Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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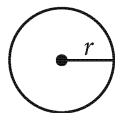

DIRECTIONS

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.
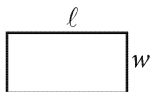
NOTES

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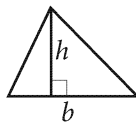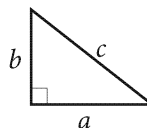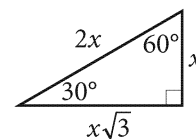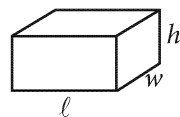
REFERENCE

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

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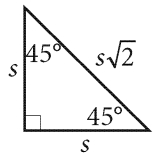
$A = \frac{1}{2}bh$

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

Special Right Triangles

$V = \ell w h$

$V = \pi r^2 h$

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

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

$V = \frac{1}{3}\ell w h$

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 function h is defined by $h(x) = -\dfrac{1}{4}x - 2$. Which is the graph

of $y = h(x)$?

A)

B)

C)

D)

CONTINUE
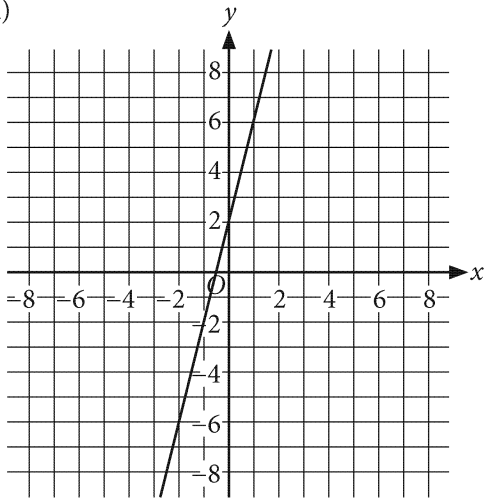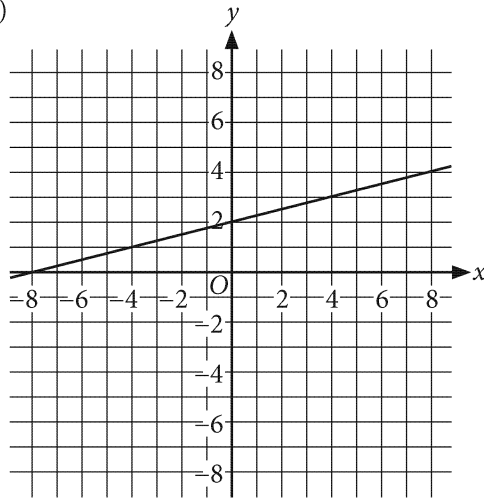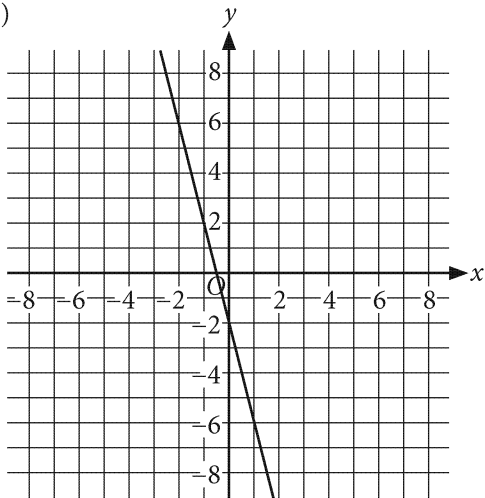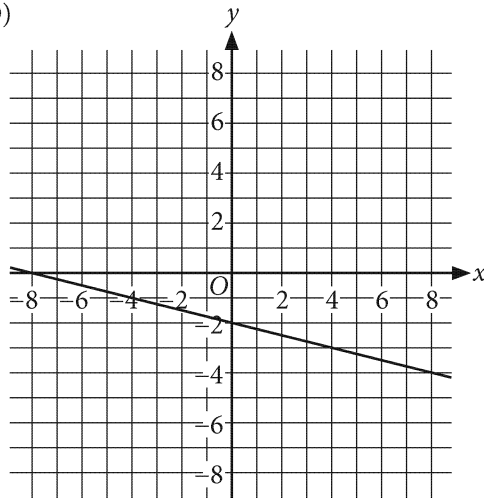
2

$$x^2 + 10 = 91$$

What is the positive solution to the given equation?

