

SECTION 3: MATH TEST—NO CALCULATOR 

20 Questions • 25 minutes


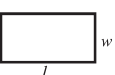
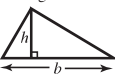


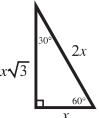
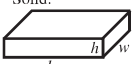

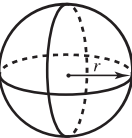
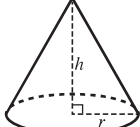
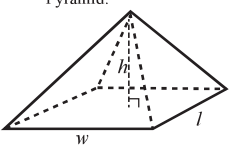
TURN TO SECTION 3 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

Directions: For Questions 1–15, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 16 will provide information on how to enter your answers in the grid.

ADDITIONAL INFORMATION:

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

Reference Information

<p>Circle:</p>  <p>$C = 2\pi r$ $A = \pi r^2$</p>	<p>Rectangle:</p>  <p>$A = lw$</p>	<p>Triangle:</p>  <p>$A = \frac{1}{2}bh$</p>  <p>$a^2 + b^2 = c^2$</p>  		
<p>Rectangular Solid:</p>  <p>$V = lwh$</p>	<p>Cylinder:</p>  <p>$V = \pi r^2 h$</p>	<p>Sphere:</p>  <p>$V = \frac{4}{3}\pi r^3$</p>	<p>Cone:</p>  <p>$V = \frac{1}{3}\pi r^2 h$</p>	<p>Rectangular Based Pyramid:</p>  <p>$V = \frac{1}{3}lwh$</p>

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

1 One angle of a triangle measures 82° . The other two angles have a ratio of 2:5. Find the number of degrees in the smallest angle of the triangle.

- (A) 14
- (B) 28
- (C) 38
- (D) 82

2 $(\sqrt{18} - \sqrt{8})^2 =$

- (A) 1
- (B) $\sqrt{2}$
- (C) 2
- (D) 10

practice test



- 3 If $f(x) = x^2 + 2$ and $g(x) = x - 1$, which expression represents $f(g(a))$?

(A) $a^2 + 1$
 (B) $a^2 - 2$
 (C) $a^2 + 2a - 3$
 (D) $a^2 - 2a + 3$

- 4 Which expression is equivalent to $(2x - y)(x - y) - xy$?

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

- 5 Simplify:

$$\frac{x^2 - y^2}{x - y}$$

(A) $\frac{xy}{x + y}$

(B) $\frac{x + y}{xy}$

(C) $x + y$

(D) xy

- 6 Which of the following complex numbers is equivalent to $(3 - i)(8 + 4i)$?

(A) $20 - (-4i)$
 (B) $20 + 4i$
 (C) $24 - 4i$
 (D) $28 + 4i$

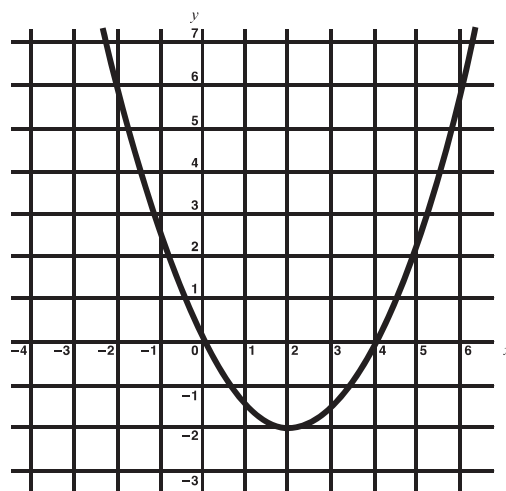
- 7 Which of these expressions is equivalent to $(x + y)^2 - (x - y)^2$?

(A) 0
 (B) $2y^2$
 (C) $4xy$
 (D) $4xy + 2y^2$

- 8 An economist studied the labor forces in several randomly selected states. He found the average minimum wage of these states was \$7.50, with a 95% confidence interval of ± 0.25 . How should the economist interpret the data?

(A) States that have a minimum wage below \$7.75 represent 95% of the states.
 (B) States that have a minimum wage above \$7.25 represent 95% of the states.
 (C) There is a 95% probability that a randomly selected state will have a minimum wage between \$7.25 and \$7.75.
 (D) There is a 95% probability that the actual average minimum wage of all states is between \$7.25 and \$7.75.

9



The curve shown on the xy -plane represents the function $f(x)$. Which of these equations represents the same function?

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



- 10 A 10% saline solution is to be mixed with a 40% saline solution to obtain 5 liters of a 20% saline solution. Which system of equations can be used to find the number of liters of the 10% solution, x , that will be needed to be combined with the number of liters of the 40% solution, y ?

(A) $0.1x + 0.4y = 1$
 $x + y = 5$

(B) $0.1x + 0.4y = 5$
 $x + y = 5$

(C) $0.1x + 0.4y = 1$
 $x + y = 1$

(D) $0.1x + 0.4y = 5$
 $x + y = 1$

- 11 The function $f(t) = -4.9t^2 + 40t + 4$ is used to model the height of a ball, in meters, above the ground t seconds after being thrown. Which statement accurately describes the meaning of the number 40 in this function?

- (A) The ball will achieve a maximum height of 40 meters.
(B) The ball will achieve its maximum height after 40 seconds.
(C) The ball was thrown upwards at a velocity of 40 meters per second.
(D) The ball was initially thrown from a height 40 meters above the ground.

12 $2x + 3y = 3$
 $x = 2 - 9y$

If (x, y) is the solution of the system of equations above, what is the value of y ?

(A) $-\frac{7}{15}$

(B) $\frac{1}{15}$

(C) $\frac{2}{9}$

(D) $\frac{3}{2}$

- 13 What is the equation of the line that is parallel to $y = 5x + 7$ and contains the point $(1, 3)$?

(A) $y = -5x + 8$

(B) $y = 5x - 2$

(C) $y = 5x + 3$

(D) $y = 5x + 2$

- 14 When Rafael parked his car in the city garage for 3 hours, the charge was \$5. When he parked his car for 5 hours, the charge was \$6.50. If the cost of parking a car in the city garage is a linear function of time in hours, which function represents the charge, y , to park for x hours?

(A) $y = \frac{5}{3}x$

(B) $y = 1.3x$

(C) $y = 3x + 5$

(D) $y = 0.75x + 2.75$

- 15 What is the solution of the equation $3(x - 9) = 4x + 3(1 - 2x)$?

(A) -4

(B) 6

(C) 12

(D) 30

practice test



16

How many degrees are in $\frac{4\pi}{5}$ radians?
(Do not grid in the degree symbol.)

19

What is the x -intercept of the graph of $y - 3 = 5(x - 2)$?

17

What is the solution of the equation $\frac{3}{2}x + 7 = 4x$?

20

Find a solution of $\sqrt{x+3} = x-3$.

18

What is a solution of $x^2 + 4 = 9x - x^2$?

practice test

STOP

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

SECTION 4: MATH TEST—CALCULATOR 

38 Questions • 55 minutes

TURN TO SECTION 4 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

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Reference Information

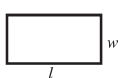
Circle:



$$C = 2\pi r$$

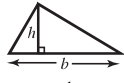
$$A = \pi r^2$$

Rectangle:

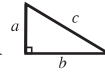


$$A = lw$$

Triangle:



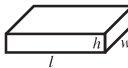
$$A = \frac{1}{2}bh$$



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



Rectangular Solid:



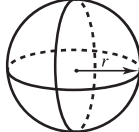
$$V = lwh$$

Cylinder:



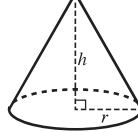
$$V = \pi r^2 h$$

Sphere:



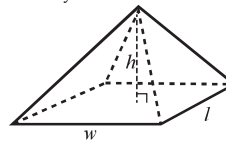
$$V = \frac{4}{3}\pi r^3$$

Cone:



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

Rectangular Based Pyramid:



$$V = \frac{1}{3}lwh$$

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

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

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

1 A salesperson earns twice as much in December as in each of the other months of a year. What part of this salesperson’s entire year’s earnings is earned in December?

- (A) $\frac{1}{7}$
- (B) $\frac{2}{13}$
- (C) $\frac{1}{6}$
- (D) $\frac{2}{11}$

2 Village A has a population of 6,800, which is decreasing at a rate of 120 per year. Village B has a population of 4,200, which is increasing at a rate of 80 per year. Which equation can be used to find the number of years, y , until the population of the two villages will be equal?

- (A) $6800 - 120y = 4200 + 80y$
- (B) $6800 + 120y = 4200 - 80y$
- (C) $6800 - 120y = 4200 - 80y$
- (D) $6800 + 120y = 4200 + 80y$

3

	Candidate A	Candidate B	Candidate C	Candidate D
Male	27	29	35	24
Female	24	49	45	17

The table above shows the results of a survey of a random sample of likely voters. What is the probability that a male voter who responded to the survey supports candidate C?

- (A) $\frac{7}{50}$
- (B) $\frac{7}{23}$
- (C) $\frac{7}{16}$
- (D) $\frac{7}{9}$



4 The formula for converting temperatures from degrees Fahrenheit to degrees Celsius is $C = \frac{5}{9}(F - 32)$.

Solve the formula for F .

- (A) $F = \frac{5}{9}(C + 32)$
- (B) $F = \frac{5}{9}(C - 32)$
- (C) $F = \frac{9}{5}C - 32$
- (D) $F = \frac{9}{5}C + 32$

5 A recent study showed that 15% of the salmon that pass through a turbine in hydroelectric dams are killed. If an initial population of 50,000 salmon must pass through n turbines, which function models the number of salmon that will survive?

- (A) $A(n) = 50,000 - 0.15n$
- (B) $A(n) = 50,000 - 0.85n$
- (C) $A(n) = 50,000 \times 0.15^n$
- (D) $A(n) = 50,000 \times 0.85^n$

6 The equation $f(x) = 1.5x + 15$ models the growth of a bamboo shoot, where x represents the number of days and $f(x)$ represents the height of the shoot in feet. Determine how many days it will take the bamboo shoot to reach a height of 19.5 feet.

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



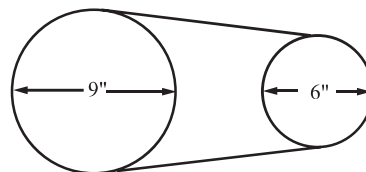
7 What part of the total quantity is represented by a 24-degree sector of a circle graph?

- (A) $6\frac{2}{3}\%$
- (B) 12%
- (C) $13\frac{1}{3}\%$
- (D) 15%

8 A high school principal wanted to estimate the mean of the grade point averages of students in her school. She randomly selected a group of students and found the mean grade point average to be 2.8 on a four-point scale, with a 95% confidence interval of ± 0.2 . How should the principal interpret the data?

- (A) Students with a grade point average below 3.0 make up 95% of the students in the school.
- (B) Students with a grade point average above 2.6 make up 95% of the students in the school.
- (C) There is a 95% probability that a randomly selected student will have a grade point average between 2.6 and 3.0.
- (D) There is a 95% probability that the actual mean grade point average of all students in the school is between 2.6 and 3.0.

9



A pulley having a 9-inch diameter is belted to a pulley having a 6-inch diameter, as shown in the figure. If the large pulley runs at 120 rpm, how fast does the small pulley run, in revolutions per minute?

- (A) 80
- (B) 100
- (C) 160
- (D) 180

10

$$y = x^2 - 7x + 10$$

$$x - y = 4$$

If (x, y) is a solution of the system of equations above, what is the value of y^2 ?

- (A) 2
- (B) $\frac{9}{2}$
- (C) $18 - 8\sqrt{2}$
- (D) 14

11

The water level of a swimming pool, 75 feet by 42 feet, is to be raised 4 inches. How many gallons of water must be added to accomplish this? (7.48 gal. = 1 cubic ft.)

- (A) 1,684
- (B) 7,854
- (C) 12,600
- (D) 94,248

- 12 If $\frac{3}{7}$ of a bucket can be filled in 1 minute, how many minutes will it take to fill the rest of the bucket?

(A) $\frac{7}{3}$
(B) $\frac{4}{3}$
(C) $\frac{3}{4}$
(D) $\frac{4}{7}$

- 13 The distance from the center of a circle to a chord is 5. If the length of the chord is 24, what is the length of the radius of the circle?

(A) 5
(B) 10
(C) 13
(D) 26

- 14 A 40-pound bag of garden soil contains 0.8 cubic feet of soil. What is the weight, in pounds, of the garden soil needed to cover a 12-foot by 12-foot square garden to a depth of 3 inches?

(A) 1152
(B) 1800
(C) 4608
(D) 5760



- 15 The demand for a certain product can be defined by the function $y = 500 - 12x$, where y is the number of units of the product that can be sold at a price of x dollars. Which statement must be true?

(A) If the price of the product decreases by \$1, the number of units that can be sold decreases by 12.
(B) If the price of the product increases by \$12, the number of units that can be sold decreases by 1.
(C) The y -intercept of the graph of the function represents the units of the product that can be sold at a cost of \$1.
(D) The x -intercept of the graph of the function represents the price at which no units of the product will be sold.

- 16 $y = (x - 5)(x + 1)$

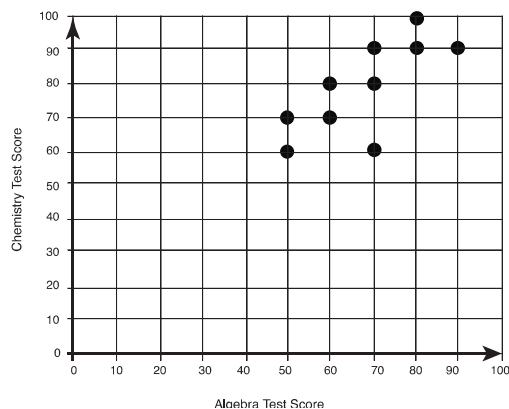
The equation above represents a parabola. Which of the following equivalent forms of the equation shows the coordinates of the vertex of the parabola as constants or coefficients?

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

practice test

QUESTIONS 17–19 REFER TO THE FOLLOWING GRAPH.

This scatterplot shows the scores for 10 students on their most recent Algebra and Chemistry tests.



17 What is the arithmetic mean of the students' algebra test scores?

- (A) 68
- (B) 70
- (C) 79
- (D) 80

18 A line of best fit of the data is given by $y = 0.76x + 27.6$, where x is a student's algebra test score, and y is a student's chemistry test score. Which interpretation is valid?

- (A) The average chemistry test score is 27.6 points higher than the average algebra test score.
- (B) The average algebra test score is 0.76 times the average chemistry test score.
- (C) Students with higher algebra test scores tended to have higher chemistry test scores.
- (D) There is not enough information to determine a relationship between the students' chemistry test scores and their algebra test scores.



19 Using the line of best fit, $y = 0.76x + 27.6$, what is the predicted algebra test score of a student with a chemistry test score of 70, rounded to the nearest whole number?

- (A) 50
- (B) 56
- (C) 77
- (D) 81

20 The velocity of an object dropped from a tower is given by the function $v(t) = -9.8t$, where t is the number of seconds after the object was dropped and $v(t)$ is given in meters per second. If the object hits the ground and stops moving after 4 seconds, which inequality shows the possible values of $v(t)$?

- (A) $-39.2 \leq v(t) \leq 0$
- (B) $-2.45 \leq v(t) \leq 0$
- (C) $0 \leq v(t) \leq 2.45$
- (D) $0 \leq v(t) \leq 39.2$

21 To predict the results of an election for city council, a polling company surveyed 200 randomly selected likely voters within the city. Of those surveyed, 80 planned to vote for candidate A. The polling company reported a margin of error of 3.5%. What is a reasonable estimate of the percentage of likely voters who support candidate A?

- (A) Between 36.5% and 43.5%
- (B) Between 46.5% and 53.5%
- (C) Between 56.5% and 63.5%
- (D) Between 76.5% and 83.5%

- 22 Corporate Average Fuel Economy sets targets for fuel economy for cars and light trucks. The target for the year 2020 is 42 miles per gallon, and for 2025, it is 54.5 miles per gallon. Which function can be used to estimate progress toward the goal y years after 2020 until 2025?

(A) $g(y) = 54.5 - 2.5y$
 (B) $g(y) = 42 - 2.5y$
 (C) $g(y) = 54.5 + 2.5y$
 (D) $g(y) = 42 + 2.5y$

- 23 A municipal light plant buys energy from windmill farms that have two sizes of windmills. Small windmills produce 1.45 megawatts of power, and large windmills produce 2.75 megawatts of power. Which inequality represents the number of small windmills, x , and large windmills, y , needed to supply the light plant with a total power supply of at least 200 megawatts?

(A) $2.75x + 1.45y \leq 200$
 (B) $1.45x + 2.75y \geq 200$
 (C) $2.75x + 1.45y \geq 200$
 (D) $1.45x + 2.75y \leq 200$

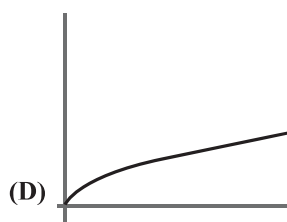
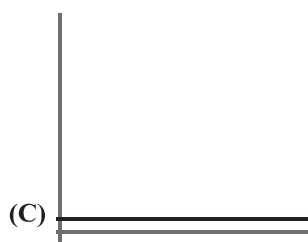
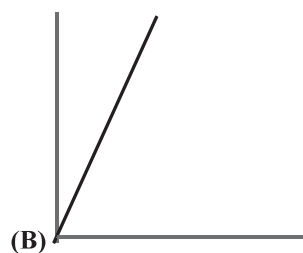
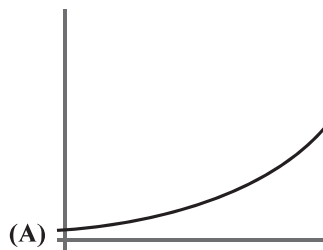
- 24 If x_1 and x_2 are the solutions of $x^2 - 4x = 3$, what is $|x_2 - x_1|$?

(A) 0
 (B) 2
 (C) 4
 (D) $2\sqrt{7}$

- 25 A group of 18 coins has a total value of \$3.10. If the coins consist only of quarters and nickels, how many more quarters are there than nickels?

(A) 3
 (B) 4
 (C) 7
 (D) 11

- 26 Which graph would be drawn to represent an economy that is growing at a fixed percentage rate?



- 27 The graph of the line $2x + 3y = 15$ is drawn on the coordinate plane. What is the equation of the perpendicular line with the same y -intercept?

(A) $y = \frac{2}{3}x + \frac{15}{2}$
 (B) $y = -\frac{2}{3}x + \frac{15}{2}$
 (C) $y = \frac{3}{2}x + 5$
 (D) $y = -\frac{3}{2}x + 5$



28 $x + 3y < 1$
 $x + y > 1$

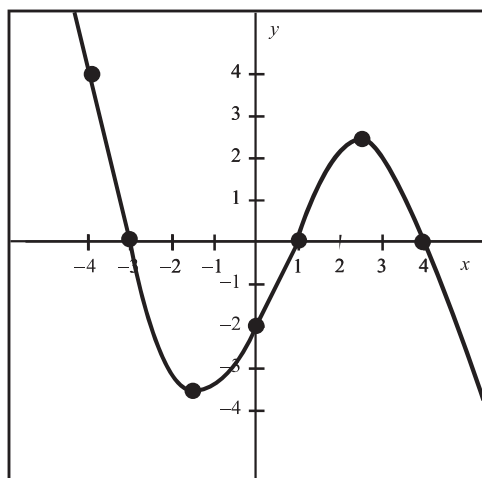
Which of these points is in the solution set of the system of inequalities above?

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

30 The points (-3, 2) and (3, 2) are the endpoints of a diameter of a circle. Which equation represents the circle?

- (A) $(x - 2)^2 + y^2 = 3$
- (B) $(x - 2)^2 + y^2 = 6$
- (C) $x^2 + (y - 2)^2 = 9$
- (D) $x^2 + (y - 2)^2 = 16$

29



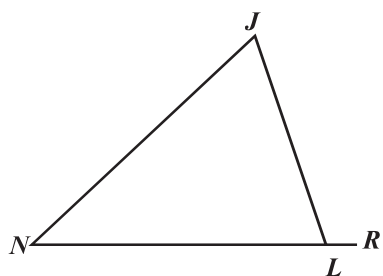
A polynomial function $p(x)$ is shown on the xy -coordinate plane. If $q(x)$ is a quadratic function, which of these equations can represent $p(x)$?

- (A) $p(x) = (x - 1)q(x)$
- (B) $p(x) = (x + 2)q(x)$
- (C) $p(x) = (x - 3)q(x)$
- (D) $p(x) = (x + 4)q(x)$



- 31 A local politician requested donations to pay for the cost of a radio ad. Twelve donors offered to split the cost equally, so they each paid \$75. If the politician was able to find 20 donors to equally split the same cost, how much would each pay?
- 33 Jessica caught five fish with an average weight of 10 pounds. If three of the fish weigh 9, 9, and 10 pounds, respectively, what is the average (arithmetic mean) weight of the other two fish?

32



In the figure above, $\angle N = (9x - 40)^\circ$, $\angle J = (4x + 30)^\circ$, and $\angle JLR = (8x + 40)^\circ$. What is the measure of $\angle J$? (Do not grid the degree symbol.)

- 34 In 2012, Algeria had a population of approximately 37.44 million. In 2013, the population had grown to 38.19 million. If the function $p(t) = a \cdot b^t$ is used to model the population in millions, $p(t)$, t years after 2012, what is the value of b ? Round your answer to the nearest hundredth.



- 35 Juliette runs 20 miles a week. She would like to increase her running distance by 10% each week. How many miles should Juliette run after 2 times of increasing her distance by 10%?

37 $3.6x + 2.4y = 12$
 $x - y = 2$

If (x, y) is a solution of the system of equations above, what is the value of y ?

- 36 For which value of a will the equation $5(x + 7) - ax = ax + 35$ have infinitely many solutions?

- 38 The function $f(x) = x^2 - 4$ is translated 3 units to the right to create function $g(x)$. What is the value of $g(9)$?

STOP

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

practice test



Section 3: Math Test—No Calculator

1. B

2. C

3. D

4. D

5. C

6. D

7. C

8. D

9. A

10. A

11. C

12. B

13. B

14. D

15. B

16. 144

17. $14/5$ or 2.818. 4 or $1/2$ 19. 1.4 or $7/5$

20. 6

MATH TEST—NO CALCULATOR RAW SCORE
(Number of correct answers)

1. **The correct answer is (B).** Let the other two angles be $2x$ and $5x$. Thus,

$$2x + 5x + 82 = 180$$

$$7x = 98$$

$$x = 14$$

$$2x = 28$$

$$5x = 70$$

The smallest angle = 28° .

2. **The correct answer is (C).**

$$(\sqrt{18} - \sqrt{8})^2 = (3\sqrt{2} - 2\sqrt{2})^2 = (\sqrt{2})^2 = 2$$

3. **The correct answer is (D).**

$$g(a) = a - 1$$

$$f(a - 1) = (a - 1)^2 + 2 = a^2 - 2a + 1 + 2$$

$$f(g(a)) = a^2 - 2a + 3$$

4. **The correct answer is (D).**

$$\begin{aligned} (2x - y)(x - y) - xy &= 2x^2 - 2xy - xy + y^2 - xy \\ &= 2x^2 - 4xy + y^2 \end{aligned}$$

5. **The correct answer is (C).** The numerator is the difference between perfect squares; $x^2 - y^2$ is equal to the product of $(x + y)$ and $(x - y)$.

$$\text{Therefore, } \frac{x^2 + y^2}{x - y} = \frac{(x + y)(x - y)}{x - y} = x + y$$

6. **The correct answer is (D).**

$$\begin{aligned} (3 - i)(8 + 4i) &= 24 + 12i - 8i - 4i^2 \\ &= 24 + 4i - (-4) \\ &= 28 + 4i \end{aligned}$$



7. **The correct answer is (C).**

$$\begin{aligned}(x+y)^2 - (x-y)^2 &= x^2 + 2xy + y^2 - (x^2 - 2xy + y^2) \\ &= x^2 + 2xy + y^2 - x^2 + 2xy - y^2 \\ &= 4xy\end{aligned}$$

8. **The correct answer is (D).** The confidence interval indicates the interval that the estimated population parameter is likely to fall within. A 95% confidence interval of ± 0.25 means that it can be said, with 95% confidence, that the average minimum wage of all states will fall \$0.25 above the average of the randomly selected states and \$0.25 below the average of the randomly selected states. The economist found the average of the randomly selected states to be \$7.50, so $\$7.50 + \$0.25 = \$7.75$, and $\$7.50 - \$0.25 = \$7.25$. Therefore, the average minimum wage of all states will be found within the range of \$7.25 and \$7.75, with 95% confidence.

9. **The correct answer is (A).** Since we know the roots of the quadratic function are 0 and 4, the equation must take the form $y = ax(x - 4)$. We can use the vertex, $(2, -2)$, to find the value of a :

$$-2 = a(2)(2 - 4) = -4a \rightarrow a = \frac{1}{2}$$

Substituting this value into the equation, we get:

$$\begin{aligned}y &= \frac{1}{2}x(x - 4) \\ &= \frac{1}{2}x^2 - 2x\end{aligned}$$

10. **The correct answer is (A).** The amount of the solutions x and y combined must equal 5 liters, so $x + y = 5$. The amount of salt in the two solutions, $0.1x$ and $0.4y$, must combine to equal the amount of salt in the total: $(0.2)(5) = 1$

11. **The correct answer is (C).** In the standard equation for ballistic motion,

$$y = \frac{1}{2}at^2 + bt + c,$$

the coefficient of the first-degree term is determined by the initial velocity. So the ball was thrown upwards at a velocity of 40 meters per second.

12. **The correct answer is (B).** Substitute the expression equivalent to x from the second equation into the first equation and solve:

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

$$4 - 18y + 3y = 3$$

$$4 - 15y = 3$$

$$-15y = -1$$

$$y = \frac{1}{15}$$

13. **The correct answer is (B).** The slope of the line $y = 5x + 7$ is 5, and a line parallel to this line would have the same slope. Therefore, the desired line is of the form $y = 5x + b$. Substitute $(1, 3)$ into this equation to compute the value of b :

$$3 = 5 \times 1 + b$$

$$-2 = b$$

Thus, the equation of the line is $y = 5x - 2$.



- 14. The correct answer is (D).** Find the equation of a line that passes through the points (3, 5) and (5, 6.5), by finding the slope, then substituting one of the ordered pairs in the slope-intercept form of an equation to find b .

$$m = \frac{6.5 - 5}{5 - 3} = 0.75$$

$$5 = 0.75(3) + b \rightarrow b = 5 - 0.75(3) = 2.75$$

$$y = 0.75x + 2.75$$

- 15. The correct answer is (B).**

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

$$3x - 27 = 4x + 3 - 6x$$

$$3x - 27 = -2x + 3$$

$$5x = 30$$

$$x = 6$$

- 16. The correct answer is 144.**

$$\frac{4\pi}{5} \times \frac{180}{\pi} = \frac{720}{5} = 144$$

- 17. The correct answer is 14/5 or 2.8**

$$\frac{3}{2}x + 7 = 4x$$

$$7 = 4x - \frac{3}{2}x$$

$$7 = \frac{5}{2}x$$

$$\frac{14}{5} = x$$

- 18. The correct answer is 4 or 1/2.** (Either is acceptable.)

$$x^2 + 4 = 9x - x^2$$

$$2x^2 - 9x + 4 = 0$$

$$(2x - 1)(x - 4) = 0$$

$$x = \frac{1}{2} \text{ or } x = 4$$

- 19. The correct answer is 1.4 or 7/5.**

To find the x -intercept, set y equal to 0 and solve for x :

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

$$-3 = 5x - 10$$

$$7 = 5x$$

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

- 20. The correct answer is 6.**

$$\sqrt{x+3} = x-3$$

$$(\sqrt{x+3})^2 = (x-3)^2$$

$$x+3 = x^2 - 6x + 9$$

$$0 = x^2 - 7x + 6$$

$$0 = (x-6)(x-1)$$

$$x = 6 \text{ or } x = 1$$

Because $\sqrt{1+3} = 2 \neq 1-3 = -2$, only $x = 6$ is an actual solution.



Section 4: Math Test—Calculator

1. B	9. D	17. A	25. B	33. 11
2. A	10. A	18. C	26. A	34. 1.02
3. B	11. B	19. B	27. C	35. 24.2
4. D	12. B	20. A	28. C	36. $5/2$ or 2.5
5. D	13. C	21. A	29. A	37. 0.8
6. C	14. B	22. D	30. C	38. 32
7. A	15. D	23. B	31. 45	
8. D	16. B	24. D	32. 70	

MATH TEST—CALCULATOR RAW SCORE
(Number of correct answers)

1. **The correct answer is (B).** Let x = amount earned each month. Since the salesperson earned twice as much in December as in every other month, $2x$ = amount earned in December. Then, the entire earnings are

$$11x + 2x = 13x. \quad \frac{2x}{13x} = \frac{2}{13}.$$

2. **The correct answer is (A).** Because the population of village A is decreasing by 120 per year, the population in year y will be $6800 - 120y$. Because the population of village B is increasing by 80 per year, the population in year y will be $4200 + 80y$. Set the two expressions equal to find when the populations will be the same:

$$6800 - 120y = 4200 + 80y.$$

3. **The correct answer is (B).** There are a total of $27 + 29 + 35 + 24 = 115$ males who responded to the survey. Of the 115 males, 35 supported candidate C:

$$\frac{35}{115} = \frac{7}{23}$$

4. **The correct answer is (D).**

$$C = \frac{5}{9}(F - 32)$$

$$\frac{9}{5}C = F - 32$$

$$\frac{9}{5}C + 32 = F$$

$$F = \frac{9}{5}C + 32$$

5. **The correct answer is (D).** Because this is a recursive percent decrease, an exponential model is appropriate. A model for exponential decay is $f(t) = a(1 - r)^t$, where a is the initial amount, and r is the decay rate. The initial amount is 50,000 and the decay rate is 0.15, so the appropriate model in this case is $A(n) = 50,000(1 - 0.15)^n = 50,000 \times 0.85^n$.
6. **The correct answer is (C).** Substitute 19.5 for $f(x)$ and solve the resulting equation for x :

$$19.5 = 1.5x + 15$$

$$4.5 = 1.5x$$

$$3 = x$$



7. **The correct answer is (A).** There are 360 degrees in a circle. A 24-degree sector is

$$\frac{24}{360} = 0.067, \text{ or about } 6\frac{2}{3}\% \text{ of a circle.}$$

8. **The correct answer is (D).** The confidence interval indicates the interval into which the estimated population parameter is likely to fall.

