compared its results to solely the standard procedure, no conclusion can be made about alternate procedures for early detection of skin cancer.

15. **(A)** From the graph, $g(2)$ yields a value of 2 while $f(2)$ yields a value of −2. In other words:

$$f(2) = -2$$
$$g(2) = 2$$

When $x = 2$, $f(x) + g(x) = 0$

16. **(D)** Find the number of seconds in one year.

(365 days) × (24 hours in a day) × (60 minutes in an hour) × (60 seconds in a minute) = 31,536,000 seconds in one year.

Next, find the product of 31,536,000 and 186,000 to find how many miles light travels in one year.

$$186{,}000 \times 31{,}536{,}000 = 5{,}860{,}000{,}000{,}000 \text{ (about 6 trillion miles)}$$

Multiply 5,860,000,000,000 by 8 to find the number of miles to Sirius.

$$5{,}860{,}000{,}000{,}000 \times 8 = 46.9 \text{ trillion}$$

Choice (D), 50 trillion, was the closest to this figure.

17. **(C)** Divide 186,000 miles by one billion. Scientific notation will facilitate this process.

$$\frac{1.86 \times 10^5}{1 \times 10^9} = 1.86 \times 10^{-4} = .000186$$

In one billionth of a second, light travels .000186 miles. Multiply .000186 by 5,280 feet, the number of feet in a mile.

$$.000186 \times 5{,}280 = .98 \text{ foot.}$$

.98 foot is closest to choice (C) 1 foot.

18. **(B)** Ground speed is defined as air speed ± wind speed. If there is no wind, then the ground speed is the air speed because $500 \pm 0 = 500$.

$$C(500) = 100 + \frac{500}{10} + \frac{36{,}000}{500} = 222$$

19. **(D)** The line of best fit predicts 500 Garibaldi would be counted per cubic mile in August. The actual number that was counted, however, was 450. Find the difference by subtracting 450 from 500.

$$500 - 450 = 50.$$

20. **(D)** Assume that the largest of the three numbers is 60% of 780 because 60% is 50% more than 40% [40 + (.5)(40) = 60]. Therefore, the largest of the three numbers is 60% of 780.

$$(.6)(780) = 468$$

21. **(A)** Since the angles are complementary and $\sin(m°) = \cos(m°)$, it follows from the complementary angle property of sines and cosines that $m + n = 90$. Substituting $3x - 12$ for m and $6x - 18$ for n gives $(3x - 12) + (6x - 18) = 90$, which simplifies to $9x - 30 = 90$. Therefore, $9x = 120$, and $x = 13.\overline{3}$.

22. **(B)** Let x equal the number of students in the chemistry class. When providing 8 milliliters per student we get $m = 8x + 6$. This reflects the fact that 6 milliliters are left over from the jar containing m milliliters. When Ms. Garcia wished to provide 10 milliliters per student, she required an additional 16 milliliters to ensure each student had the

same amount. This situation is represented by the equation $m = 10x - 16$. Since $8x + 6$ and $10x - 16$ both equal m, set each expression equal to one another.

$$10x - 16 = 8x + 6$$
$$2x = 22$$
$$x = 11$$

There are 11 students in Ms. Garcia's chemistry class.

23. **(D)** Find the volume of the cylinder and the cone and add 10% to that sum.
Volume of a cylinder, $\pi r^2 h$: $\pi(8^2)(12) = 2{,}412$

Volume of a cone, $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(8^2)(8) = 536$

Add the two quantities to find the volume of the silo.

$$2{,}412 + 536 = 2{,}948$$

The farmer needs 10% more space so find 10% of 2,948 and add it to 2,948.

$$2{,}948 + (.10)(2{,}948) = 3{,}243$$

Once the volume of the silo has been determined to be 2,948 you don't need to finish the calculation. Only choice (D), 3,243, is larger than 2,948.

24. **(B)** In order for the line containing $(6, m)$ and $(m, 54)$ to pass through the origin, each point must share the slope that connects it to the origin. Use the formula $\frac{\text{rise}}{\text{run}}$ for both points and set the quantities equal.

$$\frac{m}{6} = \frac{54}{m}$$

Cross-multiply and solve for m.

$$m^2 = 324$$
$$m = 18 \text{ or } m = -18$$

Although both 18 and −18 are solutions to the equation, only 18 was provided as an answer choice.

25. **(A)** The area of a rectangle is found by using the formula $A = lw$ where l and w are the length and width, respectively. Reducing the length by 10% gives $.9l$. Reducing the width by x% gives us $(1.0 - .01x)w$. The new dimensions reduce the area by 32.5% so the new area is $.675A$. Use a system of equations to find x.

$$A = lw$$
$$.675A = .9l(1.0 - .01x)w$$

Multiply $.9l$ and $(1.0 - .01x)w$.

$$.675A = .9lw - .009lwx$$

Substitute A for lw in the second equation.

$$.675A = .9A - .009Ax$$
$$.675A - .9A = -.009Ax$$
$$-.225A = -.009Ax$$

Divide both sides by A and solve for x.

$$-.225 = -.009x$$
$$25 = x$$

The width in the original rectangle was reduced by 25%.

26. **(D)** From 1980 to 2005, the record appreciated 12% five times. Twenty-five years had elapsed and the record grew in value every 5 years. We add 1.0 to .12 to ensure growth. Thus, choices (A) and (B) are eliminated because each would represent depreciation.

27. **(C)** There are three different measures of length in this situation: yards, feet, and inches. In order to accurately decide which deal is the best, convert all the deals into the same unit of measure. Since inches are the smallest unit of measure, let's convert all the units into inches. But first, a reminder about unit conversion from grade school:

1 yard = 3 feet
1 foot = 12 inches

We can also deduce the following:

1 yard = 36 inches

Solve each deal as a cost per inch:
Deal 1: 1 yard for \$5.40 means 36 inches for \$5.40. Therefore, \$5.40 ÷ 36 = \$.15 per inch.
Deal 2: 1 foot for \$1.92 means 12 inches for \$1.92. Therefore, \$1.92 ÷ 12 = \$.16 per inch
Deal 3: 1 inch for \$.14
Deal 3 is the most economical.

28. **(B)** Begin isolating x by raising both sides of the equation to the sixth power.

$$2x^{\frac{2}{3}} = 6^{\frac{1}{2}}$$
$$(2x^{\frac{2}{3}})^6 = (6^{\frac{1}{2}})^6$$
$$64x^4 = 6^3$$
$$64x^4 = 216$$

Divide both sides of the equation by 64.

$$\frac{64x^4}{64} = \frac{216}{64}$$
$$x^4 = \frac{27}{8}$$

Raise both sides of the equation to the $\frac{1}{4}$ th power.

$$(x^4)^{\frac{1}{4}} = \left(\frac{27}{8}\right)^{\frac{1}{4}}$$
$$x = \left(\frac{27}{8}\right)^{\frac{1}{4}}$$

29. **(D)** $g(x)$ is not defined by any value x that makes $x^2 - 3$ equal to 0 or $x^2 - 4 < 0$.
$x^2 - 3 = 0$ only if $x = \sqrt{3}$ or $x = -\sqrt{3}$, neither of which are integers.
$x^2 - 4 < 0$ for $-2 < x < 2$. The only integers that satisfy this inequality are -1, 0, and 1.
Therefore, there are three integers in which $g(x)$ is not defined.

30. **(C)** For direct variation, use the model

$$\frac{p_1}{q^{-1}{}_1} = \frac{p_2}{q^{-1}{}_2}$$

Remember, $q^{-1} = \frac{1}{q}$.

$$\frac{\frac{1}{6}}{\frac{8}{5}} = \frac{p_2}{\frac{1}{18}}$$

Cross-multiply and solve for p_2.

$$\frac{8}{5}p_2 = \left(\frac{1}{6}\right)\left(\frac{1}{18}\right)$$
$$p_2 = \frac{5}{864}$$

31. **3** or **4** Subtract \$18 from \$51 and \$62 to find the amount of money Kara may have spent on belts.

$$51 - 18 = 33$$
$$62 - 18 = 44$$

Kara may have spent between \$33 and \$44 for belts. Given that each belt cost \$11, Kara could have purchased 3 or 4 belts.

32. **3** Multiply $2x^2 + 4x - 2$ by 3.

$$3(2x^2 + 4x - 2) = 6x^2 + 12x - 6$$

Subtract $6x^2 + 12x - 6$ from $-8x^2 + 15x - 2$.

$$(-8x^2 + 15x - 2) - (6x^2 + 12x - 6) = -14x^2 + 3x + 4$$

$3x$ represents the bx term in $ax^2 + bx + c$ so $b = 3$.

33. **8.53** The ramp pictured in the diagram is a right triangle. Note the base is measured in feet while the height is measured in inches. Convert 18 inches to feet so both of the triangle's dimensions use the same label.

1 foot = 12 inches so 18 inches equals 1.5 feet.

The side opposite the angle of elevation and the adjacent side to that angle are both known, so use the tangent function to calculate the measure of the angle.

$$\tan^{-1}\left(\frac{1.5}{10}\right) \approx 8.53°$$

34. **4.4** Find the total points amassed by the first 12 reviews by multiplying 12 by the 4.3, the average review.

$$12 \times 4.3 = 51.6$$

Add 10 to 51.6 to include the two additional 5-star reviews.

$$51.6 + 10 = 61.6$$

Divide 61.6 by 14, the total number of reviewers.

$$61.6 \div 14 = 4.4$$

35. **275** After his initial deposit, Terrence made fixed monthly deposits. Consider the initial deposit to have occurred in month zero, prior to the start of the monthly deposits.

$$\begin{aligned} \text{Let } m &= 0 \\ A &= 25(0) + 275 \\ A &= 275 \end{aligned}$$

Terrence made an initial deposit of $275.

