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Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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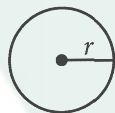

DIRECTIONS

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**.

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4. All figures lie in a plane unless otherwise indicated.

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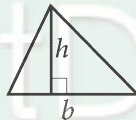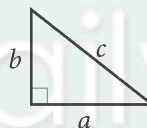
REFERENCE

$A = \pi r^2$
$C = 2\pi r$
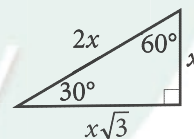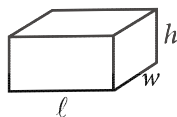
$A = \ell w$
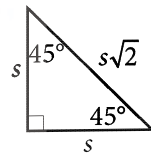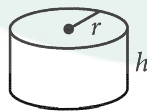
$A = \dfrac{1}{2}bh$

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

Special Right Triangles

$V = \ell wh$

$V = \pi r^2 h$

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

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

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

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

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1

Which expression is equivalent to $a^2b^3(a^3b^4)$?

A) a^5b^7

B) a^5b^{12}

C) a^6b^7

D) a^6b^{12}

2

Sydney is studying the sediment in the valley of a canyon. She determines that the age of the sediment at the top of the canyon is 2,000,000 years old. She knows that the layers below were created at a rate of 1 meter every 800 years. Which equation can Sydney use to determine the age of the sediment y, in years, where x is the number of meters below the top of the canyon?

A) $2,000,000 = 800x + y$

B) $y = 2,000,000x + 800$

C) $y = 800x + 2,000,000$

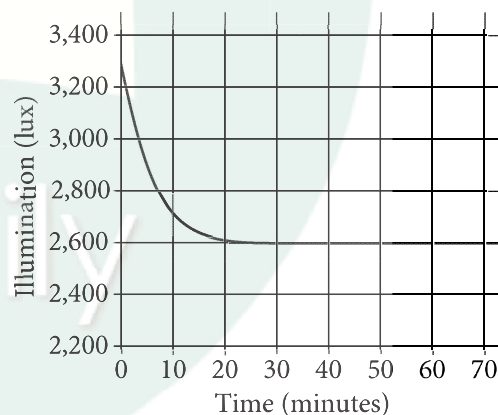D) $x = y + (800)(2,000,000)$

3

The function f is defined as $f(x) = 2$ if $x < 3$ and $f(x) = 0$ if $x \geq 3$. At how many points does the graph of $y = f(x)$ in the xy-plane intersect the x-axis?

A) 0

B) 2

C) 3

D) Infinitely many

4

A certain LED lightbulb initially produces 3,300 lux of illumination. When the LED lightbulb is left on, its illumination decreases exponentially, as shown in the graph.

Which statement best compares the illumination at 30 minutes with the illumination at 0 minutes?

A) The illumination is identical at 30 minutes and at 0 minutes.

B) The illumination is approximately 20% less at 30 minutes than it was at 0 minutes.

C) The illumination is approximately 50% less at 30 minutes than it was at 0 minutes.

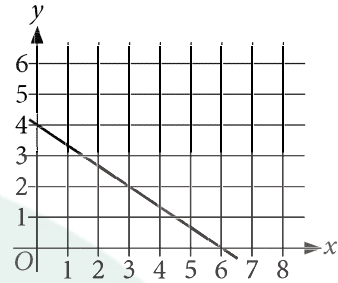D) The illumination is approximately 80% less at 30 minutes than it was at 0 minutes.

5
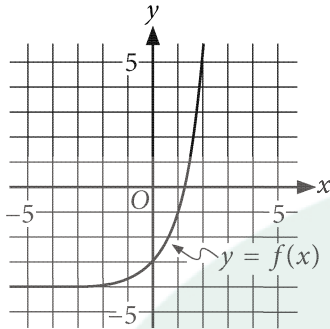
The graph of $y = f(x)$ is shown. What is the y-intercept of the graph of $y = f(x) + 2$?

A)　$(0, 2)$

B)　$(0, -1)$

C)　$(0, -2)$

D)　$(0, -5)$

6

A line in the xy-plane passes through the points $(2, 6)$ and $(6, 12)$. Which of the following is an equation of this line?

A)　$y = \dfrac{2}{3}x + \dfrac{14}{3}$

B)　$y = \dfrac{2}{3}x + 8$

C)　$y = \dfrac{3}{2}x + \dfrac{14}{3}$

D)　$y = \dfrac{3}{2}x + 3$

7

What is an equation of the graph shown?

A)　$6x - 3y = 4$

B)　$6x + 3y = 12$

C)　$2x - 3y = 4$

D)　$2x + 3y = 12$

8

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

The graph of the given system of equations has an intersection point (x, y) in the xy-plane. What is a possible value of y ?

A)　-2

B)　-1

C)　0

D)　2

CONTINUE

9

$$4x + 7 - x = 3(x + 2) + 1$$

How many solutions does the given equation have?

A) Zero

B) Exactly one

C) Exactly two

D) Infinitely many

10

In right triangle XYZ, angle Z is a right angle. The value of $\sin X$ is 0.64. What is the value of $\cos Y$?
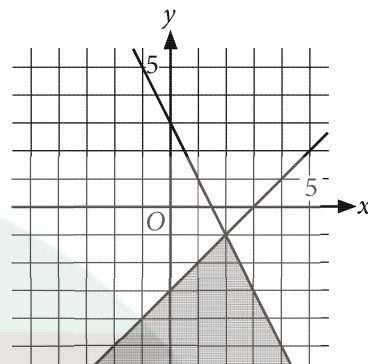
A) 0.26

B) 0.36

C) 0.64

D) 0.77

11

Which expression is equivalent to $\sqrt{ab}$, where a and b are positive numbers?