9. **The correct answer is (D).** This is an inverse proportion; that is:

$$\begin{aligned} \frac{9}{6} &= \frac{x}{120} \\ 6x &= 1080 \\ x &= 180 \end{aligned}$$

10. **The correct answer is (A).** Since $x - y = 4$, $y = x - 4$. Set the equations equal to each other. Then combine like terms and use the quadratic formula to solve for x . To solve for y , substitute the value for x into one of the given equations. The answer will be y^2 :

$$\begin{aligned} x - 4 &= x^2 - 7x + 10 \\ 0 &= x^2 - 8x + 14 \\ x &= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(14)}}{2(1)} = 4 \pm \sqrt{2} \\ y &= x - 4 = (4 \pm \sqrt{2}) - 4 = \pm\sqrt{2} \\ y^2 &= 2 \end{aligned}$$

11. **The correct answer is (B).** Four inches is

$$\begin{aligned} \frac{1}{3} \text{ ft. The volume of the added level is} \\ 75 \times 42 \times \frac{1}{3} &= 1050 \text{ cubic ft.} \end{aligned}$$

There are 7.48 gallons in 1 cubic ft., so $1050 \text{ cubic ft.} \times 7.48 \text{ gal./cubic ft.} = 7,854 \text{ gallons.}$

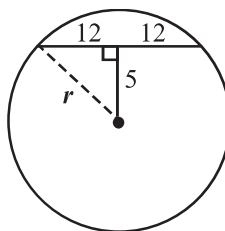
12. **The correct answer is (B).** Let x = number of minutes to fill

$$\frac{4}{7} \text{ of bucket. Then, } \frac{3}{1} = \frac{4}{x},$$

$$3x = 4$$

$$\text{or } \frac{3}{1} = \frac{4}{x} \quad x = \frac{4}{3}$$

13. **The correct answer is (C).**



A radius drawn perpendicular to a chord bisects the chord. Construct the radius as shown above.

$$\begin{aligned} 5^2 + 12^2 &= r^2 \\ 25 + 144 &= r^2 \\ 169 &= r^2 \\ 13 &= r \end{aligned}$$

14. **The correct answer is (B).** Three inches equal 0.25 feet. To cover the garden, we'll need $12 \text{ feet} \times 12 \text{ feet} \times 0.25 \text{ feet} = 36 \text{ cubic feet of garden soil.}$

$$\begin{aligned} \frac{x \text{ pounds}}{36 \text{ cubic feet}} &= \frac{40 \text{ pounds}}{0.8 \text{ cubic feet}} \\ x &= \frac{(40)(36)}{0.8} \\ x &= 1800 \end{aligned}$$

15. **The correct answer is (D).** The x -intercept occurs at the point where $y = 0$, or where no products will be sold.



16. **The correct answer is (B).** To find the equation that shows the vertex of the parabola, change from factored form to standard form, and then complete the square:

$$y = (x - 5)(x + 1)$$

$$y = x^2 - 4x - 5$$

$$y = x^2 - 4x + 4 - 5 - 4$$

$$y = (x - 2)^2 - 9$$

17. **The correct answer is (A).** The arithmetic mean of the algebra test scores is $50 + 50 + 60 + 60 + 70 + 70 + 70 + 80 + 80 + 90 = 680 \div 10 = 68$.

18. **The correct answer is (C).** The slope of the line of best fit is positive, indicating that the y -variable tends to increase as the x -variable increases.

19. **The correct answer is (B).** Set $y = 70$ and solve for x :

$$70 = 0.76x + 27.6$$

$$42.4 = 0.76x$$

$$x = \frac{42.4}{0.76} \approx 56$$

20. **The correct answer is (A).** At $t = 0$, the object is moving at $-9.8(0) = 0$ meters per second. At $t = 4$ seconds, the object is moving at a $-9.8(4) = -39.2$ meters per second. The velocity must be equal to or between these two extremes.

21. **The correct answer is (A).**

$$\frac{80}{200} = 40\%$$

$$40\% - 3.5\% = 36.5\%$$

$$40\% + 3.5\% = 43.5\%$$

22. **The correct answer is (D).** Since we are interpolating, we can use a linear model as the basis for the estimate. The rate of change is

$$\frac{54.5 - 42}{2025 - 2020} = 2.5. \text{ In 2020, the target is}$$

42, and the target increases by 2.5 each year.

23. **The correct answer is (B).** Multiply 1.45 by x and 2.75 by y . The total power supply must be at least 200, so the inequality is $1.45x + 2.75y \geq 200$.

24. **The correct answer is (D).** First, find the solutions:

$$x^2 - 4x = 3$$

$$x^2 - 4x + 4 = 7$$

$$(x - 2)^2 = 7$$

$$x - 2 = \pm\sqrt{7}$$

$$x = 2 \pm \sqrt{7}$$

Then, find the absolute value of the difference of the solutions:

$$\left| (2 + \sqrt{7}) - (2 - \sqrt{7}) \right| = 2\sqrt{7}$$

25. **The correct answer is (B).** Let n be the number of nickels and q be the number of quarters. Then, solve the resulting system of equations:

$$0.05n + 0.25q = 3.10$$

$$n + q = 18 \rightarrow q = 18 - n$$

$$0.05n + 0.25(18 - n) = 3.10$$

$$0.05n + 4.5 - 0.25n = 3.10$$

$$-0.2n = -1.4$$

$$n = 7$$

Since there are 7 nickels, there must be 11 quarters: $11 - 7 = 4$.



26. **The correct answer is (A).** Because the rate of growth is a fixed percentage, an exponential graph is appropriate.

27. **The correct answer is (C).** Put the equation into slope–intercept form to find the slope and intercept:

$$2x + 3y = 15$$

$$3y = -2x + 15$$

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

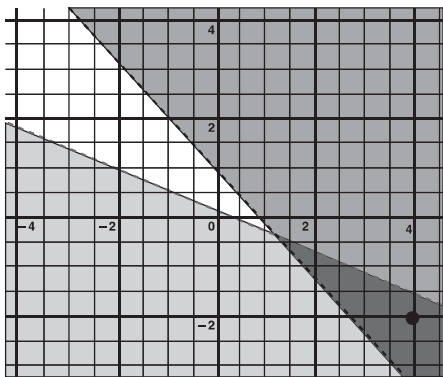
The perpendicular line will have the opposite reciprocal as its slope and the same y -intercept:

$$y = \frac{3}{2}x + 5$$

28. **The correct answer is (C).** Rewrite the inequalities as

$$y < \frac{1}{3}x + \frac{1}{3}$$

and $y > -x + 1$. Then, sketch the inequalities to observe that only $(4, -2)$, choice (C), is in the overlapping region.



29. **The correct answer is (A).** Since 1 is a 0 of the graph, $(x-1)$ is a factor of the polynomial.

30. **The correct answer is (C).** Since $(-3, 2)$ and $(3, 2)$ are the endpoints of a diameter of a circle, the center of the circle is at $(0, 2)$ and the radius of the circle is 3. The general form of the equation of a circle with center

(a, b) and radius r is $(x - a)^2 + (y - b)^2 = r^2$. Substituting the values for a , b , and r , we obtain $x^2 + (y - 2)^2 = 9$.

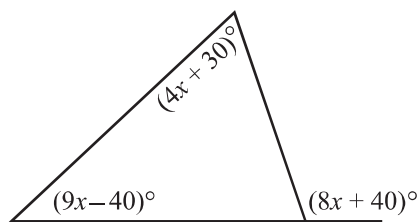
31. **The correct answer is 45.**

$$\frac{x}{12} = 75$$

$$x = 900$$

$$\frac{900}{20} = 45$$

32. **The correct answer is 70.**



An exterior angle of a triangle is equal to the sum of the two remote interior angles.

$$8x + 40 = (9x - 40) + (4x + 30)$$

$$8x + 40 = 13x - 10$$

$$5x = 50$$

$$x = 10$$

$$\angle J = (4x + 30)^\circ = (40 + 30)^\circ = 70^\circ$$

33. **The correct answer is 11.**

$$\frac{9 + 9 + 10 + x + y}{5} = 10$$

$$28 + x + y = 50$$

$$x + y = 22$$

The average of x and y is

$$\frac{x + y}{2} = \frac{22}{2} = 11$$

34. **The correct answer is 1.02.** Because this is an exponential growth model, divide the population in 2013 by the population in 2012 to find the value of b : $(38.19 \text{ million}) \div (37.44 \text{ million}) \approx 1.02$.



35. The correct answer is 24.2.

$$20 \times 1.1 = 22$$

$$22 \times 1.1 = 24.2$$

36. The correct answer is 5/2 or 2.5.

$$5(x + 7) - ax = ax + 35$$

$$5x + 35 - ax = ax + 35$$

$$5x - 2ax = 0$$

$$x(5 - 2a) = 0$$

This equation has solutions when $x = 0$ or for any value of x when

$$a = \frac{5}{2}$$

37. The correct answer is 0.8.

$$3.6x + 2.4y = 12$$

$$x - y = 2$$

Multiply the second equation by 3.6 and subtract it from the first equation. Then, solve for y :

$$3.6x + 2.4y = 12$$

$$\underline{3.6x - 3.6y = 7.2}$$

$$6y = 4.8$$

$$y = 0.8$$

38. The correct answer is 32. Since $g(x)$ is a translation of $f(x)$ 3 units to the right,

$$g(x) = f(x - 3): g(9) = f(9 - 3) = f(6) = 6^2 - 4 = 32.$$



Section 5: Essay

Analysis of Passage

The following is an analysis of the passage by Elizabeth Roberts-Pedersen, noting how the writer used evidence, reasoning, and stylistic or persuasive elements to support her claims, connect the claims and evidence, and add power to the ideas she expressed. Check to see if you evaluated the passage in a similar way.

Adapted from “From Shell Shock to PTSD: Proof of War’s Traumatic History” by Elizabeth Roberts-Pedersen, originally published by The Conversation on April 14, 2015. Elizabeth Roberts-Pedersen is a lecturer in history at the University of Western Sydney in Australia. (This passage was edited for length. To read the complete article, see <http://theconversation.com>.)

- | | |
|---|--|
| <p>1 2015 marks several important First World War anniversaries: the centenary of the first use of poison gas in January; the centenary of the Gallipoli landings and the Armenian genocide in April. It is also 100 years since <i>The Lancet</i> published Charles S. Myers’ article, “A Contribution to the Study of Shell Shock.”</p> <p>The study of shell shock</p> <p>2 Myers’ article is generally regarded as the first use of the term “shell shock” in medical literature. It was used as a descriptor for “three cases of loss of memory, vision, smell and taste” in British soldiers admitted to a military hospital in France.</p> <p>3 While Myers presented these cases as evidence of the spectacular concussive effects of artillery on the Western Front, British medical opinion soon came to regard these symptoms as psychological in origin.</p> | <p>1 <i>The writer provides a historical context to support her central idea: people have long known that war is psychologically traumatic.</i></p> <p>2 <i>The writer lays the groundwork for her argument by providing facts about and describing the symptoms of this trauma, which was initially called “shell shock.”</i></p> <p>3 <i>The writer supports her argument with facts that show that “shell shock,” which was at first used to describe symptoms caused by “concussive effects of artillery,” came to be seen as “psychological in origin.”</i></p> |
|---|--|



- 4 The men presenting to medical officers with tics, tremors, and palpitations, as well as more serious symptoms of “functional” blindness, paralysis, and loss of speech, were not concussed—but nor were they necessarily cowards or malingerers.
- 5 Instead, these were men simply worn down by the unprecedented stresses of trench warfare—in particular, the effort required to push out of one’s mind the prospect of joining the ranks of the maimed or the corpses lying in no man’s land
- 6 For contemporaries and later for historians, shell shock came to encapsulate all the horror of this new form of industrialized warfare. As historian Jay Winter suggests, it moved “from a diagnosis into a metaphor.”
- ...
- Developing a diagnosis**
- 7 It is tempting to view shell shock as the unambiguous turning point in psychiatry’s history, popularizing the idea that unconscious processes might produce symptoms that operate separately from moral qualities such as endurance and courage. However, scholarship over the last 15 years suggests that this position was far from widely accepted.
- 8 ... The notion that many patients had some “predisposing” weakness— independent of their combat experiences—persisted throughout the interwar period and into the Second World War.
- 4 *The writer strengthens her argument with facts that demonstrate those suffering from shell shock were suffering genuine psychological trauma, and were not, as often believed, cowards or people trying to avoid combat. The author’s examples of “functional” problems shows that even without physical damage, people can become deaf, mute, or paralyzed because of psychological damage.*
- 5 *The writer offers evidence that shows the psychological effects of combat.*
- 6 *The writer quotes a historian who views shell shock not only as devastating in itself, but as absolute confirmation of the horrors of war.*
- 7 *The writer makes the point that even though shell shock was being generally accepted as a legitimate condition, there was still resistance to the idea.*
- 8 *Continuing to trace resistance to the validity of shell shock, the writer cites one opposing argument. She also provides additional historical perspective, saying that resistance continued even into WWII.*



- 9 It wasn't until the Vietnam War that this formulation was reversed, which in turn bridged the gap between combatant syndromes and the civilian sphere.
- 10 This development is only comprehensible as part of a broader political context. The notion that the Vietnam War exacted a form of psychic damage on American soldiers was championed by the anti-war activists of Vietnam Veterans Against the War (VVAW) and psychiatrists Chaim Shatan and Robert Jay Lifton.
- 11 "Post-Vietnam syndrome," Shatan wrote, was caused by the "unconsummated grief" of a brutal and brutalizing war.
- 12 The VVAW's advocacy was instrumental in securing official recognition for this condition. It was included in 1980 in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III)* as "post-traumatic stress disorder."
- 13 PTSD's inclusion in *DSM-III* legitimated the suffering of Vietnam veterans and held out the possibility of subsidized medical care and compensation. But the *DSM-III* definition of PTSD was significant in two additional ways.
- First, it identified the disorder as a condition that could afflict soldiers and civilians alike—not a diagnosis exclusive to combat, like shell shock.
- Second, it focused attention on the continuing effects of a traumatic experience, rather than on the personality and constitution of the patient.
- 14 The ramifications of these changes have been immense. PTSD and a broader field of "traumatology" are now entrenched in psychiatric and popular discourse. In Australia, we now assume that warfare is objectively traumatizing, and that
- 9 *The writer completes this part of her argument, providing a specific time frame (the Vietnam War) for when shell shock was fully legitimized as a combat-related condition. She also identifies this period as a time when the concept of trauma-caused damage began to be extended to civilian experiences outside of military participation.*
- 10 *The writer provides historical, political, and social contexts for this acceptance.*
- 11 *The writer uses the evocative words brutal and brutalizing to communicate the particular horrors of the Vietnam War.*
- 12 *The writer provides facts and dates to show when "shell shock" was officially recognized as a legitimate condition and when it was renamed post-traumatic stress disorder (PTSD).*
- 13 *The writer explains why official recognition of PTSD was so important. She details how the shift in emphasis from the patient to the experience removed the stigma from those suffering from PTSD.*
- 14 *The writer cites benefits that sufferers of PTSD can now receive as a consequence of the improved attitude toward PTSD.*



governments ought to provide medical and financial support for affected service personnel, even if a recent Four Corners program confirmed that this is not always the case.

How is PTSD viewed today?

- 15 Though PTSD has its origins in opposition to the Vietnam War, the politics of the condition are now largely ambivalent, with its significance shifting according to circumstance.

This point is well illustrated by the film *American Sniper*, which demonstrates the possibility of two contrary positions. After his return to civilian life, SEAL sniper Chris Kyle (Bradley Cooper) is shown to be suffering from some characteristic after-effects of combat

...

The real Chris Kyle was shot dead by Eddie Ray Routh [another veteran], in 2013. At trial, the accused's lawyers pursued a defense of insanity, compounded by the inadequate care provided by veterans' mental health services. Routh was found guilty of Kyle's murder in March of 2015.

- 16 In the 100 years since Myers' article on shell shock, the psychological consequences of war remain as relevant as ever.

- 15 *The writer addresses the perception of PTSD today, citing two recent examples of former soldiers linked to PTSD.*

- 16 *The writer concludes her argument by juxtaposing these modern instances of PTSD with the article that introduced the term "shell shock," and restating her central idea: The psychological consequences of war are as relevant and deserving of attention today as they were 100 years ago. By referring to the 100 years since Myers' article on shell shock, the writer reinforces her central idea that she is offering "proof of war's traumatic history."*

SECTION 3: MATH TEST—NO CALCULATOR

20 Questions • 25 minutes


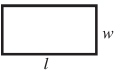
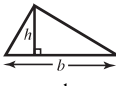

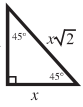
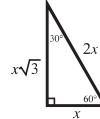
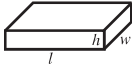

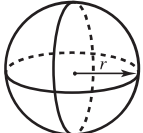
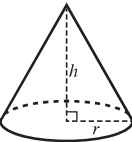
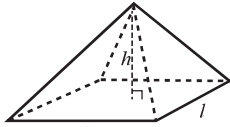
TURN TO SECTION 3 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

Directions: For Questions 1–15, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 16 will provide information on how to enter your answers in the grid.

ADDITIONAL INFORMATION:

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

Reference Information

<p>Circle:</p>  <p>$C = 2\pi r$ $A = \pi r^2$</p>	<p>Rectangle:</p>  <p>$A = lw$</p>	<p>Triangle:</p>  <p>$A = \frac{1}{2}bh$</p>	 <p>$a^2 + b^2 = c^2$</p>		
<p>Rectangular Solid:</p>  <p>$V = lwh$</p>	<p>Cylinder:</p>  <p>$V = \pi r^2 h$</p>	<p>Sphere:</p>  <p>$V = \frac{4}{3}\pi r^3$</p>	<p>Cone:</p>  <p>$V = \frac{1}{3}\pi r^2 h$</p>	<p>Rectangular Based Pyramid:</p>  <p>$V = \frac{1}{3}lwh$</p>	

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

1 Simplify the expression

$$(4x^2 - 5x + 8) - (3x^2 - 5 - 2x).$$

(A) $x^2 - 3x + 13$
(B) $x^2 - 3x + 3$
(C) $x^2 - 7x + 13$
(D) $x^2 - 7x + 3$

2 Which expression is equivalent to

$$x^{\frac{2}{3}} \cdot x^{\frac{-4}{3}} ?$$

(A) $-\sqrt[3]{x^8}$
(B) $-\sqrt[3]{x^2}$
(C) $\sqrt[3]{x^2}$
(D) $\frac{1}{\sqrt[3]{x^2}}$

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- 3 Which expression is equivalent to

$$\frac{3}{4}(3x - 4y) + \frac{2}{3}(-3y + 5x) ?$$

(A) $\frac{67x}{12} - 5y$

(B) $\frac{x}{4} + \frac{y}{3}$

(C) $\frac{19x}{12} - 5$

(D) $\frac{17x}{4} + \frac{19y}{3}$

- 4 $8x - 9 = x^2 - y$

Which of the following equations is equivalent to the equation above and in a form that includes the vertex of the parabola as coefficients?

(A) $y = (x + 1)(x - 9)$

(B) $y = (x - 4)^2 - 7$

(C) $y = x^2 - 8x + 9$

(D) $x = \sqrt{y + 7} + 4$

- 5 If $a + 4b = 16$, what is the value of $3(a + 4b)$?

(A) 48

(B) 24

(C) 16

(D) $5\frac{1}{3}$

- 6 $S = 2\pi r^2 + 2\pi r h$

The formula above gives the surface area S of a cylinder with a radius r and height h . Which of the following gives h in terms of S and r ?

(A) $h = \frac{S}{2\pi r} - r$

(B) $h = \frac{S}{2\pi r} + r$

(C) $h = \frac{2\pi r^2 - S}{2\pi r}$

(D) $h = \frac{S + 2\pi r^2}{2\pi r}$

- 7 A group of economists performed a study on the decreasing population in a small town for a time period of 10 years. They determined that as a result of factors such as loss of jobs and a poor economy, the population of the town decreased by about 3.5% each year. Write an equation for the population of the town, P , in terms of its initial population, P_0 , and n , the number of years of the study.

(A) $P = P_0(0.965)^n$

(B) $P = P_0(0.965)n$

(C) $P = P_0(1.035)^n$

(D) $P = P_0(1.035)n$

- 8 If f is a linear function and if $f(4) = 2$ and $f(6) = 10$, which of the following could be the function f ?

(A) $f(x) = x - 2$

(B) $f(x) = 2x - 2$

(C) $f(x) = 2x - 6$

(D) $f(x) = 4x - 14$



9

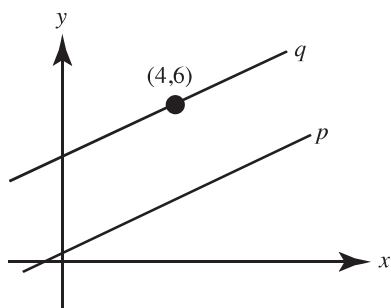


Figure not drawn to scale.

In the figure above, lines p and q are parallel. If $y = x + 1$ represents the equation of line p , what is the y -intercept of line q ?

- (A) 2
- (B) 3
- (C) 4
- (D) 5

10

A certain brand of yogurt is sold in either large or small cups. If 3 small cups and 2 large cups hold 30 ounces of yogurt, and 4 small cups and 1 large cup hold 25 ounces of yogurt, how much yogurt, in ounces, does a large cup of yogurt hold?

- (A) 2 ounces
- (B) 4 ounces
- (C) 7 ounces
- (D) 9 ounces

11

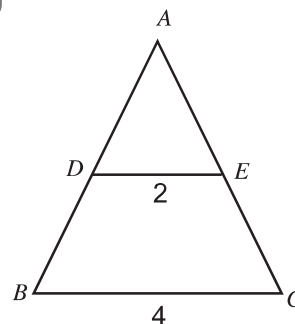


Figure not drawn to scale.

In the figure above, DE is parallel to BC and $AD = 3$. What is the length of segment AB ?

- (A) 2
- (B) 3
- (C) 4
- (D) 6

12

A student opened a savings account that earns $r\%$ annual interest compounded monthly. The equation that shows the total amount of money in the account at any

$$\text{time is } A = P \left(1 + \frac{r}{1200} \right)^{12t}.$$

What does t represent in the equation?

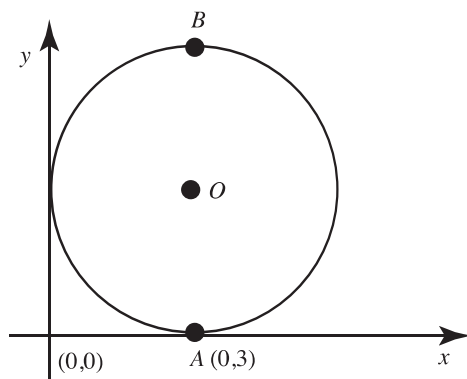
- (A) The initial investment in the savings account
- (B) The rate of interest
- (C) The number of years the money has been in the account
- (D) The total amount of money in the account



- 13 If $(x + 2)^2 - (x - 3)^2 = 0$, which of the following are possible values of x ?

(A) $\frac{1}{2}$ only
 (B) -2 and 3
 (C) -3 and 2
 (D) -2 and $\frac{1}{2}$

14



If AB is a diameter of the circle with center O , and AB is parallel to the y -axis, which equation represents the circle?

(A) $(x - 3)^2 + (y - 3)^2 = 3$
 (B) $(x - 3)^2 + y^2 = 3$
 (C) $(x - 3)^2 + (y - 3)^2 = 9$
 (D) $(x - 3)^2 + y^2 = 9$

- 15 A line in the xy -plane with the slope $-\frac{4}{5}$ passes through the point $(3, 4)$. Which of the following points lies on the line?

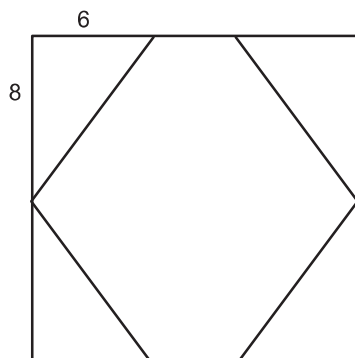
(A) $(-5, 12)$
 (B) $(-2, 0)$
 (C) $(7, -1)$
 (D) $(13, -4)$

practice test



- 16 Miguel is making a new garden. He is buying a new wheelbarrow and bags of peat moss. Each bag weighs 32 pounds and the wheelbarrow weighs 65 pounds. If his truck can carry a maximum of 1500 pounds in the bed, what is the greatest number of whole bags of peat moss he can carry in the bed of his truck, along with the wheelbarrow?

17



A sign is made by cutting four identical right triangles out of a square, as shown above. What is the perimeter of the sign, in inches?

- 18 What is the value for b that will make the equation below true?

$$\frac{5x+2}{x-4} = 5 + \frac{b}{x-4}$$

- 19 $y = 3x - 4$
 $y = 2x - 5$

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

- 20 $6x - 5y = 9$
 $ax + by = -27$

What value of b will make the system of equations above have infinitely many solutions?

STOP

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

practice test

SECTION 4: MATH TEST—CALCULATOR 

38 Questions • 55 minutes

TURN TO SECTION 4 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

Directions: For Questions 1–30, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 31 will provide information on how to enter your answers in the grid.

ADDITIONAL INFORMATION:

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

Reference Information

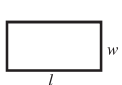
Circle:



$$C = 2\pi r$$

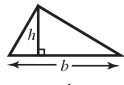
$$A = \pi r^2$$

Rectangle:

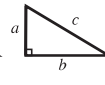


$$A = lw$$

Triangle:



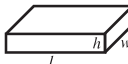
$$A = \frac{1}{2}bh$$



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



Rectangular Solid:



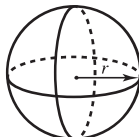
$$V = lwh$$

Cylinder:



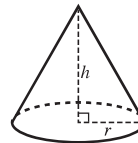
$$V = \pi r^2 h$$

Sphere:



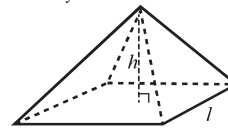
$$V = \frac{4}{3}\pi r^3$$

Cone:



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

Rectangular Based Pyramid:



$$V = \frac{1}{3}lwh$$

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

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

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

- 1 A large bottle of soda holds 3 times as much as a small bottle of soda, which holds 12 fluid ounces. How many large bottles are completely filled by 120 fluid ounces of soda?

(A) 2
(B) 3
(C) 4
(D) 5

- 2 If $4(x + 10) - 3(x + 10) = 0$, what is the value of x ?

(A) -40
(B) -10
(C) 2
(D) 20

3 In the 1908 London Olympics, the 400-meter race was introduced. Wyndham Halswelle of Great Britain won with a time of 50.0 seconds. In 1996, Michael Johnson of the United States ran the 400-meter race with a time of 43.18 seconds, which is the current record. If they had been racing together, approximately how many meters would Halswelle still have had to run after Johnson finished the race?

- (A) 10
- (B) 25
- (C) 55
- (D) 100

4 If $18 - 6x$ is 4 less than -8 , what is the value of $-3x$?

- (A) -15
- (B) -5
- (C) 5
- (D) 15

5 1000 milligrams = 1 gram

1000 grams = 1 kilogram

Ibuprofen is an over-the-counter drug used to treat arthritis and relieve pain, fever, and swelling. The dose contained in a standard tablet is 200 mg. If ibuprofen is sold in cartons of 24 bottles with 250 standard tablets per bottle, how much pain medication is in the carton in all?

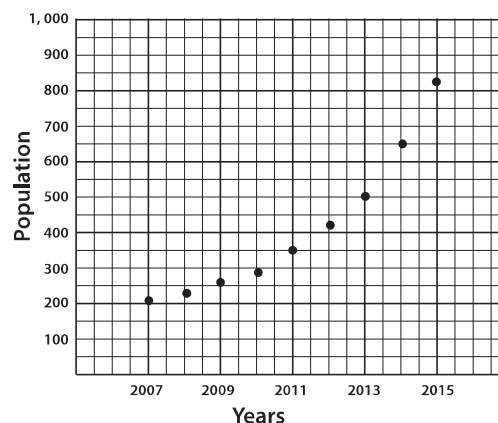
- (A) 0.12 kilograms
- (B) 1.2 kilograms
- (C) 12 kilograms
- (D) 120 kilograms

6 A local newspaper reported a poll of 100 adults that found 80% of respondents were in favor of building a new school. The poll was taken by asking random parents picking up their students after school. Which of the following statements about the sampling method for this poll is NOT true?

- (A) The sampling method was not representative of the town as a whole because some students take the bus home.
- (B) The sampling method was not representative of the town as a whole because not everyone has children who go to school.
- (C) The sampling method was not representative of the town as a whole because the population of the town is much greater than 100.
- (D) The sampling method was not representative of the town as a whole because people who do not have students in school are less likely to support a new school.

QUESTIONS 7 AND 8 REFER TO THE FOLLOWING INFORMATION.

The graph below shows the population of a small town, from the years 2007 through 2015.



7 Assuming that the population growth trend continues, what is the best prediction for the town's population in 2016?

- (A) 850
- (B) 900
- (C) 950
- (D) 1,025

8 Which of the following best describes the relationship between the population of the small town and the number of years?

- (A) The relation is an example of linear growth, because a line can be drawn between any two points on the grid that exactly shows the relation.
- (B) The relation is an example of linear growth, because all of the points lie on a single line.
- (C) The relation is an example of exponential growth, because the slope of the line between any two points is increasing as the x -values increase.
- (D) The relation is an example of exponential decay, because the vertical space between the points gets greater as the number of days increases.

9 The median salary at a large biotech company is \$45,000. The mean income is \$60,000. Which of the following statements best explains the difference between the mean and the median?

- (A) There are a few people at the biotech company with very low salaries.
- (B) There are a few people at the biotech company with very high salaries.
- (C) Most of the salaries at the biotech company are between \$45,000 and \$60,000.
- (D) All of the salaries at the biotech company are within a small range.



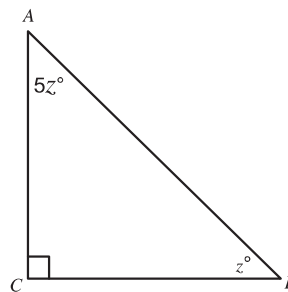
10 Mount Asgard in Auyuittuq (pronounced: *ow-you-eet-took*) National Park, Baffin Island, Nunavut, was used in the opening scene for the James Bond movie *The Spy Who Loved Me*. A stuntman skis off the edge of the mountain, free-falls for several seconds, and then opens a parachute. The height, h , in meters, of the stuntman above the ground t seconds after he opens the parachute is represented by the equation $h(t) = -10.5t + 980$. What does the 980 in the equation represent?