36. **2** Substitute either (2, 7) or (−3, 37) for x and y and solve for a.

$$\begin{aligned} 7 &= (a)(2)^2 - (4)(2) + 7 \\ 7 &= 4a - 8 + 7 \\ 8 &= 4a \\ 2 &= a \end{aligned}$$

37. **1.66 or 1.67 or $\frac{5}{3}$** Input 80% for v into the formula of special relativity.

$$F(t) = \frac{t}{\sqrt{1-v^2}}$$

$$F(1) = \frac{1}{\sqrt{1-.8^2}} = 1.\overline{66}$$

38. **.866** Input 1 and 2 for t and $F(t)$, respectively, into the special relativity formula.

$$\begin{aligned} F(t) &= \frac{t}{\sqrt{1-v^2}} \\ 2 &= \frac{1}{\sqrt{1-v^2}} \\ 2(\sqrt{1-v^2}) &= 1 \\ \sqrt{1-v^2} &= .5 \\ (\sqrt{1-v^2})^2 &= (.5)^2 \\ 1-v^2 &= .25 \\ -v^2 &= -.75 \\ v &= .866 \end{aligned}$$

MATH TEST (NO CALCULATOR)

25 MINUTES, 20 QUESTIONS

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

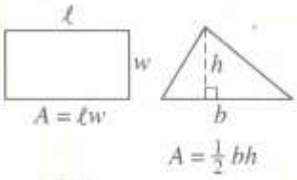
Directions: For questions 1–15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16–20, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

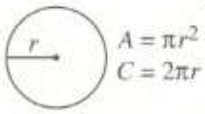
Notes:

- You **CANNOT** use a calculator on this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

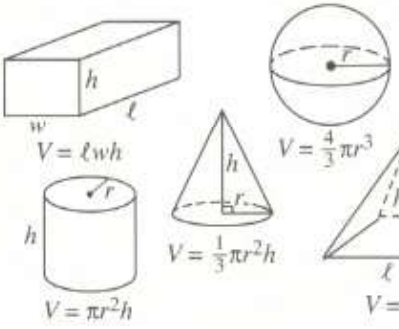
REFERENCE INFORMATION

Area Facts

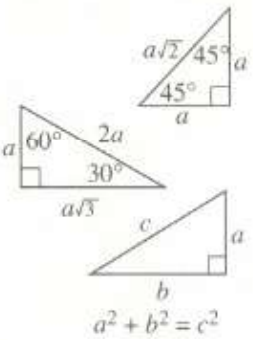




Volume Facts



Triangle Facts



The arc of a circle contains 360°.
The arc of a circle contains 2π radians.
The sum of the measures of the angles in a triangle is 180°.

GO ON TO THE NEXT PAGE

1. The Milky Way galaxy contains approximately 250,000,000 stars. Of these stars, about 44% of them have planets and 18% of these stars have planets that are in the habitable zone, i.e., water can remain in a liquid state. What is the best estimate of the number of planets in the Milky Way that are in the habitable zone?

   (A) 20 million
   (B) 35 million
   (C) 55 million
   (D) 100 million

2. If $\frac{2k}{7} = 30$, what is the value of $2k + 7$?

   (A) 105
   (B) 179
   (C) 217
   (D) 287

3. Line A is perpendicular to a line that is parallel to $y = \frac{5}{9}x + 7$. What is the slope of line A?

   (A) $\frac{9}{5}$
   (B) $\frac{5}{9}$
   (C) $-\frac{5}{9}$
   (D) $-\frac{9}{5}$

4. Tina repairs sinks in a large housing development. Each month, the number of sinks she has to repair is represented by the following equation:

   $$B = 360 - 88w$$

   where B is the balance of sinks left to repair and w is the number of weeks she has worked in a certain month. What is the meaning of 360 in the equation $B = 360 - 88w$?

   (A) Tina will repair 360 sinks each week.
   (B) Tina starts each month with 360 sinks to repair.
   (C) Tina repairs 360 sinks a year, almost one per day.
   (D) Tina will repair 360 sinks daily.

$$(-4x^3y - xy^3 + 4x) - (7x - 4xy^3 + 2x^2)$$

5. Which of the following is equivalent to the expression above?

   (A) $-4x^3y + 3xy^3 - 2x^2 - 3x$
   (B) $6x^3y^3 - 3x$
   (C) $-4x^3y + 3xy^3 + 2x^2 - 11x$
   (D) $-9x^3y^3 + 3x$

6. The specific gravity of a substance is the ratio of the weight of the substance compared to the volume of an equal weight of water. If water weighs 62.5 pounds per cubic foot, what is the weight in pounds per cubic foot of a liquid that has a specific gravity of 3?

   (A) .047
   (B) 130
   (C) 187.5
   (D) 260

GO ON TO THE NEXT PAGE

7. If $a^{\frac{3}{2}} = 64$, what is the value of $\sqrt{a}$?

(A) 2
(B) 4
(C) $2\sqrt{2}$
(D) 8

x	$g(x)$
0	6
−2	2
−3	0
−4	−2

8. The function g is defined by a certain polynomial. Some of the values of $g(x)$ are shown in the table above. Which of the following must be a factor of $g(x)$?

(A) $x-6$
(B) $x-3$
(C) $x+3$
(D) $x+6$

9. If $\frac{m^{x^2}}{m^{y^2}} = m^{36}$, $m > 1$, and $x + y = 9$, what is the value of $x - y$?

(A) 4
(B) 6
(C) 9
(D) 16

10. Sean owed p dollars for a loan he secured for college expenses. He promised to pay off the debt in monthly installments, each installment equal to 20% of the existing debt. After two monthly payments, which expression reflects the balance due on his loan?

(A) $.8p$
(B) $.64p$
(C) $.6p$
(D) $.48p$

11. A commercial pilot is beginning his descent to eventually land at the local airport. His line of sight to the ground is currently at 75.4° and he is currently flying at 7,000 feet. He wants to know what will be the length of his trajectory to the ground. Which of the following equations will help him determine that value?

(A) $\sin 14.6 = \frac{7{,}000}{x}$

(B) $\cos 75.4 = \frac{x}{7{,}000}$

(C) $\tan 14.6 = \frac{7{,}000}{x}$

(D) $\tan 14.6 = \frac{x}{7{,}000}$

12. What is the sum of all values of x that satisfy $4x^2 - 2x - 6 = 0$?

(A) $-\frac{\sqrt{2}}{2}$

(B) $-\frac{1}{2}$

(C) $2\sqrt{2}$

(D) $\frac{1}{2}$

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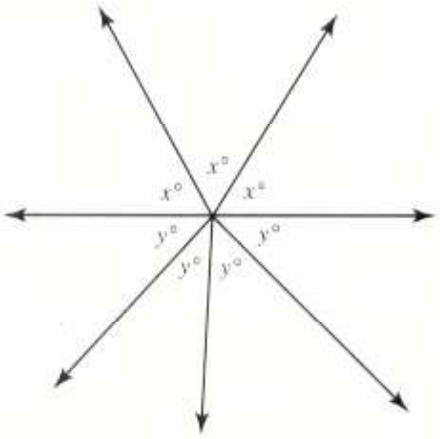


13. In the figure above, what is the value of $(x + y) \div 2(x - y)$?

(A) 3
(B) 3.5
(C) 4
(D) 5.5

$$\frac{6-4i}{2+4i}$$

14. If the expression above is rewritten in the form of $a + bi$, what is the value of $a - 2b$?

(A) $4 + 2i$
(B) $4 - 2i$
(C) $\frac{8}{5}$
(D) 3

15. It costs \$1.85 for x mangoes and \$2.25 for y guavas. Which of the following expressions, expressed in cents, models the cost of purchasing 7 mangoes and 9 guavas?

(A) $\frac{185}{7+x}+\frac{225}{9+y}$
(B) $9\left(\frac{185}{x}\right)+7\left(\frac{225}{y}\right)$
(C) $7\left(\frac{x}{185}\right)+9\left(\frac{y}{225}\right)$
(D) $7\left(\frac{185}{x}\right)+9\left(\frac{225}{y}\right)$

GO ON TO THE NEXT PAGE

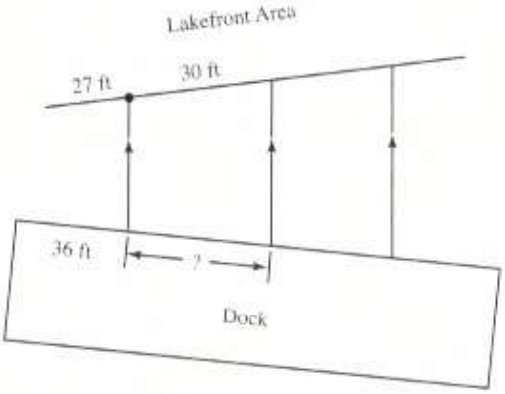
16. Oscar wants to place molding surrounding the floor in his study room that is in the shape of a rectangle. He remembers that the area of the room is 180 square feet and that the width of the room is 12 feet. However, he does not know the measure of the length of the room. His tape measure is out in the car, but Oscar thinks he can solve the problem with simple algebra. Assuming no waste, how much floor molding should Oscar purchase (answers in linear feet)?

$$x^3 - 6x^2 + 2x - 12 = 0$$

17. What real value of x makes the above equation true?

$$mx + ny = 8$$
$$2x + 8y = 64$$

18. In the system of equations above, m and n are constants. If the system of equations has infinitely many solutions, what is the value of $\frac{n}{m}$?



