3

Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

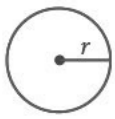
DIRECTIONS

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

NOTES

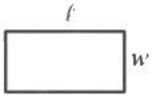
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

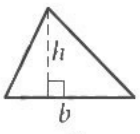


$A = \pi r^2$

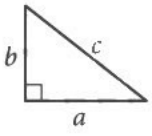
$C = 2\pi r$



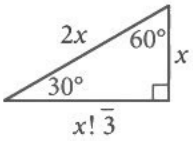
$A = \ell w$

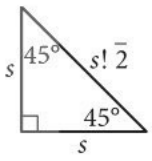


$A = \frac{1}{2}bh$

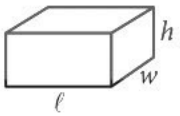


$c^2 = a^2 + b^2$

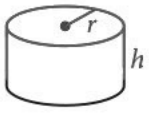




Special Right Triangles

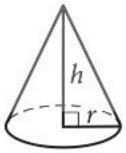


$V = \ell wh$

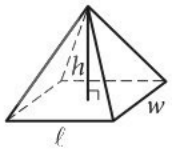


$V = \pi r^2 h$

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



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



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

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

CONTINUE

3

1

$$3k + 2k = 5$$

What is the solution to the given equation?

A) 0

B) 1

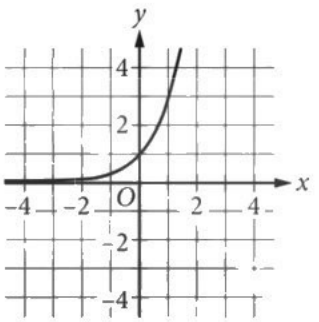
C) 3

D) 5

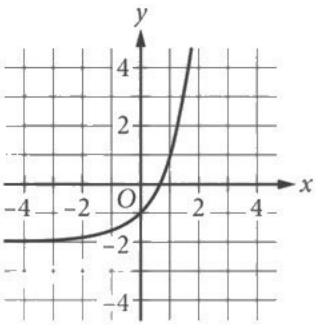
2

What is the graph of the equation $y = 3^x$?

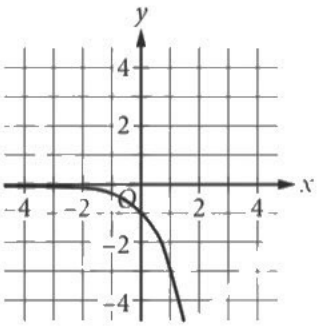
A)



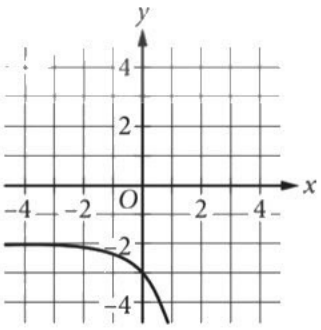
B)



C)



D)



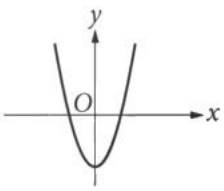
CONTINUE

3

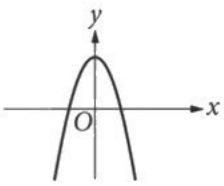
For the quadratic function f, the table shows some values of x and their corresponding values of $f(x)$. Which of the following could be the graph of $y = f(x)$?

x	-1	0	1
$f(x)$	0	-4	0

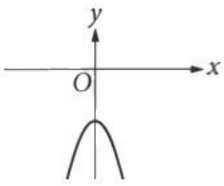
A)



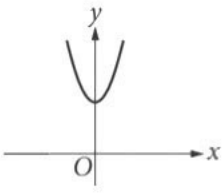
B)



C)



D)



4

$$f(x) = 3x^2 + 4x - c$$

In the given quadratic function f, c is a constant and $f(2) = 12$. What is the value of c?