- (A) The speed of the stuntman
- (B) The height of the mountain
- (C) The height of the stuntman when he opens the parachute
- (D) The total length of time the stuntman is in the air

11 According to Einstein's theory of relativity, no object can travel faster than the speed of light, which is approximately 180,000 miles per second. Which inequality represents this information?

- (A) $x \leq 180,000$
- (B) $x \geq 180,000$
- (C) $x = 180,000$
- (D) $x > 180,000$

12



What is the value of z in right triangle ABC?

- (A) 15
- (B) 18
- (C) 30
- (D) 36

- 13 In 1992, the first AA lithium battery was released. Suppose a pack of 4 AA lithium batteries costs x dollars. At this rate, how much do 100 batteries cost?

(A) $5x$
 (B) $10x$
 (C) $25x$
 (D) $100x$

- 14 What is the value of y if

$$\frac{7}{4} + \frac{6}{y} = 1?$$

(A) -24
 (B) -8
 (C) -4
 (D) 6

- 15 A food truck sells sandwiches for \$5.95 each and drinks in cans or bottles. Which of the following statements is true about the equation that represents the food truck revenue, $5.95x + 1.75y = z$?

(A) x is the number of customers served
 (B) z is the number of customers served
 (C) y is the number of beverages sold
 (D) y is the number of sandwiches sold

- 16 $2x + y \geq a$
 $x + 2y \geq b$

In the xy -plane, if $(-1, -1)$ is a solution to the system of inequalities above, which of the following relationships must be true about a and b ?

(A) $a > b > 0$
 (B) $a < b < 0$
 (C) $b < a < 0$
 (D) $a < 0$ and $b < 0$

- 17 Alex is baking cupcakes and cookies. The cupcake pan holds 15 cupcakes and the cookie pan holds 18 cookies. Alex wants to make at least twice as many cookies as cupcakes, but no more than 165 total cookies and cupcakes. Which of the following system of inequalities fits the situation?

(A) $18x + 15y \leq 165$
 $x \leq 2y$

(B) $18x + 15y \leq 165$
 $x \geq 2y$

(C) $18x + 15y < 165$
 $x < 2y$

(D) $18x + 15y < 165$
 $x > 2y$

- 18 Which of the following equals x , if

$$3\sqrt{x} + 8 = 20?$$

(A) 4
 (B) 8
 (C) 12
 (D) 16

- 19 According to historians, Archimedes proved that a crown made for his king was not pure gold. Suppose the crown had a density of 800 grams and a volume of 50 grams. The density of gold is about 19 grams per cc, and the density of silver is about 10.5 grams per cc. The system below models this relationship (G = volume of gold, S = volume of silver).

$$G + S = 50$$

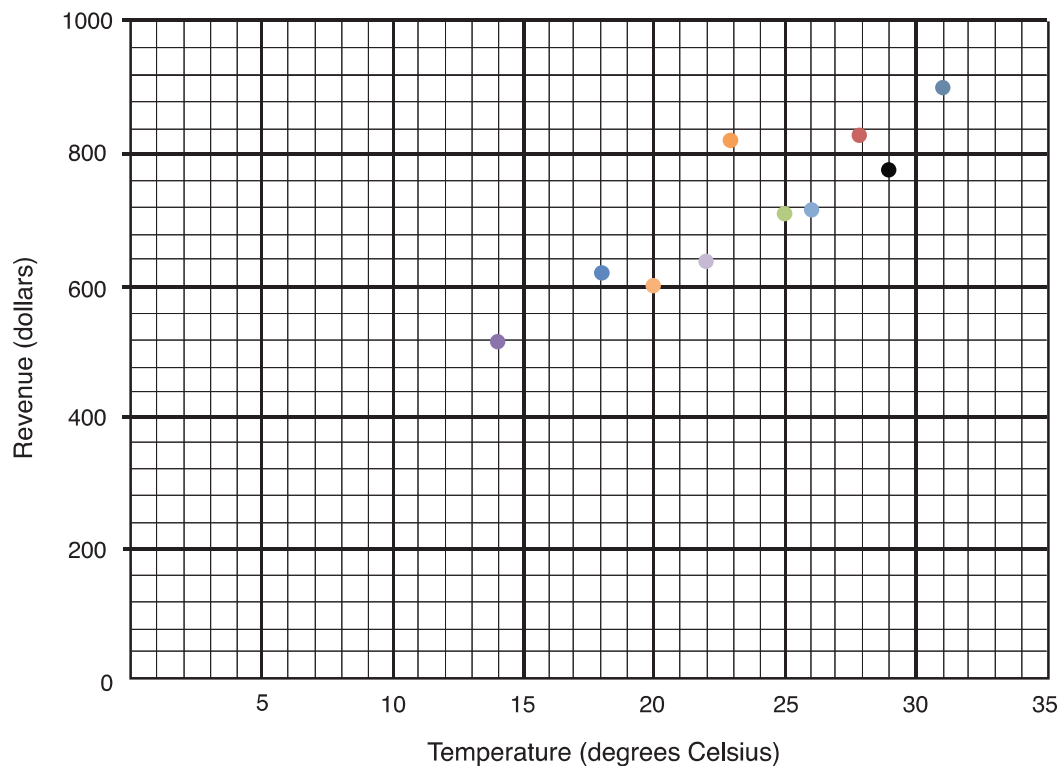
$$19G + 10.5S = 800$$

If the crown contained both silver and gold, about what percent of the crown is silver?

(A) 19 percent
 (B) 36 percent
 (C) 62 percent
 (D) 81 percent



QUESTIONS 20 AND 21 REFER TO THE FOLLOWING INFORMATION.



The graph above displays the total revenue R in dollars for an ice cream shop when the temperature is T degrees Celsius.

- 20 Which of the following best describes the association between R and T ?
- (A) Strong positive correlation
 (B) Strong negative correlation
 (C) Weak positive correlation
 (D) Weak negative correlation

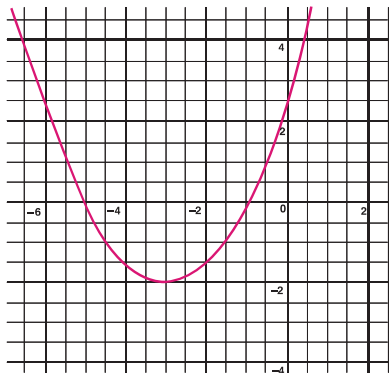
- 22 Simplify $(5 - 3i)(4 + 2i)$.

- (A) $20 - 2i$
 (B) $20 - 6i$
 (C) $26 - 2i$
 (D) $26 - 6i$

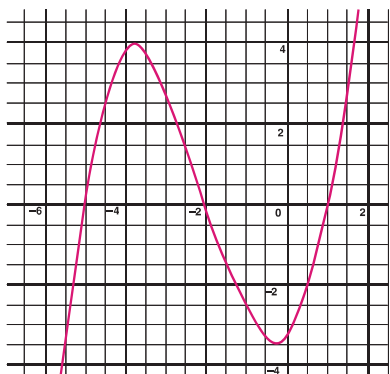
- 21 Which of the following is the best fit equation for the data in the graph?

- (A) $y = 500 + 1.2x$
 (B) $y = 1.33x$
 (C) $y = 20x + 250$
 (D) $y = 725$

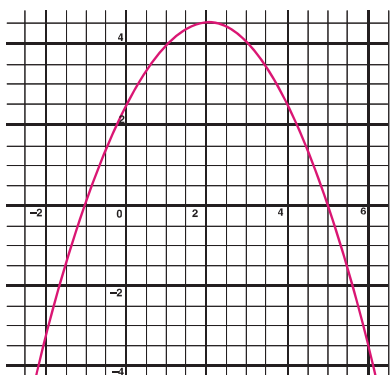
- 23 If $(x - 1)$ and $(x + 5)$ are factors of $f(x)$, which of the following graphs shows a possible graph of the function f ?



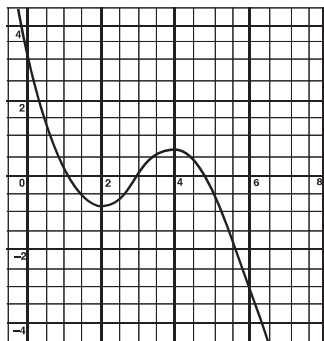
(A)



(B)



(C)



(D)

- 24 The graph of a parabola has x -intercepts at 4 and -2 and a y -intercept at 8. Which of the following could be the equation of the graph?

- (A) $y = -(x - 1)^2 + 9$
- (B) $y = x^2 - 2x + 8$
- (C) $y = (x - 1)^2 - 9$
- (D) $y = x^2 + 2x - 8$

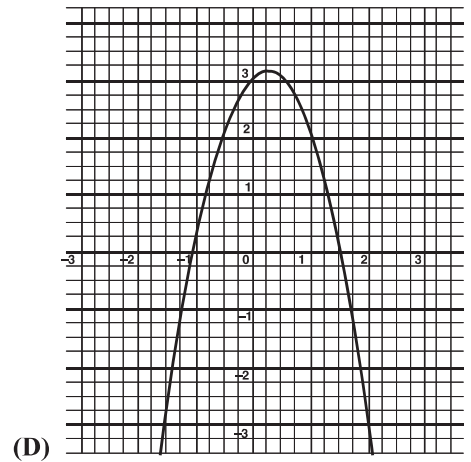
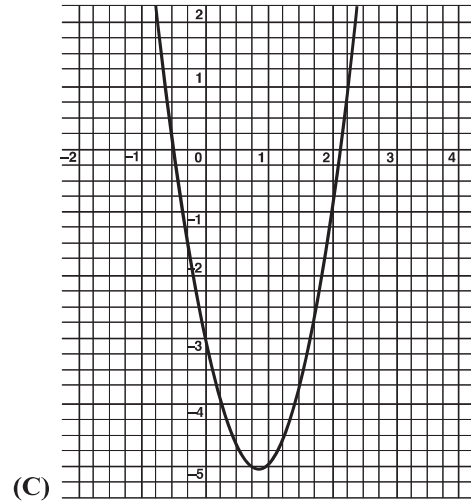
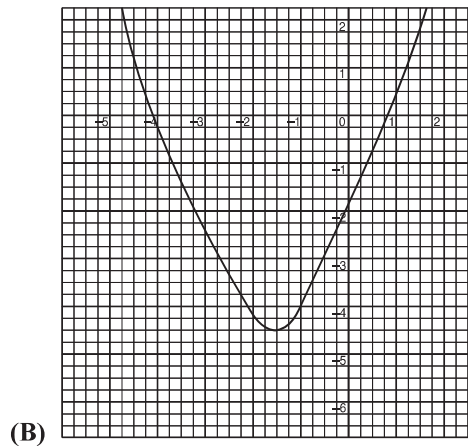
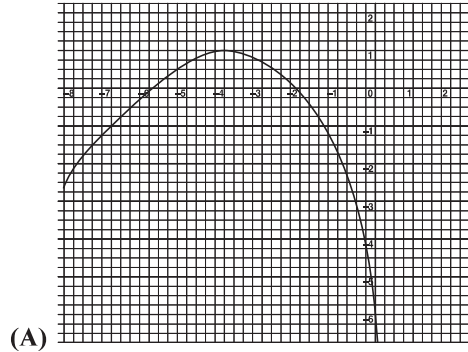
- 25 A population of bacteria in a sample increases in number by 30% every hour. Which best describes the relation between the time h in hours and the number of bacteria B in the sample?

- (A) The relation between B and h is linear, because the population increases by the same percent each hour.
- (B) The relation between B and h is linear, because the population increases by the same amount each hour.
- (C) The relation between B and h is exponential, because the population increases by the same percent each hour.
- (D) The relation between B and h is exponential, because the population increases by the same amount each hour.

practice test



- 26 If k is a negative constant less than -1 , which of the following could be the graph of $y = kx^2 + bx + c$?



QUESTIONS 27 AND 28 REFER TO THE FOLLOWING INFORMATION.

An educational researcher chose 200 randomly selected college students and asked them how they would best categorize their political inclinations. The results are shown in the table below.

	Liberal	Moderate	Conservative
Seniors	6	18	34
Juniors	20	42	30
Sophomores	8	6	4
Freshmen	22	8	2

- 27 What is the probability that a junior of this group is a conservative?

- (A) $\frac{17}{29}$
 (B) $\frac{9}{15}$
 (C) $\frac{2}{9}$
 (D) $\frac{15}{46}$

- 28 If there were a total of 4,000 students at the college, about how many of those students would categorize themselves as moderates?

- (A) About 74
 (B) About 1,120
 (C) About 1,400
 (D) About 1,480

- 29 A recent poll found that 11% of the respondents approve of the job that the U.S. Congress is doing. The margin of error for the poll was $\pm 3\%$ with 95% confidence interval. Which of the following statements is a conclusion that can accurately be drawn from this poll?

- (A) The true percentage of people who disapprove of the job that the U.S. Congress is doing is between 86% and 92%.
 (B) The true percentage of people who approve of the job that the U.S. Congress is doing is between 8% and 14%.
 (C) The pollsters are 95% confident that the true percentage of people who approve of the job that the U.S. Congress is doing is between 86% and 92%.
 (D) The pollsters are 95% confident that the true percentage of people who approve of the job that the U.S. Congress is doing is between 8% and 14%.

- 30 Line m intersects the x -axis at $(3, 0)$ and the y -axis at $(0, -2)$. Line n passes through the origin and is perpendicular to line m . Which of the following is an equation of line n ?

- (A) $y = \frac{3}{2}x$
 (B) $y = \frac{2}{3}x$
 (C) $y = -\frac{3}{2}x$
 (D) $y = -\frac{2}{3}x$



- 31 A baboon troop has 60 members, 35% of which are male. What is the ratio of males to females in the baboon troop? (Grid your answer as a fraction.)

34 $3(5 - 2x) = -4(cx + 4)$

What value for c in the equation above will make the equation have no solutions?

- 32 During a recent baseball season, 2 hitters on a team had a total of 66 home runs. Batter B had 14 fewer home runs than batter A . How many home runs did batter A hit?

- 35 If a cube with a surface area of 600 square centimeters holds 1 liter, how many liters are held in a cube with a surface area of 5400 square centimeters?

- 33 A community radio station operates 24 hours per day, every day of the week. Each radio show lasts 90 minutes. What is the total number of shows that the radio station will broadcast Monday through Friday?

36 $f(x) = 3x^2 - 4x + 8$
 $g(x) = 2x - 5$

Use the functions above to find the value of $g(f(-2))$.

practice test



37

$$y = 2x - 3$$

$$y = -3(x - 1)^2 + 4$$

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

38

The total rainfall in Plainville increased by 25% from 2012 to 2013. The rainfall decreased by 30% from 2013 to 2014. Then, it increased again by 40% from 2014 to 2015. What was the percent of increase in rainfall from 2012 to 2015? Write your answer as a percent, but do not write in the percent symbol.

STOP

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



Section 3: Math Test—No Calculator

1. A

5. A

9. A

13. A

17. 48

2. D

6. A

10. D

14. C

18. 22

3. A

7. A

11. D

15. D

19. 7

4. B

8. D

12. C

16. 44

20. 15

MATH TEST—NO CALCULATOR TEST RAW SCORE

(Number of correct answers)

1. **The correct answer is (A).** Subtract like terms when simplifying the expression: $4x^2 - 3x^2 = x^2$, $-5x - (-2x) = -3x$, and $8 - (-5) = 13$. Put together, we get the expression: $x^2 - 3x + 13$.

2. **The correct answer is (D).** To simplify the expression, first add the exponents, and then use the rule that a negative exponent is equal to the reciprocal of the positive exponent of the same number. Finally, rewrite the rational exponent in radical form:

$$\begin{aligned} x^{\frac{2}{3}} \cdot x^{-\frac{4}{3}} &= x^{-\frac{2}{3}} \\ &= \frac{1}{x^{\frac{2}{3}}} \\ &= \frac{1}{\sqrt[3]{x^2}} \end{aligned}$$

3. **The correct answer is (A).** Multiply, combine like terms, and simplify:

$$\begin{aligned} \frac{3}{4}(3x - 4y) + \frac{2}{3}(-3y + 5x) &= \frac{9x}{4} - 3y - 2y + \frac{10x}{3} \\ &= \frac{9x}{4} + \frac{10x}{3} - 5y \\ &= \frac{27x}{12} + \frac{40x}{12} - 5y \\ &= \frac{67x}{12} - 5y \end{aligned}$$

4. **The correct answer is (B).** Solve the equation for y , then complete the square to write it in vertex form.

$$\begin{aligned} y &= x^2 - 8x - 9 \\ (x^2 - 8x + 16) - 9 - 16 & \\ (x - 4)^2 - 25 & \end{aligned}$$

In vertex form, the constants are the coordinates of the vertex for the parabola. Choices (A) and (C) show equations equivalent to the given equation, but in intercept form and standard form instead of vertex form. Choice (D) includes the coordinates of the vertex, but it is not equivalent to the given equation; it only represents half of the parabola.

5. **The correct answer is (A).** If $a + 4b = 16$, then three times that quantity equals $3 \times (16)$, or 48.

6. **The correct answer is (A).** Divide both sides by $2\pi r$ to simplify. Then set the equation equal to h :

$$\begin{aligned} S &= \frac{2\pi r^2 + 2\pi r h}{2\pi r} \\ \frac{S}{2\pi r} &= r + h \\ \frac{S}{2\pi r} - r &= h \end{aligned}$$



7. **The correct answer is (A).** The population will be reduced by 3.5% each year, so each year the population is multiplied by $(1 - 0.035)$, or (0.965) . The only answer choice that shows repeated multiplication of (0.965) , through the use of the exponent n , is choice (A): $P = P_0(0.965)^n$.

8. **The correct answer is (D).** Substitute the values 4 and 6 for x and check which equation has the correct function values for both, or calculate the slope between the points and substitute one point to find the y -intercept:

$$\frac{10-2}{6-4} = 4$$

$$y = 4x + b$$

$$2 = 4(4) + b$$

$$-14 = b$$

$$y = 4x - 14$$

9. **The correct answer is (A).** The standard Slope-Intercept form of the equation of a line is $y = mx + b$, where m is the slope of the line and b is the y -intercept. Therefore, the slope of line p equals 1. Since lines p and q are parallel, their slopes are equal. Therefore, the slope of line q equals 1. Let line q be represented by the standard equation of a line, $y = mx + b$. Since the slope of line q equals 1, substitute $m = 1$ in the equation: $y = x + b$.

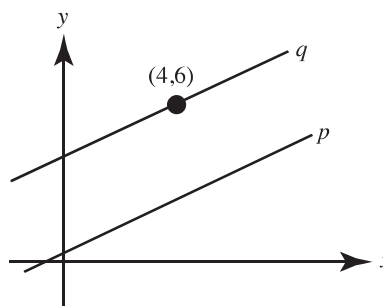


Figure not drawn to scale.

From the above figure, we know that point $(4, 6)$ lies on line q . Therefore, $x = 4$ and $y = 6$ must satisfy the equation of the line. Substitute these values in the above equation and solve for b , which is the y -intercept:

$$6 = 4 + b$$

$$2 = b$$

Therefore, the y -intercept of line q equals 2.

10. **The correct answer is (D).** Write equations based on the information given; let s = a small cup and L = a large cup. Multiply the first equation by 4 and the second one by 3, so that s gets eliminated during the subtraction. Then solve for L :

$$4(3s + 2L = 30)$$

$$\underline{-3(4s + L = 25)}$$

$$5L = 45$$

$$L = 9$$



11. **The correct answer is (D).** If the angles of a triangle are equal to the corresponding angles of another triangle, the two triangles are similar. Also remember that when two triangles are similar, their corresponding sides are proportional.

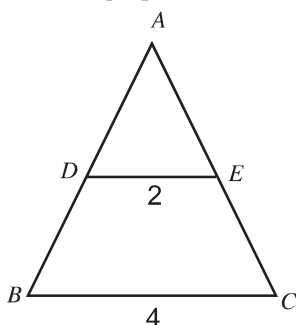


Figure not drawn to scale.

Since DE is parallel to BC , then $\angle ABC = \angle ADE$ and $\angle ACB = \angle AED$. Also, the angle at point A is common to both triangles. Thus, all three angles of triangle ABC are congruent with the corresponding angles of triangle ADE .

Therefore, triangle ABC and triangle ADE are similar and their corresponding sides are proportional.

Now set up a proportion of their corresponding sides and solve for the length of segment AB :

$$\frac{AB}{AD} = \frac{BC}{DE}$$

$$\frac{AB}{3} = \frac{4}{2}$$

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

$$AB = 6$$

Therefore, the length of segment $AB = 6$.

12. **The correct answer is (C).** The compound interest formula is

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

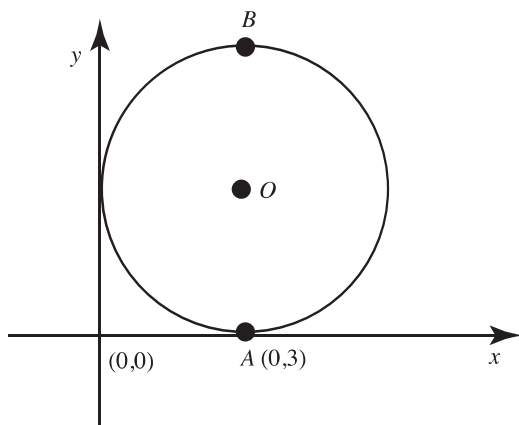
where A is the total amount of money in the account including interest, P is the initial investment in the account, r is the rate of interest, n is the number of times the interest is compounded, and t is the number of years the amount is in the account. In the problem, the exponent is $12t$. Since the account has interest that is compounded monthly, the number of times in one year that it compounds is 12, so $n = 12$. This means that t equals the number of years the money has been in the account.

13. **The correct answer is (A).** You can work backward with the answer choices to determine the value of x . None of the values works except

$$\begin{aligned} x = \frac{1}{2} : (x+2)^2 + (x-3)^2 &= \left(\frac{5}{2}\right)^2 + \left(-\frac{5}{2}\right)^2 \\ &= \frac{25}{4} + \frac{25}{4} \\ &= 0 \end{aligned}$$



14. The correct answer is (C).



The center of the circle is at the point (3, 3), and because the circle is tangent to the x - and y -axes, the horizontal and vertical distance between the center and the axes must be equal. The standard form for the equation of a circle is $(x-h)^2 + (y-k)^2 = r^2$, where (h, k) is the center and r is the radius. So an equation for the circle is $(x-3)^2 + (y-3)^2 = 9$.

15. The correct answer is (D). Check each answer choice to see if the slope between the point (3, 4) and the given coordinates is $-\frac{4}{5}$.

Only choice (D) gives us this answer:

$$\begin{aligned}\frac{y-4}{x-3} &= -\frac{4}{5} \\ \frac{-4-4}{13-3} &= \\ \frac{-8}{10} &= -\frac{4}{5}\end{aligned}$$

16. The correct answer is 44. Let x be the number of 32-pound bags that Miguel can safely carry. Because his truck can safely carry only a maximum of 1500 pounds, the weight of the bags plus the weight of the wheelbarrow has to be equal to or less than that, which gives us the inequality $32x + 65 \leq 1500$. Solve for x to get the number of bags:

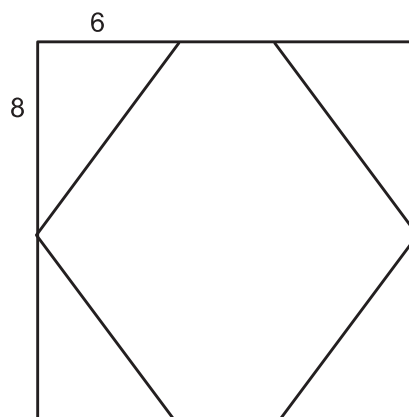
$$32x + 65 \leq 1500$$

$$32x \leq 1435$$

$$x \leq 44.84375$$

Because Miguel can't take partial bags, he can safely take 44 bags.

17. The correct answer is 48.



We know that each side of the square has length 16 since two triangle sides of length 8 form one side of the square. From this, we know that the shortest sides of the hexagonal sign must equal 4: the square side $- 2$ triangle edges $= 16 - 2(8) = 4$. Now all we have to do is find the hypotenuse of one triangle and multiply it by 4.

Use the Pythagorean Theorem: $a^2 + b^2 = c^2$, where c is the length of the hypotenuse. In this case: $8^2 + 6^2 = c^2$,

$$64 + 36 = c^2, 100 = c^2, \text{ and } 10 = c.$$

So the perimeter of the sign is

$$10(4) + 4(2) = 40 + 8 = 48 \text{ inches.}$$



- 18. The correct answer is 22.** To solve for b , first multiply both sides by $x - 4$ to get $5x + 2 = 5x - 20 + b$. Then, subtract $5x - 20$ from both sides to get $22 = b$.

$$\begin{aligned}\frac{5x+2}{x-4} &= \frac{5x-20+22}{x-4} \\ &= \frac{5x-20}{x-4} + \frac{22}{x-4} \\ &= 5 + \frac{22}{x-4} \\ b &= 22\end{aligned}$$

- 19. The correct answer is 7.**

$$\begin{aligned}3x - 4 &= 2x - 5 \\ x &= -1 \\ y &= 3(-1) - 4 = -7 \\ xy &= (-1)(-7) = 7\end{aligned}$$

- 20. The correct answer is 15.**

$$\begin{aligned}-3(6x - 5y) &= -3(9) \\ -18x + 15y &= -27\end{aligned}$$

Multiplying the first equation by -3 will yield an equivalent equation, so if the second equation actually had the coefficients of -18 and 15 for a and b , there would be infinitely many solutions. So, $b = 15$ is the answer.



Section 4: Math Test—Calculator

1. B	9. B	17. B	25. C	33. 80
2. B	10. C	18. D	26. D	34. 1.5
3. C	11. A	19. B	27. D	35. 27
4. A	12. A	20. A	28. D	36. 51
5. B	13. C	21. C	29. D	37. 2
6. C	14. A	22. C	30. C	38. 22.5
7. D	15. C	23. B	31. 7/13	
8. C	16. D	24. A	32. 40	

MATH TEST—CALCULATOR RAW SCORE
(Number of correct answers)

- The correct answer is (B).** We know that a small bottle holds 12 ounces of soda, and so a large bottle holds three times that amount, or 36 ounces. The key to solving this problem lies in the phrasing, “how many large bottles are *completely* filled.” With 120 ounces of soda, we know that three bottles can be filled completely (108 ounces), leaving 12 ounces. But since this remaining amount isn’t enough to fill an additional large bottle completely, the correct answer is choice (B).
- The correct answer is (B).** Simplify the algebraic expression:

$$4(x + 10) - 3(x + 10) = 0$$

$$4x + 40 - 3x - 30 = 0$$

$$x + 10 = 0$$

$$x = -10$$
- The correct answer is (C).** Johnson ran the 400-meter race in 43.18 seconds. In that time, Halswelle ran at a rate of 8 meters per second ($400 \text{ meters} / 50 \text{ seconds} = 8 \text{ meters/second}$). So he would have run $43.18 \text{ seconds} \times 8 \text{ meters/second} = 345.44 \text{ meters}$. So Halswelle would have had about 55 more meters to run before reaching the end of the 400-meter race.
- The correct answer is (A).** The description can be written as $18 - 6x = -8 - 4$, which is equivalent to $18 - 6x = -12$. Subtracting 18 from both sides gives $-6x = -30$. Since $-3x$ is half of $-6x$, dividing both sides by 2 gives $-3x = -15$.
- The correct answer is (B).** The total amount of pain medication is $24(250)(200) = 1,200,000$ milligrams. The answers are all in kilograms, so convert the measure in milligrams to kilograms one step at a time: $1,200,000 \text{ milligrams} = 1200 \text{ grams}$, and $1200 \text{ grams} = 1.2 \text{ kilograms}$.



6. **The correct answer is (C).** A sample is not equivalent to the population, and just because a sample is smaller than the population does not mean that it is not representative.
7. **The correct answer is (D).** The slope of the curve is increasing as the number of years increases, and between the years of 2014 and 2015, the population increased by approximately 175 people, so the best prediction for the population in 2016 is 1,025.
8. **The correct answer is (C).** The slope is increasing as the number of years increases, which models exponential growth.
9. **The correct answer is (B).** If the mean is significantly greater than the median, there must be some values that are much greater than the rest in order to increase the mean.
10. **The correct answer is (C).** In the equation $h(t) = -0.5t + 980$, 980 represents the height above the ground of the stuntman when he opens the parachute.
11. **The correct answer is (A).** The speed of the object must be less than or equal to (\leq) 180,000.
12. **The correct answer is (A).** We know that the internal angles of a triangle always add up to 180; the fact that the triangle may or may not be drawn to scale is irrelevant. In this case, we have:
- $$90 + 5z + z = 180$$
- $$90 + 6z = 180$$
- $$6z = 90$$
- $$z = 15$$

13. **The correct answer is (C).** This is a good question to plug in numbers. Let's use a number instead of x . We can make x equal anything as long as it makes sense, so let's try $x = 10$. If it costs 10 dollars for a pack of 4 batteries, then how much would it cost to buy 100 batteries? Using proportions, we find:

$$\frac{\$10}{4} = \frac{y}{100}$$
$$y = \frac{\$10(100)}{4}$$
$$y = \$250$$

Substituting 10 for x in each of the answer choices will show that the correct answer is choice (C), since it is the only expression that equals \$250.

14. **The correct answer is (B).** You could solve this problem by working backwards. Start with answer choice (C). If $y = -4$, then

$$\frac{7}{4} + \frac{6}{-4} = \frac{1}{4},$$

which does not equal 1. Eliminate this choice. Try answer choice (B): If $y = -8$, then

$$\frac{7}{4} + \frac{6}{-8} = \frac{14}{8} - \frac{6}{8} = \frac{8}{8} = 1.$$

This is correct, so there is no need to check the other answer choices.

15. **The correct answer is (C).** If \$5.95 is the cost per sandwich, then $5.95x$ is the revenue from sandwiches, and y must be the number of beverages sold, since the number of beverages sold is an unknown value, and z must be the total revenue.
16. **The correct answer is (D).** Both coefficients must be negative to make the system of inequalities true, but neither must be greater than the other.