A)　9

B)　10

C)　41

D)　51

3

$$x + 7 = 3(x - 3)$$

What value of x satisfies the given equation?

A)　4

B)　8

C)　9

D)　16

4

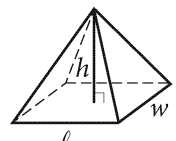A line in the xy-plane has a slope of 1 and passes through the point $(0, 2)$. Which is an equation of the line?

A)　$y = \dfrac{x}{2}$

B)　$y = 2x$

C)　$y = x + 2$

D)　$y = x - 2$

5

From 1990 to 2001, German currency included coins called *pfennigs*, worth 1 pfennig each, and *groschen*, worth 10 pfennigs each. Which equation represents the number of pfennig coins, p, and groschen coins, g, that have a combined value of 85 pfennigs?

A)　$p + g = 85$

B)　$p + 10g = 85$

C)　$10p + g = 85$

D)　$10(p + g) = 85$

6

If $x > 0$, which of the following is equivalent to $\dfrac{1}{x} + \dfrac{1}{2x}$?

A) $\dfrac{1}{x}$

B) $\dfrac{1}{2x}$

C) $\dfrac{3}{2x}$

D) $\dfrac{2}{3x}$

7

$$x^2 - 10x + y^2 + 6y = 2$$

The graph in the xy-plane of the equation above is a circle. What are the coordinates of the center of the circle?

A) $(-5, -3)$

B) $(-5, 3)$

C) $(5, -3)$

D) $(5, 3)$

8

$$y > 4x$$
$$y < -x$$

When graphed in the xy-plane, what point (x, y) is a solution to the given system of inequalities?

A) $(1, 1)$

B) $(-2, -2)$

C) $(3, -3)$

D) $(-4, 4)$

9

The equation $h = 150 + 10t$ gives the total number of housing units, h, in a community t months after a new zoning law was passed. How many housing units are added to the community each month after the zoning law was passed?

A)   10

B)   150

C)   160

D) 1,500

10

Which expression is equivalent to

$(2x^2 + 3x - 2) - (5x^2 - x - 7)$?

A) $7x^2 + 4x + 9$

B) $3x^2 + 4x + 5$

C) $-3x^2 + 2x - 9$

D) $-3x^2 + 4x + 5$

11

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

The graph in the xy-plane of the equation above contains the point (a, b). If $-1 \le a \le 1$, which of the following is NOT a possible value of b ?

A) -2

B) -1

C) 0

D) 1

12

Two beach balls are each in the shape of a sphere. The larger beach ball has a diameter of $3x$, and the smaller beach ball has a diameter of x. What is the ratio of the volume of the larger beach ball to the volume of the smaller beach ball?

A) 3 to 1

B) 6 to 1

C) 9 to 1

D) 27 to 1

13

What is the graph of the equation $y = 2(3)^x$?