A) 8

B) 30

C) 32

D) 468

5

$$11.5x + 3.5y = 265$$

A person used a total of 265 kilocalories (kcal) while walking and running on a treadmill. Running at a constant rate required 11.5 kcal per minute, and walking at a constant rate required 3.5 kcal per minute. The relationship between the number of minutes running, x, and the number of minutes walking, y, is given by the equation shown. If this person ran for 20 minutes, how many minutes did this person walk?

A) 35

B) 29

C) 17

D) 10

CONTINUE

6

$$\frac{\left(\frac{6}{x}\right)}{18}$$

Which of the following is equivalent to the given expression?

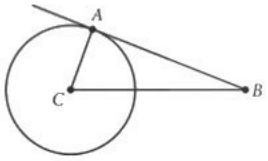
A) $\frac{3}{x}$

B) $\frac{1}{3x}$

C) $\frac{108}{x}$

D) $\frac{x}{12}$

7



In the figure shown, C is the center of the circle and $\overline{AB}$ is tangent to the circle at A. Which of the following is true about the measure of angle BAC?

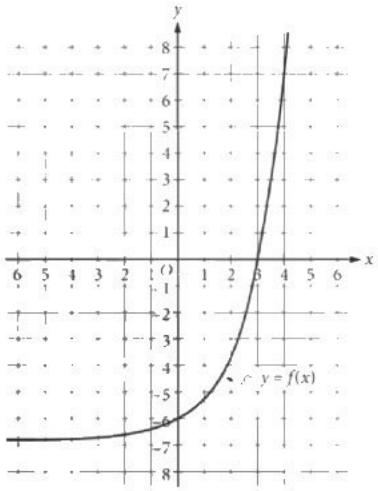
A) The measure is less than 90°.

B) The measure is greater than 90°.

C) The measure is equal to 90°.

D) It cannot be determined whether the measure is less than, greater than, or equal to 90°.

8



The graph of the function f is shown. What is the value of x for $f(x) = 0$?

A) -6

B) -3

C) 0

D) 3

9

$$A = P(rt + 1)$$

The equation shown gives A in terms of P, r, and t, where P and r are not equal to 0. Which equation gives t in terms of A, P, and r ?

A) $t = \frac{A}{P} - \frac{1}{r}$

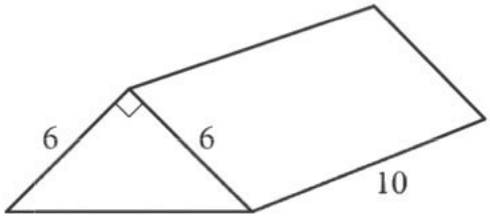
B) $t = \frac{A}{Pr} - \frac{1}{Pr}$

C) $t = \frac{A}{Pr} - \frac{1}{r}$

D) $t = \frac{A}{r} - \frac{P}{r}$

CONTINUE

10



What is the volume, in cubic units, of the right triangular prism shown?

A) 22

B) 60

C) 180

D) 360

11

A hotel has a total of 180 rooms, and on a certain day, half the rooms were cleaned. There were 9 housekeepers on duty at the hotel that day, and each housekeeper cleaned the same number of rooms, r. Which of the following equations represents the information given in terms of r?

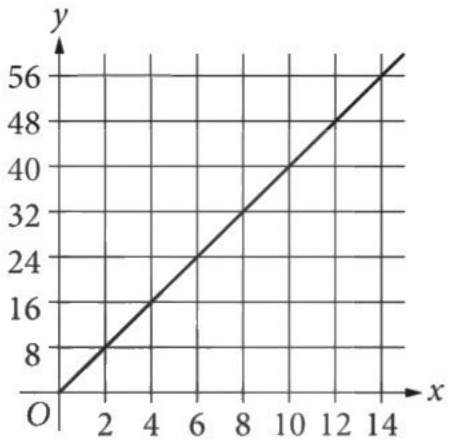
A) $2(9r) = 180$

B) $\frac{1}{2}(9r) = 180$

C) $2(r+9) = 180$

D) $\frac{1}{2}(r+9) = 180$

12



A patio is to be made using square paving stones that are all the same size. There will be no gaps between the paving stones, and they will not overlap. The line in the xy-plane above represents the relationship between the area y, in square feet, of the patio and the number of paving stones, x, used to make the patio. The top surface of each paving stone is a square with side length k feet. What is the value of k?

