



SAT[®] MAY 2017 US

IMPORTANT REMINDERS:

1

A No. 2 pencil is required for the test. Do not use a mechanical pencil or pen.

2

Sharing any questions with anyone is a violation of the SAT[®] Program's Test Security and Fairness policies and may result in your scores being canceled.

3

Requests to cancel scores must be received in writing by the Wednesday following the test date.



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

DIRECTIONS

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

NOTES

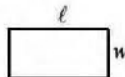
- The use of a calculator is **not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

REFERENCE

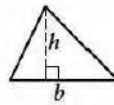


$$A = \pi r^2$$

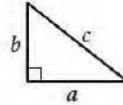
$$C = 2\pi r$$



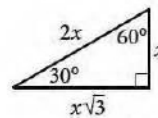
$$A = \ell w$$



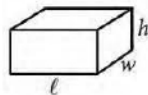
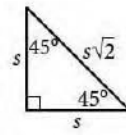
$$A = \frac{1}{2}bh$$



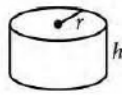
$$c^2 = a^2 + b^2$$



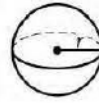
Special Right Triangles



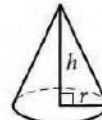
$$V = \ell wh$$



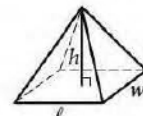
$$V = \pi r^2 h$$



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



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



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

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

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

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



1

In the xy -plane, what is the y -intercept of the line with equation $y = 4x - 1$?

- A) 4
- B) $\frac{1}{4}$
- C) $-\frac{1}{4}$
- D) -1

2

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

For the function f above, what is the value of $f(7) - f(5)$?

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

3

$$3(x + y) = 12$$

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

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

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

4

$$D = 60 - \frac{3}{4}P$$

$$S = \frac{1}{4}P$$

In economics, the equilibrium price is defined as the price at which quantity demanded and quantity supplied are equal. If the quantity demanded, D , and quantity supplied, S , in terms of the price in dollars, P , are given by the equations above, what is the equilibrium price?

- A) \$0
- B) \$60
- C) \$80
- D) \$120



5

If $(x - 2)^2 - 6(x - 2) + 9 = 0$, what is the value of x ?

- A) 2
- B) 3
- C) 5
- D) 7

6

A chef plans to cook a maximum of 100 entrées for a dinner party; each entrée will include either chicken or fish. The cost of ingredients for each chicken entrée is \$7, and the cost of ingredients for each fish entrée is \$9. If no more than \$850 can be spent on ingredients for the entrées and the chef cooks c chicken entrées and f fish entrées, which of the following systems best represents the constraints on c and f ?

- A) $c + f = 16$
 $7c + 9f \leq 100$
- B) $c + f \leq 100$
 $7c + 9f > 850$
- C) $c + f \leq 100$
 $7c + 9f \leq 850$
- D) $c + f = 100$
 $7c + 9f < 850$

7

If $x + y = 13$ and $x - y = 2$, what is the value of $x^2 - y^2$?

- A) 4
- B) 26
- C) 121
- D) 165

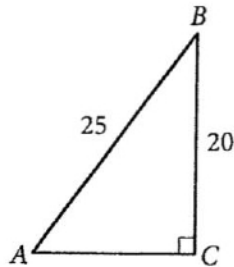
8

Every Saturday, Bob bakes loaves of bread to sell at the farmer's market. Each loaf costs him \$1 to make, and he sells the loaves for \$3 each. He also pays a vendor's fee of \$75 every Saturday to set up his booth. What is the least number of loaves of bread Bob needs to sell every Saturday to cover the cost of the vendor's fee?

- A) 38
- B) 37
- C) 25
- D) 19



9



In the right triangle above, the tangent of $\angle A$ is $\frac{4}{3}$.

What is the sine of $\angle B$?

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

10

$$wxy + xyz = wx + yz$$

In the equation above, w , x , and z are each greater than 1. Which of the following is equivalent to y ?

- A) $-x$
- B) $-\frac{1}{x}$
- C) $\frac{1}{xz - z}$
- D) $\frac{wx}{wx + xz - z}$

11

The pressure exerted on an object under water increases by 1 atmosphere every 33 feet below the surface of the water. At sea level, the pressure is 1 atmosphere. Which equation gives the total pressure p , in atmospheres, exerted on an underwater object at a depth of f feet below sea level?