- 17. The correct answer is (B).** The number of cookies and cupcakes that Alex bakes are $18x$ and $15y$ respectively. The number of cookies and cupcakes are x and y respectively. Since the number of pans of cookies is “at least” twice as many, the “greater than or equal to” symbol should be used. Also “no more than 165” means to use the “less than or equal to” symbol.
- 18. The correct answer is (D).** Isolate \sqrt{x} on one side of the equation and then square both sides to solve.
- $$3\sqrt{x} + 8 = 20$$
- $$3\sqrt{x} = 12$$
- $$\sqrt{x} = 4$$
- $$x = 16$$
- 19. The correct answer is (B).** First, solve the system of equations for S :
- $$G + S = 50$$
- $$\underline{19G + 10.5S = 800}$$
- $$19G + 19S = 950$$
- $$\underline{19G + 10.5S = 800}$$
- $$8.5S = 150$$
- $$S = 17.65$$
- $$S \approx 18$$
- Then divide the total volume of the crown by 50:
- $$\frac{18}{50} = 0.36$$
- $$= 36\%$$
- 20. The correct answer is (A).** The trend of the graph is positive, and most of the data points are close to a line, so the association is a strong positive correlation.
- 21. The correct answer is (C).** The trend of the graph is positive and most of the data points are close to a line, and the line for $y = 20x + 250$ goes through the center of the data. The other graphs don't go through the center or don't follow the trend of data.
- 22. The correct answer is (C).** Use FOIL to multiply:
- $$(5 - 3i)(4 + 2i) = 20 + 10i - 12i - 6i^2$$
- $$= 20 - 2i - 6(-1)$$
- $$= 26 - 2i$$
- 23. The correct answer is (B).** Because the function f has $(x - 1)$ and $(x + 5)$ as factors, the function should have zeros when $x - 1 = 0$ and $x + 5 = 0$. The only graph that shows a curve that has x -intercepts at 1 and -5 is choice (B).
- 24. The correct answer is (A).** Only the graphs of (A) and (B) have y -intercepts at 8. Only the graphs of (A) and (C) have x -intercepts at 4 and -2 .
- 25. The correct answer is (C).** The relation between the number of bacteria and the time in hours should be an equation like $B = A(1.3)^h$, where A is the initial population of bacteria, h is the number of hours, 0.3 is the rate of growth, and B is the sample population after h hours.
- 26. The correct answer is (D).** If $k < -1$, then the graph must open downward and be relatively steep.
- 27. The correct answer is (D).** There were 92 juniors, and, of those, 30 students categorized themselves politically as conservative:
- $$\frac{30}{92} = \frac{15}{46}$$



28. **The correct answer is (D).** Of the 200 students surveyed, there were 74 students total who categorized themselves as moderates.

$$\frac{74}{200} \times 4000 = 1480$$

29. **The correct answer is (D).** The 95% confidence that the margin of error is $\pm 3\%$ is important, and choices (A) and (B) ignore the confidence interval. Choice (C) is not correct because there are likely people who don't know or have no opinion of the job that the U.S. Congress is doing. Only choice (D) accurately uses the confidence interval and the data given in the problem.

30. **The correct answer is (C).** First, find the slope of line m using the points on the line:

$$\frac{-2-0}{0-3} = \frac{2}{3}$$

A line that is perpendicular to line m will have a slope that is the negative reciprocal

of that slope, so the slope of line n is $-\frac{3}{2}$,

which means that choice (C) is correct.

31. **The correct answer is 7/13.** First, determine how many male baboons there are in the troop; 35% of 60 equals 21. So, there are 21 males and 39 females. Since the fraction $\frac{21}{39}$ won't fit into the grid, you must reduce. Divide both the numerator and the denominator by 3 to get $\frac{7}{13}$.

32. **The correct answer is 40.** Write and solve an equation that represents the home runs hit by batters A and B and solve for the desired number.

n = number of home runs by batter A

$n - 14$ = number of home runs by batter B

$$n + n - 14 = 66$$

$$2n - 14 = 66$$

$$2n = 80$$

$$n = 40$$

33. **The correct answer is 80.** First, calculate how many hours there are in five days:

$$5(24 \text{ hrs.}) = 120 \text{ hrs.}$$

Then, convert the length of each show to hours:

$$90 \text{ min.} \left(\frac{1 \text{ hr.}}{60 \text{ min.}} \right) = \frac{3}{2} \text{ hrs.}$$

Finally, divide the number of hours by the length of each show:

$$\frac{120 \text{ hrs.}}{\frac{3}{2} \text{ hrs.}} = 80$$

34. **The correct answer is 1.5.** First simplify the equation, and then determine which value of c will make the equation have no solutions, which is when the coefficient for $x = 0$.

$$3(5 - 2x) = -4(cx + 4) \quad 4c - 6 = 0$$

$$15 - 6x = -4cx - 16 \quad 4c = 6$$

$$4cx - 6x = -31 \quad c = 1.5$$



- 35. The correct answer is 27.** A cube has 6 equally sized faces, which means that each face has an area of 100 square centimeters, since the total surface area is 600 square centimeters. One edge of the cube must equal 10 centimeters, the square root of 100 square centimeters. The volume of the cube is $l \times w \times h = 10 \text{ cm} \times 10 \text{ cm} \times 10 \text{ cm} = 1000$ cubic centimeters. So 1000 cubic centimeters hold 1 liter.

The larger cube has a combined surface area of 5400 centimeters; one face will have a surface area of 900 square centimeters. One edge of the cube must equal 30 centimeters ($30 \times 30 = 900$). So the volume of the cube is $30 \text{ cm} \times 30 \text{ cm} \times 30 \text{ cm} = 27,000$ cubic centimeters. If 1000 cubic centimeters hold 1 liter, then 27,000 cubic centimeters hold 27 liters.

- 36. The correct answer is 51.**

$$f(-2) = 3(-2)^2 - 4(-2) + 8 = 28$$

$$g(28) = 2(28) - 5 = 51$$

$$g(f(-2)) = 51$$

- 37. The correct answer is 2.** First, combine the equations by substituting $2x - 3$ for y in the second equation. Then solve for x :

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

$$2x - 3 = -3x^2 + 6x - 3 + 4$$

$$0 = -3x^2 + 4x + 4$$

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

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

Negative answers cannot be gridded, so the only correct answer is 2.

- 38. The correct answer is 22.5.** To find the percent of change, multiply $1.25(1 - 0.3)$ (1.4) to show the three years of change as (1.225). This is equivalent to a 22.5% increase. The problem asks to write the answer as a percent without a percent symbol, so the answer is 22.5.

SECTION 3: MATH TEST—NO CALCULATOR 

20 Questions • 25 minutes


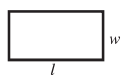
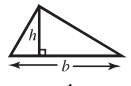
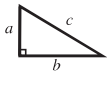
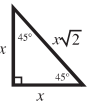
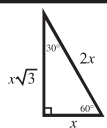
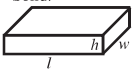

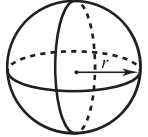
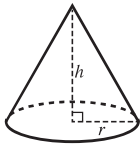
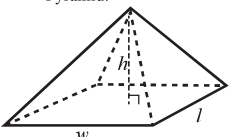
TURN TO SECTION 3 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

Directions: For Questions 1–15, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 16 will provide information on how to enter your answers in the grid.

ADDITIONAL INFORMATION:

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

Reference Information

<p>Circle:</p>  <p>$C = 2\pi r$ $A = \pi r^2$</p>	<p>Rectangle:</p>  <p>$A = lw$</p>	<p>Triangle:</p>  <p>$A = \frac{1}{2}bh$</p>	 <p>$a^2 + b^2 = c^2$</p>	 <p>x, x, $x\sqrt{2}$</p>	 <p>x, $x\sqrt{3}$, $2x$</p>
<p>Rectangular Solid:</p>  <p>$V = lwh$</p>	<p>Cylinder:</p>  <p>$V = \pi r^2 h$</p>	<p>Sphere:</p>  <p>$V = \frac{4}{3}\pi r^3$</p>	<p>Cone:</p>  <p>$V = \frac{1}{3}\pi r^2 h$</p>	<p>Rectangular Based Pyramid:</p>  <p>$V = \frac{1}{3}lwh$</p>	

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

1 Jared is beginning to track the number of steps he walks each day. Yesterday he walked 950 steps. He set a goal of increasing his steps per day by 125, with an eventual goal of walking at least 3,000 steps per day. Which of the following functions can be used to determine the number of steps Jared plans to take d days from yesterday?

- (A) $f(d) = 3000 - (950 + 125d)$
- (B) $f(d) = 3000 - 125d$
- (C) $f(d) = 950 + 125d$
- (D) $f(d) = 950 - 125d$

2 If $f(1) = 3$, $f(3) = -1$, $g(3) = 1$, and $g(-1) = 3$, what is the value of $f(g(3))$?

- (A) -3
- (B) -1
- (C) 1
- (D) 3

practice test

www.petersons.com



- 3 The amount of radioactive iodine 131 that remains in an object after d days is found using the formula

$$y = a(0.5)^{\frac{d}{8.02}}$$

What does a represent in the formula?

- (A) The number of days for the object to lose half of its radioactive iodine 131
- (B) The initial amount of radioactive iodine 131
- (C) The amount of radioactive iodine 131 after d days
- (D) The amount of radioactive iodine 131 lost each day

- 4 An architect is designing the roof of a house. The peak of the roof is 8 ft. above the house. If the outside of the roof is separated into two parts, how long is each part from the peak of the roof to its edge?

- (A) 15 ft.
- (B) 17 ft.
- (C) 23 ft.
- (D) 31 ft.

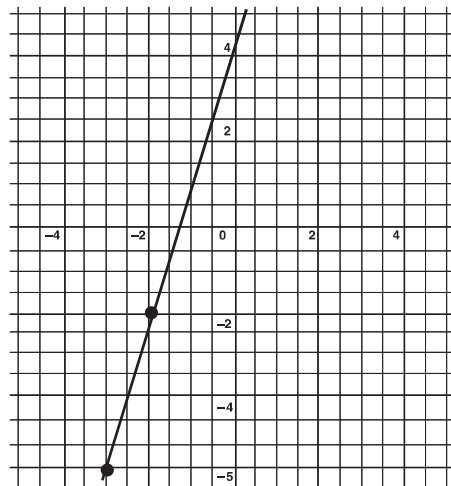
5 $y = 2(x - 5)^2 - 2$

Which equation is equivalent to the equation above and shows the x -intercepts as constants?

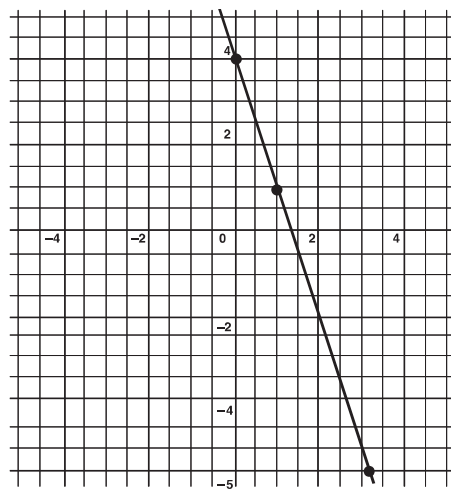
- (A) $y = 2x^2 - 20x + 48$
- (B) $y = 2(x^2 - 10x + 24)$
- (C) $y = 2(x - 4)(x - 6)$
- (D) $y = (2x - 8)(x - 6)$

- 6 Which of the following graphs represents the equation $3x + y = 4$?

(A)

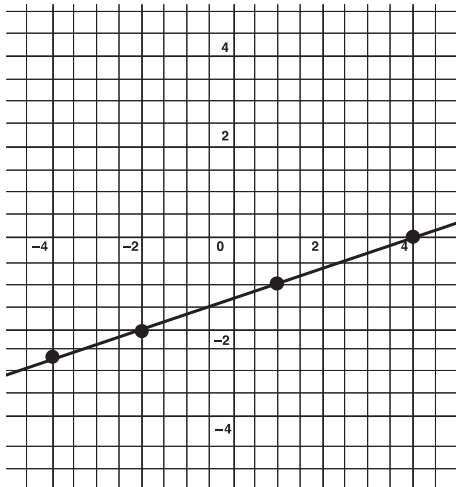


(B)

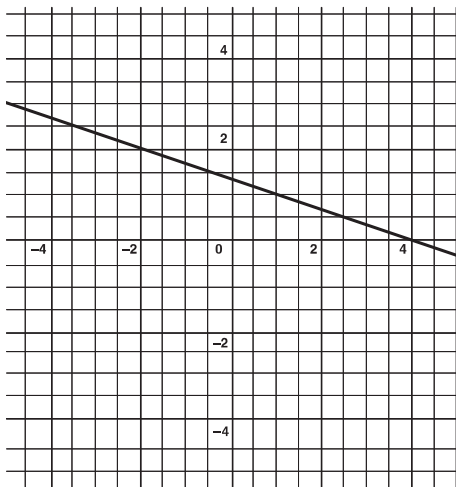




(C)



(D)



7 Which of the following is an equation for the line through the point (2, 3) with a slope of -1 ?

- (A) $2x + 3y = -1$
- (B) $3x + 3y = 15$
- (C) $3x + 2y = 10$
- (D) $x + y = -5$

8 Which of the following expressions is equivalent to

$$\frac{3}{4}(x-4)(3+5x)?$$

- (A) $\frac{3x^2}{4} - 15x - 9$
- (B) $\frac{9x^2}{4} - \frac{7x}{4} - 15$
- (C) $\frac{15x^2}{4} - \frac{51x}{4} - 9$
- (D) $\frac{15x^2}{4} - \frac{69x}{4} - 9$

9 Which of the following is equal to $x^{\frac{3}{4}}$?

- (A) $4x^3$
- (B) $3x^4$
- (C) $\sqrt[4]{x^3}$
- (D) $\sqrt[3]{x^4}$

10 Which of the following is the equation for the graph of a parabola that has a vertex at (3, -5) and a y -intercept at 13?

- (A) $y - 28 = (x - 3)(x + 5)$
- (B) $y = 2(x - 3)^2 - 5$
- (C) $y = (x - 3)^2 - 13$
- (D) $y = x^2 - 6x + 13$

practice test



- 11** The admission cost for a play is \$12 for adults and \$7 for children. Which system of equations can be used to determine the number of adults and number of children that attended if 117 people attended the play and the total amount collected for admission was \$1,079?
- (A) $12x + 7y = 117$
 $x + y = 1079$
- (B) $12x + y = 117$
 $x + 7y = 1079$
- (C) $12x + 7y = 1079$
 $x + y = 117$
- (D) $x + 7y = 117$
 $12x + y = 1079$
-
- 12** Which of the following is equivalent to $\frac{4-i}{3+i}$ that can be found by multiplying by the complex conjugate of the denominator?
- (A) $\frac{1}{3}$
- (B) $\frac{17}{11+7i}$
- (C) $\frac{11-7i}{10}$
- (D) $\frac{13+i}{8}$
-
- 13** What is the solution to the equation $-6(t+1) = 2(1-3t) - 8$?
- (A) -8
- (B) -6
- (C) No solution
- (D) Infinitely many solutions
-
- 14** A small city in Spain grows at an average rate of 1.7% a year. The population of the city in 1980 was 2,845. The equation that models the city's population in 1990 is $P = 2845e^{(0.017)(10)}$. What does 10 represent in the equation?
- (A) The city's population in 1980
- (B) The number of years
- (C) The city's average grown rate
- (D) The factor of increase of the city's population each year
-
- 15** If p and q are positive and $\frac{2p+2n}{qn} = 2$, which of the following is equivalent to n ?
- (A) $\frac{p}{q-1}$
- (B) $\frac{p-1}{q-1}$
- (C) $\frac{q+1}{p}$
- (D) $\frac{q-1}{p}$



16 If $\sqrt{x+1} - 2 = 3$, what is the value of x ?

19 $y = 3x + 7$
 $4x - ty = 5$

According to the system of equations above, what is the value of b that makes the system of equations have no solutions?

17 If $f(x) = 3x - 2$, for what value of x does $f(x)$ equal 1?

20 A spherical scoop of ice cream is placed on top of a hollow ice cream cone. The scoop and cone have the same radius. The ice cream melts completely and it fills the cone to the top. How many times greater is the height of the cone than the radius of the cone?

18
$$\frac{3x^2 - 4x - 18}{x + 3} = 3x - c + \frac{21}{x + 3}$$

What is the value for c that will make the equation above true?

STOP

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

SECTION 4: MATH TEST—CALCULATOR 

38 Questions • 55 minutes


TURN TO SECTION 4 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

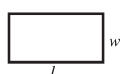
Directions: For Questions 1–30, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 31 will provide information on how to enter your answers in the grid.

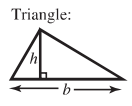
ADDITIONAL INFORMATION:


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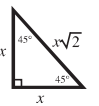
Reference Information

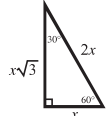
Circle: 
 $C = 2\pi r$
 $A = \pi r^2$

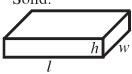
Rectangle: 
 $A = lw$


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

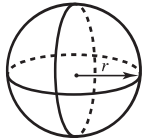

 $a^2 + b^2 = c^2$

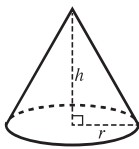

 x , x , $x\sqrt{2}$

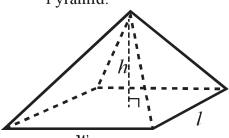

 $x\sqrt{3}$, $2x$, x

Rectangular Solid: 
 $V = lwh$

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

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

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

Rectangular Based Pyramid: 
 $V = \frac{1}{3}lwh$

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

- 1 A certain insect is estimated to travel 1,680 feet per year. At this rate, about how many months would it take for the insect to travel 560 feet?

(A) 0.75
 (B) 3
 (C) 4
 (D) 5.5

- 2 A librarian is tracking the circulation of books at the library. In one day of checking books, 18 were renewed, 46 were returned on time, and 11 were returned late. At this rate, about how many books will be renewed if the library loans 25,000 books each year?

(A) 4,000
 (B) 6,000
 (C) 9,000
 (D) 15,000

3

	Smalltown	Littletown	Total
Male	175	210	385
Female	195	205	400
Total	370	415	785

Smalltown and Littletown are two towns in Tinytown County. The table above shows the distribution of population of males and females of the towns. If a person from the county is selected at random, what is the probability that the person will be either a male from Littletown or a female from Smalltown?

- (A) $\frac{39}{74}$
 (B) $\frac{42}{83}$
 (C) $\frac{56}{157}$
 (D) $\frac{81}{157}$

4

A pink dogwood tree has an average growth rate of 0.36 inches per week. Based on the average growth rate, if a pink dogwood tree was newly planted, what would its height, in inches, be in 10 years?

- (A) 43.2 inches
 (B) 187.2 inches
 (C) 218 inches
 (D) 360 inches



5

Glen earns \$10.25 per hour and pays \$12.50 per day to commute to and from work on the bus. He wants to make sure that he works long enough to earn at least three times as much as he spends commuting. Which of the following inequalities best represents this situation?

- (A) $10.25h \geq 3(12.50)$
 (B) $3(10.25) \geq 12.50h$
 (C) $3(10.25h) \geq 12.50$
 (D) $h \geq 3(12.50)(10.25)$

6

Nadia spent 7 more hours on math homework last month than Peter. If they spent total of 35 hours doing math homework last month, how many hours did Peter spend on math homework?

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

7

If c is 22 percent of e and d is 68 percent of e , what is $d - c$ in terms of e ?

- (A) $90e$
 (B) $46e$
 (C) $0.9e$
 (D) $0.46e$

8

$$2x - 9y < 12$$

$$-3x + 4y > 5$$

Which of the following is a solution to the system of inequalities shown above?

- (A) $(-4, -4)$
 (B) $(-4, 4)$
 (C) $(4, -4)$
 (D) $(4, 4)$

9 If $n = 7$, what is $2m(16 - 6n)$ in terms of m ?

- (A) $-52m$
- (B) $-15m$
- (C) $-14m$
- (D) $32m$

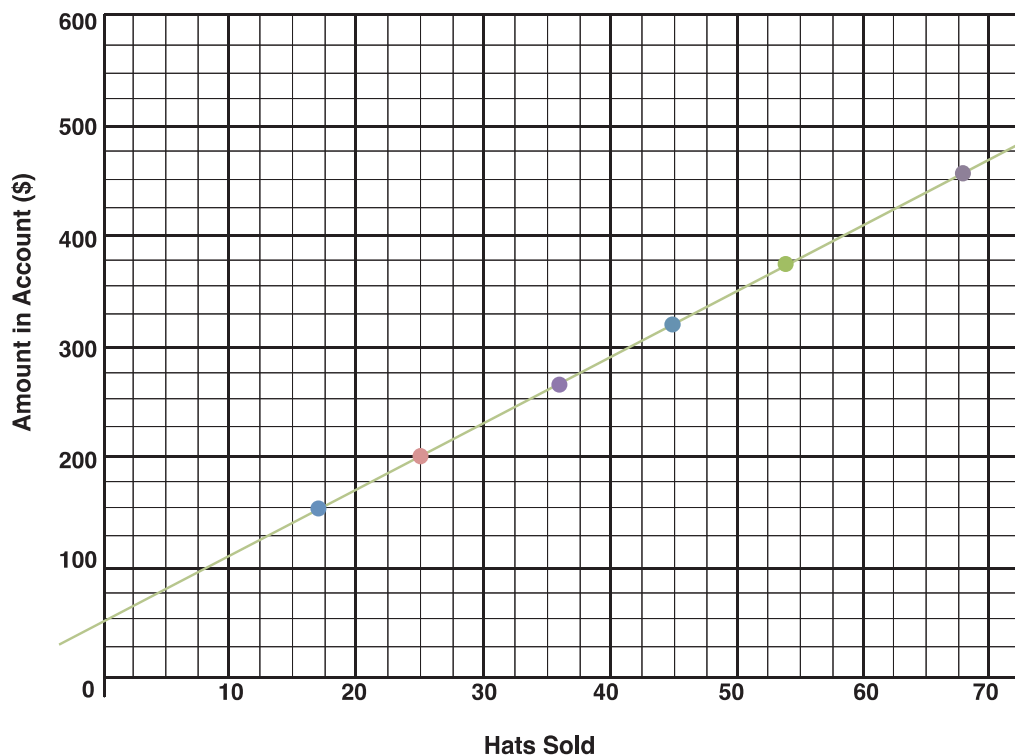


10 Tessa wants to raise a total of \$250 for her favorite charity. She has already raised \$145. Tessa asks for \$15 contributions from each person she contacts. Which equation best represents this situation?

- (A) $15x = 250$
- (B) $145(15x) = 250$
- (C) $145 + 15x = 250$
- (D) $145 - 15x = 250$

QUESTIONS 11 AND 12 REFER TO THE FOLLOWING INFORMATION.

A class raised money selling t-shirts, and then began selling hats. The graph represents the total amount of money in the class account as the number of hats sold increases.



11 According to the graph, which of the following best approximates the number of hats that must be sold for the class to have raised a total of \$400

- (A) 54
- (B) 58
- (C) 64
- (D) 68

12 What does the slope of the line signify?

- (A) The amount of money already raised
- (B) The amount of money raised by selling each hat
- (C) The number of hats that are sold
- (D) The number of hats that must be sold to meet the fundraising goal



- 13** A survey was conducted to determine whether the voters in a city of 38,000 would support funding a new park. A sample of 18 voters randomly selected from the voting list revealed that 11 voters favored funding the park, 4 voters did not want to fund the park, and 3 voters had no preference. Which of the following makes it least likely that a reliable conclusion can be drawn from the data?
- (A) The size of the sample population
(B) The size of the city's population
(C) The number of people with no preference
(D) How the sample population was selected
- 14** In 2010, a census showed a city had a population of 22,500. The results of the census also showed that the mean income of the population was \$72,350, and the median income was \$65,580. Which of the following could describe the difference between the mean income and the median income of the population?
- (A) Most of the income values are between the mean and median income values.
(B) There are a few income values that are much less than the other income values.
(C) There are a few income values that are much greater than the other income values.
(D) The range in income values is greater than the income value.
- 15** A group of h neighbors has 1,230 CDs they are selling at a yard sale. If each neighbor sells on average x CDs per day for j days of the yard sale, which of the following represents the total number of CDs that will be left when the yard sale is over?
- (A) $1230 - jhx$
(B) $1230 - hx - j$
(C) $1230 - \frac{jx}{h}$
(D) $1230 + \frac{jx}{h}$
- 16** $y = -16x^2 + 50x + 2$
- The equation above represents the height y of a ball, in feet, x seconds after it has been thrown upwards. Which of the following best describes the meaning of the coefficient 50?
- (A) The height of the ball when it is thrown
(B) The height of the ball after x seconds
(C) The initial velocity of the ball when it is thrown
(D) The acceleration of the ball's upward velocity

QUESTIONS 17 AND 18 REFER TO THE FOLLOWING INFORMATION.

Quinn is moving across the state and needs to rent a moving truck that will fit her belongings. The table below shows the mileage rate and daily rental cost for trucks from three different companies.

	Mileage rate, b , in cents per mile	Rental rate, a , in dollars per day
Company J	15	19
Company K	10	30
Company L	12	25

The total cost, y , for renting the truck for one day and driving x miles is found by using the formula $y = a + 0.01bx$.

- 17** For which numbers of miles x is the cost of renting from Company J less than renting from Company K?
- (A) $x < 44$
 (B) $x < 55$
 (C) $x < 220$
 (D) $x < 980$
- 18** If the relationship between the total cost, y , of renting the truck from Company L and driving it x miles for one day is graphed in the xy -plane, what does the slope of the line represent?
- (A) The daily rental cost for the truck
 (B) The cost to drive the truck each mile
 (C) The total cost for the miles driven
 (D) The total cost for renting and driving the truck

QUESTIONS 19 AND 20 REFER TO THE FOLLOWING INFORMATION.

A sample of the population in two neighborhood towns, Town A and Town B, was surveyed in order to determine the most popular types of house styles. The results of the survey are shown in the table.

TYPES OF HOUSES

House Style	Ranch	Colonial	Cape Cod	Victorian
Town A	75	25	53	20
Town B	62	65	43	32

- 19** According to the table above, what is the probability that a randomly selected house in Town B is a colonial house?
- (A) $\frac{65}{202}$
 (B) $\frac{17}{18}$
 (C) $\frac{31}{45}$
 (D) $\frac{25}{62}$
- 20** What is the probability that a house randomly selected from Town A is a Victorian house?
- (A) $\frac{5}{13}$
 (B) $\frac{20}{43}$
 (C) $\frac{4}{75}$
 (D) $\frac{32}{375}$

- 21 Which of the following are the solutions to the equation $y - 5 = 3x^2 - 5x - 7$?

(A) $2, -\frac{1}{3}$

(B) $3, -1\frac{1}{3}$

(C) $\frac{5 \pm \sqrt{109}}{6}$

(D) $\frac{5}{6}$

22

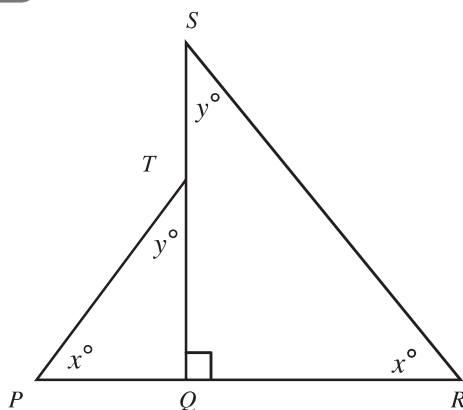


Figure not drawn to scale.

In the figure above, if $QP = 11.5$, $TQ = 15$, and $QR = 46$, what is the value of SQ ?

- (A) 65
 (B) 60
 (C) 49.5
 (D) 42.5



23 $1 = \frac{3}{x-4} + \frac{4}{x-3}$

Which of the following are the values of x in the equation above?

(A) $7 \pm 2\sqrt{3}$

(B) $7 \pm \sqrt{62}$

(C) $7 \pm \sqrt{86}$

(D) 1, 13

- 24 A certain type of weather radar, known as a Base Reflectivity Radar, has a circumference of 572π miles. The central angle of a sector of the circle that the

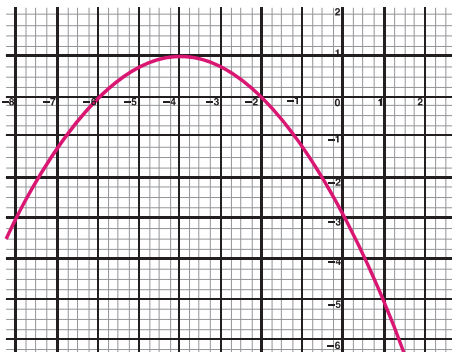
radar makes is $\frac{3\pi}{4}$.

What is the area, in square miles, of the sector of the circle?

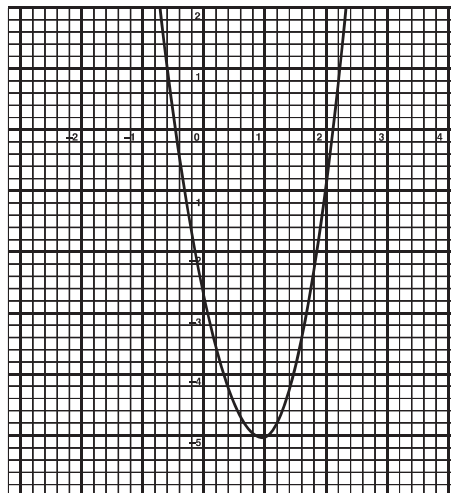
- (A) 858π square miles
 (B) $\frac{429\pi}{4}$ square miles
 (C) $\frac{61,347\pi}{2}$ square miles
 (D) $81,796\pi$ square miles

- 25 If c is a negative constant less than 1 and b is a positive constant greater than 1, which of the following could be the graph of $y = a(x + b)(x + c)$?