A)
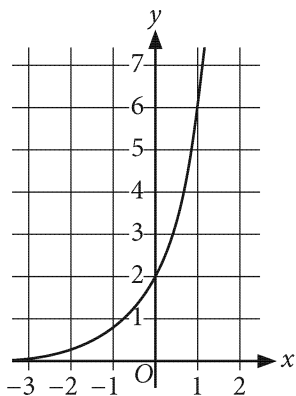
B)
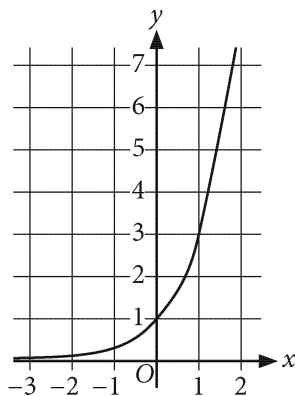
C)
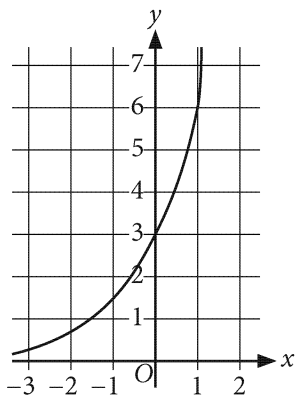
D)
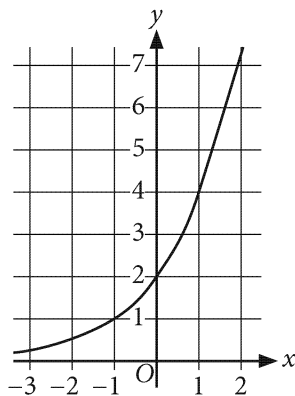
14
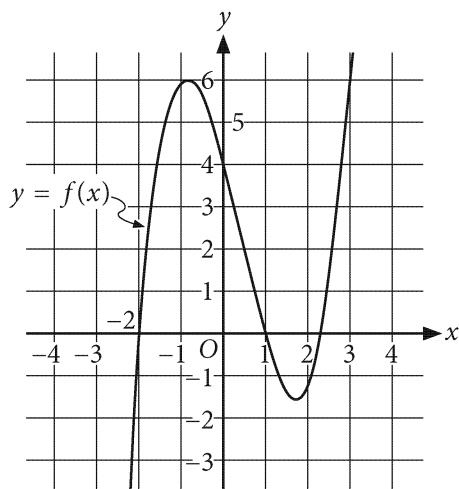
The graph of the function f is shown. Which of the following is a value of x for which $f(x) = 0$?

A) -1

B) 0

C) 1

D) 4

15

The function $A(t) = 12(2)^{\frac{t}{6}}$ models the number of water hyacinths in a population over time, where $A(t)$ is the number of water hyacinths and t is the time, in days, since the population was first measured. Which is the best interpretation of $(2)^{\frac{t}{6}}$ in this context?

A) The number of water hyacinths doubled t times.

B) The number of water hyacinths doubled every 6 days.

C) The number of water hyacinths increased by 2 every $\dfrac{t}{6}$ days.

D) The number of water hyacinths increased by 2 every t days.

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 $\boxed{3\ 1\ /\ 2}$ 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: $\frac{7}{12}$ **are:**   **Answer: 2.5**

Write answer in boxes.

Fraction line

Decimal point

Grid in result.

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.
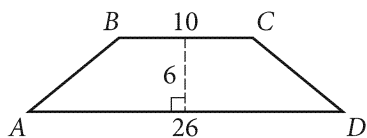
16

$$4T - 8D = 12H$$

The given equation can be rewritten as $T = aD + bH$, where a and b are constants. What is the value of a ?

17

In the figure shown, $\overline{BC}$ is parallel to $\overline{AD}$ and $AB = CD$. What is the perimeter of quadrilateral $ABCD$?

18

$$x^2 - 2x - 1 = 0$$

The equation above has solutions $x = n + \sqrt{k}$ and $x = n - \sqrt{k}$, where n and k are positive integers. What is the value of $n + k$?

19

$$4x + y = 7$$
$$2x - 7y = 1$$

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

20

$$\frac{1}{2}x + 5 = kx + 7$$

In the given equation, k is a constant. The equation has no solution. What is the value of k ?