19. The diagram above shows a lakefront area divided into small parcels for boat owners. Each area is marked by a rope to a dock where each owner secures his/her boat. The ropes between the parcels are parallel to one another. What is the length of the docking area for the boat owner who has a 30 foot lakefront border illustrated above?

20. If $f(x) = 2x + 3$ and $f(2x + 3) = 5x$, what is the value of $3x^2$?

If there is still time remaining, you may review your answers.

MATH TEST (CALCULATOR)

55 MINUTES, 38 QUESTIONS

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

Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid. Please use scrap paper to work out your answers.

Notes:

- The use of a calculator on this section IS permitted.
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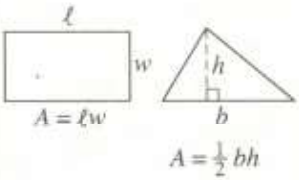
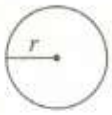


$A = \ell w$

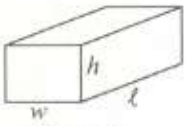
$A = \frac{1}{2}bh$



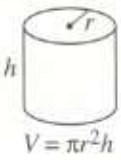
$A = \pi r^2$

$C = 2\pi r$

Volume Facts

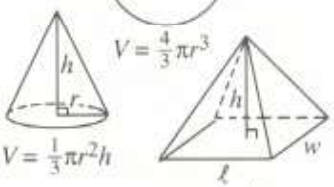


$V = \ell wh$



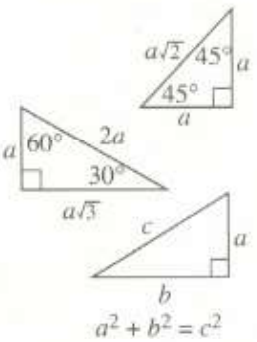
$V = \pi r^2 h$

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



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

Triangle Facts



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

The arc of a circle contains 360°.

The arc of a circle contains 2π radians.

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

GO ON TO THE NEXT PAGE

1. Andrea has accepted a part-time job as an activities director at a nearby pre-school. She is guaranteed $40 for the one, four-hour shift she works on Wednesday afternoon. If she conducts a group activity, such as a painting class, she is awarded an extra $8 per activity. Which of the following expressions models the amount of money Andrea can make on any Wednesday afternoon?

   (A) $40n + 8$
   (B) $48n$
   (C) 48
   (D) $40 + 8n$

2. Gina is saving money for a cross-country road trip with two of her friends. She currently has $240 saved for the excursion and can save $125 each month in the future. Which of the following expressions represents the amount of money Gina will save after m months?

   (A) $365m$
   (B) $125 + 240m$
   (C) $240 + 125m$
   (D) $365m + 240$

3. Jake has five 12-packs of juice for his school's summer picnic. If all of the juice containers are divided into 3 main groups and each group is then divided into 5 smaller groups, how many juice containers are in each of these smaller groups?

   (A) 2
   (B) 4
   (C) 5
   (D) 10

4. Connor surveyed a random sample of 80 students in his class regarding the need for additional crosswalks at the school. Only 15.6% of the students felt they were necessary. Of the 320 students in his sophomore class, about how many would favor additional crosswalks?

   (A) 50
   (B) 58
   (C) 71
   (D) 74

5. The density of an object is found by dividing the object's mass by its volume. If the density of an object is 4 grams per milliliter and its mass is 30 grams, what is the volume in milliliters of the object?

   (A) 4.8
   (B) 6.1
   (C) 7.5
   (D) 9.2

6. Virginia and Chad were performing community service hours for their high school graduation requirement. Chad served three more hours than Virginia did this week and their combined hours were 47. How many hours did Chad work?

   (A) 22
   (B) 25
   (C) 27
   (D) 31

GO ON TO THE NEXT PAGE

7. A caterer has been contracted to create a dinner for a small group of executives. The caterer must produce no more than 9 pasta salads (p) and at least 18 chicken dishes(c). The cost for these dishes, \$3 for each pasta dinner and \$4 for each chicken dinner, cannot exceed \$300 in total. Which of the following inequalities models the caterer's production constraints?

(A) $0 \le p \le 9$
$c \ge 18$
$3p + 4c \le 300$

(B) $0 < p < 9$
$c > 18$
$3p + 4c < 300$

(C) $18c + 9p > 300$
$18c > 9p$

(D) $0 < p \le 9$
$c \ge 18$
$9p + 18c \le 300$

$$(4 - 3i)(6 + 5i)$$

8. The above expression can be expressed in the form of $a + bi$. What is the value of b in the expression?
(Note: $i = \sqrt{-1}$)

(A) 41
(B) 39
(C) 2
(D) −2

9. The linear function f has values $f(4) = -14$ and $f(-3) = 14$. What would be the value of $f(7)$?

(A) 37.4
(B) 17.28
(C) −26.0
(D) −28.6

Questions 10 and 11 refer to the information below.

The sunrise/sunset was recorded in San Diego during the course of the week of July 21, 2015.

Sun in San Diego—Next 7 days

2015	Sunrise/Set		Day Length	
Jul	Sunrise	Sunset	Length	Difference
Jul 21	5:55 AM	7:55 PM	13:59:21	−1:10
Jul 22	5:56 AM	7:54 PM	13:58:08	−1:13
Jul 23	5:57 AM	7:53 PM	13:56:54	−1:14
Jul 24	5:57 AM	7:53 PM	13:55:37	−1:17
Jul 25	5:58 AM	7:52 PM	13:54:19	−1:18
Jul 26	5:58 AM	7:51 PM	13:53:00	−1:19
Jul 27	5:59 AM	7:51 PM	13:51:38	−1:22

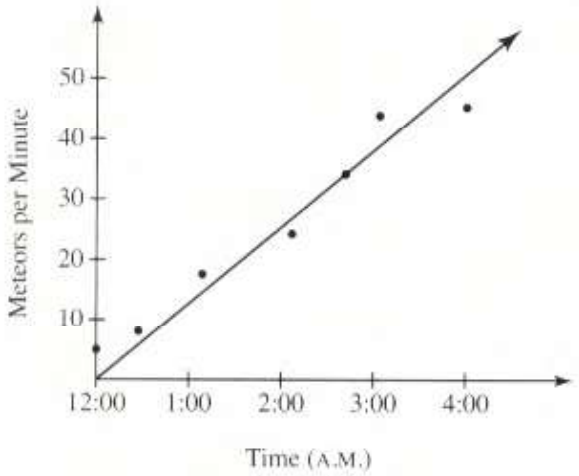
10. Which of the following is **not** true about the data provided above?

(A) To the nearest minute, from 7/21 to 7/27, the length of time the sun was out was reduced by 8 minutes.
(B) There was sunlight for more than 13 hours each day of the week.
(C) To the nearest minute, the sun rose later each day.
(D) The figures in the Difference column represent the decreasing amount of sunlight each day.

11. The category "Difference" decreases during the week because:

(A) As the week progressed, sunrise was generally later and sunset was generally earlier, causing fewer hours of daylight.
(B) Sunrise was generally later; sunset was not a factor in this calculation.
(C) Sunset was generally earlier; sunrise was not a factor in this calculation.
(D) The length of a particular day was shorter than it was in 2014.

GO ON TO THE NEXT PAGE



When a comet passes by the sun, it leaves a trail of rocks, ice, and dust. As the Earth passes through this trail, some of the particles enter the earth's atmosphere, manifesting as meteorites or "shooting stars." The graph above is the line of best fit of a meteor shower that took place in November 2014.

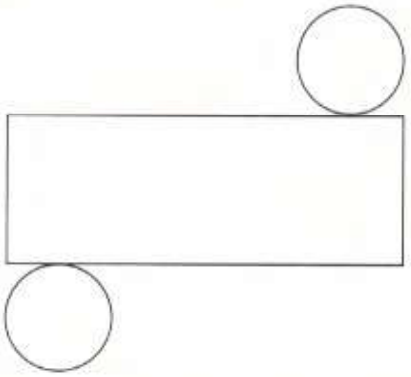
12. Which of the following can be deduced about the line of best fit and the actual number of meteors seen per minute at 3:00 AM?

(A) The line of best fit predicted 5 fewer meteors per minute than were actually witnessed.
(B) The line of best fit predicted 5 more meteors per minute than were actually witnessed.
(C) There were fewer meteors witnessed at 3:00 AM than there were at 2:00 AM.
(D) The line of best fit and the actual number of meteors witnessed at 3:00 AM were equivalent.

13. Modern television screens are categorized by the lengths of their diagonals. Ethan was watching a show on his 32" screen in which a truck appeared to be 11" long. Had he watched that show on a television that had a 44" inch diagonal, to the nearest inch, how long would the truck appear to be?