A) 1

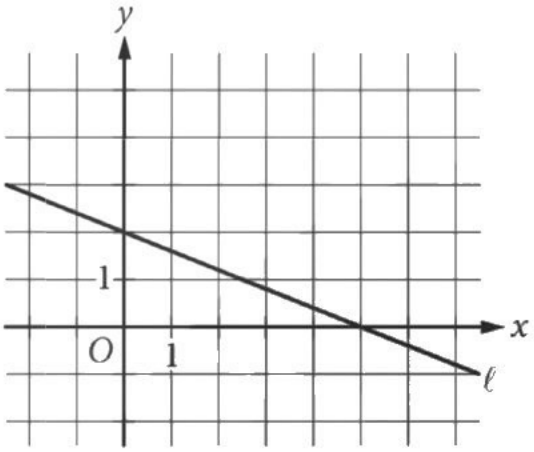
B) 2

C) 3

D) 4

CONTINUE

13



Line ℓ is shown in the xy-plane above. Which of the following is an equation of line ℓ ?

A) $5x-2y=10$

B) $5x+2y=10$

C) $2x-5y=10$

D) $2x+5y=10$

14

$$nx+3y=1$$
$$12x-6y=0$$

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

A) -9

B) -6

C) 3

D) 6

15

Which of the following is equivalent to $\sqrt{16a^{16}}$?

A) $4a^4$

B) $4a^8$

C) $8a^4$

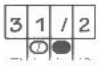
D) $8a^8$

CONTINUE

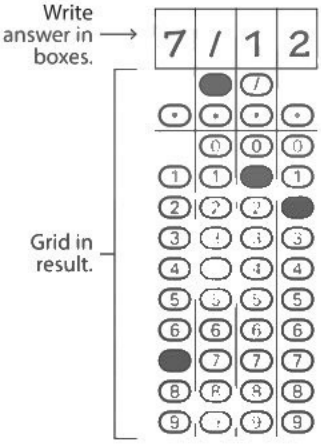
3

DIRECTIONS

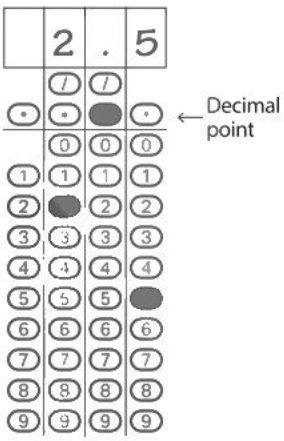
For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