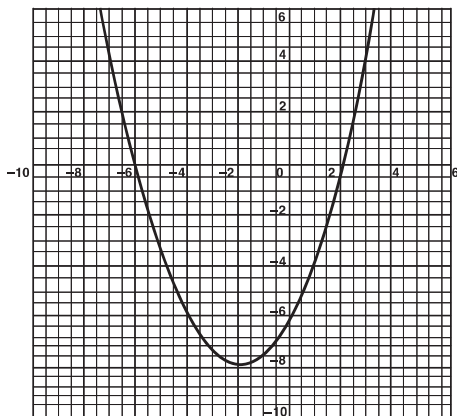
(A)



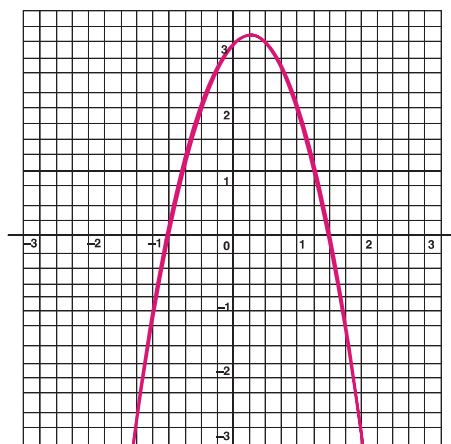
(C)



(B)



(D)



- 26 $2x - 5y < 6$
 $x + ay < -3$

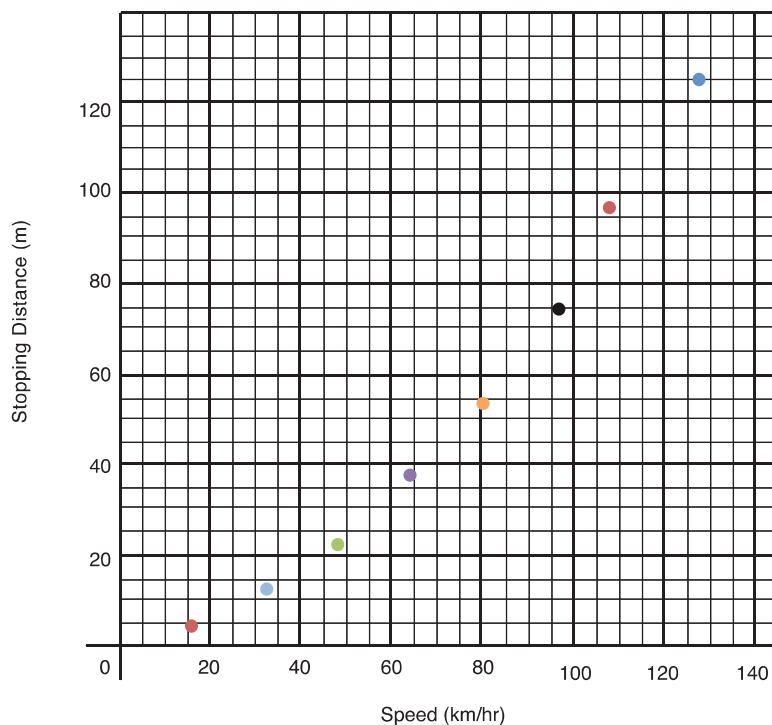
Which of the following must be true if the system of inequalities has solutions only in quadrants II and III?

- (A) $a < 0$
- (B) $a = 0$
- (C) $0 \leq a \leq 2.5$
- (D) $a > 2.5$



QUESTIONS 27 AND 28 REFER TO THE FOLLOWING INFORMATION.

The graph below shows the results of a study to see how far a vehicle travels before coming to a complete stop at different speeds.



- 27** Which equation best models the relationship shown in the graph between the speed in kilometers per hour, x , and the stopping distance in meters, y ?

- (A) $y = \frac{1}{4}x$
- (B) $y = x - 10$
- (C) $y = 4.82(1.03)^x$
- (D) $y = 4.82x^{1.03}$

- 28** Which of the following best describes the relationship represented in the graph?

- (A) The relationship between the initial speed and the stopping distance is linear, because the points are close to a line.
- (B) The relationship between the initial speed and the stopping distance is linear, because the points are all on a line.
- (C) The relationship between the initial speed and the stopping distance is modeled by exponential growth, because the slope of the line connecting any two points increases as the initial speed increases.
- (D) The relationship between the initial speed and the stopping distance is modeled by exponential decay, because the slope of the line connecting any two points increases as the initial speed increases.



- 29 A recent national poll of adults in the United States found that 64% favor stricter emissions on power plants. The margin of error for the poll was $\pm 4\%$ with 95% confidence. Which of the following statements is a conclusion that can accurately be drawn from this poll?
- (A) The true percentage of people who oppose stricter emissions of power plants is definitely between 32% and 40%.
- (B) The true percentage of people who support stricter emissions of power plants is definitely between 60% and 68%.
- (C) The pollsters are 95% confident that the true percentage of people who oppose stricter emissions of power plants is between 32% and 40%.
- (D) The pollsters are 95% confident that the true percentage of people who support stricter emissions of power plants is between 60% and 68%.
- 30 The equation for the graph of a circle in the xy -plane is $x^2 + y^2 - 10x + 4y = -20$. What are the coordinates of the center of the circle?
- (A) $(5, -2)$
- (B) $(-5, 2)$
- (C) $(10, -4)$
- (D) $(-10, 4)$

practice test



- 31 A bowling alley charges \$4.50 per hour to use a lane. They also charge \$2.50 to rent a pair of bowling shoes. Miguel and his friend rent a pair of bowling shoes each. The total cost before taxes is \$16.25. How many hours did they bowl?
- 32 If $4s - 3 < 2$ and s is an integer, what is the greatest possible value of $4s + 5$?
- 33 If $2a - b = 7$ and $2a + 2b = 16$, what is the value of $3a + 7b$?
- 34 The current population of a certain type of organism is about 100 million. The population is currently increasing at an annual rate that will make the population double in 18 years. If this pattern continues, what will the population of this country be, in millions of organisms, 54 years from now?
- 35 Sally sold pieces of her pottery for x dollars each at an art show. Paul sold pieces of his pottery for y dollars each at the same show. Paul sold four pieces of pottery for a total of \$85 and Sally sold five pieces for a total of \$40 more than Paul. How much more, in dollars, did Sally charge for each piece of her pottery than Paul charged for his? (Ignore the dollar sign when gridding in your answer.)



- 36 Carl knitted 4 more scarves this year than last year. If he knitted 16% more scarves this year than last year, how many did he knit this year?

- 38 The average weekly median household income in a country from 2010 through 2014 was \$1,007. What is the least average weekly median household income for 2015 that would keep an average of at least \$1,000? Grid in your answer without the dollar sign.

- 37 $y = 2x + 5$
 $y = -2(x + 1)^2 + 3$

If (x, y) is a solution to the system of equations above, what is one possible value of y ?

STOP

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



Section 3: Math Test—No Calculator

1. C	5. C	9. C	13. D	17. 1
2. D	6. B	10. B	14. B	18. 13
3. B	7. B	11. C	15. A	19. $\frac{4}{3}$
4. B	8. C	12. C	16. 24	20. 4

MATH TEST—NO CALCULATOR TEST RAW SCORE
(Number of correct answers)

- The correct answer is (C).** The question asks for Jared's goal in steps per day after d days. He increases his goal by 125 steps each day, so after 1 day it will go up $125(1)$, after 2 days it will go up by $125(2)$, and after d days it will go up by $125d$ from his original amount of 950.
- The correct answer is (D).** Use the correct order of evaluating functions. First evaluate $g(3) = 1$, then substitute in $f(g(3))$ as $f(1)$ to find that $f(g(3)) = 3$.
- The correct answer is (B).** The formula for exponential decay is $y = a(1 - r)^n$, where r is the rate of change, n is the number of times the rate is applied, a is the initial amount, and y is the amount remaining.
- The correct answer is (B).** First, find half the length of the horizontal distance, which is 15 ft. Then, use the Pythagorean Theorem to find the length of each of the slanted sides.

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

$$8^2 + 15^2 = c^2$$

$$64 + 225 = c^2$$

$$289 = c^2$$

$$17 = c$$
- The correct answer is (C).** Since $y = 2(x - 4)(x - 6)$ is equivalent to the equation, and it is given in the form $y = a(x - b)(x - c)$, it shows the x -intercepts (4 and 6) as constants.
- The correct answer is (B).** Find the x - and y -intercepts of the given equation.

$$3x + y = 4$$

$$3(0) + y = 4$$

$$y = 4$$

$$3x + 0 = 4$$

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

Check the intercepts on the graph of each line to see if they match the intercepts of the equation in the problem. Only choice (B) has intercepts at $(0, 4)$ and $(\frac{4}{3}, 0)$.
- The correct answer is (B).** Use the point slope form of a linear equation to write the slope-intercept form of the equation:

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

$$y - 3 = -1(x - 2)$$

$$y - 3 = -x + 2$$

$$y = -x + 5$$



Then find the equation that is equivalent to the slope-intercept form:

$$3x + 3y = 15$$

$$3y = -3x + 15$$

$$y = -x + 15$$

8. **The correct answer is (C).** Use FOIL to solve:

$$\begin{aligned} \frac{3}{4}(x-4)(3+5x) &= \frac{3}{4}(3x+5x^2-12-20x) \\ &= \frac{3}{4}(5x^2-17x-12) \\ &= \frac{15x^2}{4} - \frac{51x}{4} - 9 \end{aligned}$$

9. **The correct answer is (C).** To solve this problem, you need to remember the rule of fractional exponents, which states that if x is a nonzero rational number and m and n

are positive integers, then $x^{\frac{m}{n}}$ equals the n^{th} root of x^m :

$$x^{\frac{m}{n}} = \sqrt[n]{x^m}$$

$$x^{\frac{3}{4}} = \sqrt[4]{x^3}$$

10. **The correct answer is (B).** The equation for a parabola with a vertex at (h, k) is $y = a(x-h)^2 - k$, and if the y -intercept is 13, then $(0, 13)$ is a point on the parabola and $13 = a(0-h)^2 - k$. Since $13 = 2(0-3)^2 - 5$, choice (B) is correct.

11. **The correct answer is (C).** The amount per each type of admission is \$12 and \$17, so the total admission of \$1079 based upon number of adults and children is $12x + 7y$. The total number of people, 117, is represented by $x + y$.

12. **The correct answer is (C).**

$$\frac{4-i}{3+i} \times \frac{3-i}{3-i} = \frac{11-7i}{10}$$

13. **The correct answer is (D).** Solve the equation:

$$-6(t+1) = 2(1-3t) - 8$$

$$-6t - 6 = 2 - 6t - 8$$

$$-6 = -6$$

The equation has infinitely many solutions.

14. **The correct answer is (B).** The formula for population growth is $P = P_0 e^{rt}$, where P represents the total population, P_0 represents the initial population, e represents the constant value, r represent the rate of growth, and t represents the time. The “10” in the problem represents the time, in years, between the two years of interest—the initial year 1980 and the city’s population in 1990. There are 10 years between 1980 and 1990.

15. **The correct answer is (A).** It’s probably easiest to answer this question by plugging in numbers. We want to select easy numbers to represent the variables p and q . It is always a good idea stay away from numbers like 0 and 1, which have special properties; for this question, we also want to avoid the number 2, since it already appears in the equation. So, let’s say that $p = 4$ and $q = 3$. If we plug these numbers into the original equation, we get:

$$\frac{2(4)+2n}{3n} = 2$$

$$8+2n = 6n$$

$$8 = 4n$$

$$2 = n$$

When we plug the numbers 4 and 3 in for the variables p and q in each of the answer choices, we see that the expression in choice (A) works out to be 2, and that none of the other choices work.

$$\frac{p}{q-1} = \frac{4}{3-1} = 2$$



16. **The correct answer is 24.** To solve this problem, first isolate $\sqrt{x+1}$ on one side of the equation. Then, square both sides:

$$\begin{aligned}\sqrt{x+1} - 2 &= 3 \\ \sqrt{x+1} &= 5 \\ x+1 &= 25 \\ x &= 24\end{aligned}$$

17. **The correct answer is 1.** To solve this problem, substitute the value of $f(x) = 1$ in the given equation and solve for x :

$$\begin{aligned}f(x) &= 3x - 2 \\ 1 &= 3x - 2 \\ 3 &= 3x \\ 1 &= x\end{aligned}$$

18. **The correct answer is 13.** To find the value of c , divide the numerator by the denominator using either long division or synthetic division. Remember that the remainder can be written as a fraction, with the remainder as the numerator and the divisor as the denominator.

$$\frac{3x^2 - 4x - 18}{x + 3} = x + 3 \overline{)3x^2 - 4x - 18} \begin{array}{l} 21 \\ \hline \end{array}$$

Here, the remainder is 21, so the fraction is equal to $3x - 13 + \frac{21}{x+3}$. Set this equal to the expression in the equation to find that $c = 13$.

$$\frac{3x^2 - 4x - 18}{x + 3} = 3x - 13 + \frac{21}{x + 3} \\ c = 13$$

19. **The correct answer is $\frac{4}{3}$.** The equations need to have the same slope but different y -intercepts. The first equation is already written in slope-intercept form. First, rewrite the second equation so that it is in slope-intercept form, then find the value for t that make the slope 3. This should make the y -intercept different than 7.

$$\begin{aligned}4x - ty &= 5 \\ -ty &= -4x + 5 \quad \text{So, } \frac{-4}{-t} = 3 \\ y &= \frac{-4x + 5}{-t} \quad -4 = 3t \\ y &= \frac{-4x}{-t} + \frac{5}{-t} \quad t = \frac{4}{3}\end{aligned}$$

To check that the y -intercept is not 7:

$$\begin{aligned}\frac{5}{-t} &= \frac{5}{-\frac{4}{3}} \\ &= 5 \left(-\frac{3}{4} \right) \\ &= -\frac{15}{4}\end{aligned}$$

20. **The correct answer is 4.** Use the formula for the volume of a sphere and of a cone and set the formulas equal to each other since their volumes are equal. Then solve for the value of $\frac{h}{r}$.

$$\begin{aligned}V_{\text{cone}} &= V_{\text{scoop}} \\ \frac{1}{3}\pi r^2 h &= \frac{4}{3}\pi r^3 \\ h &= \frac{\cancel{\pi} \left(\frac{4}{\cancel{\pi}} \cancel{r} r^{\cancel{3}^2} \right)}{\cancel{\pi} \cancel{r}} \\ h &= 4r \\ \frac{h}{r} &= 4\end{aligned}$$



Section 4: Math Test—Calculator

1. C	9. A	17. C	25. B	33. 36
2. B	10. C	18. B	26. C	34. 800
3. D	11. B	19. A	27. C	35. 3.75
4. B	12. B	20. C	28. C	36. 29
5. A	13. A	21. A	29. D	37. 1 or 3
6. B	14. C	22. B	30. A	38. 965
7. D	15. A	23. A	31. 2.5	
8. B	16. C	24. C	32. 9	

MATH TEST—CALCULATOR RAW SCORE
(Number of correct answers)

1. **The correct answer is (C).** We must first determine how many feet the insect travels in an average month. Then we can determine how many months it will take for the insect to travel 560 feet. To determine the number of feet the insect travels per month, we divide the yearly total by 12:

$$\frac{1680}{12} = 140$$

The insect travels 140 feet each month. To determine how many months it would take the insect to travel 560 feet, we divide the total number of feet (560) by the amount of feet that the insect travels in a month (140):

$$\frac{560}{140} = 4$$

Traveling at a rate of 140 feet per month, it would take the insect 4 months to travel 560 feet.

2. **The correct answer is (B).** The question asks for the number of books that will be renewed if the library loans 25,000 books. Use a proportion to solve.

$$\begin{aligned}\frac{18}{75} &= \frac{x}{25,000} \\ 75x &= 18(25,000) \\ x &= \frac{18(25,000)}{75} \\ x &= 6000\end{aligned}$$

3. **The correct answer is (D).** The number of males in Littletown is 210, and the number of females in Smalltown is 195. The probability of choosing a male who lives in Littletown

is $\frac{210}{785}$ and the probability of choosing a

woman who lives in Smalltown is $\frac{195}{785}$.

The probability of choosing one or the other is the sum of the individual probabilities:

$$\frac{210}{785} + \frac{195}{785} = \frac{405}{785} = \frac{81}{157}$$



4. **The correct answer is (B).** There are 52 weeks in a year, so multiplying 0.36 inches by 52 weeks is 18.72 inches. If the tree grows 18.72 inches in a year, then it will grow $18.72 \times 10 = 187.2$ inches in ten years.

5. **The correct answer is (A).** The total amount that Glen earns in one day is $10.25h$ where h is the number of hours Glen works and $3(12.50)$ is three times what he spends commuting. If he wants to earn at least three times what he spends commuting, then choice (A) is the only answer that represents the situation.

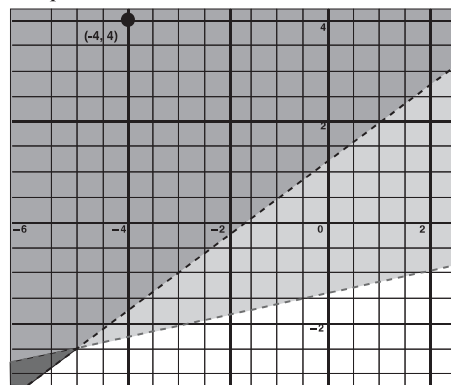
6. **The correct answer is (B).** If Peter spent x hours, then Nadia spent $x + 7$ hours on math homework, and together they spent $x + (x + 7) = 35$ hours. Solve for x :

$$\begin{aligned}x + (x + 7) &= 35 \\2x + 7 &= 35 \\2x &= 28 \\x &= 14\end{aligned}$$

7. **The correct answer is (D).** Since c is 22 percent of e , c equals $(e \times 0.22)$, or $= 0.22e$. Likewise, because d is 68 percent of e , d equals $(e \times 0.68)$, or $= 0.68e$. To find the value of $d - c$, in terms of e , we can set up an equation:

$$\begin{aligned}d - c &= (0.68e - 0.22e) \\d - c &= (0.46e)\end{aligned}$$

8. **The correct answer is (B).** Graph the inequalities and look for where they overlap, or substitute each point into both inequalities to determine which point satisfies both inequalities.



Only choice (B) is correct:

$$\begin{array}{ll}2x - 9y < 12 & -3x + 4y > 5 \\2(-4) - 9(4) < 12 & -3(-4) + 4(4) > 5 \\-8 - 36 < 12 & 12 + 16 > 5\end{array}$$

9. **The correct answer is (A).** The question is just asking us to substitute the value that we are given for n and then to simplify the expression. We're asked to provide an answer in terms of m , or in other words, an answer that contains the variable m . Let's see what we get when we substitute 7 for n :

$$\begin{aligned}2m(16 - 6n) &= 2m[16 - 6(7)] \\&= 2m(16 - 42) \\&= 2m(-26) \\&= -52m\end{aligned}$$

10. **The correct answer is (C).** The total amount that she has raised is \$145. If she gets \$15 from each additional donor, then the total contributions will be equal to $145 + 15x$, where x is the number of contributions she gets from this point forward.

11. **The correct answer is (B).** Read the graph and look for where the line has a vertical coordinate of \$400. The closest approximation is 58 hats.



12. **The correct answer is (B).** The x -axis of the graph shows the number of hats sold, and the y -axis shows the amount of money raised. Consequently, the slope of the line shows the amount of money received per hat.
13. **The correct answer is (A).** A sample size of 18 people is not large enough to make a conclusion for a city of 38,000. The sample population was randomly selected, the size of the city population alone doesn't affect the reliability, and the number of people with no preference does not affect the reliability.
14. **The correct answer is (C).** When the mean and median of a set of data are not the same, outliers tend to affect the mean more than the median. If some income values are much greater than the others, the mean will be greater than the median.
15. **The correct answer is (A).** The amount of CDs sold would be equal to the number of days in the sale (j) times the number of neighbors (h) times the average number of CDs sold (x), or jhx . To determine the number of CDs that will be *left* after the total number of CDs, (jhx), are sold, we subtract jhx from 1230. This value can be expressed as $1230 - jhx$.
16. **The correct answer is (C).** The formula that is useful for this problem is the formula for projectile motion: $y = 0.5at^2 + vt + h$, where a is the acceleration, v is the upward velocity, h is the initial height, t is the time in seconds, and y is the height after t seconds. Here, the coefficient, v , equals 50, so the correct answer must be choice (C).
17. **The correct answer is (C).** First, write inequalities that represent the price for each company. Then let the price from Company J be less than the price for Company K and solve the inequality.
Company J = $0.15x + 19$
Company K = $0.10x + 30$
 $0.15x + 19 < 0.10x + 30$
 $0.05x < 11$
 $x < 220$
18. **The correct answer is (B).** The daily rental cost for the truck is the y -intercept. The slope of the graph of this relationship is the per mile cost. The total cost for the miles driven in the truck is $0.12x$. The total cost for driving the truck the entire distance is $0.12x + 25$.
19. **The correct answer is (A).** To find the probability that a randomly chosen house in Town B is a colonial house, first find the total number of houses that are in Town B: $62 + 65 + 43 + 32 = 202$. Then write and simplify a ratio of colonial houses in Town B to the total number of houses in Town B in the survey: $\frac{65}{202}$
20. **The correct answer is (C).** The total number of houses in the survey is 375. The number of Victorian houses in Town A is 20. The probability that a randomly selected house is chosen from Town A and is a Victorian house is $\frac{20}{375} = \frac{4}{75}$.



21. **The correct answer is (A).** To solve the quadratic equation, first add 5 to both sides of the equation: $y = 3x^2 - 5x - 2$. Then, use the quadratic formula with $a = 3$, $b = -5$, $c = -2$ and simplify the expression.

$$\begin{aligned} x &= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(-2)}}{2(3)} \\ &= \frac{5 \pm \sqrt{49}}{6} \\ &= 2, -\frac{1}{3} \end{aligned}$$

22. **The correct answer is (B).** The key to solving this geometry problem is to recognize that the figure contains two similar triangles. We know that the triangles are similar because their corresponding angles are equal ($x = x$, $y = y$, and the two right angles are equal). Since the triangles have equal corresponding angles, we know that the sides are in proportion to one another.

We want to determine the ratio between the corresponding sides in the larger triangle, SQR , and the smaller triangle, TQP . We can do this by comparing the two corresponding sides for which we have measures. We're given the length of QP in the smaller triangle as 11.5. We're also given the length of its corresponding leg from the larger triangle, QR , as 46. How many times bigger is QR than QP ? If we divide 46 by 11.5, we see that QR is 4 times as large as QP .

The question asks us to determine the length of SQ , which is a side of the larger triangle, SQR . We know that the measure of its corresponding side in the smaller triangle, TQP , is TQ , which measures 15. We also know that all corresponding sides in the larger triangle, SQR , are 4 times as long as the ones in the smaller triangle, TQP , so SQ measures 4 times as much as TQ , or $4 \times 15 = 60$.

23. **The correct answer is (A).** First, rewrite the equation as a quadratic one:

$$\begin{aligned} 1 &= \frac{3}{x-4} + \frac{4}{x-3} \\ (x-3)(x-4) &= (x-3)(x-4) \left[\frac{3}{x-4} + \frac{4}{x-3} \right] \\ x^2 - 7x + 12 &= 3x - 9 + 4x - 16 \\ x^2 - 14x + 37 &= 0 \end{aligned}$$

Now use the quadratic formula with $a = 1$, $b = 14$, and $c = 37$ to simplify:

$$\begin{aligned} x &= \frac{14 \pm \sqrt{(-14)^2 - 4(37)}}{2} \\ x &= \frac{14 \pm \sqrt{196 - 148}}{2} \\ x &= 7 \pm 2\sqrt{3} \end{aligned}$$

24. **The correct answer is (C).** Use the circumference of the circle to find the radius.

$$\begin{aligned} C &= 2\pi r \\ 572\pi &= 2\pi r \\ 286 &= r \end{aligned}$$

Then use the measure of the central angle and the radius to find the area of the sector:

$$\begin{aligned} A &= \frac{3\pi}{2\pi} \pi (r)^2 \\ A &= \frac{3}{8} \pi (286)^2 \\ A &= \frac{61,347\pi}{2} \end{aligned}$$

25. **The correct answer is (B).** If $b < -1$ and $c > 1$, then the x -intercepts of the graph must be greater than 1 and less than -1 .

26. **The correct answer is (C).** If a is any value less than 0, then the border of $x + ay < -3$ will intersect the y -axis and there will be solutions in quadrant I. Eliminate choice (A). If a is greater than 2.5 then there will be solutions in quadrant IV. Eliminate choice (D). If $0 \leq a \leq 2.5$, then there are only solutions in quadrants II and III. Since a can take on values other than 0, choice (B) is incorrect.



27. **The correct answer is (C).** The slope increases between the points, so it is not a linear relationship. Eliminate choices (A) and (B). An exponential relationship uses the x -variable for the exponent. Eliminate choice (D). Checking approximate points (32, 13), (80, 54) and (96, 75) using choice (C):

$$y = 4.82(1.03)^x \rightarrow 4.82(1.03)^{32} \rightarrow y \approx 12.4$$

$$y = 4.82(1.03)^x \rightarrow 4.82(1.03)^{80} \rightarrow y \approx 51.3$$

$$y = 4.82(1.03)^x \rightarrow 4.82(1.03)^{96} \rightarrow y \approx 82.3$$

The equation approximately models the data, so choice (C) is correct.

28. **The correct answer is (C).** The relationship between the initial speed and the stopping distance is modeled by exponential growth, because the slope of the line connecting any two points increases as the initial speed increases. While the points are close to a line, an exponential growth curve better approximates the relationship.

29. **The correct answer is (D).** The 95% confidence that the margin of error is ± 34 is important, and choices (A) and (B) ignore the confidence interval. Choice (C) is not correct because there are likely people who don't know or have no opinion on whether there should be stricter emissions standards for power plants. Only choice (D) accurately uses the confidence interval and the data given in the problem.

30. **The correct answer is (A).** Use completing the square to find the coordinates of the center of the circle. Separate the equation x - and y -terms:

$$x^2 + y^2 - 10x + 4y = -20$$

$$x^2 - 10x + y^2 + 4y = -20$$

$$(x^2 - 10x + 25) + (y^2 + 4y + 4) = -20 + 25 + 4$$

$$(x - 5)^2 + (y + 2)^2 = 9$$

The center is (5, -2), because the standard form of the circle is $(x - h)^2 + (y - k)^2 = r^2$.

31. **The correct answer is 2.5.** Write an equation to represent the situation, and then solve:

$$16.25 = 2.5(2) + 4.5x$$

$$11.25 = 4.5x$$

$$2.5 = x$$

32. **The correct answer is 9.** Solve for the expression requested in the inequality, then interpret the answer in the context of the question asked:

$$4s - 3 < 2$$

$$4s < 5$$

$$s < \frac{5}{4}$$

Since s is an integer, s must be 1, and so $4s + 5 = 4(1) + 5 = 9$. The greatest integer value that is less than 10 is 9.

33. **The correct answer is 36.** Use the method of combination to determine the values of a and b . Start by subtracting the first equation from the second equation:

$$2a + 2b = 16$$

$$-(2a - b) = -(7)$$

$$3b = 9$$

$$b = 3$$

Insert $b = 3$ into the first equation:

$$2a - (3) = 7$$

$$2a = 10$$

$$a = 5$$

Now you are ready to plug both values into the expression in question:

$$3a + 7b = 3(5) + 7(3)$$

$$= 15 + 21$$

$$= 36$$



- 34. The correct answer is 800.** The formula for population growth is given in terms of n , the number of years. In order to solve this problem, plug the value of n , in this case 54, into the formula and calculate the value of the expression $100(2)^{\frac{n}{18}}$:

$$\begin{aligned} \text{Population in millions after } n \text{ years} &= 100(2)^{\frac{n}{18}} \\ &= 100(2)^{\frac{54}{18}} \\ &= 100(2)^3 \\ &= 800 \end{aligned}$$

- 35. The correct answer is 3.75.** Read the question carefully; it asks for the difference in the prices of one object, not the difference between the amounts of money they made, or any other quantity.

Since Paul sold four pieces of pottery for

$$\text{\$85, he made } y = \frac{85}{4} = \text{\$21.25 per piece.}$$

Sally made $\text{\$40}$ more than Paul did for all of her pieces, so she made $\text{\$85} + \text{\$40} = \text{\$125}$ in total. Since she sold five pieces, she made

$$x = \frac{125}{5} = \text{\$25.00 per piece. Per piece, Sally}$$

made $x - y = \text{\$25} - \text{\$21.25} = \text{\$3.75}$ more than Paul did. The correct answer is 3.75.

- 36. The correct answer is 29.** First, find the original amount using a percent proportion. Then add 4 to find the new total.

$$\begin{aligned} \frac{16}{100} &= \frac{4}{x} \\ 16x &= 400 \\ x &= \frac{400}{16} \\ x &= 25 \\ 25 + 4 &= 29 \end{aligned}$$

- 37. The correct answer is 1 or 3.** First, combine the equations by substituting $2x + 5$ for y in the second equation. Then solve for x . Next, substitute the x -values back in and solve for y :

$$\begin{aligned} 2x + 5 &= -2(x+1)^2 + 3 \\ 2x + 5 &= -2x^2 - 4x - 2 + 3 \\ 0 &= -2x^2 - 6x - 4 \\ 0 &= -2(x+2)(x+1) \\ x &= -1, -2 \\ y &= 2(-1) + 5 = 3 \\ &\text{or} \\ y &= 2(-2) + 5 = 1 \end{aligned}$$

- 38. The correct answer is 965.** If the average of the 2010–2014 weekly median income is $\text{\$1,007}$, and the average after 2015 is at least $\text{\$1,000}$, then an equation can be written to solve for the least amount that the weekly median income amount can be for 2015:

$$\begin{aligned} \frac{1,007 \cdot 5 + x}{6} &= 1,000 \\ 5,035 + x &= 6,000 \\ x &= 965 \end{aligned}$$

Therefore, the least average weekly median household income for 2015 that will keep the average of at least $\text{\$1,000}$ is $\text{\$965}$.

SECTION 3: MATH TEST—NO CALCULATOR 

20 Questions • 25 minutes


TURN TO SECTION 3 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

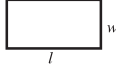
Directions: For Questions 1–15, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 16 will provide information on how to enter your answers in the grid.

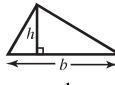
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
- The use of a calculator in this section is **not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
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-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

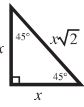
Reference Information

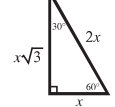
Circle:  $C = 2\pi r$
 $A = \pi r^2$

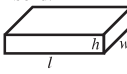
Rectangle:  $A = lw$


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

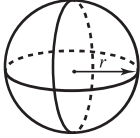
 $a^2 + b^2 = c^2$

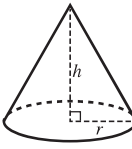
 x , x , $x\sqrt{2}$

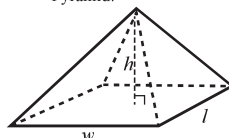
 x , $x\sqrt{3}$, $2x$

Rectangular Solid:  $V = lwh$

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

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

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

Rectangular Based Pyramid:  $V = \frac{1}{3}lwh$

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

1 If $x + x + x + 7 = x + x + 9$, what is the value of x ?

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

2 Which shows the simplified form of $(3x^2 - 7x + 5) - (-6x^2 + 5x - 4)$?

- (A) $-3x^2 - 2x + 1$
(B) $-3x^2 - 12x + 9$
(C) $9x^2 - 2x + 1$
(D) $9x^2 - 12x + 9$



3

$$y \leq 3x - 4$$

$$5x + 4y \geq 6$$

Which point is a solution to the system of inequalities?