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.
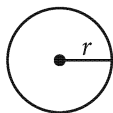

DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding 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 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.
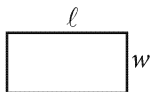
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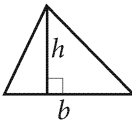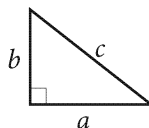
REFERENCE
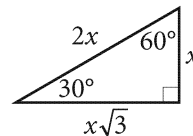
$A = \pi r^2$
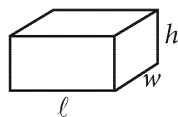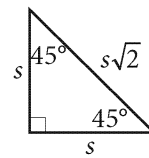$C = 2\pi r$

$A = \ell w$

$A = \dfrac{1}{2}bh$
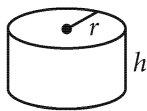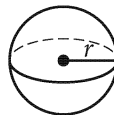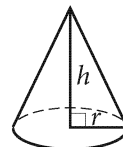
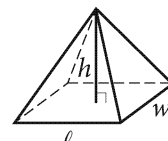$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell w h$

$V = \pi r^2 h$

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

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

$V = \dfrac{1}{3}\ell w h$

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

A sample of water was taken from each of ten different locations in a pond. The pH of each sample was measured. The measurements are summarized in the frequency table shown.

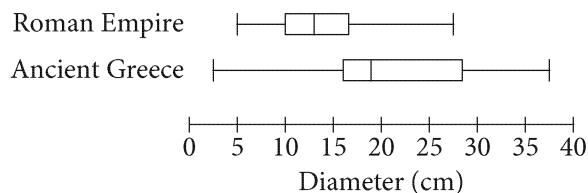| pH	Frequency
6.8 to 7.0	1
7.1 to 7.3	2
7.4 to 7.6	4
7.7 to 7.9	3

How many samples have a pH of 7.4 or greater?

A) 3

B) 4

C) 6

D) 7

2

In 2015, the city of Miami had a population of 441,000 people and an area of 36 square miles. What was the population density of Miami, in people per square mile, in 2015?

A) 10,750

B) 12,250

C) 14,250

D) 16,750

3

Roman Empire
Ancient Greece
0   5   10   15   20   25   30   35   40
Diameter (cm)

The Metropolitan Museum of Art has plates on display from the Roman Empire and ancient Greece. The box plots shown summarize the distributions of the diameters, in centimeters, of all the museum's plates from each region. How does the median diameter of the plates from the Roman Empire, r, compare to the median diameter of the plates from ancient Greece, g ?

A) $r < g$

B) $r > g$

C) $r = g$

D) There is not enough information to compare the medians.

4

The combustion of glucose releases energy. The ratio of grams of glucose combusted to kilocalories of energy released is 12.0 to 45.0. How many grams of glucose must be combusted to provide 85.5 kilocalories of energy?

A)   5.7

B)   9.9

C)   22.8

D) 320.6

5

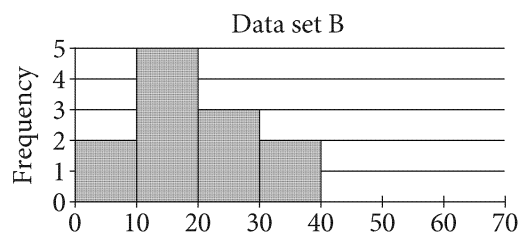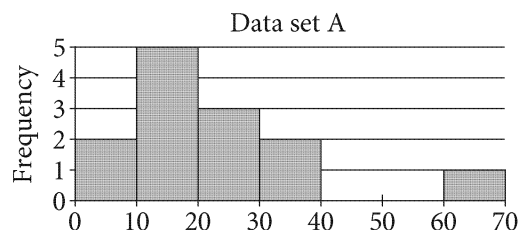The function f is defined by $f(x) = x^2 - 7$. What is the value of $f(3)$?

A) −16

B) −2

C) 2

D) 16

6

The probability of an unfair coin landing heads side up is 0.6. A student tossed this coin into the air 9 times. It landed tails side up 5 times and heads side up 4 times. What is the probability that the coin will land heads side up on the 10th toss?