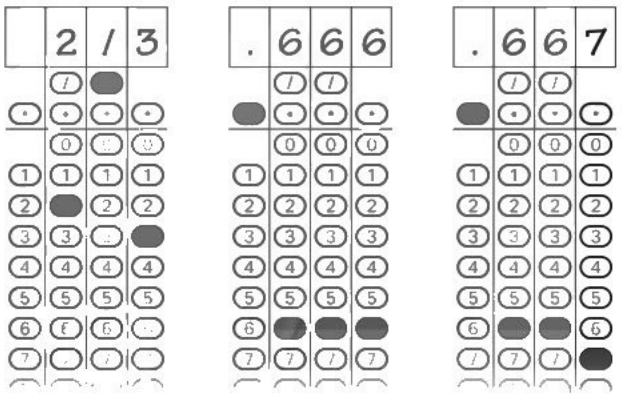
Answer: $\frac{7}{12}$



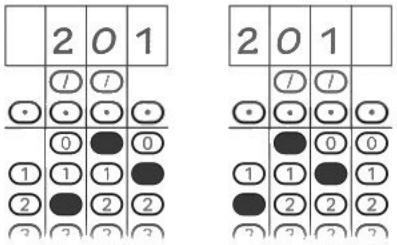
Answer: 2.5



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



Answer: 201 – either position is correct



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

CONTINUE

3

16

The graph of $y = \frac{3}{5}x - 8$ in the xy-plane is a line. What is the slope of this line?

17

$$3x + 2y = 8$$
$$4x - 3y = 5$$

The solution to the given system of equations is (x, y). What is the value of x?

18

In right triangle XYZ, $\sin X = \cos 20°$. What is the measure, in degrees, of angle X?

19

$$|x - 2| = 3$$

What is the sum of the solutions to the given equation?

20

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

In the given equation, b is a positive constant. The sum of the solutions of the equation is 5. What is the value of b?

CONTINUE

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

DIRECTIONS

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

NOTES

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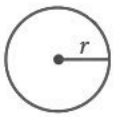

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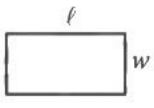

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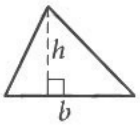

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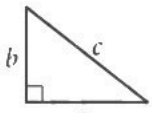

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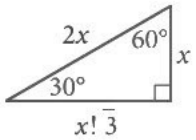
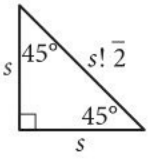
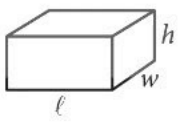




Special Right Triangles



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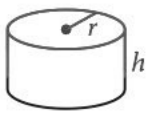
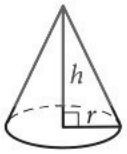
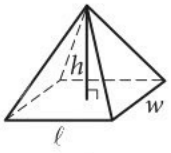


$V = \pi r^2 h$

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



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



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

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.

CONTINUE

1

The mass of a piece of wood is 10.0 grams. The volume of the wood is 12.5 cubic centimeters. What is the density, in grams per cubic centimeter, of the piece of wood? (Density equals mass divided by volume.)

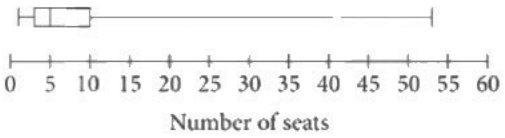
A) 0.80

B) 1.25

C) 2.50

D) 22.5

2



The box plot summarizes the number of seats in the US House of Representatives currently allocated to each of the 50 states. What is the median number of allocated seats in the US House of Representatives?

A) 2

B) 5

C) 10

D) 53

3

A calf, the offspring of a cow, weighed 62 pounds at birth. The calf is expected to gain 2 pounds every day for the first 2 years of its life. For this time period, which of the following types of functions best models the weight of the calf as a function of time?

A) Increasing linear

B) Decreasing linear

C) Increasing exponential

D) Decreasing exponential

CONTINUE

4

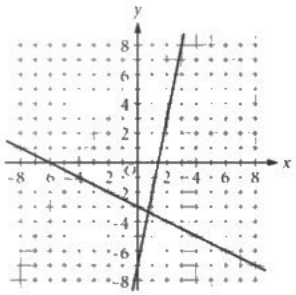
4

$$y = -\frac{1}{2}x - 3$$

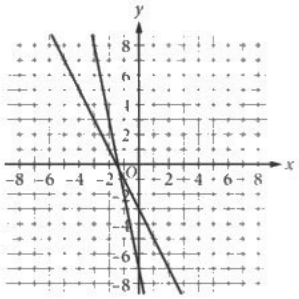
$$y = -5x - 7$$

Which of the following graphs in the *xy*-plane represents the equations in the given system?