- (A) (0, 0)
- (B) (-1, 5)
- (C) (2, -3)
- (D) (3, 4)

4

Angie took $3x$ hours to make it on time for her brother's birthday party in another state, and she drove the route at an average of z miles per hour. If b is the number of hours Angie spent at rest stops, when she was NOT traveling, which of the following represents the total distance Angie traveled to get to her brother's party?

- (A) $z(b - 3x)$
- (B) $b - 3x$
- (C) $z(3x - b)$
- (D) $3xz - b$

5

If $3s - r = 9$ and $6s = 36$, what is the value of r ?

- (A) 3
- (B) 6
- (C) 9
- (D) 12

6

Gary deposits \$50 into an existing savings account. Each month he plans to increase the amount he deposits by \$7. Using $y = 50 + 7(x - 1)$ to represent this situation, what is the meaning of y in the equation?

- (A) The total amount that Gary has in the account after x months
- (B) The number of months that Gary has been making deposits
- (C) The amount that Gary deposits into his account in month x
- (D) The increase in the monthly amount of Gary's deposits

7

If $f(x) = cx - \frac{d}{x}$, which of the following

represents $f\left(\frac{1}{c}\right)$?

- (A) $1 - cd$
- (B) $1 + cd$
- (C) $c^2 - \frac{d}{c}$
- (D) $\frac{d}{c} - c^2$

8

The graph of a function has a y -intercept at 3 and an x -intercept at 1.5. Which of the following could be the equation for that function?

- (A) $y = -\frac{3}{x-3} + 2$
- (B) $y = \frac{1}{x-3} + 2$
- (C) $y = \frac{3}{x-3} + 2$
- (D) $y = \frac{3}{x-1} + 2$

9

The x -intercepts of the function $g(x)$ are -2, 3, and 5. Which of the following is a factor of $g(x)$?

- (A) $x + 2$
- (B) $x + 3$
- (C) $x - 15$
- (D) $x - 30$

10

The ratio of marbles in each package of marbles is 2 red: 3 green: 4 blue. How many green and blue marbles does Ina have if she bought 108 marbles?

- (A) 12
- (B) 36
- (C) 48
- (D) 84



- 11 What is the value of a , if

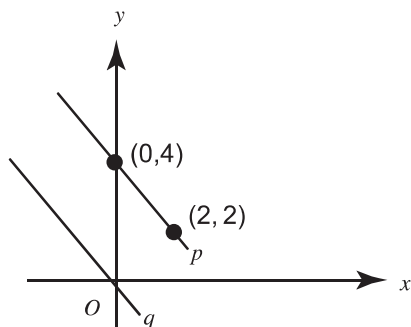
$$x^{\frac{1}{5}} \cdot x^{\frac{4}{5}} = x^{-a}?$$

- (A) -5
 (B) -1
 (C) 1
 (D) 5

- 12 In the figure above, lines p and q are parallel. If point (x, y) lies on line q , which of the following represents the relationship between x and y ?

- (A) $x + y = 0$
 (B) $x - y = 0$
 (C) $x + y = 1$
 (D) $x - y = -1$

13



In a right triangle DEF , $\sin F = \frac{2}{3}$ and $m\angle E = 90^\circ$. Which of the following statements is true?

- (A) $\cos F = \frac{1}{3}$
 (B) $\tan F = 2$
 (C) $\cos D = \frac{2}{3}$
 (D) $\sin D = \frac{1}{3}$

- 14 A circle is drawn on an xy -plane. The diameter of the circle has endpoints at $(-9, 7)$ and $(15, -3)$. Which of the following is an equation for the graph of the circle?

- (A) $(x - 3)^2 + (y - 2)^2 = 169$
 (B) $(x - 3)^2 + (y - 2)^2 = 676$
 (C) $(x - 6)^2 + (y - 4)^2 = 169$
 (D) $(x - 6)^2 + (y - 4)^2 = 676$

15

$$\frac{3x^2 - 5x + 9}{x - 3}$$

Which expression is equivalent to the expression above?

- (A) $3x + 4 + \frac{21}{x - 3}$
 (B) $3x - 5 - \frac{6}{x - 3}$
 (C) $3x + 9 + \frac{36}{x - 3}$
 (D) $3x - 14 + \frac{51}{x - 3}$

practice test



- 16 A ball is tossed into the air from 6 meters off of the ground, with a velocity of 13 meters per second. The equation that represents the height of the ball (h , in meters) at time (t , in seconds) is $h = 6 + 13t - 5t^2$. How many seconds will it take for the ball to hit the ground?

- 19 What is the value of x , if

$$\sqrt{x+10} - \sqrt{2x-5} = 0?$$

- 17 If $b = 6$ is a solution to the equation $6b + m = 270$, where m is a constant, what is the value of m ?

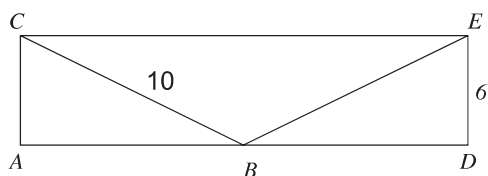
- 20 $fx + gy = -16$

$$3x - 8y = 32$$

In the system of equations above, f and g are constants. If the system has infinitely

many solutions, what is the value of $-\frac{g}{f}$?

18



In the figure above, $ACED$ is a rectangle and B is the midpoint of \overline{AD} . What is the value of \overline{AD} ?

STOP

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

SECTION 4: MATH TEST—CALCULATOR 

38 Questions • 55 minutes


TURN TO SECTION 4 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

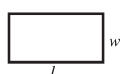
Directions: For Questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For Questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before Question 31 on how to enter your answers in the grid.

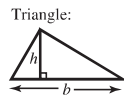
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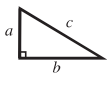
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- All figures lie in a plane unless otherwise indicated.
- Unless otherwise specified, the domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

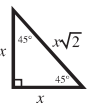
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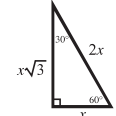
Circle:  $C = 2\pi r$
 $A = \pi r^2$

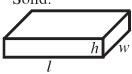
Rectangle:  $A = lw$


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

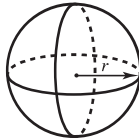
 $a^2 + b^2 = c^2$

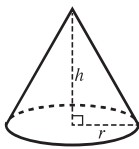
 x , x , $x\sqrt{2}$

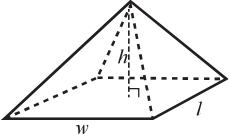
 x , $x\sqrt{3}$, $2x$

Rectangular Solid:  $V = lwh$

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

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

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

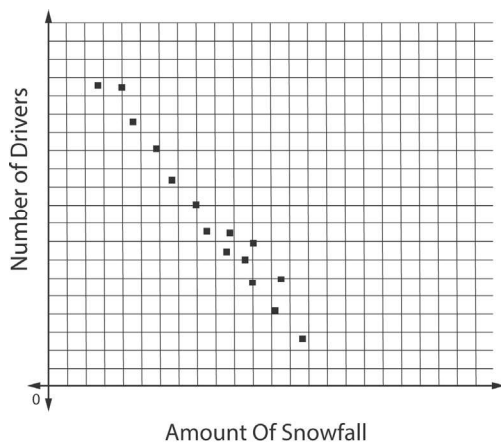
Rectangular Based Pyramid:  $V = \frac{1}{3}lwh$

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

- 1 A 6-pound bag of flour is poured into 24 containers, with the same amount in each container. How many ounces of flour is in each container?

- (A) 2 (C) 6
(B) 4 (D) 8

- 2 A major city performed a recent study to see the effect that snowfall totals have on the number of drivers on the road. The results of the study are represented in the scatterplot, where the x-axis represents the amount of snowfall and the y-axis represents the number of drivers. Which statement best describes the results of the study?



- (A) There is no correlation between the amount of snowfall and the number of drivers on the road.
- (B) There is a positive correlation between the amount of snowfall and the number of drivers on the road.
- (C) There is a negative correlation between the amount of snowfall and the number of drivers on the road.
- (D) The scatterplot does not display enough data to interpret a correlation between the amount of snowfall and the number of drivers on the road.
- 3 How many quarters must Lilly charge for a box of cookies in order to make \$18 after selling 3 boxes of cookies of equal value?
- (A) 6
- (B) 10
- (C) 14
- (D) 24



- 4 Martina earns \$480 per week plus 15% commission on all of her sales. Which shows the amount she earns each week as a function of her total sales, x ?
- (A) $f(x) = 480(0.15x)$
- (B) $f(x) = 480 + 0.15x$
- (C) $f(x) = 480(15x)$
- (D) $f(x) = 480 + 15x$
- 5 The city of Smallville had an increase of 8% in its tax revenues from last year to this year. For next year, the mayor projects the city's tax revenues to increase by 10% from this year. What will be the total percent increase from last year to next year's projection?
- (A) 18%
- (B) 18.8%
- (C) 19%
- (D) 19.8%
- 6 A random sample of people in a county were asked whether or not they drive more when gas prices decrease. Of the 682 people who responded, 471 of them said they do not drive more when gas prices decrease. If there are about 898,000 people living in the county, about how many people would be expected to not drive more when gas prices decrease?
- (A) 280,000
- (B) 320,000
- (C) 580,000
- (D) 620,000
- 7 A scale model drawing of the Moon shows its diameter as 6 inches. The scale of the drawing is 1 inch = 360 miles. What is the approximate diameter of the actual Moon?
- (A) 2,160 miles
- (B) 2,260 miles
- (C) 3,060 miles
- (D) 3,360 miles

- 8 There are 380 seats in a movie theater. The theater must collect at least \$600 in admission per movie screening in order to make a profit. The prices for admission are \$6.50 for children and \$8.25 for adults. Which system of inequalities best describes this situation?

$$x + y \geq 380$$

(A) $6.5x + 8.25y \leq 600$

$$x + y < 380$$

(B) $6.5x + 8.25y > 600$

$$x + y \leq 380$$

(C) $6.5x + 8.25y \leq 600$

$$x + y \leq 380$$

(D) $6.5x + 8.25y \geq 600$

- 9 A couch is on sale for 15% off the retail price r . A 6% sales tax is added to the sale price. Which expression represents the total cost of the couch, including the sales tax?

(A) $0.85r + 1.06$

(B) $0.85r + 1.06r$

(C) $0.85r \times 1.06$

(D) $0.85r \times 1.06r$

- 10 A hiking club bought energy bars for \$2.25 each and reusable water bottles for \$12.50 each and spent a total of \$447.50. Which equation can be used to determine the number of energy bars x and water bottles y that the club bought?

(A) $2.25x + 12.5y = 447.5$

(B) $12.5x + 2.25y = 447.5$

(C) $14.75(x + y) = 447.5$

(D) $\frac{x}{2.25} + \frac{y}{12.5} = 447.5$

- 11 If $b \neq 1$ and...hich of the following expressions is equivalent to $\frac{a-3}{3b-3}$?

(A) $-b$

(B) $-\frac{1}{b}$

(C) $-a$

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

- 12 Which of the following is equivalent to $3\sqrt[4]{x^3}$?

(A) $3x^{\frac{4}{3}}$

(B) $3x^{\frac{3}{4}}$

(C) $3(x^3)^4$

(D) $3(x^4)^{\frac{1}{3}}$

- 13 Aaron earns \$9 working part-time at the pool and \$11 working part-time at the bakery. He needs to make at least \$215 each week, but he cannot work more than a total of 25 hours each week. Which system of inequalities represents this situation?

(A) $9x + 11y \geq 215$

$$x + y \leq 25$$

(B) $9x + 11y < 215$

$$x + y < 25$$

(C) $9x + 11y < 215$

$$x + y > 25$$

(D) $9x + 11y > 215$

$$x + y \leq 25$$

- 14** A book company sells science textbooks and science laboratory activity books. If the maximum weight for one shipment of books is 50 pounds, which inequality can be used to determine the number of each book that can be shipped when the textbooks weigh 2.5 pounds each and the laboratory books weigh 1.25 pounds each?

- (A) $2.5x + 1.25y > 50$
 (B) $2.5x + 1.25y < 50$
 (C) $2.5x + 1.25y \geq 50$
 (D) $2.5x + 1.25y \leq 50$

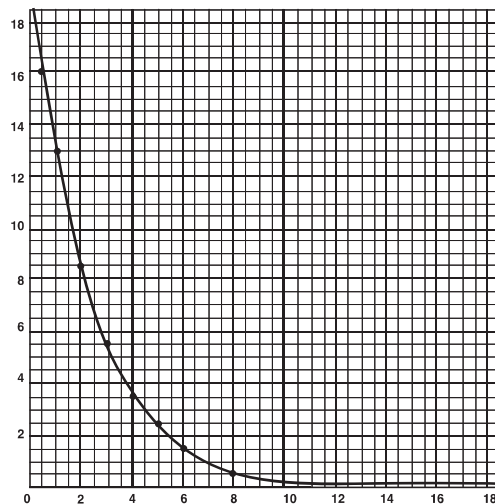
- 15** What is the y -intercept of the line whose equation is $3x + 4y = 16$?

- (A) $\left(\frac{3}{4}, 0\right)$
 (B) $(4, 0)$
 (C) $\left(0, \frac{3}{4}\right)$
 (D) $(0, 4)$



QUESTIONS 16 AND 17 REFER TO THE FOLLOWING INFORMATION.

The graph below shows the amount of radioactive material in y grams that remains after x days in a container. Each point shows a measured amount that remains, and the best fit relation between those points is drawn to connect those points.



- 16** Which of the statements describes the relation between the amount of radioactive material and the number of days that have passed?
- (A) Linear increasing
 (B) Linear decreasing
 (C) Exponential growth
 (D) Exponential decay
- 17** About how much radioactive material remained after 9 days?
- (A) 0.25 gram
 (B) 0.5 gram
 (C) 0.75 gram
 (D) 1 gram

18

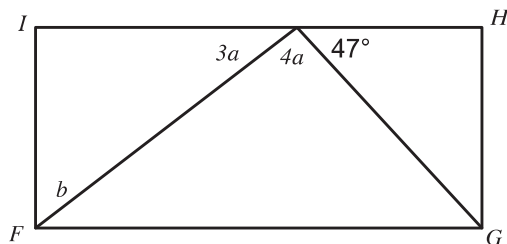


Figure not drawn to scale.

In the rectangle $FGHI$ above, what is the value of $\angle b$?

- (A) 17°
- (B) 20°
- (C) 33°
- (D) 45°

19

The population of a country has been growing at an annual rate of about 2.5%. The population in the year 2014 was estimated at 339,800. Which of the following equations shows the projected population of the country x years after 2010?

- (A) $y = 339,800(1.025)^x$
- (B) $y = 339,800(1.025)^{x-4}$
- (C) $y = 339,800(2.5)^x$
- (D) $y = 339,800(2.5)^{x-4}$

20

A city newspaper randomly surveyed 250 subscribers about their support for the mayor. Of the respondents, 27% said they supported the mayor, and the results had a margin of error of 3%. The newspaper ran a headline that less than 30% of city residents support the mayor. Which of the following statements best explains why the results do not support the conclusion stated in the headline?

- (A) The sample size is too small.
- (B) The percent of supporters could be exactly 30.
- (C) The margin of error is too large to make any conclusions.
- (D) The sample is likely biased and not representative of the city.

21

If $a > 0$ and $(3^{-a})^{\frac{2}{3}} = \left(9^{\frac{1}{a}}\right)^6$ what is the value of a ?

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

QUESTIONS 22 AND 23 REFER TO THE FOLLOWING INFORMATION.

The tables below give the number of days of rain per month for one year in Town A and Town B.

Town A		Town B	
Days of Rain	Frequency	Days of Rain	Frequency
5	1	1	1
6	3	3	3
7	2	5	2
8	1	9	1
9	2	12	2
10	1	15	1
11	2	19	2

22

Which of the following is true about the data shown in the table?

- (A) The median number of days of rain is greater in Town A.
- (B) The median number of days of rain is greater in Town B.
- (C) The median number of days of rain is the same in both towns.
- (D) There is not enough information to compare the mean, median, or mode.

practice test

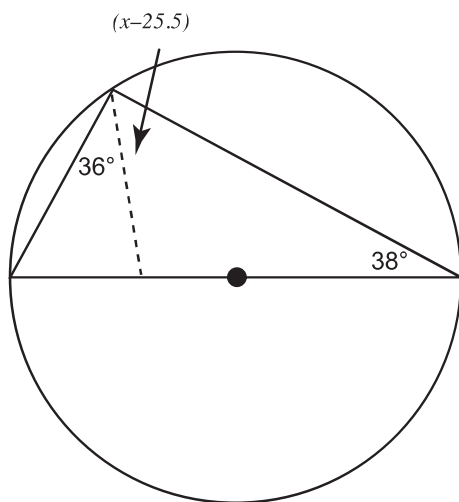
23 Which of the following is true about the standard deviation of the data shown in the tables?

- (A) The standard deviation of days of rain per month in Town A is greater.
- (B) The standard deviation of days of rain per month in Town B is greater.
- (C) The standard deviation of days of rain per month is the same in both towns.
- (D) There isn't enough information to calculate the standard deviations.

24 The graph of a linear function has intercepts at $(a, 0)$ and $(0, a)$. Which of the following is true about the slope of the graph of the function?

- (A) It is positive.
- (B) It is negative.
- (C) It is zero.
- (D) It is undefined.

25 What is the value of x in the diagram below?



not drawn to scale

- (A) 16
- (B) 41.5
- (C) 54
- (D) 79.5



QUESTIONS 26 AND 27 REFER TO THE FOLLOWING INFORMATION.

A poll surveyed 300 randomly selected voters for an upcoming city election. Of the respondents, 31% said that they will vote for Candidate A. The margin of error for the results was $\pm 4\%$ with 95% confidence.

26 Which of the following statements is best supported by the data?

- (A) The sample size is too small to make an inference about the election.
- (B) The margin of error is too large to make an inference about the election.
- (C) The sample is likely biased, so an inference about the election cannot be made.
- (D) The sample is likely unbiased and large enough to make an inference about the election.

27 Which of the following statements can be best drawn from this data?

- (A) The actual percentage of voters who will vote for Candidate A is 27%.
- (B) The actual percentage of voters who will vote for Candidate A is 35%.
- (C) The actual percentage of voters who will vote for Candidate A is most likely between 27% and 35%.
- (D) The actual percentage of voters who will vote for Candidate A is most likely between 91% and 99%.



- 28 The diameter of Pluto's largest moon Charon is about 750 miles. The diameter of Pluto is about 2 times greater than the diameter of Charon. Which of the following best describes the volume of Pluto?

- (A) The volume of Pluto is about two times as great as the volume of Charon.
- (B) The volume of Pluto is about four times as great as the volume of Charon.
- (C) The volume of Pluto is about six times as great as the volume of Charon.
- (D) The volume of Pluto is about eight times as great as the volume of Charon.

29 $y = -2$
 $y = ax^2 - b$

Which of the following values for a and b will make the system of equations have one solution?

- (A) $a = 3, b = -3$
- (B) $a = -2, b = -2$
- (C) $a = -2, b = 2$
- (D) $a = 3, b = 3$

30 $h(x) = -(x - 8)(x + 2)$

Which of the following is an equivalent form of the function h above in which the maximum value of h appears as a constant or coefficient?

- (A) $h(x) = -x^2 + 16$
- (B) $h(x) = -x^2 + 6x + 16$
- (C) $h(x) = -(x + 3)^2 - 7$
- (D) $h(x) = -(x - 3)^2 + 25$

practice test



- 31 Sorin rents a car for \$49, plus mileage, for the weekend. The car rental company charges a fee for every mile over 100 miles driven. The equation $y = 49 + 0.24(x - 100)$ shows the total cost to rent the car and drive x miles. What is the fee, in cents per mile, for more than 100 miles?
- 32 Amber has \$25 to spend. She wants to buy a book for \$12 and pens that cost \$2.75 each. What is the greatest number of pens she can buy?
- 33 A team scored 74 points in a basketball game, not including foul shots. They scored on a total of 33 field goals, including 2-point shots and 3-point shots. How many 2-point shots did the team score in the game?

QUESTIONS 34 AND 35 REFER TO THE FOLLOWING INFORMATION:

The data provided in the table shows the results of a 2010 census showing the estimated population of four countries, in millions of people, divided into males and females in each country.

	Canada	China	Mexico	United States	Total
Males	16.9	696.3	55.9	153.1	922.2
Females	17.1	645.0	57.5	157.2	876.8
Total	34	1,341.3	113.4	310.3	1,799.0

- 34 If a person is chosen at random, what is the probability that the person is a female from China? Express your answer as a decimal rounded to the nearest hundredth?
- 35 If a person is chosen at random, what is the probability that the person is NOT male? Express your answer as a decimal rounded to the nearest hundredth.

practice test



36
$$g(x) = \frac{1}{(x-6)^2 + 2(x-6) + 1}$$

For what value of x is the function g above undefined?

QUESTIONS 37 AND 38 REFER TO THE FOLLOWING INFORMATION.

The value of a famous painting last sold for \$300,000 ten years ago. Similar paintings have increased by about 14% annually in that time. The current owner of the painting is using the equation $V = 300(r)^t$ to model the value, V , in thousands of dollars t years after it was last sold.

37 What value should the current owner use for r ?

38 What is the estimated value, to the nearest whole thousands of dollars, of the painting today? (Disregard the dollar sign when gridding your answer.)

STOP

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



Section 3: Math Test—No Calculator

1. B

5. C

9. A

13. C

17. 234

2. D

6. C

10. D

14. A

18. 16

3. D

7. A

11. B

15. A

19. 15

4. C

8. A

12. A

16. 3

20. $\frac{8}{3}$ or 2.66
or 2.67

MATH TEST—NO CALCULATOR TEST RAW SCORE
(Number of correct answers)

1. **The correct answer is (B).** One way to solve this problem is to add the x s and the numbers. When you do this, you'll get $3x + 7 = 2x + 9$. Then put all the x s on one side of the equation and all the numbers on the other to get $x = 2$.

Another way to solve this problem is to work backwards. Plug in the numbers in the answer choices for x and see if the sides are equal. If you use answer choice (C), 3, you'll get

$$3 + 3 + 3 + 7 = 3 + 3 + 9, \text{ or } 16 = 15.$$

This is not true, so choice (C) is not correct. Try choice (B), 2, and you'll get

$$2 + 2 + 2 + 7 = 2 + 2 + 9, \text{ or } 13 = 13,$$

which is true. That means choice (B) is the correct answer.

2. **The correct answer is (D).** Subtract the two polynomials by combining like terms:
 $(3x^2 - 7x + 5) - (-6x^2 + 5x - 4) = (3x^2 - (-6x^2))$
 $+ (-7x - 5x) + (5 - (-4)) = 9x^2 - 12x + 9$

3. **The correct answer is (D).** To determine which point is correct, substitute each value into each inequality:

$$0 \leq 3(0) - 4$$

(A) $5(0) + 4(0) \geq 6$ Wrong

$$5 \leq 3(-1) - 4$$

(B) $5(-1) + 4(5) \geq 6$ Wrong

$$-3 \leq 3(2) - 4$$

(C) $5(2) + 4(-3) \geq 6$ Wrong

$$4 \leq 3(3) - 4$$

(D) $5(3) + 4(4) \geq 6$ Correct



4. **The correct answer is (C).** Pick values for the numbers. Suppose $x = 1$. That means Angie took 3×1 , or 3, hours to get to the party. If it took her 3 hours to get to the party, she could have stopped for 1 hour ($b = 1$) and driven 30 miles per hour ($z = 30$). If she took 3 hours to get to the party and she stopped for 1 hour, then she was only driving for 2 hours. That means that she must have driven 30×2 , or 60, miles total. Now try the answer choices. Plug in $x = 1$, $b = 1$, and $z = 30$. The answer choice that is correct will also total 60. Choice (C) results in: $30(3 \times 1 - 1) = 30(3 - 1) = 30(2) = 60$

It is the correct answer.

You can also solve this problem by thinking it through. You are looking for a distance, and distance = rate \times time. The rate is z miles per hour. The time is the amount of time it took Angie to arrive at the party ($3x$) minus any time she stopped during the trip (b). So the time is $3x - b$. If you multiply the rate by the time to find the distance, you get $z(3x - b)$, which is choice (C).

5. **The correct answer is (C).** First, solve for s : $6s = 36$; $s = 6$. Now plug in 6 for s to solve for r : $3s - r = 9$; $3(6) - r = 9$; $18 - r = 9$; $-r = -9$; $r = 9$.

Another way you could solve this is to work backwards. After finding the value of s to be 6, plug in each answer choice as a value for r . For example, if you started with choice (A): $3(6) - 3 = 18 - 3 = 15$, which is not 9, so eliminate choice (A). You could try out each answer choice until you reached choice (C) and found that: $3(6) - 9 = 18 - 9 = 9$, so (C) is correct.

6. **The correct answer is (C).** The value of y is dependent on the number of x months of increasing deposits, so y represents the amount that Gary deposits into his account in month x , making choice (C) the correct answer. Choice (A) incorrectly assumes that the equation is totaling the amounts added each month, when it is only calculating the amount deposited each month based on the previous month. Choice (B) is incorrect because the formula is calculating a total amount; the variable x represents the number of months. Choice (D) is incorrect because calculating the increase would involve a comparison of the previous month(s).

7. **The correct answer is (A).** In order to find the value of $f\left(\frac{1}{c}\right)$ plug $x = \frac{1}{c}$ into the given function and simplify:

$$f\left(\frac{1}{c}\right) = c\left(\frac{1}{c}\right) - \frac{d}{c} = 1 - cd$$

8. **The correct answer is (A).** Substitute $(0, 3)$ and $(1.5, 0)$ into each equation to determine which will have those intercepts. Use your understanding of intercepts to find the equation of the function.

$$\begin{aligned} y &= -\frac{3}{x-3} + 2 & y &= -\frac{3}{x-3} + 2 \\ 3 &= -\frac{3}{0-3} + 2 & 0 &= -\frac{3}{1.5-3} + 2 \\ 3 &= 1 + 2 & \text{and} & 0 = -2 + 2 \end{aligned}$$

9. **The correct answer is (A).** The factors of a function can be found from its x -intercepts through a process like below:

$$\begin{aligned} x &= -2, x = 3, x = 5 \\ x + 2 &= 0, x - 3 = 0, x - 5 = 0 \\ g(x) &= f(x)(x + 2)(x - 3)(x - 5) \end{aligned}$$



10. **The correct answer is (D).** The total per package is 9 marbles, and 108 marbles is $9 \times 12 = 108$. So the number of each color needs to be multiplied by 12; $3 \times 12 = 36$, $4 \times 12 = 48$, $36 + 48 = 84$.

11. **The correct answer is (B).** When multiplying exponential terms with the same base, exponents are added:

$$x^{\frac{1}{5}} \cdot x^{\frac{4}{5}} = x^{-a}$$

$$x^{\frac{1+4}{5}} = x^{-a}$$

$$x^{\frac{5}{5}} = x^{-a}$$

$$x^1 = x^{-a}$$

$$-a = 1$$

$$a = -1$$

12. **The correct answer is (A).** When two lines are parallel, their slopes are equal. Since you know that line p passes through points $(0, 4)$ and $(2, 2)$, you can use this information to find the slope of p :

$$\begin{aligned}\text{Slope of } p &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{2 - 4}{2 - 0} \\ &= \frac{-2}{2} \\ &= -1\end{aligned}$$

Since lines p and q are parallel, their slopes must be equal. This means that the slope of q is also equal to -1 .

Since you know that line q passes through points $(0, 0)$ and (x, y) and the slope is -1 , you can write an equation representing the relationship between x and y :

$$\begin{aligned}\text{Slope of } q &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{y - 0}{x - 0} \\ &= \frac{y}{x} \\ \frac{y}{x} &= -1 \\ y &= -x \\ x + y &= 0\end{aligned}$$

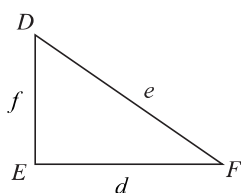
Therefore, the relationship between x and y can be represented by the equation $x + y = 0$.



13. **The correct answer is (C).** In any right triangle the sine of one acute angle is equal to the cosine of the other acute angle.

$$\begin{aligned}\sin F &= \frac{\text{opposite}}{\text{hypotenuse}} \\ &= \frac{f}{e} = \frac{2}{3}\end{aligned}$$

$$\begin{aligned}\cos D &= \frac{\text{adjacent}}{\text{hypotenuse}} \\ &= \frac{f}{e} = \frac{2}{3}\end{aligned}$$



14. **The correct answer is (A).** First, find the center of the circle by finding the midpoint of its diameter. The distance between the x -values is $15 - (-9) = 24$ units. Half that distance is:

$$\left(\frac{-9+15}{2}, \frac{7+(-3)}{2} \right) \rightarrow \left(\frac{6}{2}, \frac{4}{2} \right) \rightarrow (3, 2)$$

Next, find the radius of the circle by finding half the length of the diameter:

$$\frac{\sqrt{(-9-15)^2 + (7-(-3))^2}}{2} = 13$$

Then, plug the center and the radius into the standard form for the equation of a circle and simplify:

$$(x-h)^2 + (y-k)^2 = r^2$$

$$(x-3)^2 + (y-2)^2 = 13^2$$

$$(x-3)^2 + (y-2)^2 = 169$$

15. **The correct answer is (A).** Divide the two expressions using either long division or synthetic division:

$$\begin{array}{r} 3x+4 \\ x-3 \overline{) 3x^2-5x+9} \\ \underline{-(3x^2-9x)} \\ 0x^2+4x+9 \\ \underline{-(4x-12)} \\ 0x^2+0x+21 \end{array}$$

Alternatively, you can use the remainder theorem to solve. Substitute 3 for x in the numerator, and the value should be the remainder:

$$3(3)^2 - 5(3) + 9 = 27 - 15 + 9 = 21$$

16. **The correct answer is 3.** To find a solution, first set the equation equal to 0, since the height of the ball when it hits the ground is 0. Then, solve the equation for t using factoring.

$$0 = 6 + 13t - 5t^2$$

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

$$0 = (5t+2)(t-3)$$

$$5t+2=0; \quad t=3$$

$$t = -\frac{2}{5}; \quad t=3$$

Since the time cannot be negative, the solution is $t=3$. The ball will hit the ground in 3 seconds.