(A) 8"
(B) 15"
(C) 27"
(D) 38"

14. A net deconstructs a geometric solid into two-dimensional plane figures. A net of a cylinder is pictured below.

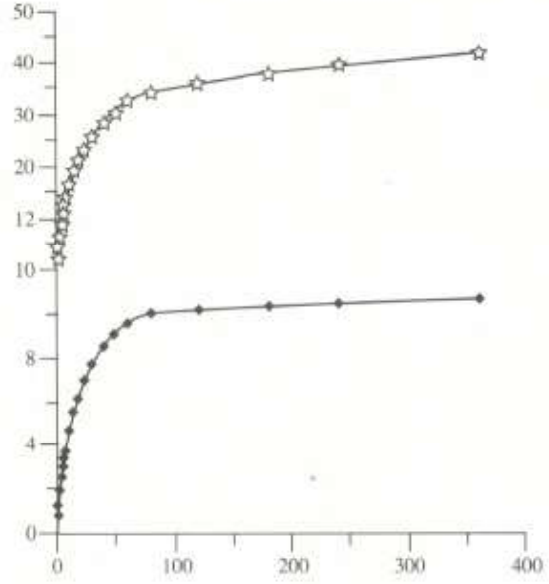


The cylinder above has a volume of 327 cubic inches and a height that measures 6 inches. What is the best estimate of the area, in square inches, of the rectangular portion of the net?

(A) 121
(B) 134
(C) 157
(D) 208

GO ON TO THE NEXT PAGE

Question 15 refers to the graph below.



Absorption Rates of Enzyme X and Enzyme Y

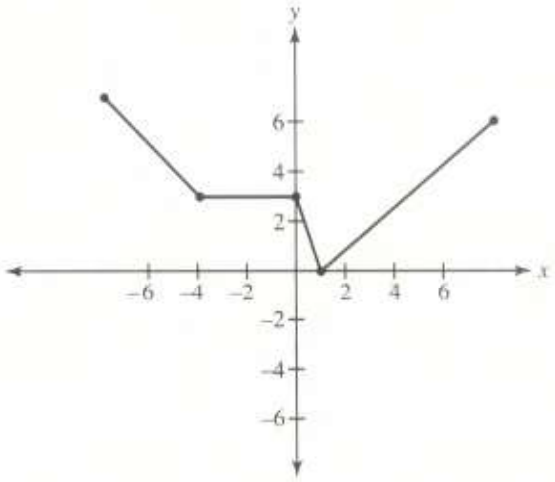
15. The graph above represents the absorption rates of two enzymes in the small intestine of a frog. The vertical axis represents the percent of absorption and the horizontal axis represents time measured in seconds. The star symbol represents enzyme X and the diamond-shaped symbol represents enzyme Y. Which of the following **cannot** be concluded about the absorption rates of enzymes X and Y?

(A) The absorption rates of both enzymes begin to level off at 100 seconds.
(B) Both enzymes increased at the same percentage rate over the first 100 seconds.
(C) At 400 seconds, the difference between the absorption rates of enzyme X and Y is about 31%.
(D) Both enzymes saw their greatest increase in the rate of absorption occurring within the first 20 seconds.

$$5x + 13y = 17$$
$$bx + 54.6y = 37$$

16. In the system of equations above, b is a constant. If there is no solution to the system, what is the value of b?

(A) 17.4
(B) 19.6
(C) 21.0
(D) 27.3



17. The complete graph of the function g is shown in the xy-plane above. What value of x yields the minimum value of $g(x)$?

(A) 0
(B) 1
(C) 2
(D) 5

GO ON TO THE NEXT PAGE

18. Swimmers who participate in backstroke races depend on a series of banners strung overhead. The banners warn the swimmer that the wall is 5 yards away. A company sells these banners in long cords that repeat a sequence of colors in the following order:

Red Yellow Blue Green Orange Purple

If a high school bought 40 yards of a banner string that contained 75 banners, what was the color of the 59th banner?

(A) yellow
(B) green
(C) orange
(D) purple

19. A food stand sells Mexican fare. Tacos cost $2.00 each and enchiladas cost $4.50 each. On a certain day, revenue from tacos and enchiladas was $198.00 and the number of tacos and enchiladas sold was 54. How many enchiladas were sold?

(A) 54
(B) 36
(C) 27
(D) 18

$$x^2 + y^2 + 6x - 8y = 12$$

20. The equation of a circle in the xy-plane is provided above. What is the radius of the circle?

(A) 5
(B) $3\sqrt{3}$
(C) 6
(D) $\sqrt{37}$

21. The lengths of the legs of a particular right triangle are integers. The tangent of an acute angle in the triangle is equal to 0.8. Of the following, which could be the area of the triangle?

(A) 124 square inches
(B) 243 square inches
(C) 441 square inches
(D) 490 square inches

$$C(x) = x^3 + 5x^2 + 5x - 2$$

22. In the function above, which of the following can be assumed?

(A) $x + 3$ is a factor
(B) $x + 2$ is a factor
(C) $x - 5$ is a factor
(D) $x + 4$ is a factor

23. A manufacturer of basketballs charges $24 for each basketball and sells 1,000 per week. The production control department estimates that for every $1 discount, the manufacturer will sell an additional 100 basketballs. At what price will the manufacturer maximize revenue?

(A) $19
(B) $18
(C) $17
(D) $14

GO ON TO THE NEXT PAGE

24. Two types of peaches, classified as A and B, are being cultivated. An estimate of the number of peaches of type A, after a 30-day experiment, is approximately 5,200. If type A peaches grew 30% more quickly than type B, what is the estimated count of the type B peaches at the same 30-day mark?

(A) 3,900
(B) 4,000
(C) 4,200
(D) 4,500

Questions 25 and 26 refer to the following information.

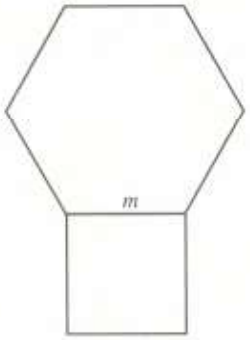
A theater group began with a budget from the city of $1.5 million. However, the group had seen its annual funding decline by 6.8% per year. By January 1, 2000, its annual budget was $975,000.

25. What function models the declining balance of annual funding provided by the city?

(A) $f(x) = 1{,}500{,}000(1.068)^t$
(B) $f(x) = 1{,}500{,}000(.932)^t$
(C) $f(x) = 1{,}500{,}000(.068)^t$
(D) $f(x) = 1{,}500{,}000(-.068)^t$

26. Due to decreasing budgets, the city council sought to combine its theater group with another city's group on 1/1/2004. If the 6.8% decline in annual budget funds continued, and the two cities needed to have at least $1.2 million, how much did the neighboring city have to provide to the budget?

(A) $684,442
(B) $521,862
(C) $484,324
(D) $464,356



27. The figure above is a regular hexagon with sides of length m and a square with sides of length m as well. If the area of the hexagon is $324\sqrt{3}$ square inches, what is the area of the square in square inches?

(A) 108
(B) 216
(C) 256
(D) 324

$$3x + m = 5x - 6$$
$$3y + n = 5y - 6$$

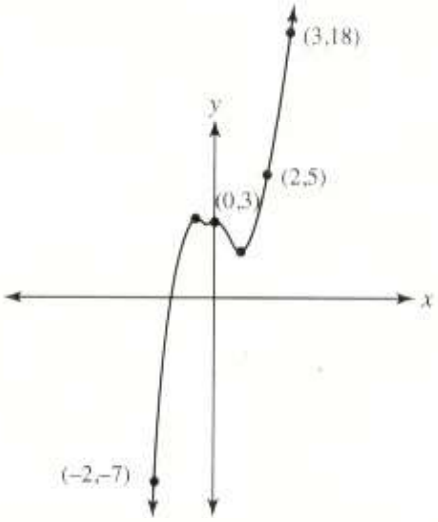
28. In the equations shown above, m and n are constants. If $m = n + \frac{1}{2}$ which of the following statements is true?

(A) x is y plus $\frac{1}{4}$
(B) x is y minus $\frac{1}{4}$
(C) x is y minus 1
(D) x is y plus 1

GO ON TO THE NEXT PAGE

29. The distance between the points (7, 5) and $(x, 4)$ is 8. What is/are the coordinate(s) of x?

(A) $7 + 3\sqrt{7}$
(B) $7 - 3\sqrt{7}$
(C) $3 \pm \sqrt{7}$
(D) $7 \pm 3\sqrt{7}$



30. The function $f(x) = x^{3b} - x^{2b} - x + 3$ is shown above in the xy-plane. If n is a constant such that $f(x) = n$ has three real solutions, which of the following could be the value of n?

(A) 3
(B) 2
(C) 1
(D) –3

GO ON TO THE NEXT PAGE

31. A college uses an auditorium for Psychology 101 lectures due to the class' large enrollment. The auditorium has 6 sections each with no fewer than 100 seats but no more than 150 seats. If every student in the Psychology class is present, what is one possible value of the number of students in the class?

Age	Target HR Zone 50–85%	Average Maximum Heart Rate, 100%
20 years	100–170 beats per minute	200 beats per minute
30 years	95–162 beats per minute	190 beats per minute
35 years	93–157 beats per minute	185 beats per minute
40 years	90–153 beats per minute	180 beats per minute

32. The chart above indicates data relating to heart beat rates for adults between the ages of 20 and 40 as put forth by the American Medical Association. If a woman aged 35 has a heart rate that is the mean of the extremes of the Target HR Zone for her age, what percent of the maximum heart rate is that measure (round to the nearest tenth of a percent)?