- A) $p = \frac{f}{33}$
- B) $p = 33f$
- C) $p = 33f + 1$
- D) $p = \frac{f}{33} + 1$



12

Which of the following equations has a graph in the xy -plane with no x -intercepts?

- A) $y = x^2 + 3x + 4$
- B) $y = x^2 - 5x - 6$
- C) $y = 3x^2$
- D) $y = 2x - 5$

13

$$y = 5x + 1$$

$$y = x^2 + 3x + 2$$

What is the y -coordinate of the point of intersection, in the xy -plane, of the graphs of the equations above?

- A) 1
- B) 2
- C) $\frac{9}{4}$
- D) 6

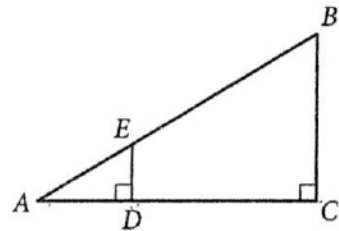
14

Which of the following expressions is equivalent

to $(16x^2)^{\frac{1}{2}}$?

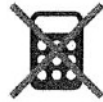
- A) $4|x|$
- B) $8|x|$
- C) $\sqrt{8x}$
- D) $16x$

15



In the figure above, $BC = 5$, and the length of line segment AD is half the length of line segment CD . What is the length of line segment DE ?

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



DIRECTIONS

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

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

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

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

Write answer in boxes. →

← Fraction line

Grid in result. {

Answer: 2.5

	2	.	5
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

← Decimal point

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

2	/	3
○	○	○
○	○	○
①	①	①
②	②	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
⑦	⑦	⑦

.	6	6	6
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦

.	6	6	7
○	○	○	○
○	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦

Answer: 201 – either position is correct

2	0	1
○	○	○
○	○	○
①	①	①
②	②	②

2	0	1
○	○	○
○	○	○
①	①	①
②	②	②

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



16

In the equations $a = x - 4$ and $b = x + 4$, a and b are constants. When the product ab is written in the form $x^2 - c$, where c is a constant, what is the value of c ?

17

Isabella sells only rings and necklaces on her website. Rings sell for \$50 each, and necklaces sell for \$30 each. If Isabella sold 25 pieces of jewelry and her sales totaled \$1050, how many necklaces did Isabella sell?

18

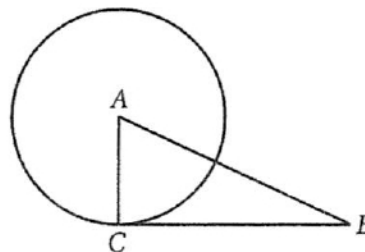
$$1.2(h + 2) = 2h - 1.2$$

What value of h is the solution of the equation above?

19

If $r > 0$ and $\sqrt[3]{\frac{9r}{2}} = \frac{1}{2}r$, what is the value of r ?

20



Note: Figure not drawn to scale.

In the figure above, the circle has center A , and line segment CB is tangent to the circle at point C . If $AB = 1.0$ and $CB = 0.8$, what is the length of the diameter of the circle?

STOP

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



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

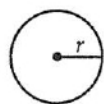
DIRECTIONS

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

NOTES

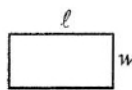
- The use of a calculator is permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain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

REFERENCE

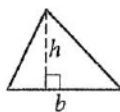


$$A = \pi r^2$$

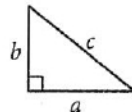
$$C = 2\pi r$$



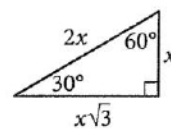
$$A = \ell w$$



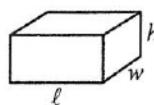
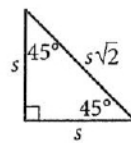
$$A = \frac{1}{2}bh$$



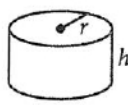
$$c^2 = a^2 + b^2$$



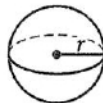
Special Right Triangles



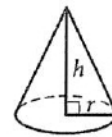
$$V = \ell wh$$



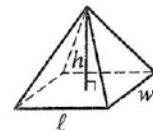
$$V = \pi r^2 h$$



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



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



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

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

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

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



1

Ms. Anderson currently has 550 contacts on an online professional networking site. Her goal is to have at least 1,000 contacts. If she wants to meet this goal in 25 weeks, what is the minimum number of contacts per week, on average, she should add?