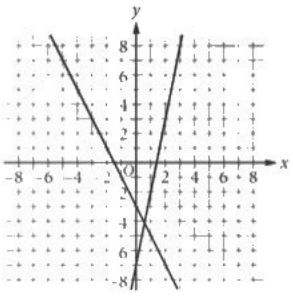
A)



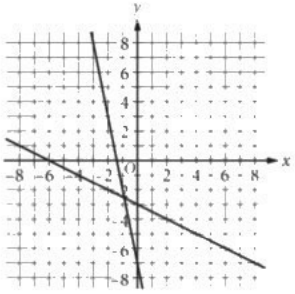
B)



C)



D)



5

If $6(x+4)=36$, what is the value of $x+4$?

A) 2

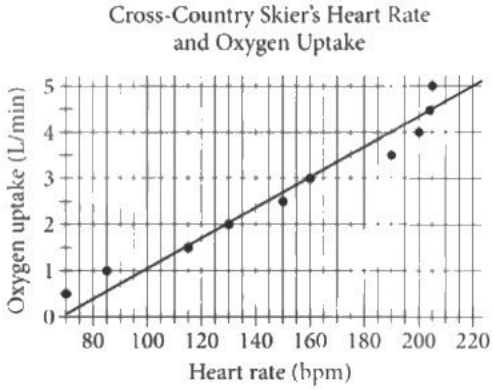
B) 6

C) 9

D) 30

6

For a particular cross-country skier, each point in the scatterplot gives the skier's heart rate, in beats per minute (bpm), and the skier's oxygen uptake, in liters per minute (L/min), as measured at various points on a cross-country ski course. A line of best fit is also shown.



When the skier's heart rate was 85 bpm, which of the following is closest to the difference, in L/min, between the skier's actual oxygen uptake and the oxygen uptake predicted by the line of best fit shown?

A) 0.5

B) 1.0

C) 2.5

D) 5.0

CONTINUE

7

Data set X: 5.50, 5.50, 5.60, 5.65, 5.66
Date set Y: 4.00, 5.50, 5.50, 5.60, 5.65, 5.66

Data sets X and Y show the acidity, or pH, of rainwater samples from two different locations. Which statement about the mean pH of data set X and data set Y is true?

A) The mean pH of data set X is greater than the mean pH of data set Y.

B) The mean pH of data set X is less than the mean pH of data set Y.

C) The mean pH of data set X is equal to the mean pH of data set Y.

D) There is not enough information to compare the mean pH of the two data sets.

Questions 8 and 9 refer to the following information.

$$f(t) = 0.025t + 10.30$$

The function f models the length $f(t)$, in micrometers, of a yeast cell of a certain strain t minutes after completing cell division for $0 \le t \le 30$.

8

What is the predicted length, rounded to the nearest tenth of a micrometer, of a yeast cell 10 minutes after completing cell division?

A) 10.1

B) 10.3

C) 10.6

D) 12.8

9

What is the best interpretation of the number 0.025 in the context of this model?

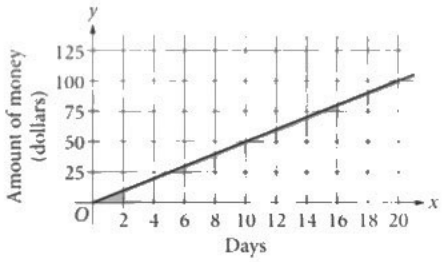
A) The predicted length, in micrometers, of a yeast cell before cell division starts

B) The predicted length, in micrometers, of a yeast cell each minute after completing cell division

C) The increase in the predicted length, in micrometers, of a yeast cell every 10.3 minutes after completing cell division

D) The increase in the predicted length, in micrometers, of a yeast cell each minute after completing cell division

10



Ivan plans to save up to $5 per day. The graph shows the possible amounts of money y, in dollars, he saved after x days. Which ordered pair (x,y) represents a possible amount of money y, in dollars, he saved after x days?