33. If the height of a cylinder is doubled and the length of its radius is tripled, how many times greater is the volume of the larger cylinder compared to the volume of the original?

34. Katie has a brand new car with 4,568 miles on the odometer. She begins a trip from Providence, RI to Birmingham, AL. When her odometer reads 4,667, she has $\frac{7}{8}$ of a tank of gasoline. By the time her odometer reads 4,754, she has $\frac{1}{2}$ of the tank left. If her gas usage proceeds at the same rate, to the nearest mile, what will her odometer read when the gas tank is $\frac{3}{16}$ full?

$$f(x)=\frac{1}{(x-3)^2+6(x-3)+9}$$

35. For what value of x is the function f undefined?

36. A supermarket chain received an average grade (arithmetic mean) of 65% customer satisfaction from 10 recent customer surveys. The chain manager wants to earn at least an 80% rating from its first 20 customer surveys. What is the lowest score the 17th survey can receive and still achieve the 80% satisfaction rate from its first 20 surveys?

GO ON TO THE NEXT PAGE

Questions 37 and 38 refer to the information below.

Nutritionists recommend daily consumption of 4,700 milligrams of potassium. Men generally consume 3,200 milligrams per day and women consume about 2,300 milligrams per day. Below is a list of potassium-rich foods as recommended by nutritional experts.

Foods with Potassium	Serving Size	Potassium (mg)
Apricots, dried	10 halves	407
Avocados, raw	1 ounce	180
Bananas, raw	1 cup	594
Beets, cooked	1 cup	519
Brussel sprouts, cooked	1 cup	504
Cantaloupe	1 cup	494
Dates, dry	5 dates	271
Figs, dry	2 figs	271
Kiwi fruit, raw	1 medium	252
Lima beans	1 cup	955
Melons, honeydew	1 cup	461
Milk, fat free or skim	1 cup	407
Nectarines	1 nectarine	288
Orange juice	1 cup	496
Oranges	1 orange	237
Pears (fresh)	1 pear	208
Peanuts dry roasted, unsalted	1 ounce	187
Potatoes, baked	1 potato	1081
Prune juice	1 cup	707
Prunes, dried	1 cup	828
Raisins	1 cup	1089
Spinach, cooked	1 cup	839
Tomato products, canned sauce	1 cup	909
Winter squash	1 cup	896
Yogurt, plain, skim milk	8 ounces	579

37. Jake read that the headaches he was enduring after running were caused by potassium depletion. Although he was consuming 3,200 milligrams of potassium daily, he was told he needed at least 10% more potassium than was recommended by nutritionists. To accrue this amount, Jake has decided to consume an extra potato and a cup of lima beans in his daily diet. If he consumes these extra items each day, how much more potassium will he consume than is recommended for his augmented need of this nutrient?

38. Joan consumes 22,400 milligrams of potassium each week. She has decided to add a serving of spinach and a glass of orange juice each day. If she maintains this addition to her daily diet, how many more milligrams of potassium will Joan need to reach the recommended milligrams per week?

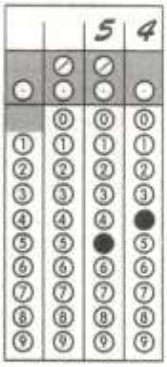
If there is still time remaining, you may review your answers.

ANSWER KEY
Practice Test 6

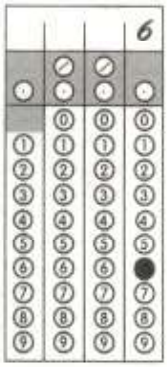
Section 3: Math (No Calculator)

1. **A**
2. **C**
3. **D**
4. **B**
5. **A**
6. **C**
7. **B**
8. **C**
9. **A**
10. **B**
11. **A**
12. **D**
13. **B**
14. **D**
15. **D**

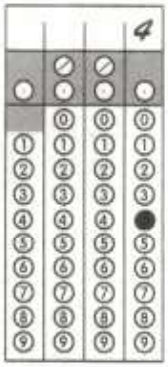
16. **54**



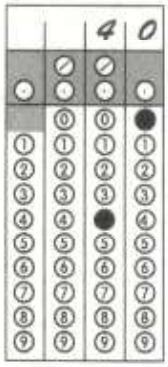
17. **6**



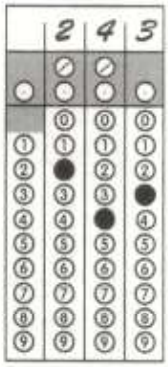
18. **4**



19. **40**



20. **243**



Number Correct _____

Number Incorrect _____

PRACTICE TEST 6

ANSWER KEY
Practice Test 6

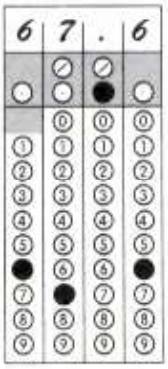
Section 4: Math (Calculator)

1. **D**	7. **A**	13. **B**	19. **B**	25. **B**
2. **C**	8. **C**	14. **C**	20. **D**	26. **D**
3. **B**	9. **C**	15. **B**	21. **D**	27. **B**
4. **A**	10. **C**	16. **C**	22. **B**	28. **A**
5. **C**	11. **A**	17. **B**	23. **C**	29. **D**
6. **B**	12. **A**	18. **C**	24. **B**	30. **A**

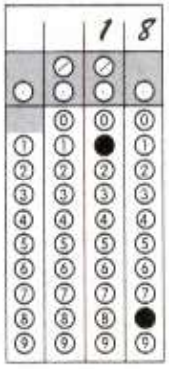
31. Answers may vary.

$600 \le x \le 900$

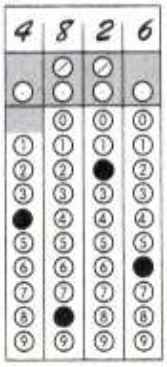
32. **67.6**



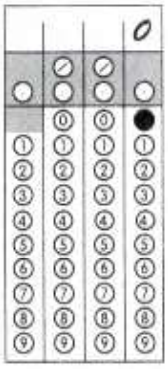
33. **18**



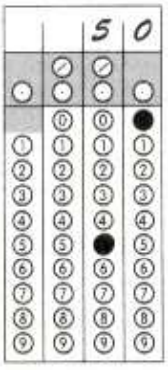
34. **4,826**



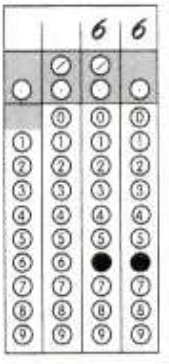
35. **0**



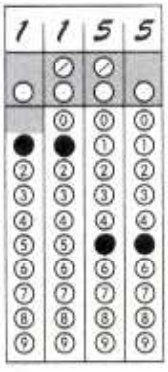
36. **50**



37. **66**



38. **1,155**



Number Correct _____

Number Incorrect _____

PRACTICE TEST 6

40. **(A)** This is the correct choice. It creates a clear and grammatical sentence in which the word "projecting" is a present participle and the first word of a participial phrase that modifies the noun "building."

41. **(D)** All of the other choices are not grammatical because they create run-on sentences. This choice creates a clear and grammatical sentence in which the conjunction "but" joins the dependent clause beginning with "which" to the preceding dependent clause. The word "but" is used here to signal a contrast with what was said earlier in the sentence about the actors.

42. **(B)** This is the best choice because it makes sense that the dresses were moved to "the cadence [beat] of the music."

43. **(C)** Choice (A) is a run-on sentence. Choice (D) makes little sense and is not grammatical. Choice (B) is grammatical and makes good sense. However, choice (C) is the better choice because it is more appropriate to use a semicolon than a colon after the word "audience" because the independent clause after the punctuation elaborates on the audience, not on *Nō* drama.

44. **(B)** Choices (A) and (B) can be used to describe sound, but choices (C) and (D) cannot be so used. A *crackle* is a sharper sound than a *rustle* and is not as appropriate as *rustle* in context because the sound of pages being turned is not sharp. A *rustle* is "a low crisp rubbing sound," which is an appropriate description of the pages being turned by the ladies.

Section 3: Math Test (No Calculator)

1. **(A)** Round 44% to 40% and 18% to 20%. Express both as decimals and multiply them by 250,000,000.

$$(.4)(.2)(250{,}000{,}000) = 20{,}000{,}000$$

Answer choice (A), 20 million, is closest to this figure.

2. **(C)** Solve for $2k$.

$$\frac{2k}{7} = 30$$
$$2k = 210$$
$$2k + 7 = 217$$

You do not have to solve for k in this problem.

3. **(D)** Parallel lines have the same slope. Since the slope of $y = \frac{5}{9}x + 7$ is $\frac{5}{9}$, then a line parallel to it will also have a slope that measures $\frac{5}{9}$. Perpendicular lines have slopes that are the opposite reciprocals of one another. Thus, a line perpendicular to a line with slope $\frac{5}{9}$ will have a slope of $-\frac{9}{5}$.

4. **(B)** Tina starts each month with 360 sinks to repair. As each week passes, Tina will have 88 fewer sinks to repair within the month.