- A) 18
- B) 19
- C) 21
- D) 22

2

At her summer job, Paula earns the same amount of money for each hour she works. If she earns \$240 for working 20 hours, how much does she earn for 5 hours?

- A) \$12
- B) \$50
- C) \$60
- D) \$100

3

If $3x = 24$, what is the value of $2x - 3$?

- A) 8
- B) 10
- C) 11
- D) 13

4

Yuna sold boxes of cookies and bags of candy. The ratio of the number of boxes of cookies she sold to the number of bags of candy she sold was 2 to 1. If Yuna sold 8 boxes of cookies, how many bags of candy did she sell?

- A) 4
- B) 8
- C) 10
- D) 16



5

For each repair job, an elevator technician charges r dollars per hour for each hour worked plus a flat fee of k dollars. If the technician charges \$210 for a 2-hour job, which of the following represents the relationship between r and k ?

- A) $210 = k + 2r$
- B) $210 = 2k + r$
- C) $210 = 2r - k$
- D) $210 = r - 2k$

6

A box in the shape of a right rectangular prism has a volume of 60 cubic inches. If the dimensions of the box are 3 inches by 5 inches by h inches, what is the value of h ?

- A) 3
- B) 4
- C) 5
- D) 6

7

A 15-foot wire and a 5-foot wire were each cut completely into 10-inch pieces. How many more 10-inch pieces resulted from the 15-foot wire than from the 5-foot wire? (12 inches = 1 foot)

- A) 6
- B) 9
- C) 12
- D) 18

8

Parabola D in the xy -plane has equation $x - 2y^2 - 8y - 11 = 0$. Which equation shows the x -intercept(s) of the parabola as constants or coefficients?

- A) $x = 2y^2 + 8y + 11$
- B) $x = 2(y + 2)^2 + 3$
- C) $x - 3 = 2(y + 2)^2$
- D) $y = -\sqrt{\frac{x-3}{2}} - 2$

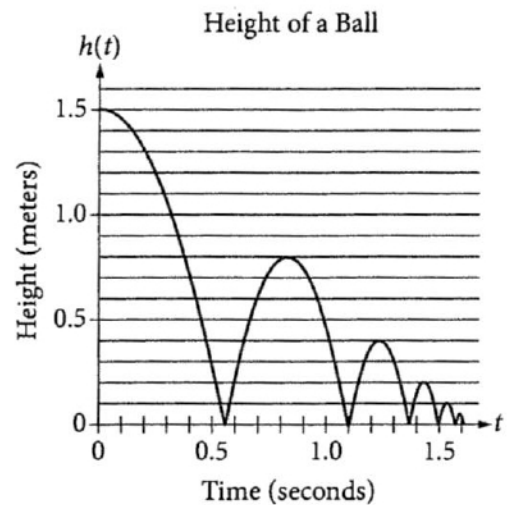


9

The sum of two different numbers x and y is 70, and the difference when the smaller number is subtracted from the larger number is 30. What is the value of xy ?

- A) 100
- B) 210
- C) 1,000
- D) 2,100

10



A ball was dropped from a height of 1.5 meters and hit the ground several times. The graph above represents the height h , in meters, of the ball t seconds after it was dropped. Of the following, which best approximates the maximum height, in meters, of the ball between the second and third time it hit the ground?

- A) 0.2
- B) 0.4
- C) 0.8
- D) 1.5



11

Which of the following is an equation of the circle in the xy -plane that has center $(0, 0)$ and radius 4?

- A) $x^2 + y^2 = 4$
- B) $x^2 + y^2 = 8$
- C) $x^2 + y^2 = 16$
- D) $x^2 + y^2 = 64$

12

Which of the following expressions is equivalent

to $(16x^9y^3)^{\frac{1}{2}}$, where $x \geq 0$ and $y \geq 0$?