A) (18,50)

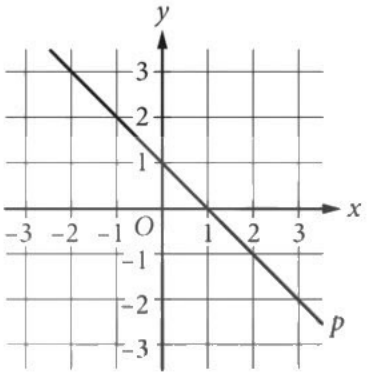
B) (12,75)

C) (8,100)

D) (4,125)

CONTINUE

11



Line p is shown in the xy-plane. Line q (not shown) is perpendicular to line p and also passes through . Which of the following points lies on line q ?

A) (-1,0)

B) (0,-1)

C) (0,1)

D) (1,1)

12

The function $A(t) = 10\left(\frac{1}{2}\right)^{\frac{t}{30}}$ represents the mass $A(t)$, in grams, of a certain radioactive isotope remaining in a substance after t seconds. Which of the following is the best interpretation of the value 10 in this context?

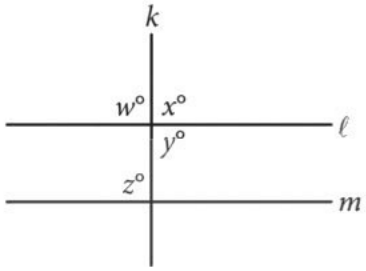
A) The initial mass, in grams, of the radioactive isotope in the substance when $t = 0$

B) The mass, in grams, of the radioactive isotope in the substance after 30 seconds

C) The number of seconds it takes for the radioactive isotope in the substance to completely disappear

D) The number of seconds it takes for half of the initial mass of radioactive isotope in the substance to disappear

13



In the figure, lines ℓ and m each intersect line k. Which of the following is sufficient to prove that lines ℓ and m are parallel?

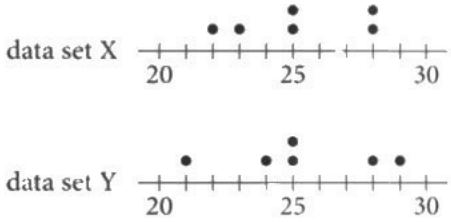
A) $w = y$

B) $w = z$

C) $x = y$

D) $x = z$

14



Data set X and data set Y are displayed by the two dot plots shown. Which of the following is(are) the same for both data sets?

1.The mean
2.The median

A) I only

B) II only

C) I and II

D) Neither I nor II

CONTINUE

4

15

In 480 BC, the population of the Persian Empire was approximately 49.4 million. The population of the Persian Empire was 44% of the world population at that time. Which of the following is the best estimate of the world population in 480 BC?

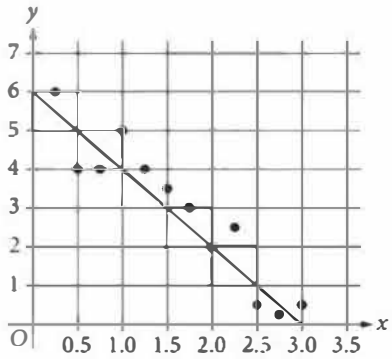
A) 21.7 million

B) 89.1 million

C) 93.4 million

D) 112.3 million

16



The scatterplot shows 12 values from a data set. A line of best fit for the data is also shown. Which of the following is the best interpretation of the y-coordinate of the y-intercept of the line of best fit?

A) For the value $x = 6$, the line of best fit predicts the corresponding y-value to be approximately 0.

B) For the value $y = 0$, the line of best fit predicts the corresponding x-value to be approximately 3.

C) For the value $x = 0$, the line of best fit predicts the corresponding y-value to be approximately 6.