5. **(A)** $(-4x^3y - xy^3 + 4x) - (7x - 4xy^3 + 2x^2)$
Combine like terms.

$$-xy^3 - (-4xy^3) = 3xy^3$$
$$4x - 7x = -3x$$

There are no other like terms so arrange the expression as shown in choice (A).

$$-4x^3y + 3xy^3 - 2x^2 - 3x$$

6. **(C)** Use the ratio $\frac{62.5 \text{ pounds}}{1 \text{ cubic foot}}$ to find the weight of a liquid that has a specific gravity of 3.

$$\frac{62.5}{1} = \frac{x}{3}$$
$$(3)(62.5) = x$$
$$187.5 = x$$

7. **(B)** Raise each side of the equation to the $\frac{2}{3}$ power to isolate a.

$$(a^{\frac{3}{2}})^{\frac{2}{3}} = 64^{\frac{2}{3}}$$
$$a = 16$$
$$\sqrt{16} = 4$$

8. **(C)** Note that when $x = -3$, $y = 0$. When a function intersects the x-axis in the xy-plane then $y = 0$; that x value is a root of the function. We therefore conclude that $x = -3$ is a root of the function and that $x + 3$ is a factor of the function.

9. **(A)** $\frac{m^{x^2}}{m^{y^2}} = m^{36}$
When dividing like terms, subtract the exponents.

$$m^{x^2 - y^2} = m^{36}$$

Drop the base, m, to get $x^2 - y^2 = 36$. Factor by using the difference of squares.

$$(x + y)(x - y) = 36$$

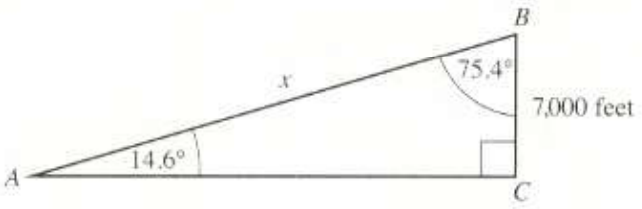
It was given in the question that $x + y = 9$, so $x - y$ must equal 4 because $9 \times 4 = 36$.

10. **(B)** After the first month of paying off his student loan, Sean's remaining balance looks like this.

$$p - .2p = .8p$$

Sean's loan balance after one month was $.8p$. He now must pay off 20% of the $.8p$ that remains as the loan balance.

$$.8p - (.2)(.8p) = .64p$$



11. **(A)** The descent of the airplane and its eventual landing point can be depicted in the figure above. Although the angle for his line of sight to the ground is 75.4°, none of the other answer choices uses that ratio correctly. Since a triangle measures 180°, we can also use $\angle A$, which measures 14.6°. From that perspective, we know BC is 7,000 feet, $\angle A$ measures 14.6°, and the flight trajectory is unknown. We know the measure of the angle and the opposite side and we want to know the measure of the hypotenuse. The sine is found by using the formula $\frac{\text{opposite side}}{\text{hypotenuse}}$, so we arrive at $\sin 14.6 = \frac{7000}{x}$.

12. **(D)** This problem can be solved using factoring or the quadratic equation.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a = 4 \quad b = -2 \quad c = -6$$

$$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(4)(-6)}}{2(4)}$$

$$\frac{2 \pm \sqrt{4 - (-96)}}{8}$$

$$\frac{2 \pm 10}{8}$$

$$\frac{3}{2}, -1$$

The sum of the roots, -1 and $\frac{3}{2}$ is $\frac{1}{2}$.

13. **(B)** The sum of the angles above and below the line are each 180°. Use that information to solve for both x and y.

$$3x = 180$$
$$x = 60$$
$$4y = 180$$
$$y = 45$$

Inputting 60 and 45 for x and y, respectively, yields $105 \div 30 = 3.5$.

14. **(D)** In order to rewrite $\frac{6-4i}{2+4i}$ in the form of $a + bi$, multiply the denominator and numerator by $2 - 4i$, the conjugate of $2 + 4i$.

$$\frac{6-4i}{2+4i} \times \frac{2-4i}{2-4i} = \frac{-4-32i}{20} = -\frac{1}{5} - \frac{8}{5}i$$

Using the general form of a complex number, $a + bi$, we find that $a = -\frac{1}{5}$ and $b = -\frac{8}{5}$.

Substituting those values for a and b, we get:

$$a - 2b = -\frac{1}{5} - (2)\left(-\frac{8}{5}\right) = 3$$

15. **(D)** The cost per mango can be found by dividing the cost of the mangoes, 185(in cents), by x, the number of mangoes. Therefore, each mango costs $\frac{185}{x}$. Multiply this value by 7 to find the cost of 7 mangoes.

$$\text{The cost of 7 mangoes is } 7\left(\frac{185}{x}\right)$$

Similarly, the cost of a single guava is found by dividing the cost in cents, 225, by y, the number of guavas. The cost of a single guava is $\frac{225}{y}$. Multiply this value by 9 to find the cost of 9 guavas.

$$\text{The cost of 9 guavas is } 9\left(\frac{225}{y}\right)$$

Add the costs of 7 mangoes and 9 guavas by adding the expressions we have created.

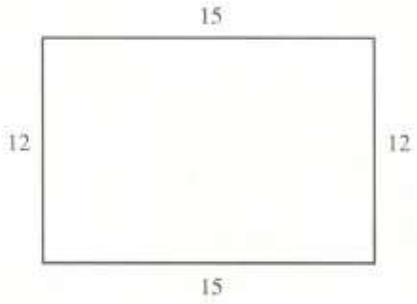
$$7\left(\frac{185}{x}\right) + 9\left(\frac{225}{y}\right)$$

16. **54** The molding, which surrounds the floor, is equal to the rectangle's perimeter. We are missing the length but we know the area and width. The area of a rectangle can be found by using the formula Area = length × width

Input the known information to solve for *"l."*

$$180 = l \times 12$$
$$15 = l$$

We now know the rectangular floor has the following dimensions:



We can use the formula Perimeter = $(2 \times l) + (2 \times w)$ to find the number of feet of molding Oscar needs to surround the floor:

$$(2 \times 15) + (2 + 12) = 54$$

Oscar needs 54 feet of molding to surround the floor of his study.

17. **6** Factor by grouping.

$$\begin{aligned} x^3 - 6x^2 + 2x - 12 &= 0 \\ (x^3 - 6x^2) + (2x - 12) &= 0 \\ x^2(x-6) + 2(x-6) &= 0 \\ (x^2+2)(x-6) &= 0 \\ x^2 + 2 = 0 \text{ or } x - 6 &= 0 \\ x = \pm i\sqrt{2} \text{ or } x &= 6 \end{aligned}$$

Of the three solutions, only 6 is a real solution to the equation.

18. **4** In order for a system of equations to have infinitely many solutions, the two equations must be some multiple of one another. Note that $64 = 8 \times 8$, so 2 must be eight times the value of m and 8 must be eight times the value of n. We conclude that m must equal $\frac{1}{4}$ and n must equal 1. Therefore, $\frac{n}{m} = \frac{1}{\frac{1}{4}} = 4$.

19. **40** If three parallel lines intersect two transversals, they divide the transversals proportionally. The lakefront length that is 27 feet corresponds to a dock length of 36. The lakefront length that is 30 feet should have a docking length that is proportional to the 27:36 ratio. Set up a proportion to find the docking length of the wider dock length. You will find it useful to simplify $\frac{27}{36}$ to $\frac{3}{4}$.

$$\begin{aligned} \frac{3}{4} &= \frac{30}{x} \\ 3x &= 120 \\ x &= 40 \end{aligned}$$

20. **243** Use $f(x) = 2x + 3$ and $f(2x + 3)$ together to find the value of x. Since $f(x) = 2x + 3$, then $f(2x + 3)$ must equal $2(2x + 3) + 3$. Set that expression equal to $5x$ and solve for x.

$$\begin{aligned} 2(2x + 3) + 3 &= 5x \\ 4x + 6 + 3 &= 5x \\ 9 &= x \end{aligned}$$

Substitute 9 for x in $3x^2$.

$$3(9^2) = 243$$

Section 4: Math Test (Calculator)

1. **(D)** If Andrea worked a four-hour shift and conducted 2 classes, the pay would be $40 + 2(8) = \$56$. In other words, she earns her base pay of \$40 and \$8 for each group activity she leads. Therefore, a general expression that represents her pay package is $40 + 8n$, where n represents the number of extra activities performed.

2. **(C)** Gina has \$240 saved so that sum will be part of the answer. Each month, for m months, she will save \$125. Therefore, she will save an additional $\$125m$ after m months. Adding the initial savings and the monthly accumulation of money, we arrive at $240 + 125m$ as the amount saved after m months.

3. **(B)** Find the total number of juice containers by multiplying 5 by 12.

$$5 \times 12 = 60$$

There were 3 main groups of juice containers, so divide 60 by 3 to find how many containers are in each group.

$$60 \div 3 = 20$$

Finally, divide 20 by 5 to find how many containers are in each of the smaller groups.

$$20 \div 5 = 4$$

4. **(A)** The survey size of 80 is sizeable enough to draw conclusions about the class in general. Since 15.6% of the surveyed students felt that additional crosswalks were necessary, that fraction of the entire class will probably feel the same way.

Find 15.6% of 320.

$$320\ (.156) = 49.92$$

Round the answer to 50 students that can be expected to favor additional crosswalks.