A) 0.4

B) 0.5

C) 0.6

D) 1

7

Data set A

Data set B

The two histograms show the distribution of data set A and data set B, respectively. Data set B is the result of removing the outlier from data set A. Which of the following statements about the means of data set A and data set B is true?

A) The means of data set A and B are the same.

B) The mean of data set A is greater than the mean of data set B.

C) The mean of data set A is less than the mean of data set B.

D) No comparison about the means of the data sets can be made.

Questions 8 and 9 refer to the following information.

Haimi drove a car from West Union, Minnesota, through North Dakota, to Miles City, Montana. The total distance she traveled through each state is shown in the figure.

West Union, Minnesota	Minnesota 120 miles	North Dakota 360 miles	Minnesota 120 miles	Miles City, Montana
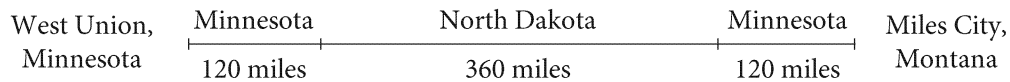
The distance d, in miles, Haimi drove as a function of the time t, in hours, since she started driving is modeled by the equation $d = 60t$.

8

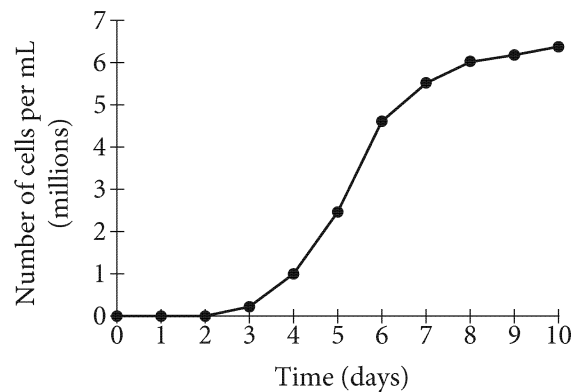According to the model, what distance, in miles, had Haimi driven 3 hours after she started driving?

A) 20

B) 60

C) 120

D) 180

9

What interval represents all values of t during which Haimi drove in North Dakota?

A) $2 \le t \le 10$

B) $2 \le t \le 8$

C) $0 \le t \le 8$

D) $0 \le t \le 2$

10

The graph shows the number of algae cells grown during an experiment, in millions of cells per milliliter (mL) of water, d days after the start of an experiment. Between which two days was the growth rate, in millions of cells per mL of water per day, of the algae the greatest?

A) Day 4 and day 5

B) Day 5 and day 6

C) Day 7 and day 8

D) Day 9 and day 10

11

A local restaurant gives teachers a 20% discount on all their meals. If a teacher pays $14.00 for a meal after the discount was applied, what was the price of the meal before the discount?

A) $16.80

B) $17.50

C) $20.00

D) $25.20

12

Amount of Water
in 80 Bottles

Fluid ounces	Frequency
19.6	1
19.7	0
19.8	12
19.9	10
20.0	31
20.1	14
20.2	11
20.3	1
20.4	0

The frequency table above shows the distribution of the actual number of fluid ounces of water in a random sample of 80 20-ounce bottles of the water at a bottling plant. Bottles are only sold if they contain at least 19.8 but no more than 20.2 fluid ounces of water. If the proportion of bottles that can be sold is the same for the sample and the 16,000 20-ounce bottles produced at the plant each day, how many of the 16,000 bottles cannot be sold?

A) 800

B) 600

C) 400

D) 200

13

x	$f(x)$
−4	14
−2	8
3	−7
5	−13

For the linear function, f, the table shows several values of x and their corresponding values of $f(x)$. What is the y-intercept of the graph of $y = f(x)$ in the xy-plane?