17. **The correct answer is 234.** Since m is a constant, that means that m must always have the same value. So use $b=6$ to solve for m .

$$6b+m=270$$

$$6(6)+m=270$$

$$36+m=270$$

After subtracting 36 from both sides of the equation, you will get $m=234$.



18. **The correct answer is 16.** You know that opposite sides of a rectangle are equal, so since $\overline{ED} = 6$, \overline{CA} must also equal 6. You know from the diagram that $\overline{CB} = 10$. Since $\triangle ABC$ is a right triangle, you can use the Pythagorean Theorem or what you know about 3-4-5 triangles to find the length of \overline{AB} .

Using the Pythagorean Theorem:

$$a^2 + b^2 = c^2; 6^2 + b^2 = 10^2; 36 + b^2 = 100; \\ b^2 = 64; b = 8.$$

So now you know that $\overline{AB} = 8$. You know that B is the midpoint of \overline{AD} and that the midpoint divides a segment in half. That means that $\overline{AB} = \overline{BD}$. Since $\overline{AB} = 8$, \overline{BD} also equals 8. That means that the length of $\overline{AD} = 8 + 8 = 16$.

19. **The correct answer is 15.** Transfer the radical expressions on the opposite sides of the equation and then square both sides:

$$\begin{aligned} \sqrt{x+10} - \sqrt{2x-5} &= 0 \\ \sqrt{x+10} &= \sqrt{2x-5} \\ (\sqrt{x+10})^2 &= (\sqrt{2x-5})^2 \\ x+10 &= 2x-5 \\ 10+5 &= 2x-x \\ x &= 15 \end{aligned}$$

20. **The correct answer is 8/3.** For a system of linear equations to have infinitely many solutions, the equations must be equivalent. To make the first equation equivalent to the second equation, we must multiply by -2 :

$$-2(fx + gy = -16) = -2fx - 2gy = 32$$

$$-2fx - 2gy = 32$$

$$3x - 8y = 32$$

$$-2f = 3 \rightarrow f = -\frac{2}{3}$$

$$2g = 8 \rightarrow g = 4$$

Then write and simplify the ratio that is asked for in the problem:

$$f = -\frac{3}{2}, g = 4$$

$$-\frac{g}{f} = -\frac{4}{-\frac{3}{2}} = \frac{4}{\frac{3}{2}} = \frac{8}{3}$$

The correct answer is $\frac{8}{3}$, which you would grid as 8/3.



Section 4: Math Test—Calculator

1. B	9. C	17. B	25. D	33. 25
2. C	10. A	18. C	26. D	34. .36
3. D	11. B	19. B	27. C	35. .49
4. B	12. B	20. D	28. D	36. 5
5. B	13. A	21. B	29. C	37. 1.14
6. D	14. D	22. A	30. D	38. 1112
7. A	15. D	23. B	31. 24	
8. D	16. D	24. B	32. 4	

MATH TEST—CALCULATOR RAW SCORE
(Number of correct answers)

- The correct answer is (B).** Using 1 pound = 16 ounces, multiply 6 by 16 to find that there are 96 ounces of flour in the bag. Then, divide the overall number of ounces by the number of containers, $96 \div 24 = 4$. Each container has 4 ounces of flour, which is choice (B).
- The correct answer is (C).** A negative correlation is a relationship between two variables such that when one variable increases, the other variable decreases. The points on the scatterplot show that as the amount of snowfall increases, the number of drivers on the road decreases. Therefore, the scatterplot shows a negative correlation.
- The correct answer is (D).** $\$18 \div 3 = \6 for each box of cookies. $\$6 \div \$0.25 = 24$ quarters. Another way to solve this would be to figure out that she must sell each box for \$6, and then to multiply each number of quarters in the answer choices by \$0.25 to see which equals \$6.
- The correct answer is (B).** The amount of \$480 is constant, and the amount she makes in commission depends on her total sales. The term that represents her commission should include the variable, and since she makes 15% of her total sales x , the term $0.15x$ represents the amount of commission. Adding both of these amounts together results in $f(x) = 480 + 0.15x$.
- The correct answer is (B).** Choose an initial amount for the tax revenue for the town of \$100,000. An increase of 8% would be an increase of \$8,000 to \$108,000. An additional 10% increase the next year would be another \$10,800, for total revenue of \$118,800. This is 18.8% more than the original \$100,000.
- The correct answer is (D).** 471 of the 682 respondents is about $\frac{471}{682} \approx 0.69 = 69\%$. To estimate the number of people in the county who will not drive more if gas prices drop, multiply the entire population by the percent in the random sample.
 $898,000(0.69) = 619,620$
The answer that comes closest to this calculation is choice (D).



7. **The correct answer is (A).** The model drawing of the Moon's diameter is 6 inches. To find the diameter of the actual Moon, use the scale: $6 \times 360 = 2160$. Therefore, the approximate diameter of the actual Moon is 2,160 miles.
8. **The correct answer is (D).** There are 380 seats in the theater, so the total number of tickets that can be sold is at most 380. They will sell x student tickets and y adult tickets for a maximum of 380 tickets, or $x + y \leq 380$. The income from tickets will be \$6.50 per child, or $6.5x$, and \$8.25 per adult, or $8.25y$. The total amount they collect, $6.5x + 8.25y$, has to be at least \$600, or $6.5x + 8.25y \geq 600$. Only choice (D) shows both of these inequalities.
9. **The correct answer is (C).** The discount is 15%, or $1 - 0.15 = 0.85$ of the retail price, which is $0.85r$. The 6% sales tax is added to this discounted cost, which is the same as multiplying by 1.06. The expression combining those two is $0.85r \times 1.06$.
10. **The correct answer is (A).** The cost of buying energy bars can be represented by $2.25x$. The cost of buying the water bottles can be represented by $12.5y$. The total cost is represented by $2.25x + 12.5y = 447.5$.

11. **The correct answer is (B).** You know that b cannot equal 1. Pick values for a and b . For example, suppose $b = 6$. That would mean that $a = 0.5$, because $ab = 3$. Plug in these values for the expression given:

$$\begin{aligned}\frac{a-3}{3b-3} &= \frac{0.5-3}{3(6)-3} \\ &= \frac{-2.5}{15} \\ &= -\frac{5}{2} \times \frac{1}{15} \\ &= -\frac{1}{6}\end{aligned}$$

Since $b = 6$, $-\frac{1}{6} = -\frac{1}{b}$, which matches choice (B).

12. **The correct answer is (B).** Simplify the expression:

$$3\sqrt[4]{x^3} = 3(x^3)^{\frac{1}{4}} = 3x^{\frac{3}{4}}$$

13. **The correct answer is (A).** The amount earned per hour is $9x$ for the pool and $11x$ for the bakery, and needs to be at least \$215, so $9x + 11y \geq 215$ represents this. The total number of hours needs to be at most 25, so at so $x + y \leq 25$ represents this. Only choice (A) shows both of these inequalities.
14. **The correct answer is (D).** The weight has to be less than or equal to 50 pounds, and the weight of each type of book is represented by $2.5x$ and $1.25y$, so the inequality that represents this situation is $2.5x + 1.25y \leq 50$.



- 15. The correct answer is (D).** The Slope-Intercept form of the equation of a line is $y = mx + b$, where m is the slope of the line and b is the y -intercept. The coordinates of the y -intercept are $(0, b)$.

In order to solve this problem, transform the given equation into the slope-intercept form:

$$\begin{aligned} 3x + 4y &= 16 \\ 4y &= -3x + 16 \\ y &= -\frac{3}{4}x + 4 \end{aligned}$$

Comparing the above equation with the slope-intercept equation, $y = mx + b$, you can see that $b = 4$.

Therefore, the coordinates of the y -intercept are $(0, 4)$.

- 16. The correct answer is (D).** The graph shows that the slope decreases between subsequent pairs of points, so the relationship is exponential. The y -values decrease as the x -values increase, indicating exponential decay.
- 17. The correct answer is (B).** Use the curve on the graph and draw a line up from 9 along the x -axis to the curve. Then connect that intersection horizontally to the y -axis. Note the scale along the y -axis to see that 0.5 is closest to the value at $x = 9$ on the curve.

- 18. The correct answer is (C).** You know that the angles labeled $3a$, $4a$, and 47° all lie on the same line. You know that a straight line measures 180° , so you can find the value of a by adding:

$$\begin{aligned} 3a + 4a + 47^\circ &= 180^\circ \\ 7a + 47^\circ &= 180^\circ \\ 7a &= 133^\circ \\ a &= 19^\circ \end{aligned}$$

If $a = 19^\circ$, then $3a = 3(19^\circ) = 57^\circ$. Angle I and the angles labeled b and $3a$ form a triangle. The sum of the angles of a triangle is 180° . Since $FGHI$ is a rectangle, you know that angle $I = 90^\circ$. So:

$$\begin{aligned} 180^\circ &= 57^\circ + 90^\circ + b \\ 180^\circ &= 147^\circ + b \\ 33^\circ &= b \end{aligned}$$

- 19. The correct answer is (B).** Note that in the question it asks for the projected population x years after 2010, but gives the population in 2014. The equation must take into account this difference.

The formula for exponential growth is $y = a(1 + r)^n$, where a is the initial amount, r is the rate at which the amount is increasing, and n is the number of times that the amount increases at that rate. In this question $a = 339,800$, $r = 0.025$, and $n = x - 4$. Plugging these values into the formula, we get $y = 339,800(1 + 0.025)^{x-4}$, which is choice (B).

- 20. The correct answer is (D).** The sample is likely biased since they only asked subscribers of their newspaper. Also, subscribers of the newspaper may not live in the city.



21. **The correct answer is (B).** To solve this problem, first convert 9 into an exponential term with base 3, so that both sides have the same base. Then equate powers on both sides. Also remember that when raising an exponential term with another power, exponents are multiplied, thus $(x^m)^n = x^{m \times n}$

$$(3^{-a})^{\frac{2}{3}} = \left(9^{\frac{1}{a}}\right)^{-6}$$

$$(3^{-a})^{\frac{2}{3}} = \left[(3^2)^{\frac{1}{a}}\right]^{-6}$$

$$3^{\frac{-2a}{3}} = 3^{\frac{-12}{a}}$$

$$-2a^2 = -36$$

$$a^2 = 18$$

$$a = \sqrt{18}$$

$$a = \sqrt{9 \times 2}$$

$$a = \sqrt{9} \times \sqrt{2}$$

$$a = 3\sqrt{2}$$

22. **The correct answer is (A).** The median for Town A is 7.5 and for Town B is 7, so the median is greater for Town A. This is the only statement among the answer choices that is true.
23. **The correct answer is (B).** The numbers of days of rain have a much greater variation in Town B than in Town A. Since standard deviation is a measure of variation, choice (B) is correct.

24. **The correct answer is (B).** Consider an example that would make the statement in the question true. If the intercepts of a function are at $(a, 0)$ and $(0, a)$, then they could be at $(3, 0)$ and $(0, 3)$. The slope of the line through those points is:

$$\frac{3-0}{0-3} = \frac{3}{-3} = -1 \quad \text{OR} \quad \frac{a-0}{0-a} = \frac{a}{-a} = -1$$

The same is true when a is negative:

$$\frac{-a-0}{0-(-a)} = \frac{-a}{a} = -1$$

25. **The correct answer is (D).** An inscribed triangle that passes through the center forms a right triangle. So the missing angle measure is $90 - 36 = 54$. Using the given expression $x - 25.5 = 54$, $x = 79.5$.
26. **The correct answer is (D).** There is nothing to indicate that the sample is biased or too small, or that the margin of error is too large, so choice (D) is best supported by the data.
27. **The correct answer is (C).** The 95% confidence that the margin of error is $\pm 4\%$ means that there is a high probability that the actual percent of the voters that will vote for Candidate A is most likely 31%, $\pm 4\%$, or between 27% and 35%.



- 28. The correct answer is (D).** We can calculate and compare their actual volumes or the ratio of their volumes.

$$\begin{aligned} V_{Charon} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\pi\left(\frac{750}{2}\right)^3 \\ &\approx 220,781,250 \end{aligned}$$

$$\begin{aligned} V_{Pluto} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\pi(750)^3 \\ &\approx 1,766,250,000 \end{aligned}$$

$$\frac{1,766,250,000}{220,781,250} = 8$$

OR

$$\begin{aligned} \frac{V_{Pluto}}{V_{Charon}} &= \frac{\frac{4}{3}\pi(2r)^3}{\frac{4}{3}\pi r^3} \\ &= \frac{8r^3}{r^3} \\ &= 8 \end{aligned}$$

The volume comparison of any two spheres where the diameter of one sphere is twice the diameter of the other sphere is always 8 to 1.

- 29. The correct answer is (C).** For the system to have exactly one real solution, the graph of the system will be a line and a parabola that is tangent to the line. For the parabola to be tangent to the line, it must have its vertex along that line. Since the graph of $y = ax^2$ has its vertex along the line $y = 0$, then $y = ax^2 - 2$ has its vertex along the line $y = -2$.

- 30. The correct answer is (D).** Remember that the vertex form of a quadratic equation is $h(x) = a(x-h)^2 + k$, where k is the minimum or maximum value of the function. Since in this question h is the equation for a parabola that opens down, it will have a maximum at k when written in vertex form. Choices (C) and (D) are both in vertex form, but only choice (D) is equivalent to the original function. Check by writing both in standard form:

$$\begin{aligned} -(x-8)(x+2) &= -(x-3)^2 + 25 \\ -(x^2 - 6x - 16) &= -(x^2 - 6x + 9) + 25 \\ -x^2 + 6x + 16 &= -x^2 + 6x + 16 \end{aligned}$$

- 31. The correct answer is 24.** To use the formula to find the answer, find the total cost for driving one additional mile, or 101 miles.

$$\begin{aligned} y &= 49 + 0.24(x - 100) \\ y &= 49 + 0.24(101 - 100) \\ y &= 49 + 0.24 \\ y &= 49.24 \end{aligned}$$

- 32. The correct answer is 4.** Write and solve an inequality to find the number of pens she can buy, and then interpret the answer, including the remainder.

$$\begin{aligned} 2.75x + 12 &\leq 25 \\ 2.75x &\leq 13 \\ x &\leq \overline{4.72} \end{aligned}$$

Since she can't buy fractions of a pen, the greatest number of pens that Amber can buy is 4.



- 33. The correct answer is 25.** Write and solve a system of equations. Let x = the number of 2-point shots made and y = the number of 3-point shots made.

$$\begin{aligned}x + y &= 33 \\2x + 3y &= 74\end{aligned}$$

Multiply the first equation by 2:

$$\begin{aligned}2(x + y) &= 2 \times 33 \\2x + 2y &= 66\end{aligned}$$

Now subtract the second equation from this new one:

$$\begin{array}{r}2x + 2y = 66 \\-(2x + 3y) = 74 \\ \hline -y = -8 \\ y = 8\end{array}$$

Substitute $y = 8$ into the initial equation:

$$\begin{aligned}x + y &= 33 \\x + 8 &= 33 \\x &= 25\end{aligned}$$

- 34. The correct answer is .36.** The number of females in China is 645 million. The total number of people represented in the table is 1,799 million. The probability that a random person chosen in this census is a female in China is:

$$\frac{645}{1799} = 0.358 = 0.36$$

- 35. The correct answer is .49.** The probability that a person chosen is not a male is the same as the probability that a random person chosen is female. The total number of females in the census is 876.8 million, and the total number of people represented in the table is 1,799 million. Therefore, the probability that a random person chosen is not male is:

$$\frac{876.8}{1799} = 0.487 = 0.49$$

- 36. The correct answer is 5.** A function like g is undefined when the denominator is equal to 0, so set the denominator equal to 0 and solve for x :

$$\begin{aligned}(x - 6)^2 + 2(x - 6) + 1 &= 0 \\x^2 - 12x + 36 + 2x - 12 + 1 &= 0 \\x^2 - 10x + 25 &= 0 \\(x - 5)^2 &= 0 \\x - 5 &= 0 \\x &= 5\end{aligned}$$

- 37. The correct answer is 1.14.** Substitute 1.14 for r because there is an increase of 14%, so r should be $1 + 0.14$, or 1.14, in order to match the standard form for exponential growth.

- 38. The correct answer is 1112.** Substitute 1.14 for r to represent a 14% increase and 10 for t to represent 10 years after it was last sold:

$$\begin{aligned}V &= 300(1.14)^{10} \\&= 1112.166\end{aligned}$$

This is rounded to 1112, which is 1112 thousands of dollars.

SECTION 3: MATH TEST—NO CALCULATOR 

20 Questions • 25 minutes


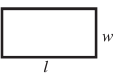
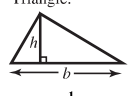


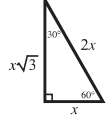
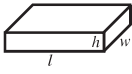

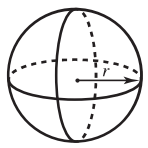
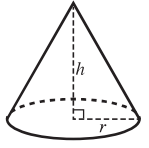
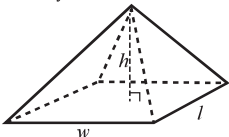
TURN TO SECTION 3 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

Directions: For Questions 1–15, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 16 will provide information on how to enter your answers in the grid.

ADDITIONAL INFORMATION:

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

Reference Information

<p>Circle:</p>  <p>$C = 2\pi r$ $A = \pi r^2$</p>	<p>Rectangle:</p>  <p>$A = lw$</p>	<p>Triangle:</p>  <p>$A = \frac{1}{2}bh$</p>  <p>$a^2 + b^2 = c^2$</p>  		
<p>Rectangular Solid:</p>  <p>$V = lwh$</p>	<p>Cylinder:</p>  <p>$V = \pi r^2 h$</p>	<p>Sphere:</p>  <p>$V = \frac{4}{3}\pi r^3$</p>	<p>Cone:</p>  <p>$V = \frac{1}{3}\pi r^2 h$</p>	<p>Rectangular Based Pyramid:</p>  <p>$V = \frac{1}{3}lwh$</p>

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

1

If $\frac{x+2}{5} = m$ and $m = -3$, what is the value of x ?

- (A) -17
- (B) -15
- (C) -5
- (D) -1

2

If $d = m - \frac{50}{m}$, and m is a positive number, then as m increases in value, d

- (A) increases in value.
- (B) decreases in value.
- (C) increases, then decreases.
- (D) decreases, then increases.

practice test



- 3 Pieces of wire are soldered together so as to form the edges of a cube whose volume is 64 cubic inches. The number of inches of wire used is

(A) 24.
 (B) 48.
 (C) 64.
 (D) 96.

- 4 Myra baked 6 sheets of cookies with r cookies on each sheet. Neil baked 7 sheets of cookies with p cookies on each sheet. Which of the following represents the total number t of cookies baked by Myra and Neil?

(A) $t = 13pr$
 (B) $t = 42pr$
 (C) $t = 6r + 7p$
 (D) $t = 7r + 6p$

- 5 If $2y = \frac{1}{3}$, then $\frac{1}{4y} =$

(A) $\frac{3}{2}$
 (B) $\frac{3}{4}$
 (C) $\frac{1}{5}$
 (D) $\frac{4}{3}$

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

Which expression is equivalent to x ?

(A) $\sqrt{4y+3}$
 (B) $\sqrt{4y+3}$
 (C) $\sqrt[3]{4y+3}$
 (D) $\sqrt[3]{4y+3}$

- 7 Hannah recently purchased a plant that grows 4.5 centimeters each week. The height of Hannah's plant can be found using the equation $h = 4.5w + 6$, where h is the height of the plant in centimeters, and w is the number of weeks. What is the meaning of the 6 in the equation?

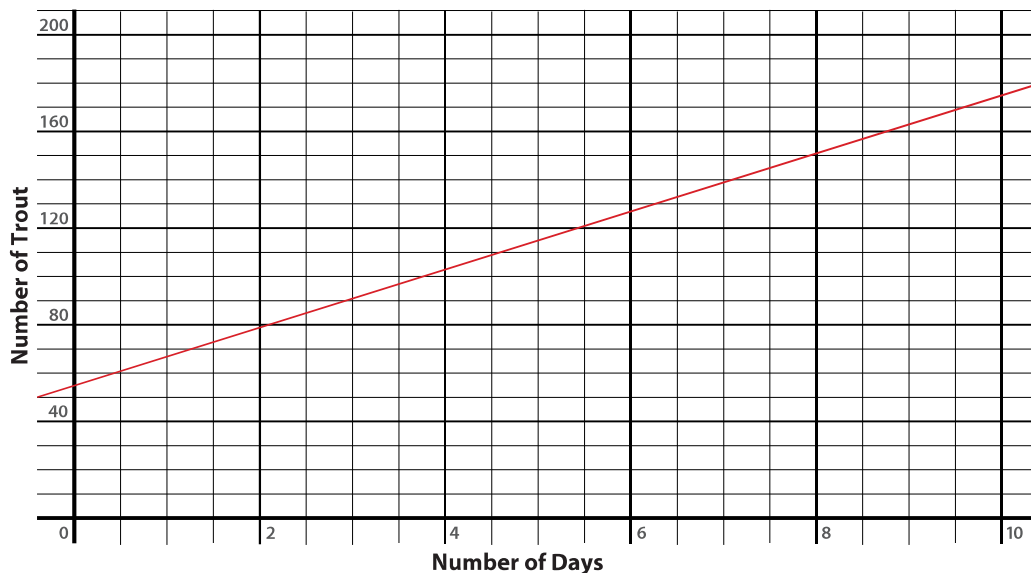
(A) Hannah's plant will be 6 centimeters tall after 4.5 weeks.
 (B) Hannah's plant grows 6 centimeters each week.
 (C) Hannah's plant will grow for 6 weeks.
 (D) Hannah's plant was initially 6 centimeters tall.

8 $(x)^6 + (2x^2)^3 + (3x^3)^2 =$

(A) $5x^5 + x^6$
 (B) $17x^5 + x^6$
 (C) $6x^6$
 (D) $18x^6$



QUESTION 9 REFERS TO THE FOLLOWING GRAPH.



- 9 Stephen was studying the population of a certain trout pond. When he started his study, there were 55 trout in the pond. He observed the pond each day for 10 days and observed that there were 12 new trout each day. The graph above represents the relationship between the number of trout in the pond and the number of days. Which of the following is an equation for the graph?
- (A) $y = 12x + 55$
 (B) $y = 10x + 12$
 (C) $y = 55x + 12$
 (D) $y = 12x + 10$
- 10 Which of the following is equal to $\left(-\frac{27}{8}\right)^{\frac{1}{3}}$?
- (A) $-\frac{3}{2}$
 (B) $-\frac{2}{3}$
 (C) $\frac{2}{3}$
 (D) $\frac{3}{2}$
- 11 The area of a square is $49x^2$. What is the length of a diagonal of the square?
- (A) $7x$
 (B) $7x\sqrt{2}$
 (C) $14x$
 (D) $\frac{7x}{\sqrt{2}}$
- 12 The distance, s , in feet that an object falls in t seconds when dropped from a height is obtained by use of the formula $s = 16t^2$. When graphed, what is the meaning of the slope between any two points in the graph?
- (A) The height in feet from where the object falls
 (B) The speed in feet per second of the object as it falls
 (C) The time in seconds it takes for the object to fall to the ground
 (D) The acceleration in feet per second squared of the object as it falls



13 $D + B = 24$
 $4D + 2B = 84$

In a system of equations, the first equation represents the total number of dogs, D , and birds, B , in a pet store. The second equation represents the number of legs a dog has, $4D$, and the number of legs a bird has, $2B$. How many dogs and birds are in the pet store?

- (A) $D = 6$; $B = 18$
- (B) $D = 18$; $B = 6$
- (C) $D = 24$; $B = 84$
- (D) $D = 60$; $B = 24$

14 $f(x) = x^2 - 4x - 21$

Which of the following is an equivalent equation that shows the zeros of the function as coefficients or constants?

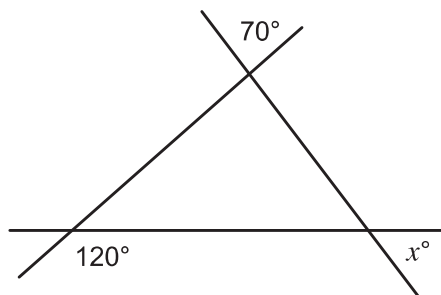
- (A) $f(x) = (x - (-7))(x - 3)$
- (B) $f(x) = (x - 7)(x - (-3))$
- (C) $f(x) = (x - 2)^2 - 21$
- (D) $f(x) = (x - 2)^2 - 25$

15 Which equation represents the equation of a line perpendicular to $y = 3x - 2$ that goes through the point $(1, 3)$?

- (A) $y = -3x + 6$
- (B) $y = -\frac{1}{3}x + \frac{10}{3}$
- (C) $y = -\frac{1}{3}x + \frac{9}{3}$
- (D) $y = 3x$



16



In the figure above, $x =$

19

$$\sqrt{4-x^2} = \sqrt{3x}$$

What is one solution to the equation?

17

The factors of the function f are $(x+3)^2$ and $(3x-2)$. What is a zero of the function?

20

$$2x + 3y = 7$$

$$ax - 12y = b$$

According to the system of equations above, what is the value of ab that will make the system of equations have an infinite number of solutions?

18

$$5(4 - 8x) = d(5 - 6x) - 4x$$

What value of d will make the equation have no solutions?

STOP

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

SECTION 4: MATH TEST—CALCULATOR

38 Questions • 55 minutes


TURN TO SECTION 4 OF YOUR ANSWER SHEET TO ANSWER THE QUESTIONS IN THIS SECTION.

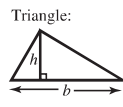
Directions: For Questions 1–30, solve each problem, select the best answer from the choices provided, and fill in the corresponding oval on your answer sheet. For Questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. The directions before Question 31 will provide information on how to enter your answers in the grid.

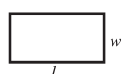
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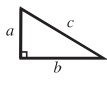
- The use of a calculator is permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise specified, the domain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

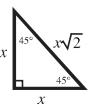
Reference Information

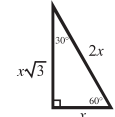
Circle:  $C = 2\pi r$
 $A = \pi r^2$

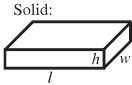
Rectangle:  $A = lw$


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

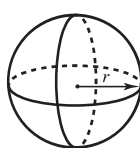
 $a^2 + b^2 = c^2$

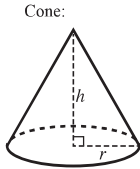
 x , x , $x\sqrt{2}$

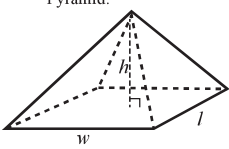
 $x\sqrt{3}$, $2x$, x

Rectangular Solid:  $V = lwh$

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

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

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

Rectangular Based Pyramid:  $V = \frac{1}{3}lwh$

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

1 If $9x + 5 = 23$, what is the numerical value of $18x + 5$?

- (A) 46 (B) 41 (C) 36 (D) 32

practice test

- 2 A pickup truck has maximum load capacity of 1,500 pounds. Bruce is going to load small radiators, each weighing 150 pounds, and large radiators, each weighing 250 pounds, into the truck. There are 15 radiators to choose from. Which system of linear inequalities represents this situation?

$$x + y < 15$$

(A) $150x + 250y < 1500$

$$x + y \geq 15$$

(B) $150x + 250y \geq 1500$

$$x + y > 15$$

(C) $150x + 250y > 1500$

$$x + y \leq 15$$

(D) $150x + 250y \leq 1500$

- 3 If 15 cans of food are needed for 7 adults for two days, how many cans are needed to feed 4 adults for seven days?

(A) 15

(B) 20

(C) 25

(D) 30

- 4 Fiona earns \$28 per hour working for herself. She saves 25% of her income to pay taxes. Which function can be used to determine the non-taxed amount Fiona earns for working x hours,?

(A) $f(x) = 28(0.25x)$

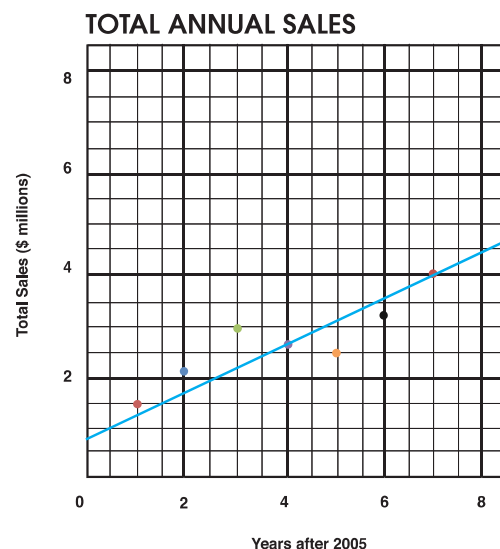
(B) $f(x) = 28 + 0.25x$

(C) $f(x) = 28(0.75x)$

(D) $f(x) = 28 + 0.75x$



QUESTIONS 5 AND 6 REFER TO THE FOLLOWING INFORMATION.



The graph above represents the sales for a company after 2005.

- 5 Which phrase best describes the correlation between the years after 2005 and the total sales?

(A) Weak negative

(B) Strong negative

(C) Weak positive

(D) Strong positive

- 6 Which equation best models the data shown in the graph?

(A) $y = 0.4x + 1$

(B) $y = x + 0.5$

(C) $y = 1.5^x$

(D) $y = 0.5^x$

- 7 If a box of notepaper costs \$4.20 after a 40% discount, what was its original price?