- A) $4x^3y^{\frac{3}{2}}$
- B) $4x^{\frac{9}{2}}y^{\frac{3}{2}}$
- C) $8x^3y^3$
- D) $8x^{\frac{9}{2}}y^3$



13

At the beginning of a laboratory experiment, Miguel had 10 milliliters of a solution in a flask. The first step of the experiment consisted of Miguel pouring x milliliters of the solution into a beaker and y milliliters of the solution into a different beaker. There remained at least 4 milliliters of the solution in the flask after the first step. Which of the following inequalities can be used to correctly represent this situation?

- A) $10 - x - y \geq 4$
- B) $10 - x + y \geq 4$
- C) $4 - x - y \geq 5$
- D) $4 - x + y \geq 5$

14

To determine if cooking with olive oil reduces the risk of heartburn for men, researchers interviewed a random sample of 5,500 men who had no history of heartburn. Study participants were identified as either regular or occasional olive oil users. Five years later, researchers interviewed the men again. They found that the proportion of men who experienced frequent heartburn was significantly lower for men identified as regular olive oil users. Which of the following is the most appropriate conclusion of the study?

- A) Olive oil use causes a reduction in the risk of heartburn for men and women.
- B) Olive oil use causes a reduction in the risk of heartburn for men but not necessarily for women.
- C) There is an association between olive oil use and the risk of heartburn for men and women, but it is not necessarily a cause-and-effect relationship.
- D) There is an association between olive oil use and the risk of heartburn for men, but it is not necessarily a cause-and-effect relationship, and the association may not exist for women.



Questions 15 and 16 refer to the following information.

$$h = 3c$$

A wildlife biologist uses the formula above to estimate the height h , in centimeters, of an elephant from its foot to its shoulder, based on the circumference c , in centimeters, of the elephant's footprint.

15

If the wildlife biologist finds a circular elephant footprint that has a diameter of 30 centimeters (cm) while on a zoological study, which of the following is closest to the biologist's estimate of the elephant's height?

- A) 90.0 cm
- B) 94.2 cm
- C) 188.4 cm
- D) 282.6 cm

16

The circumference c of a mother elephant's circular footprint is 4 times the circumference of a baby elephant's circular footprint. What is the ratio of the height of the mother to the height of the baby?

- A) 1 to 4
- B) 1 to 3
- C) 4 to 1
- D) 4 to 3

17

If $(x^{24})^a = (x^2)^4$, and $x > 1$, what is the value of a ?

- A) $\frac{1}{4}$
- B) $\frac{1}{3}$
- C) $\frac{1}{2}$
- D) 2

18

$$\begin{aligned}x^2 + y &= 7 \\x - y &= 5\end{aligned}$$

Which value is a y -coordinate of a solution to the system of equations above?

- A) -8
- B) -3
- C) -2
- D) 6



Questions 19 and 20 refer to the following information.

$$d = 2,565 - 500t$$

An airplane flies directly from a city in Pennsylvania to a city in Ecuador. The equation above estimates the distance d , in miles, from the city in Ecuador of the airplane t hours after taking off from the city in Pennsylvania.

19

Which of the following is the best interpretation of the number 2,565 in this context?

- A) The speed, in miles per hour, of the airplane
- B) The distance, in miles, the airplane travels in one hour
- C) The distance, in miles, the airplane travels between the two cities
- D) The time, in minutes, it takes the airplane to reach the city in Ecuador

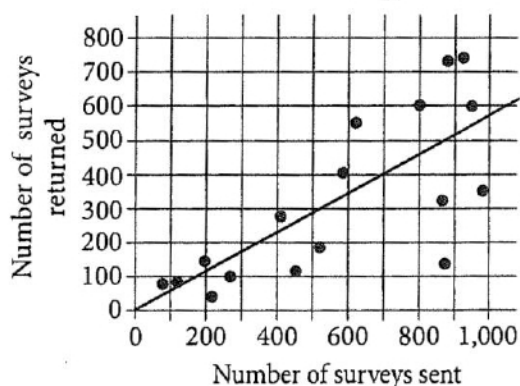
20

According to the equation, approximately how many hours will it take the airplane to travel between the two cities?

- A) 6.2
- B) 5.8
- C) 5.3
- D) 5.1

21

Surveys Sent to and Returned from 17 Neighborhoods



The scatterplot above shows the number of surveys sent to and returned from people in 17 different neighborhoods. A line of best fit for the data is also shown. For the neighborhood that had surveys sent to 800 people, which of the following is closest to the positive difference between the actual number of surveys returned and the number predicted by the line of best fit shown?