A) $(0, -3)$

B) $(0, -1)$

C) $(0, 2)$

D) $(0, 4)$

14

When a buffet restaurant charges $12.00 per meal, the number of meals it sells per day is 400. For each $0.50 increase to the price per meal, the number of meals sold per day decreases by 10. What is the price per meal that results in the greatest sales, in dollars, from meals each day?

A) $16.00

B) $20.00

C) $24.00

D) $28.00

15

The scatterplot shows the relationship between two variables, x and y. A line of best fit is also shown.
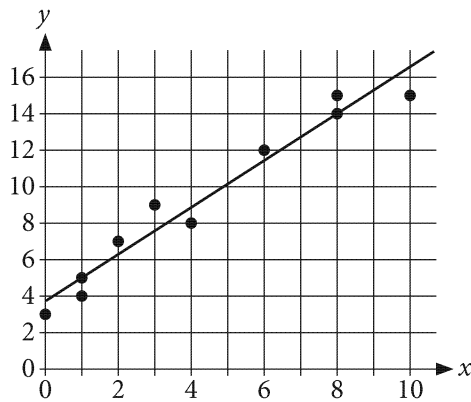
What is an equation of the line of best fit?

A) $y = 3.7 + 1.3x$

B) $y = 1.3 + 3.7x$

C) $y = 3.7 - 1.3x$

D) $y = 1.3 - 3.7x$

16

For the linear function f, $f(2) = 10$ and the graph of $y = f(x)$ in the xy-plane has a slope of 3. Which equation defines f ?

A) $f(x) = 2x + 12$

B) $f(x) = 2x + 8$

C) $f(x) = 3x + 10$

D) $f(x) = 3x + 4$

17

If $7x + 21 = -2$, what is the value of $x + 3$?

A) -5

B) -2

C) $-\dfrac{5}{7}$

D) $-\dfrac{2}{7}$

18

$$x + 2y = 10$$
$$2x - y = 5$$

The solution to the given system of equations is (x, y). What is the value of $3x + y$?

A) 5

B) 7

C) 13

D) 15

19

An advertising agency guarantees that its services will increase website traffic by 3.5% compared to each previous week. Which type of function best models the weekly guaranteed website traffic as the number of weeks increases?

A) Increasing exponential

B) Decreasing exponential

C) Increasing linear

D) Decreasing linear

20
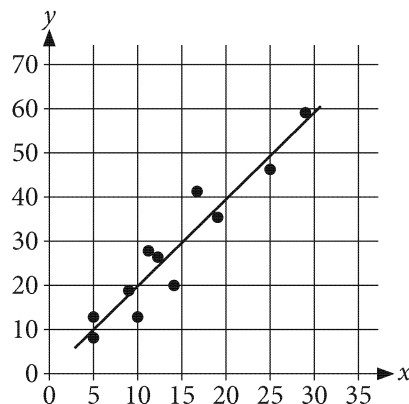
The scatterplot shows a data set of 11 points and a line of best fit for the data. For how many data points is the y-value predicted by the line of best fit greater than the actual y-value?

A) Five

B) Six

C) Seven

D) Eight

21

Dana is riding in a 100-mile-long bicycle race. The function f defined by $f(x) = 100 - 18x$ models the number of miles that Dana has remaining x hours after she starts the race. What is the best interpretation of $f(2) = 64$?

A) Dana rides about 64 miles in the first 2 hours of the race.

B) Dana will ride the last 64 miles of the race in about 2 hours.

C) When Dana has ridden 64 miles, she has about 2 hours remaining.

D) Two hours after Dana starts the race, she has about 64 miles remaining.