D) For the value $y = 3$, the line of best fit predicts the corresponding x-value to be approximately 0.

17

The graph of the equation $4x + 3y = q$, where q is a constant, is a line in the xy-plane. What are the coordinates of the point at which the line crosses the x-axis?

A) $\left(\frac{q}{3}, 0\right)$

B) $\left(\frac{q}{4}, 0\right)$

C) $\left(\frac{3}{q}, 0\right)$

D) $\left(\frac{4}{q}, 0\right)$

18

It took 20 minutes for a jet to climb from a starting altitude of 10,000 feet to a final altitude of 30,000 feet. If the jet climbed at a constant rate, what was its altitude, in feet, 14 minutes after the climb began?

A) 14,000

B) 21,000

C) 24,000

D) 28,000

CONTINUE

19

$$x(x+2)^2 = x^3 + bx^2 + cx$$

In the equation above, b and c are constants. If the equation is true for all values of x, what is the value of $b+c$?

A) 4

B) 6

C) 8

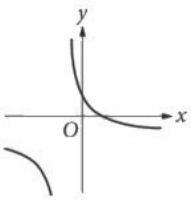
D) 16

20

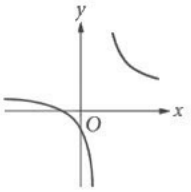
$$f(x) = \frac{k-x}{1+x}$$

In the given function f, k is a positive constant. Which of the following could be the graph of f in the xy-plane?

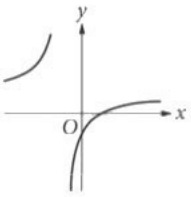
A)



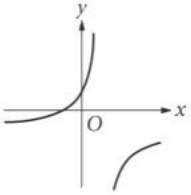
B)



C)



D)



21

A circle has center C at (1,1) and radius 2. Which of the following is an equation of this circle?

A) $(x+1)^2+(y+1)^2=2$

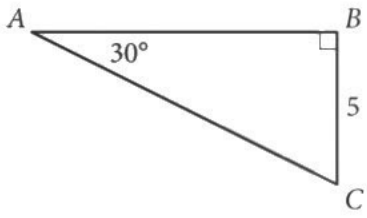
B) $(x+1)^2+(y+1)^2=4$

C) $(x-1)^2+(y-1)^2=2$

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

22

What is the length of side AC in the triangle below?



A) $5\sqrt{3}$

B) 10

C) 15

D) $10\sqrt{3}$

CONTINUE

23

A function f has the property that if point (a,b) is on the graph of the equation $y=f(x)$ in the xy-plane, then the point $\left(a+1,\frac{1}{3}b\right)$ is also on the graph. Which of the following could define f?

A) $f(x)=\frac{1}{3}\left(\frac{1}{12}\right)^x$

B) $f(x)=12\left(\frac{1}{3}\right)^x$

C) $f(x)=12(3)^x$

D) $f(x)=\frac{1}{3}(12)^x$

24

Approximately 90% of the volume of an iceberg lies below the surface of the water. If A represents the volume of an iceberg that lies above the surface of the water and V represents the total volume of the iceberg, which of the following equations best approximates A in terms of V?

A) $A = 10V$

B) $A = 0.9V$

C) $A = 0.1V$

D) $A = 0.1V+0.9$

25

In 2007, US economists gathered data about money collected for the arts, entertainment, and recreation industries in eight states. The ratio of money collected in all eight states to the money collected in the state of Florida was 11 to 8. If a total of x dollars was collected in all eight states, which expression represents the total amount of money, in dollars, collected in Florida?