5. **(C)** The formula for the density of an object is presented as density $= \frac{\text{mass}}{\text{volume}}$. Input 4 grams per milliliter for the density and 30 grams for mass to find the volume.

$$4 = \frac{30}{V}$$

Multiply both sides of the equation by V.

$$V(4 = \frac{30}{V})V$$
$$4V = 30$$
$$V = 7.5$$

6. **(B)** Since Virginia worked fewer hours than Chad, let her hours be represented by x. Chad worked three more hours than did Virginia, so let his hours be represented by $x + 3$. Their total community service hours were 47, leading to the following equation:

$$x + (x + 3) = 47$$
$$2x + 3 = 47$$
$$2x = 44$$
$$x = 22$$
$$x + 3 = 25$$

Chad provided 25 hours of community service this week for his high school graduation requirement.

7. **(A)** The number of pasta dinners, p, cannot exceed 9 dishes (but could be 0), so use $0 \le p \le 9$ as the first constraint. The number of chicken dinners must be at least 18 (or greater) so use $c \ge 18$. Together, regardless of the quantity of pasta dinners and chicken dinners, the cost cannot exceed \$300, so use $3p + 4c \le 300$ as the constraint. Choice (B) can be eliminated at once; it has the correct quantities of pasta and chicken dinners but each constraint can only feature $\ge$ or $\le$.

8. **(C)** Multiply the two parentheses using the FOIL method.

$$(4-3i)(6+5i) =$$
$$24+20i-18i-15i^2 =$$
$$24+2i-15i^2 =$$
$$24+2i+15 = 39+2i$$

Using the form of a complex number, $a+bi$, 2 is b.

9. **(C)** A linear function can be expressed in the form of $y = mx + b$, where m is the slope of the line and b is the y-intercept. Given that $f(4) = -14$ and $f(-3) = 14$, we know that $(4, -14)$ and $(-3, 14)$ are points on this line. Find the equation of the line connecting $(4, -14)$ and $(-3, 14)$ by first finding the slope.

$$\frac{14-(-14)}{-3-4} = -4$$

The formula for the line is $y = -4x + b$. Find b by substituting either point for x and y.

$$-14 = -4(4) + b$$
$$2 = b$$

The formula for the line connecting $(4, -14)$ and $(-3, 14)$ is $y = -4x + 2$. Substitute 7 for x to find $f(7)$.

$$y = -(4)(7) + 2 = -26$$
$$f(7) = -26$$

10. **(C)** Note the sunrise times on 7/23 and 7/24.

Jul 23	5:57 AM	7:53 PM	13:56:54	−1:14
Jul 24	5:57 AM	7:53 PM	13:55:37	−1:17

The sun rose at the same recorded minute, 5:57, each day. The statement that the sun rose later each day is erroneous. The other statements can be proven to be correct.

11. **(A)** Each day, the sun generally rose later and set earlier, causing a total reduction of the number of hours of daylight during the week of 7/21. The "Difference" category records how much shorter the recorded hours of time there were (in minutes and seconds) when the sun was above the opposite horizons. Both the later sunrise and earlier sunset contributed to this reduction.

12. **(A)** The line of best fit predicted 40 meteors viewed per minute, but the actual number viewed was 45. Therefore the line of best fit predicted 5 fewer meteors than actually were viewed.

13. **(B)** Use the proportion $\frac{\text{length}}{\text{diagonal}} = \frac{\text{length}}{\text{diagonal}}$ to calculate the apparent length of the truck on the television with a 44" diagonal.

$$\frac{11}{32} = \frac{x}{44}$$
$$(11)(44) = 32x$$
$$484 = 32x$$
$$15.13 = x$$

Rounded to the nearest inch, the truck would appear to be 15" long on the television with the 44" diagonal.

14. **(C)** Use the formula for the volume of a cylinder to calculate the radius of the cylinder.

$$\pi r^2 h = 327$$
$$\pi r^2 (6) = 327$$
$$r^2 = 17.3$$
$$r = 4.2$$

The circumference of either of the cylinders' bases is also the length of the rectangular portion of the net.

$$C = 2\pi r$$
$$C = (2)(4.2)(\pi) = 26.4$$

Multiply the height of the rectangle by its width.

$$26.4 \times 6 = 158.4$$

Choice (C), 157, is the closest to this answer.

15. **(B)** Although the graphs appear to have the same absorption rate over the first 100 seconds, note the scales on the vertical axis. Enzyme Y begins at about 1% absorption and progresses to approximately 11% at the 100 second mark, a difference of 10%. Although it is not clear what the beginning absorption rate is of enzyme Y, it is less than 10%. By the 100th second, the absorption rate of enzyme Y had increased to approximately 41%, a difference of at least 31%. Thus the two rates of absorption had not been about the same at the 100 second mark as suggested by choice (B). The absorption rates of at least 31% and 10% are not the same.

16. **(C)** Systems of equations have no solution if they are the equations of parallel lines. Although these equations can be graphed, it is much simpler to note the scale factor between the two equations. If the coefficients of x and y are multiples of one another, but the constants are not, the system has no solution.

$$5x + 13y = 17$$
$$bx + 54.6y = 37$$

Divide the coefficients of y.

$$54.6 \div 13 = 4.2$$

The value of b is $4.2 \times 5 = 21$.
Double-check to ensure the constants are not of the same scale factor.

$$37 \div 17 \neq 4.2$$

17. **(B)** The minimum value of $g(x)$ occurs at (1, 0) on the graph. The value of x, then, that yields the minimum value of $g(x)$ is 1.

18. **(C)** The banners are sold in the same sequence of repeating colors:

Red Yellow Blue Green Orange Purple

There are 6 banners in each sequence, so divide 59 by 6 the same way you did in 4th grade.

$$59 \div 6 = 9 \text{ remainder } 5$$

The quotient is not important but the remainder is. The quotient suggests that we have completed 9 full sequences, and we are now 5 deep into the 10th sequence of colors. Count 5 banners into the series to arrive at orange as the 59th banner.

19. **(B)** Although a plug and check strategy is possible for this problem, using a system of equations is easier.

Let x = tacos sold
Let y = enchiladas sold

There were 54 items sold so the first equation is $x + y = 54$. Tacos cost \$2.00 and enchiladas cost \$4.50 and the revenue generated was \$198.00, giving us $2x + 4.5y = 198$.

Use either elimination or substitution to proceed.

$$x + y = 54 \text{ so } y = 54 - x.$$

Substitute $54 - x$ for y in the equation $2x + 4.5y = 198$.

$$\begin{aligned} 2x + 4.5(54 - x) &= 198 \\ 2x + 243 - 4.5x &= 198 \\ -2.5x &= -45 \\ x &= 18 \end{aligned}$$

Substitute 18 into $y = 54 - x$ to find the number of enchiladas sold.

$$y = 54 - 18 = 36$$

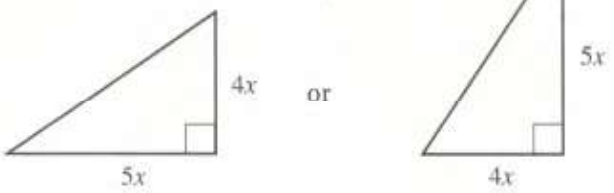
20. **(D)** The graphing form of a circle is $y = (x - h)^2 + (y - k)^2 = r^2$, where (h, k) is the center of the circle and r is the radius. Convert the equation to graphing form by completing the square.

$$\begin{aligned} x^2 + y^2 + 6x - 8y &= 12 \\ x^2 + 6x + 9 + y^2 - 8y + 16 &= 12 + 9 + 16 \\ (x + 3)^2 + (y - 4)^2 &= 37 \end{aligned}$$

The radius squared is 37, so find its square root to calculate the length of the radius.

$$\begin{aligned} r^2 &= 37 \\ r &= \sqrt{37} \end{aligned}$$

21. **(D)** Since the tangent of the acute angle is 0.8, we could also express that ratio as $\frac{4}{5}$.



Regardless of which acute angle is used, the calculation of the area will be the same: Either the base is a multiple of 5 and the height is a multiple of 4, or the height is a multiple of 5 and the base is a multiple of 4. If the height, for example, is 28 (4 × 7), then the base would have to be 35 (5 × 7). Place 28 and 35 into the area formula for a triangle.

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

$$A = \frac{1}{2}(28)(35)$$

$$A = 490$$

None of the other answers are the product of heights and bases that are in the ratio of 4 to 5. An alternate way to solve this problem is to experiment solving for area with numbers where heights and bases are in the ratio of 4 to 5 or 5 to 4. Every answer will be a multiple of 10. Only choice (D) is a multiple of 10.

22. **(B)** If $x + 2$ is a factor of $C(x) = x^3 + 5x^2 + 5x - 2$, the remainder, after dividing, is 0.

$$x+2\overline{)x^3+5x^2+5x-2}\quad x^2+3x-1$$

Since there is no remainder, we know that $x + 2$ is factor of $C(x) = x^3 + 5x^2 + 5x - 2$.

An alternate method to answering this question is to substitute –2 for x and assess the results.

$$(-2)^3 + 5(-2)^2 + 5(-2) - 2 = 0$$

The result is 0, which indicates –2 is a root of the function and $x + 2$ is a factor.

23. **(C)** Let x = the number of $1 discounts to maximize revenue. $24 - x$ = the reduced price of the basketballs.

$1{,}000 + 100x$ = the number of basketballs sold after x $1 discounts.