22
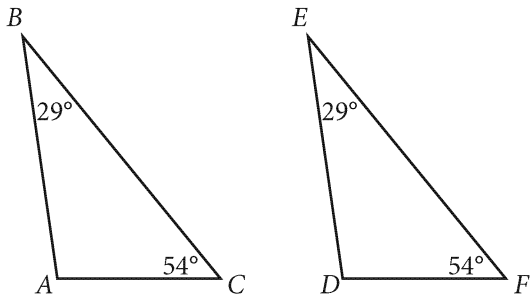
Triangle *ABC* and Triangle *DEF* each have an angle measuring 29° and an angle measuring 54°, as shown above. Which of the following statements is sufficient to prove triangle *ABC* is congruent to triangle *DEF* ?

A) The length of $\overline{EF}$ is 10.

B) The measure of angle *EDF* is 97°.

C) The length of $\overline{BC}$ is equal to the length of $\overline{EF}$.

D) The measure of angle *BAC* is equal to the measure of angle *EDF*.

23

How many solutions does the equation $|\,x + 7\,| = -4$ have?

A) Zero
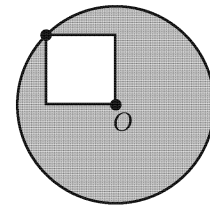
B) Exactly one

C) Exactly two

D) More than two

24

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

The solutions to the quadratic equation above are *a* and *b*. What is the value of *a* + *b* ?

A) $-\dfrac{5}{3}$

B) $-\dfrac{1}{3}$

C) $\dfrac{1}{3}$

D) $\dfrac{5}{3}$

25

In the figure shown, point *O* is the center of the circle. One vertex of the square lies on the circle, and the opposite vertex is point *O*. If the area of the shaded region is $36\pi - 18$, what is the perimeter of the square?

A) 24

B) 72

C) $12\sqrt{2}$

D) $36\sqrt{2}$

CONTINUE

26

Which of the following is equivalent to the expression $x^4 - 8x^2 + 16$?

    I. $(x + 2)^2(x - 2)^2$

    II. $(x^2 - 4)^2$

A) I only

B) II only

C) I and II

D) Neither I nor II

27

Each year the value of an investment increases by 2.5% of the previous year's value. The initial value of the investment was $500. Which equation gives the value of the investment y, in dollars, x years after the initial investment was made?

A) $y = 500(0.25)^x$

B) $y = 500(1.025)^x$

C) $y = 500(1.25)^x$

D) $y = 500(2.5)^x$

28

$$5x - y = 9$$
$$-60x + 12y = -108$$

How many solutions does the given system of equations have?

A) Zero

B) Exactly one

C) Exactly two

D) Infinitely many

29

Bridges have spaces between their sections to allow for expansion and contraction caused by temperature variation. This space is known as the gap width. The size of the gap width $w(T)$, in inches, is a linear function of temperature T, in degrees Fahrenheit (°F). For a certain bridge, the gap width is 2.875 inches at 40°F and is 1.875 inches at 100°F. Which of the following defines the relationship between temperature and gap width?

A) $w(T) = -\dfrac{1}{60}(T - 40) + 2.875$

B) $w(T) = -\dfrac{1}{60}(T + 40) - 2.875$

C) $w(T) = 60(T - 40) + 2.875$

D) $w(T) = 60(T + 40) - 2.875$

30

The number of books in a library increased by 30% from 2002 to 2014. There were x books in the library in 2002. Which expression represents the number of books in the library in 2014 in terms of x ?

A) $130x$

B) $30x$

C) $1.3x$

D) $0.3x$

DIRECTIONS

For questions 31-38, 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 $\boxed{3\,1\,/\,2}$ 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: $\frac{7}{12}$ **are:**   **Answer: 2.5**

Write answer in boxes. → | 7 / 1 2 | ← Fraction line

Grid in result.

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

| 2 / 3 | . 6 6 6 | . 6 6 7 |

Answer: 201 – either position is correct

| 2 0 1 | | 2 0 1 |

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

31

In a survey of 240 television viewers, $\frac{3}{5}$ indicated that they like comedies, some indicated that they do not like comedies, and the rest did not respond. If one of the 240 viewers is selected at random, the probability is $\frac{1}{15}$ that the viewer selected did not respond. How many of the 240 viewers indicated that they do not like comedies?