- A) 150
- B) 170
- C) 200
- D) 250



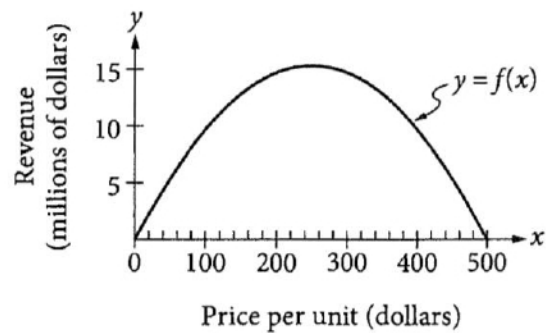
Questions 22 and 23 refer to the following information.

Annual Production (thousands of units)

	Factory W	Factory Z
Product P	21	32
Product Q	14	24

Projected Annual Revenue from Sales of Product P (millions of dollars)

$$f(x) = a(x - 250)^2 + k$$



A company makes and sells only two products, P and Q, and makes all products at factories W and Z. The table above shows the number of units of each product made at each factory during a year. The function f above represents the projected annual revenue from sales of product P as a function of the price per unit, where a and k are constants.

22

Based on the graph of f , which of the following is a factor of $f(x)$?

- A) $x - 15$
- B) $x - 240$
- C) $x - 250$
- D) $x - 500$

23

Which of the following is closest to the percent of the total number of units of products P and Q combined that are made at factory Z annually?

- A) 38%
- B) 56%
- C) 62%
- D) 91%



24

For 5 consecutive even integers, the sum of the first and third integer is 20 less than 3 times the fourth integer. What is the fifth integer?

- A) 12
- B) 14
- C) 16
- D) 26

25

A polling agency wanted to test whether a ballot measure would pass with greater than 50% yes votes. The agency sampled 1,000 registered voters selected at random, and 50.6% of the voters favored the ballot measure. The margin of error associated with this poll was $\pm 3\%$. Based on the poll's results, which of the following statements must be true?

- A) The percentage of voters who will vote yes for the ballot measure is 50.6%.
- B) The ballot measure will pass with more yes votes than no votes, but the percentage of votes it will receive cannot be predicted.
- C) The ballot measure will pass with at least 53.6% of the vote.
- D) The poll's results do not provide sufficient evidence to conclude that the ballot measure will pass.

26

Treatment	Number of plants		
	Regressed	Thrived	Total
A	80	120	200
B	140	60	200

The table above shows the results of an experiment involving the effect of two treatments, A and B, on plants. Based on the results, what fraction of the plants that thrived received treatment A?

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

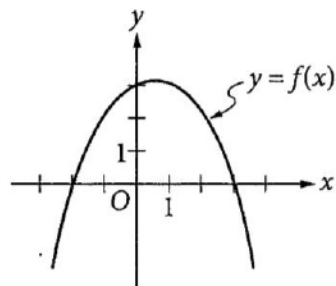


27

A sample of seawater is 3.5% salt by mass and contains 1,000 grams of salt. Which of the following is closest to the mass, in grams, of the sample of seawater?

- A) 28,600
- B) 27,600
- C) 965
- D) 35

28



x	$g(x)$
-1	-2
0	2
1	0
2	-1
3	1

The graph of the function f is shown in the xy -plane above, and selected values for the function g are shown in the table. For which of the following values of x is $g(x) > f(x)$?

- A) 0
- B) 1
- C) 2
- D) 3



29

$$h(t) = -\frac{1}{175}t + 481$$

An archeologist estimates that, as a result of erosion, the height of the Great Pyramid of Giza has been decreasing at a constant rate since it was built. The function above is used by the archeologist to model the height $h(t)$, in feet, of the pyramid t years after it was built. According to the function, which of the following statements is true?

- A) Every 1,750 years the height of the pyramid decreases by 10 feet.
- B) Every 175 years the height of the pyramid decreases by 0.1 foot.
- C) Every 100 years the height of the pyramid decreases by 1.75 feet.
- D) Every year the height of the pyramid decreases by 175 feet.