A) $\frac{8x}{11}$

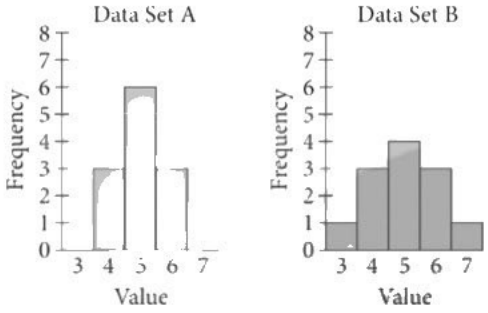
B) $\frac{11x}{8}$

C) 8

D) 11

CONTINUE

26



Data sets A and B are summarized in the graphs above. Each data set consists of 12 whole numbers. Which of the following statements must be true?

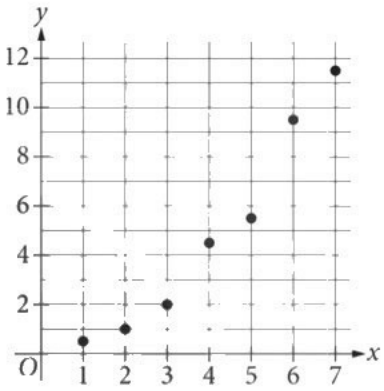
A) Data sets A and B have the same mean, but the standard deviation of data set A is greater than the standard deviation of data set B.

B) Data sets A and B have the same mean, but the standard deviation of data set B is greater than the standard deviation of data set A.

C) Data sets A and B have the same standard deviation, but the mean of data set A is greater than the mean of data set B.

D) Data sets A and B have the same standard deviation, but the mean of data set B is greater than the mean of data set A.

27



Which equation is the most appropriate quadratic model for the data shown in the scatterplot?

A) $y = 4x^2$

B) $y = 2x^2$

C) $y = \frac{1}{2}x^2$

D) $y = \frac{1}{4}x^2$

CONTINUE

28

Which of the following functions has a maximum value of m, where m is a positive constant?

A) $f(x) = mx^2$

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

C) $f(x) = -x^2 + m$

D) $f(x) = -(x + m)^2$

29

A quantity is decreased by 45% of its value. The resulting value is x. Which expression gives the value of the original quantity in terms of x?

A) $\frac{x}{0.45}$

B) $\frac{x}{0.55}$

C) $\frac{x}{1.45}$

D) $\frac{x}{1.55}$

30

The area of the Mountain Island Educational State Forest in North Carolina is 3 square miles. What is the area, in square yards, of this forest? (1 mile = 1,760 yards)

A) 5,280

B) 15,840

C) 3,097,600

D) 9,292,800

31

The ratio of students to teachers in a high school is 18 to 1. If the school has 105 teachers, how many students does it have?

CONTINUE

4

32

$$2x + 7 = bx + 5$$

In the given equation, b is a constant. If the equation has no solution, what is the value of b?

33

There are a total of 1000 four-digit numbers from 1000 to 1999. If one of these numbers is selected at random, what is the probability that the number is greater than 1499 ?

34

$$3x + 4y = 35$$
$$2x + 2y = 15$$

The solution to the given system of equations is (x,y) . What is the value of $x + 2y$?

35

$$2x^2 - 3x - 7 = 0$$

If c and d are the two solutions of the quadratic equation above, what is the value of $c + d$?

36

$$(x + 2) = (x - 5)(x + 2)$$

What is the sum of the solutions to the given equation?

CONTINUE

Questions 37 and 38 refer to the following information.

The table gives the age groups of the total population of women and the number of registered women voters in the United States in 2012, rounded to the nearest million.

	Total population of women (in millions)	Registeredwomen voters(in millions)
18 to 24 years old	15	8
25 to 44 years old	41	25
45 to 64 years old	42	30
65 to 74 years old	13	10
75 years old and over	11	8
Total	122	81

37

In 2012, the number of registered women voters was p% of the total population of women. What is the value of p, to the nearest whole number?

38

If a woman is selected at random from the total population of women ages 45 to 64 years old, what is the probability of selecting a registered woman voter, rounded to the nearest hundredth? (Express your answer as a decimal, not as a percent.)

STOP

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