32

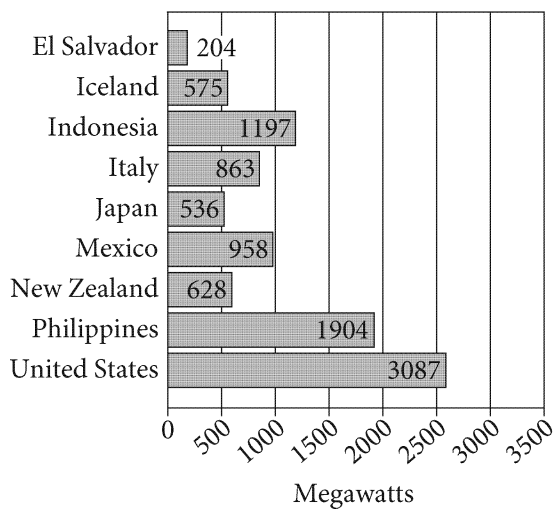What is the y-coordinate of the y-intercept of the graph of $y = 3^x + 9$?

33
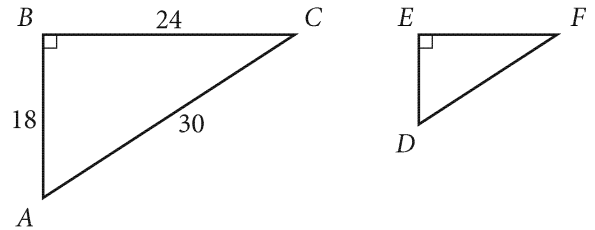
Triangle ABC is similar to triangle DEF, where angle A corresponds to angle D. What is the value of $\cos F$?

34

Geothermal Power Capacity for Nine Countries in 2010

El Salvador 204
Iceland 575
Indonesia 1197
Italy 863
Japan 536
Mexico 958
New Zealand 628
Philippines 1904
United States 3087

0 500 1000 1500 2000 2500 3000 3500

Megawatts

The graph shows the power capacity for the nine countries that had the greatest geothermal power capacity in 2010. What was the capacity, in megawatts, of the country that had the median capacity of the nine countries?

35
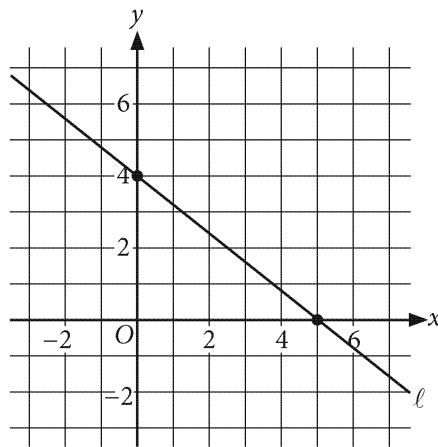
Line ℓ is shown in the xy-plane, and the point with coordinates $(2, c)$ is on line ℓ. What is the value of c ?

CONTINUE

Questions 36 and 37 refer to the following information.

The table gives the typical adult weight ranges and life spans for African and Asian elephants in the wild.

	African elephant	Asian elephant
Typical minimum weight (tons)	2.50	2.25
Typical maximum weight (tons)	7.00	5.50
Typical life span (years)	70	60

36

Based on the table, what is the typical minimum weight of an adult African elephant in the wild, in pounds? (1 ton = 2000 pounds)

37

Based on the table, the typical life span of the African elephant in the wild is $p\%$ greater than the typical life span of the Asian elephant in the wild. What is the value of p ? (Disregard the % sign when entering your answer. For example, if your answer is 39%, enter 39)

38

x	$f(x)$
2	106
3	151
4	196

The table shows several values of x and their corresponding values of $f(x)$. The function f is defined by $f(x) = mx + b$, where m and b are constants. What is the value of b ?

STOP

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