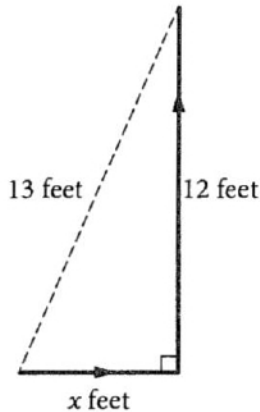
30

A biologist grows a culture of bacteria as part of an experiment. At the start of the experiment, there are 75 bacteria in the culture. The biologist observes that the population of bacteria doubles every 18 minutes. Which of the following equations best models the number, n , of bacteria t hours after the start of the experiment?

- A) $n = 75(2)^{\frac{t}{18}}$
- B) $n = 75\left(1 + \frac{t}{18}\right)$
- C) $n = 75(2)^{\frac{10t}{3}}$
- D) $n = 75\left(1 + \frac{10}{3}t\right)$



31



The solid lines in the figure above represent the route of a football player, and the dashed line represents the distance from his starting point to the point at which the player was stopped. What is the value of x ?

32

Last year, Gary's tomato plants produced 24 kilograms of tomatoes. This year, Gary increased the number of tomato plants in his garden by 25%. If his plants produce tomatoes this year at the same rate per plant as last year, how many kilograms of tomatoes can Gary expect the plants to produce this year?

33

Median Ages of Populations of Selected Countries, 2012

Country	Median age of population (years)
Brazil	29.6
China	35.9
Germany	45.3
India	26.5
Indonesia	28.5
Nigeria	17.9
Philippines	23.1
Russia	38.8
United States	37.1

What is the range, in years, of the median ages of the populations for the countries in the table above?



34

$$\begin{aligned}\frac{1}{2}x &= a \\ x + y &= 5a\end{aligned}$$

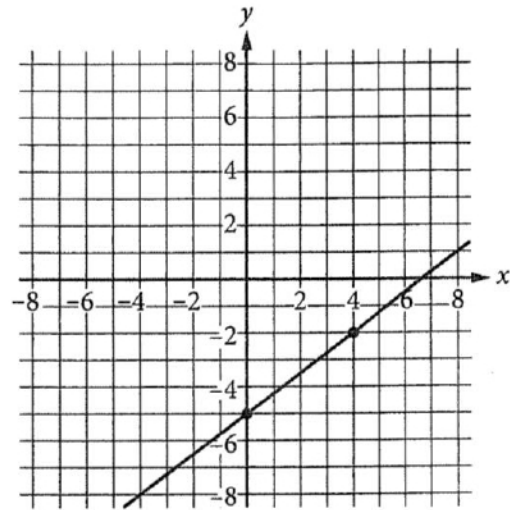
In the system of equations above, a is a constant such that $0 < a < \frac{1}{3}$. If (x, y) is a solution to the system of equations, what is one possible value of y ?

35

$$\frac{x^2 + 17x + 66}{x + 6}$$

If the expression above is equivalent to an expression of the form $x + a$, where $x \neq -6$, what will be the value of a ?

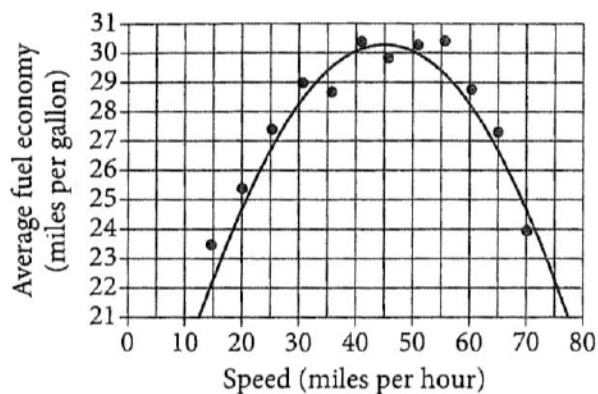
36



A line is shown in the xy -plane above. A second line (not shown) is parallel to the line shown and passes through the points $(1, 1)$ and $(3, c)$, where c is a constant. What is the value of c ?



Questions 37 and 38 refer to the following information.



The scatterplot above shows the average fuel economy for a certain class of car driven at 12 different speeds. The graph of a quadratic model for the data is also shown.

37

For what fraction of the 12 speeds does the model overestimate the average fuel economy?

38

The quadratic model predicts the average fuel economy to be 26 miles per gallon for how many different speeds?

STOP

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