Multiply $(24 - x)$ by $(1{,}000 + 100x)$ to find the equation that predicts maximum revenue.

$$(24 - x)(1{,}000 + 100x) = -100x^2 + 1400x + 24{,}000$$

The number of $1 discounts is found by using the axis of symmetry formula to find the x-coordinate of the vertex of the function.

$$-\frac{b}{2a} = -\frac{1400}{-200} = 7$$

The manufacturer must make seven, $1 discounts to maximize revenue. Therefore, the cost needed to maximize revenue is $17.

24. **(B)** Let x = the population of type B peaches at the 30-day mark.

Type A peaches had reached a total of 5,200, which is 30% greater than the total for peach type (B). Therefore, the number of type A peaches with respect to type B is $1.3x$. Set $1.3x$ equal to 5,200 to find how many of type B peaches exist at the 30-day mark.

$$1.3x = 5{,}200$$
$$x = 4{,}000$$

25. **(B)** The initial city expenditure was $1,500,000 yet this amount decreased by 6.8% per year. To calculate the continuous decay of the budgeted amount provided by the city, subtract .068 from 1.0 to see what portion of the last year's budget will be provided this year.

$$1.0 - .068 = .932$$

The exponent t in this case will refer to time in years.

Only choice (B) appears to show moderate decay in the budget. The other answers are too small or too large; choice (D) would offer alternating negative and positive values.

26. **(D)** Although funding for the theater group started out at $1.5 million, we only know the balance on 1/1/2000, which was $975,000. The question asks what the balance will be on 1/1/04 so we can assess the financial contribution of the neighboring city. Use the model you derived correctly from question 25, but remember to start with $975,000.

$$975{,}000(.932)^4 = 735{,}644$$

The city would have $735,644 in its budget so subtract that figure from $1.2 million to find the contribution needed from the nearby community.

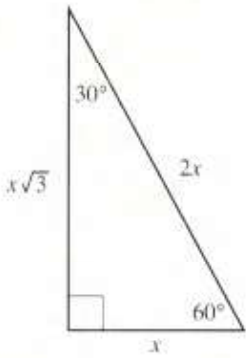
$$1{,}200{,}000 - 735{,}644 = 464{,}356$$

The nearby community would need to contribute $464,356 during its first year of the merger.

27. **(B)** A regular hexagon can be divided into six equilateral triangles. Divide $324\sqrt{3}$ by 6 to find the area of one of the equilateral triangles.

$$324\sqrt{3} \div 6 = 54\sqrt{3}$$

An equilateral triangle can be divided into two 30-60-90 triangles.



Multiply the base, x, by the height, $x\sqrt{3}$, and $\frac{1}{2}$ and set that product equal to $27\sqrt{3}$, which is one-half of $54\sqrt{3}$.

$$\left(\frac{1}{2}\right)(x)(x\sqrt{3}) = 27\sqrt{3}$$

$$\frac{1}{2}x^2 = 27$$

$$x^2 = 54$$

$$x = 3\sqrt{6}$$

Multiply $3\sqrt{6}$ by 2 to find one side of the hexagon.

$$3\sqrt{6} \times 2 = 6\sqrt{6}$$

The side length of the hexagon is also the side length of the square. Square $6\sqrt{6}$ to calculate the area of the square.

$$(6\sqrt{6})^2 = 216$$

28. **(A)** Combine like terms and solve for m and n.

$$3x + m = 5x - 6 \text{ becomes } m = 2x - 6$$
$$3y + n = 5y - 6 \text{ becomes } n = 2y - 6$$

Substitute $\left(n + \frac{1}{2}\right)$ for m as provided in the problem.

$$n + \frac{1}{2} = 2x - 6, \text{ so } n = 2x - \frac{13}{2}$$

$$n = 2y - 6 \text{ and } n = 2x - \frac{13}{2}, \text{ so } 2y - 6 = 2x - \frac{13}{2}$$

Solve for x because all of the answer choices express x as a function of y.

$$2y - 6 = 2x - \frac{13}{2}$$

$$2y + \frac{1}{2} = 2x$$

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

29. **(D)** Use the distance formula to find the missing coordinates of x.

$$\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$\sqrt{(x_1 - 7)^2 + (4 - 5)^2} = 8$$

$$(x_1 - 7)^2 + 1 = 64$$

$$(x_1 - 7)^2 = 63$$

$$x - 7 = \pm\sqrt{63}$$

$$x = 7 \pm 3\sqrt{7}$$

30. **(A)** If $f(x) = n$, then $y = n$. This provides us with the following system of equations.

$$y = x^{3b} - x^{2b} - x + 3$$
$$y = 3$$

In order for a system of equations to have three real solutions, the intersection of their graphs should occur three times. Draw the horizontal line $y = 3$ and note that there are three distinct points of intersection. Thus, when $f(x) = n$, n must be 3.

31. **Answers may vary. $600 \le x \le 900$**
There are a minimum of 100 seats in a section and a maximum of 150. Thus for the six sections in the auditorium we find the following minimum and maximum number of seats.

$$6 \times 100 = 600$$
$$6 \times 150 = 900$$

Thus, the number of students in the class is modeled by $600 \le x \le 900$.

32. **67.6** A woman age 35 has a Target HR Zone of 93 to 157 beats per minute. Find the mean of that range by adding 93 + 157 and dividing by 2.

$$93 + 157 = 250$$
$$250 \div 2 = 125$$

Find the percent that 125 is of 185 by dividing 125 by 185.

$$125 \div 185 = .6757$$

Rounded to the nearest tenth of a percent, .6757 is 67.6%.

A heart rate of 125 is 67.6% of the maximum heart rate.

33. **18** The volume of a cylinder is found by using the formula Volume $= \pi r^2 h$, where r is the radius and h is the height. Use simple numbers to verify the ratio.

Let $r = 1$ and $h = 1$ for the measures of the smaller cylinder.

$$\text{Volume} = \pi(1)^2(1) = \pi$$

Doubling the measure of the height gives $h = 2$. Tripling the measure of the radius gives $r = 3$.

$$\text{Volume} = \pi(3)^2(2) = 18\pi$$

The larger cylinder has a volume 18 times greater than the smaller.

34. **4,826** The expression ". . . at the same rate . . ." implies a linear model is used to solve this problem. When Katie's odometer reads 4,667 she has $\frac{7}{8}$ of a tank of gasoline. When her odometer reads 4,754 miles, she has $\frac{1}{2}$ of the tank left. Use the points $\left(4{,}667, \frac{7}{8}\right)$ and $\left(4{,}754, \frac{1}{2}\right)$ to determine the linear model.

$$\frac{\frac{1}{2} - \frac{7}{8}}{4754 - 4667} \approx -.0043$$
$$y = -.0043x + b$$

Substitute either of the points to solve for b.

$$\frac{1}{2} = -.0043(4754) + b$$
$$20.94 = b$$
$$y = -.0043x + 20.94$$

Substitute $\frac{3}{16}$ for y to calculate the number of miles that Katie traveled from the point her gas tank was $\frac{7}{8}$ full until she had only $\frac{3}{16}$ of a tank.

$$\frac{3}{16} = -.0043x + 20.94$$
$$-20.75 = -.0043x$$
$$4{,}826.16 = x$$

To the nearest mile, Katie's odometer read 4,826 miles when her tank was $\frac{3}{16}$ full.

35. **0**

$$f(x) = \frac{1}{(x-3)^2 + 6(x-3) + 9}$$

Division by 0 is undefined so set the denominator of the function f equal to 0.

$$(x-3)^2 + 6(x-3) + 9 = 0$$
$$x^2 - 6x + 9 + 6x - 18 + 9 = 0$$
$$x^2 = 0$$
$$x = 0$$

When $x = 0$, the function f is undefined.

36. **50** The supermarket chain manager wants to earn an 80% customer service rating from its first 20 customer service surveys. Multiply 20 by 80 to get 1,600, the total number of percentage points to be amassed. We found that the first 10 reviews yielded an average score of 65% or $10 \times 65 = 650$ percentage points. Subtracting 650 from 1,600 we get 950, the total number of percentage points to be amassed to earn the overall 80% rating. The question asks what could be the lowest the 17th survey could earn and still achieve the goal of 80% customer satisfaction from the first 20 surveys. Suppose all of the surveys from 11 through 16 and 18 through 20 gave the chain a score of 100%. That would mean those 9 customers added 900 points to the total. Given that we need 950 points from the final 10 customers, the 17th survey could score the chain as low as 50% and the chain would still receive an 80% average from the first 20 surveys.

37. **66** Although the suggested consumption of potassium for men is 4,700 milligrams, Jake's daily running indicates he needs an additional 10% above the norm. Multiply 4,700 by 1.1 to find the potassium requirement for Jake because of his running.

$$4{,}700 \times 1.1 = 5{,}170$$

Jake consumes 3,200 milligrams currently so he needs an additional 1,970 milligrams. By adding an extra potato and a cup of lima beans, he will add 1,081 + 955 = 2,036 milligrams of potassium. Since he needs 1,970 milligrams, the addition of these new foods will provide 66 milligrams more than is necessary.

38. **1,155** Find Joan's daily consumption of potassium by dividing 22,400 by 7.

$$22{,}400 \div 7 = 3{,}200$$

If Joan adds a cup of spinach (839 mg) and a glass of orange juice (496 mg), she will be consuming a total of 4,535 milligrams of potassium per day. Subtracting 4,535 from 4,700 (the recommended amount), we arrive at a daily deficiency of 165 milligrams per day. Multiplying 165 by 7, we find that Joan needs an additional 1,155 milligrams of potassium in her diet each week.