(A) \$2.52

(B) \$5.88

(C) \$7.00

(D) \$10.50

- 8** The average attendance to basketball games at a local university over the last 10 years can be modeled by the equation $y = 329x + 6489$, where y represents the average attendance at basketball games x years after 2004. Which of the following describes the meaning of 329 in the equation?
- (A) The average attendance at basketball games in 2004
(B) The total attendance at basketball games in 2004
(C) The annual increase in average attendance to basketball games.
(D) The total increase in average attendance to basketball games for the last 10 years.
- 9** A local theater company sells t-shirts and tote bags at all of their performances. They charge \$20 for each t-shirt and \$12.50 for each tote bag. Which expression can be used to determine the total amount the company earns from selling x t-shirts and y tote bags?
- (A) $12.5(x + y)$
(B) $20(x + y)$
(C) $20x + 12.5y$
(D) $12.5x + 20y$
- 10** A local library had 25,825 books at the beginning of 2010. Since then, it has added 375 books each year. The library can fit a maximum of 35,000 books. If x represents the number of years after the start of 2010, which inequality shows the number of years that the library can continue adding books at this pace without adding space?
- (A) $35,000 - 375 \leq x$
(B) $35,000 \leq 375x$
(C) $35,000 \geq 375x - 25,825$
(D) $35,000 \geq 375x + 25,825$
- 11** Which of the following is equivalent to $(6 - 5i)(3 + 2i)$?
- (A) $8 - 3i$
(B) $18 - 10i$
(C) $28 - 3i$
(D) 28
- 12** A study was performed to determine if a new medication, Z, helps people who suffer from a certain affliction. A group of 500 randomly selected people who have the affliction were included in the study. Of the group, 200 people were given Z, 200 people were given an old medication, Y, and another 100 people received no treatment. The data showed that people who received Z had significantly decreased effects of the affliction, more than people who received no treatment or who were given medicine Y. Based on the design and results of the study, which of the following is an appropriate conclusion?
- (A) Z is likely to lessen the effects of the affliction in people who suffer from the affliction.
(B) Z is likely to lessen the effects of the affliction better than any other medication.
(C) Z is likely to lessen the effects of the affliction for anyone who takes the medication.
(D) Z is likely to lessen the effects of the affliction for those who received no treatment.
- 13** A group of 27 people visit a city. The people rent either a bicycle or rollerblades. People pay \$7 to rent a bicycle for the day or \$5 to rent rollerblades for an hour. If the total cost for rentals is \$171, how many people rent bicycles?
- (A) 9
(B) 12
(C) 15
(D) 18



- 14 Scientists are creating a new pesticide spray that will help control the mosquito population. When the pesticide spray is complete and on the market, consumers will be able to buy it in a container that can be set on a circular-rotating mechanism in the middle of a yard. The spray will shoot out and cover a distance of 60 feet. If 60 feet represents the radius of the circle created by the rotating mechanism, what is the area of the sector of the circle created by a 60-degree angle at its center?

- (A) 360π
 (B) 600π
 (C) 840π
 (D) 1000π

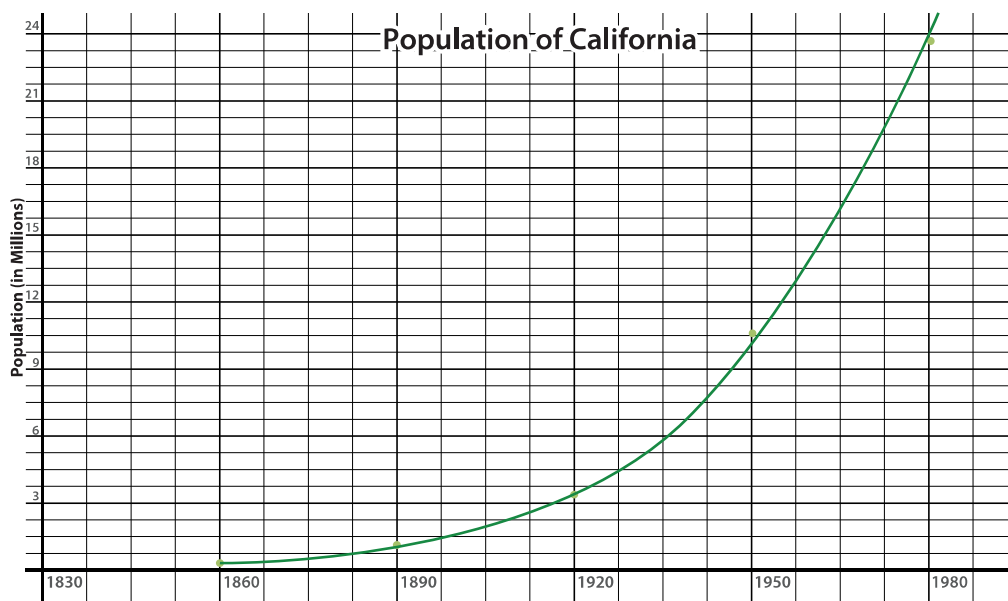
15 $y = 2x - 5$
 $y = (x - 2)^2 - 9$

Which choice shows the solutions to the system of equations?

- (A) $(-1, 0)$, $(5, 0)$
 (B) $(0, -5)$, $(3, -8)$
 (C) $(0, -5)$, $(6, 7)$
 (D) $(5, 0)$, $(6, 7)$

QUESTIONS 16 AND 17 REFER TO THE FOLLOWING INFORMATION.

The graph provided shows the population of California, in millions, from the years 1860 to 1980. Each point represents the population at a particular year. The best fit relation between the points is drawn to connect them.



- 16 Which phrase describes the relationship between the population and the number of years?
- (A) Linear increasing
 (B) Linear decreasing
 (C) Exponential growth
 (D) Exponential decay

- 17 Based on the graph, which of the following would be the best prediction of the population of California in 1990?
- (A) 20 million
 (B) 23 million
 (C) 25 million
 (D) 30 million

- 18 A rectangular sign is cut down by 10% of its height and 30% of its width. What percent of the original area remains?

(A) 37%
 (B) 57%
 (C) 63%
 (D) 70%

- 19 A recent report states that if you were to eat each meal in a different restaurant in New York City, it would take you more than 19 years to cover all of New York City's eating places, assuming that you eat three meals a day. On the basis of this information, the number of restaurants in New York City

(A) exceeds 20,500.
 (B) is closer to 20,000 than 21,000.
 (C) exceeds 21,000.
 (D) exceeds 21,000 but does not exceed 21,500.

- 20 If a cubic inch of gold weighs 0.70 pounds, how much does a cubic foot of gold weigh?

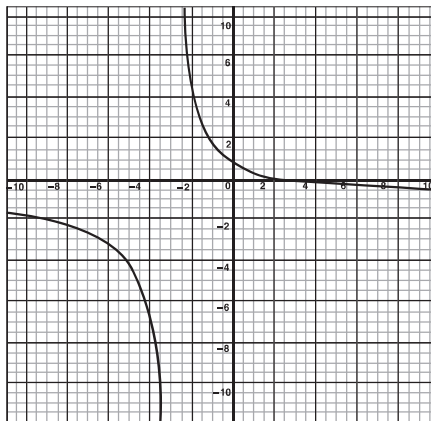
(A) 700 pounds
 (B) 1,210 pounds
 (C) 1,296 pounds
 (D) 1,728 pounds

21 $\frac{3x-1}{2x+3} - \frac{2x+3}{3x-1}$

Which of the following is equivalent to the expression above?

(A) $\frac{5x^2 - 18x - 8}{6x^2 + 7x - 3}$
 (B) $\frac{x - 4}{6x^2 + 7x - 3}$
 (C) $\frac{5x^2 + 10}{6x^2 + 7x - 3}$
 (D) $\frac{5x^2 - 12x - 8}{6x^2 + 7x - 3}$

22



Which of the following is an equation for the graph?

(A) $y = \frac{6}{x+3} - 1$

(B) $y = \frac{6}{x-3} - 1$

(C) $y = \frac{1}{x+3} - 1$

(D) $y = \frac{1}{x-3} - 1$

23

$$f(x) = \frac{3}{x-1}$$

$$g(x) = (x-4)^2$$

What is the value of $g(f(4))$?

(A) -3
 (B) 0
 (C) 1
 (D) 9

24

The number of people living in a certain city has been growing at a constant rate of about 3.8% each year since 1980. The population in 2000 was 38,500. If y is the population of the city x years after 1980, which equation best represents this situation?

(A) $y = 18,260(1.038)^x$
 (B) $y = 38,500(1.38)^x$
 (C) $y = 38,500(1.038)^x$
 (D) $y = 81,172(1.38)^x$



25 If $f(x) = x^2 - 2x - 8$, for which value(s) of x does $f(x) = 0$?

- (A) $x = -4, 2$
- (B) $x = 2, 4$
- (C) $x = -4, -2$
- (D) $x = -2, 4$

QUESTIONS 26 AND 27 REFER TO THE FOLLOWING INFORMATION.

A recent poll surveyed a random selection of 850 likely voters in a state election. Of the sample, 31% say that they favor candidate A, and 18% say that they favor candidate B. The margin of error reported for this was $\pm 3.4\%$ with 95% confidence.

26 Which of the following statements can accurately be drawn from this data?

- (A) The margin of error is too large to make any conclusions.
- (B) The sample of likely voters don't represent all voters.
- (C) The sample size is too small to represent the voters across the entire state.
- (D) The sample was randomly selected and is large enough to make conclusions.

27 Which of the following statements can accurately be drawn from this data?

- (A) The true percentage of likely voters who will vote for candidate A is 31%.
- (B) The true percentage of likely voters who will vote for candidate A is most likely between 27.6% and 34.4%.
- (C) The true percentage of likely voters who will vote for candidate B is 18%.
- (D) The true percentage of likely voters who will vote for someone other than candidate A or candidate B is most likely between 45.6% and 52.4%.

28 In a certain course, a student takes eight tests, all of which count equally. When figuring out the final grade, the instructor drops the best and the worst grades and averages the other six. The student calculates that his average for all eight tests is 84%. After dropping the best and the worst grades, the student averages 86%. What was the average of the best and the worst grades?

- (A) 68
- (B) 73
- (C) 78
- (D) 88

29 $x^2 + y^2 - 8x + 12y = 144$

What is the length of the radius of the circle with the equation above?

- (A) 6
- (B) 12
- (C) 14
- (D) 24

30 $2(2x + 3) = n\left(x + \frac{6}{8}\right) - 4x$

Which value of n gives the equation above an infinite number of solutions?

- (A) 2
- (B) 4
- (C) 6
- (D) 8

AGES OF THE UNITED NATIONS SECRETARIES GENERAL	
Name	Age (years)
Trygve Lie	49
Dag Hammarskjold	47
U Thant	52
Kurt Waldheim	53
Javier Perez de Cuellar	61
Boutros Boutros-Ghali	69
Kofi Annan	58
Ban Ki-Moon	52

- 31** The table above lists the ages of the first eight United Nations Secretaries General at the beginning of each term in office. What is the mean age? (Round your answer to the nearest tenth.)



- 32** If $\frac{x}{12} + \frac{x}{18} = 1$, what is the value of x ?

- 33** An African elephant can lift a total of approximately 660 pounds with its trunk. A small bundle of twigs weighs 12 pounds. If an African elephant lifts a small log that weighs 50 pounds, what is the greatest number of small twig bundles that it could theoretically lift in addition to the log?

QUESTIONS 34 AND 35 REFER TO THE FOLLOWING INFORMATION.

Population of United States by Gender and Age in 2010 (in millions)

	0–24 years	25–49 years	50–74 years	75–100 years	Total
Males	53.6	52.2	38.6	7.3	151.7
Females	51.2	52.6	41.8	11.2	156.8
Total	104.8	104.8	80.4	18.5	308.5

- 34** What percent of males were 49 years or younger in 2010? Round your answer to the nearest tenth.
- 35** What is the probability that a randomly selected female is between the ages of 25 and 74? Write your answer as a decimal to the nearest hundredth.

36 $5x + 4y = 11$
 $6x - 8y = 10$

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



38 $\frac{2}{x+2} + \frac{3}{x-5} = \frac{4x+7}{x^2-3x-10}$

What is the solution to the equation shown above?

37 A car travels from town A to town B, a distance of 360 miles, in 9 hours. How many hours would the same trip have taken had the car traveled 5 mph faster?

STOP

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

practice test



Section 3: Math Test—No Calculator

1. A

5. A

9. A

13. B

17. $\frac{2}{3}$, or
.666, or
.667

2. A

6. C

10. B

14. B

3. B

7. D

11. B

15. B

18. 6

4. C

8. D

12. B

16. 50

19. 1

20. 224

MATH TEST—NO CALCULATOR TEST RAW SCORE
(Number of correct answers)

1. **The correct answer is (A).** Substitute the value for m and solve for x :

$$\frac{x+2}{5} = m$$

$$\frac{x+2}{5} = -3$$

$$x+2 = -15$$

$$x = -17$$

2. **The correct answer is (A).** If h is any positive

quantity, then letting $d_h = (m+h) - \frac{50}{m+h}$, we can see that d_h is greater than d , since h

is greater than zero, and $\frac{50}{m}$ is greater than

$\frac{50}{m+h}$. Therefore, d increases as m does.

3. **The correct answer is (B).** The volume of a cube is $V = s^3$. A side of this cube is $\sqrt[3]{64}$ in. Since there are 12 edges to a cube, the amount of wire needed is 12×4 in., or 48 inches.

4. **The correct answer is (C).** The total number of cookies is equal to the sum of the cookies that Myra baked plus the cookies Neil baked. Myra baked 6 sheets of r cookies, or $6r$ cookies, and Neil baked 7 sheets of p cookies, or $7p$ cookies. The total number of cookies must be $6r + 7p$.

5. **The correct answer is (A).**

$$2y = \frac{1}{3}$$

$$6y = 1$$

$$y = \frac{1}{6}$$

$$\frac{1}{4y} = \frac{1}{4\left(\frac{1}{6}\right)} = \frac{1}{\frac{2}{3}} = \frac{3}{2}$$

6. **The correct answer is (C).**

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

$$4y = (x-3)^3$$

$$\sqrt[3]{4y} = x-3$$

$$\sqrt[3]{4y} + 3 = x$$



7. **The correct answer is (D).** The plant grows 4.5 centimeters a week, and that is represented by the $4.5w$ in the equation. Since the 6 is a constant in the equation, this represents the initial height of the plant. Therefore, the plant must have been 6 centimeters tall when Hannah bought it.

8. **The correct answer is (D).**

$$x^6 + (2x^2)^3 + (3x^3)^2 = x^6 + 8x^6 + 9x^6 = 18x^6$$

9. **The correct answer is (A).** The graph shows that the y -intercept is approximately at the point $(0, 55)$. The equation that shows a y -intercept of 55 is in choice (A). To further verify, substitute points in for the number of days to find the corresponding number of trout. For example, substitute 10 in for x : $y = 12(10) + 55 = 120 + 55 = 175$. The point $(10, 175)$ is on the graph.

10. **The correct answer is (B).**

$$\left(-\frac{27}{8}\right)^{\frac{1}{3}} = \left(-\frac{8}{27}\right)^{\frac{1}{3}} = -\frac{2}{3}x$$

11. **The correct answer is (B).** If the area is $49x^2$, the side of the square is $7x$. Therefore, the diagonal of the square must be the hypotenuse of a right isosceles triangle of leg

$$7x. \text{ Hence the diagonal} = 7x\sqrt{2}.$$

12. **The correct answer is (B).** The slope of the graph of a function is its vertical variable divided by its horizontal variable. In this case, the slope is feet divided by seconds, so the answer must be choice (B).

13. **The correct answer is (B).** Solve the system of equations by solving for one of the variables in the first equation, and then substituting that expression into the second equation:

$$D = 24 - B$$

$$4(24 - B) + 2B = 84$$

$$96 - 4B + 2B = 84$$

$$96 - 2B = 84$$

$$-2B = -12$$

$$B = 6$$

Then, substitute $B = 6$ into the other equation, and solve for D :

$$D + 6 = 24$$

$$D = 18$$

Therefore, the number of dogs in the pet store is 18, and the number of birds in the pet store is 6.

14. **The correct answer is (B).** Both choices (B) and (D) are equivalent to the original function. This can be shown by multiplying the binomial factors and simplifying the product. The form of the equation in choice (D) gives coordinates of the vertex as its coefficients, and choice (B) is in intercept form, where 7 and -3 are the x -intercepts of the function.

15. **The correct answer is (B).** The slope of a line perpendicular to another line will be the negative reciprocal of the slope of the first line. So the slope of the new line must be $-\frac{1}{3}$. The only equations with that slope are choices (B) and (C). Check which equation is correct by substituting the given point. Using choice (B), you will see that it is correct:

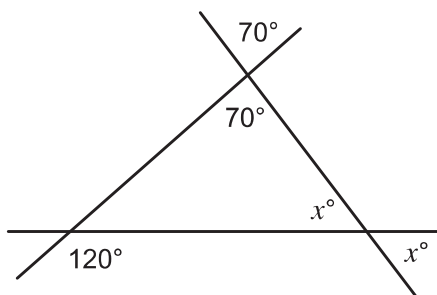
$$y = -\frac{1}{3}x + \frac{10}{3}$$

$$3 = -\frac{1}{3}(1) + \frac{10}{3}$$

$$3 = \frac{9}{3}$$



16. The correct answer is 50.



$$120 = 70 + x$$

$$x = 50$$

17. The correct answer is $\frac{2}{3}$ or .666 or .667.

If $(x + 3)^2$ is a factor of the function, then $(x + 3)^2 = 0$, $x + 3 = 0$, and $x = -3$, but that cannot be gridded. If $(3x - 2)$ is a factor of the function, then $3x - 2 = 0$, $3x = 2$, and $x = \frac{2}{3}$ or .666 or .667.

18. The correct answer is 6. The equation will have no solutions when the coefficient for x is the same on both sides of the equation, but the constant terms are different. So simplify the equations so that the variable terms are the same, and see if the constant are different:

$$5(4 - 8x) = d(5 - 6x) - 4x$$

$$20 - 40x = 5d - 6dx - 4x$$

$$-40x + 20 = (-6dx - 4x) + 5d$$

For $(-6dx - 4x)$ to equal $-40x$, $-6dx$ must be equal to $-36x$, so d must be equal to 6. This leads to $-40x + 20 = -40x + 30$.

19. The correct answer is 1.

$$\sqrt{4 - x^2} = \sqrt{3x}$$

$$4 - x^2 = 3x$$

$$0 = x^2 + 3x - 4$$

$$0 = (x + 4)(x - 1)$$

$$x = -4, x = 1$$

Only 1 works because although

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

$$\sqrt{-12} = \sqrt{-12}, \text{ negative numbers cannot be gridded.}$$

20. The correct answer is 224. The system will have an infinite number of solutions when the two equations are equivalent, so multiply each term in the first equation by -4 to find the values for a and b , then find their product:

$$-4(2x + 3y) = -4(7)$$

$$-8x - 12y = -28$$

For the two equations to be equivalent, a must be -8 and b must be -28 .

$$-8x - 12y = -28$$

$$ax - 12y = b$$

$$a = -8$$

$$b = -28$$

$$ab = -8(-28) = 224$$



Section 4: Math Test—Calculator

1. B	9. C	17. D	25. D	33. 50
2. D	10. D	18. C	26. D	34. 69.7
3. D	11. C	19. A	27. B	35. .60
4. C	12. A	20. B	28. C	36. $\frac{1}{4}$ or .25
5. D	13. D	21. A	29. C	37. 8
6. A	14. B	22. A	30. D	38. 11
7. C	15. C	23. D	31. 55.1	
8. C	16. C	24. A	32. 7.2 or $\frac{36}{5}$	

MATH TEST—CALCULATOR RAW SCORE
(Number of correct answers)

- The correct answer is (B).** If $9x + 5 = 23$, $9x = 18$, and $x = 2$. Thus, $18x + 5 = 36 + 5 = 41$.
- The correct answer is (D).** There can be at most 15 radiators, so $x + y \leq 15$. Each small radiator weighs 150 pounds, represented by $150x$. Each large radiator weighs 250 pounds, represented by $250y$. The maximum load can be equal to but not exceed 1,500 pounds: $150x + 250y \leq 1500$.
- The correct answer is (D).** Each adult needs $15 \text{ cans} / 7 \text{ adults} = \frac{15}{7}$ cans in two days, or $\left(\frac{1}{2}\right)\left(\frac{15}{7}\right) = \frac{15}{14}$ cans per adult per day. Multiply this by the number of adults and by the number of days: $\frac{15}{14} (4 \text{ adults})(7 \text{ days}) = 30$ cans of food.
- The correct answer is (C).** Fiona's non-taxed amount is 75% of what she earns each hour, or $0.75x$. This can be multiplied by the hourly rate, which in this case is \$28, leading to the expression $28(0.75x)$.
- The correct answer is (D).** The data is increasing and stays relatively close to a line of best fit that would pass through the center of the points. This means that the company has strong positive sales numbers.
- The correct answer is (A).** Using a line that passes through $(2, 1.9)$ and $(6, 3.5)$, the slope is $\frac{3.5 - 1.9}{6 - 2} = \frac{1.6}{4} = 0.4$. The line passes through $(0, 1)$, making the equation $y = 0.4x + 1$.
- The correct answer is (C).** Let x = original price. Then: $0.60x = \$4.20$
or $6x = \$42.00$
 $x = \$7.00$



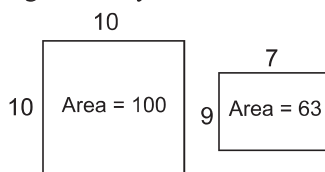
- 8. The correct answer is (C).** The number 329 represents the slope of the graph of the equation, which is the rate of increase in attendance.
- 9. The correct answer is (C).** Consider what each term represents:
 $20x$ means \$20 earned for each t-shirt.
 $12.5x$ means \$12.50 earned for each t-shirt.
 The correct answer equals the sum of $20x$ and $12.5y$. Only answer choice (C) includes the correct terms and expression.
- 10. The correct answer is (D).** The number of books that the library adds is $375x$, or 375 times the number of years. The total number of books must be the sum of $375x$ and 25,825 (the number they already have), not to exceed 35,000.
- 11. The correct answer is (C).**
 $(6 - 5i)(3 + 2i) = 6(3) + 6(2i) + (-5i)(3) + (-5i)(2i)$
 $= 18 + 12i - 15i - 10i^2$
 $= 18 - 3i - 10(-1)$
 $= (18 + 10) - 3i$
 $= 28 - 3i$
- 12. The correct answer is (A).** Choice (C) is incorrect because we cannot say with certainty that a medication will help all people who need it. Choice (D) doesn't make sense; the medication cannot help people who don't take it. Choice (B) is incorrect because we only compared Z against one other medication, Y. The inference can be applied only to the given medications and populations.
- 13. The correct answer is (D).** Write equations to represent the situation. Let x be the number of bicycles rented and y be the number of pairs of rollerblades rented. Then solve the system using elimination:
 $x + y = 27$
 $7x + 5y = 171$
 Multiply $x + y = 27$ by -5 to solve by elimination:
 $-5x - 5y = -135$
 $7x + 5y = 171$
 $2x = 36$
 $x = 18$
- 14. The correct answer is (B).**
 $A = \frac{x}{360} \pi r^2$
 $= \frac{60}{360} \pi (60)^2$
 $= \frac{1}{6} (3600) \pi$
 $= 600\pi$
- 15. The correct answer is (C).** Solve the system by substitution:
 $y = 2x - 5$
 $y = (x - 2)^2 - 9$
 $2x - 5 = (x - 2)^2 - 9$
 $2x - 5 = x^2 - 4x + 4 - 9$
 $0 = x^2 - 6x$
 $0 = x(x - 6)$
 $0 = x, 6 = x$
 Then substitute x -values into both equations to check for the y -values:
 $-5 = 2(0) - 5$
 $-5 = (0 - 2)^2 - 9$
 $-5 = -5$
 $2(6) - 5 = (6 - 2)^2 - 9$
 $7 = 7$



16. **The correct answer is (C).** The graph shows points connected by a curve with an increasing positive slope that approximates an exponential graph, so this is exponential growth.

17. **The correct answer is (D).** The graph shows an exponential growth curve, and the population of California in 1980 is approximately 24 million. Therefore, choices (A) and (B) can be eliminated, because based on the exponential growth, the population in 1990 would be more than the population in 1980. And because it is exponential growth, 30 million would be the best prediction.

18. **The correct answer is (C).** Let the original sign be 10 by 10.



Then, the new sign is 9 by 7.

$$\frac{63}{100} = 63\%$$

19. **The correct answer is (A).** Three meals a day times 365 days per year means there are $3 \times 365 = 1095$ meals in one year. Over 19 years, there are $1095 \times 19 = 20,805$ meals. Therefore, the number of restaurants in New York City exceeds 20,500.

20. **The correct answer is (B).** One cubic foot equals 12^3 , or 1,728 cubic inches. One cubic foot of gold weighs $1728 \times 0.70 = 1210$ pounds.

21. **The correct answer is (A).** Subtract by writing using a common denominator, and then simplify:

$$\begin{aligned} \frac{3x-1}{2x+3} - \frac{2x+3}{3x-1} &= \frac{(3x-1)(3x-1)}{(2x+3)(3x-1)} - \frac{(2x+3)(2x+3)}{(3x-1)(2x+3)} \\ &= \frac{(3x-1)^2 - (2x+3)^2}{(2x+3)(3x-1)} \\ &= \frac{5x^2 - 18x - 8}{6x^2 + 7x - 3} \end{aligned}$$

22. **The correct answer is (A).** The graph is a hyperbola which is of the general form $y = \frac{a}{x-b} + c$. There are asymptotes at

$x = -3$ and $y = -1$, $b = -3$ and $c = -1$. To determine whether choice (A) or (C) is the correct equation, locate points on the graph and check against both equations. $(0, 1)$ is a point on the graph.

$$\begin{aligned} y &= \frac{6}{x+3} - 1 & y &= \frac{1}{x+3} - 1 \\ 1 &= \frac{6}{0+3} - 1 & 1 &= \frac{1}{0+3} - 1 \\ 1 &= 2 - 1 & 1 &\neq -\frac{2}{3} \end{aligned}$$

Only answer choice (A) works.

23. **The correct answer is (D).**

$$\begin{aligned} g(f(x)) &= g(f(4)) \\ &= g\left(\frac{3}{4-1}\right) \\ &= g(1) \\ &= (1-4)^2 \\ &= 9 \end{aligned}$$



24. **The correct answer is (A).** To write an exponential equation for this situation, you need to find the population in 1980:

$$38,500 = P(1 + 0.038)^{20}$$

$$\frac{38,500}{(1.038)^{20}} = P$$

$$18,260 \approx P$$

So, the correct answer is choice (A).

25. **The correct answer is (D).** In order to determine when $f(x) = 0$, solve the equation $x^2 - 2x - 8 = 0$.

$$x^2 - 2x - 8 = 0 \quad \text{Factor the left-hand side.}$$

$$(x - 4)(x + 2) = 0 \quad \text{Set each factor equal to 0.}$$

$$x - 4 = 0, \quad x + 2 = 0 \quad \text{Solve each equation.}$$

$$x = 4, -2$$

26. **The correct answer is (D).** The sample size leads to the margin of error that is given with the data. As long as the margin of error is considered when making conclusions, those conclusions are reasonable.

27. **The correct answer is (B).** The 95% confidence that the margin of error is $\pm 3.4\%$ is important, and choices (A) and (C) ignore the confidence interval. Choice (D) is not correct, because this interval is centered around 49%, instead of 51%, which is the number of people who support a different candidate or no candidate at this time. Only choice (B) accurately uses the confidence interval and the data given in the problem.

28. **The correct answer is (C).** If the average for the eight tests is 84%, then the sum of the eight tests must be 8 times 84, or 672. For the six tests, the sum must be 6 times 86, or 516. The two dropped tests must have accounted for 156 points. 156 divided by 2 is 78.

29. **The correct answer is (C).** Complete the square to write the equation in standard form for a circle:

$$x^2 + y^2 - 8x + 12y = 144$$

$$x^2 - 8x + y^2 + 12y = 144$$

$$(x^2 - 8x + 16) + (y^2 + 12y + 36) = 144 + 16 + 36$$

$$(x - 4)^2 + (y + 6)^2 = 196$$

Since 196 is 14^2 , the radius is 14.

30. **The correct answer is (D).** An equation with an infinite number of solutions simplifies to $x = x$.

Simplifying the given equation leads to:

$$2(2x + 3) = n\left(x + \frac{6}{8}\right) - 4x$$

$$4x + 6 = nx + n\frac{6}{8} - 4x$$

So $nx - 4x$ must equal $4x$, which is satisfied by $n = 8$.

And $n\frac{6}{8}$ must equal 6, which is also satisfied by $n = 8$.

31. **The correct answer is 55.1.** Add the eight numbers and divide by 8. Then round to the nearest tenth.

$$\frac{49 + 47 + 52 + 53 + 61 + 69 + 58 + 52}{8} = 55.125$$

The average age is 55.1.

32. **The correct answer is 7.2 or $\frac{36}{5}$.** Begin by multiplying all terms of the equation by the LCD of 36:

$$36\left(\frac{x}{12}\right) + 36\left(\frac{x}{18}\right) = 1(36)$$

$$3x + 2x = 36$$

$$5x = 36$$

$$x = \frac{36}{5} = 7\frac{1}{5} = 7\frac{2}{10} = 7.2$$



- 33. The correct answer is 50.** Write and solve an inequality that represents the situation. Then interpret the solution:

$$50 + 12x \leq 660$$

$$12x \leq 610$$

$$25x \leq 380$$

$$x \leq 50.8$$

Since the elephant cannot lift part of a bundle, the greatest number of bundles it can lift is 50.

- 34. The correct answer is 69.7.** The males who are 49 years old or younger are in the 0–24 range and the 25–49 range. First, find this sum: $53.6 + 52.2 = 105.8$.

Then, divide it by the total number of males, which is 151.7 million:

$$\frac{105.8}{151.7} = 0.697$$

$$= 69.7\%$$

- 35. The correct answer is .60.** The probability is the number of females who are in the age range of 25 to 74 ($52.6 + 41.8 = 94.4$) divided by the total number of females, which is 156.8 million:

$$\frac{94.4}{156.8} = 0.602$$

$$\approx 0.60$$

- 36. The correct answer is $\frac{1}{4}$ or .25.** Solve using elimination so that the x -terms are eliminated:

$$-6(5x + 4y) = -6(11)$$

$$5(6x - 8y) = 5(10)$$

$$-30x - 24y = -66$$

$$+ 30x - 40y = 50$$

$$\hline -64y = -16$$

$$y = \frac{16}{64}$$

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

- 37. The correct answer is 8.** Distance = rate \times time:

$$360 = r(9)$$

$$40 = r$$

$$\text{If } r \text{ were } 40 + 5 = 45$$

$$d = rt$$

$$360 = 45t$$

$$t = 8$$

- 38. The correct answer is 11.** Solve using a common denominator, and check your answer:

$$\frac{2}{x+2} + \frac{3}{x-5} = \frac{4x+7}{x^2-3x-10}$$

$$\frac{2(x-5)}{(x+2)(x-5)} + \frac{3(x+2)}{(x-5)(x+2)} = \frac{4x+7}{x^2-3x-10}$$

$$\frac{2x-10+3x+6}{x^2-3x-10} = \frac{4x+7}{x^2-3x-10}$$

$$5x-4 = 4x+7$$

$$x = 11$$

$$\frac{2}{11+2} + \frac{3}{11-5} = \frac{4(11)+7}{(11)^2-3(11)-10}$$

$$\frac{2}{13} + \frac{3}{6} = \frac{51}{78}$$

$$\frac{2(6)}{13(6)} + \frac{3(13)}{6(13)} = \frac{51}{78}$$

$$\frac{51}{78} = \frac{51}{78}$$