A) $a^{\frac{1}{2}}b^{\frac{1}{2}}$

B) $ab^{\frac{1}{2}}$

C) a^2b^2

D) ab^2

12

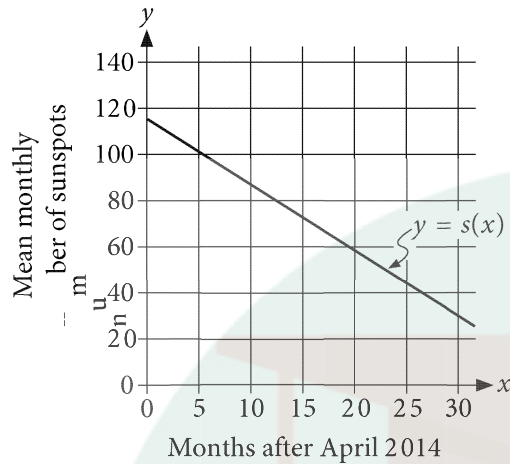In the xy-plane above, the graphs of the lines with equations $y = -2x + 3$ and $y = x - 3$ are shown. Point P (not shown) has coordinates $(2, -4)$ and lies in the shaded region. Which of the following is(are) true about point P?

    I. The coordinates of P satisfy $y < -2x + 3$.

    II. The coordinates of P satisfy $y > x - 3$.

A) I only

B) II only

C) I and II

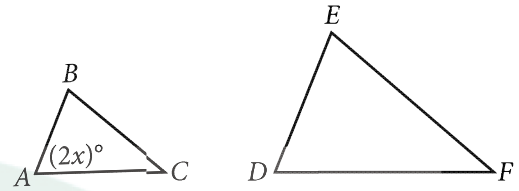D) Neither I nor II

CONTINUE

13

Months after April 2014

The graph of the linear function shown models the mean monthly number of sunspots, $s(x)$, as a function of the number of months, x, since April 2014, where $0 \le x \le 30$. Which is the best estimate for the mean monthly number of sunspots in April 2015?

A) 50

B) 60

C) 70

D) 80

14

Note: Figure not drawn to scale.

In the figures shown, triangle ABC is similar to triangle DEF, where A, B, and C correspond to D, E, and F, respectively. If $\dfrac{AB}{DE} = \dfrac{1}{4}$, what is the measure, in degrees, of $\angle D$ in terms of x ?

A) $2x$

B) $4x$

C) $6x$

D) $8x$

15

A ball was thrown into the air from a height of 4 feet (ft). One second after the ball was thrown, it reached a maximum height of 20 ft. The height of the ball can be modeled with a quadratic function, where t is the time, in seconds, since the ball was thrown and $h(t)$ is the height of the ball, in ft. Which function models the height of the ball over time?

A) $h(t) = -16\,(t-1)^2 + 4$

B) $h(t) = -16\,(t+1)^2 + 4$

C) $h(t) = -16\,(t-1)^2 + 20$

D) $h(t) = -16\,(t+1)^2 + 20$

CONTINUE

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 $3 1 / 2$ 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.

CONTINUE →

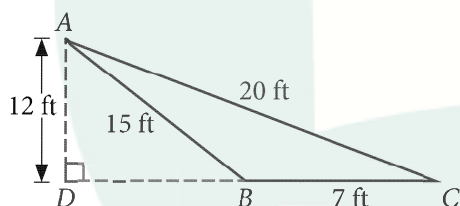**16**

$$|x + 2| = 9$$

What is the positive solution to the given equation?

17

$$3(x - 30) = x + 510$$

What value of x satisfies the given equation?

18

Note: Figure not drawn to scale.

Triangle ABC and its dimensions in feet (ft) are shown, where B, C, and D lie on the same line. What is the area, in ft^2, of triangle ABC ?

19

$$3x - 2y = 3$$
$$4x + 5y = 50$$

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

20

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

The equation above has solutions $x = \dfrac{2 + \sqrt{n}}{2}$ and $x = \dfrac{2 - \sqrt{n}}{2}$, where n is a positive integer. What is the value of n ?

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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.
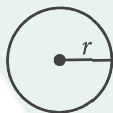
DIRECTIONS

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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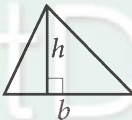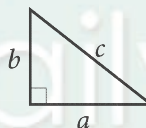
REFERENCE

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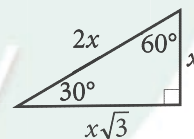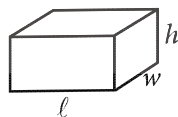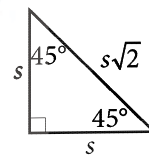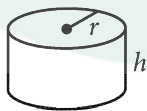
$A = \ell w$

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

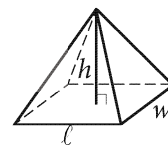$c^2 = a^2 + b^2$

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.

CONTINUE

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1

What is 48% of 50 ?

A)   2

B)   24

C)   25

D)   98

2

The function f is defined by $f(x) = 2x$. For what value of x does $f(x) = 6$?

A)   2

B)   3

C)   8

D)   12

3

When a zebra fish was 25 days old, the length of its tail fin was 3.0 millimeters (mm). The length of the fin increased by 0.06 mm each day for the next 175 days. Which of the following types of functions best describes how the fin length changed over time during this 175-day period?

A)   Increasing linear

B)   Decreasing linear

C)   Increasing exponential

D)   Decreasing exponential

4

The scatterplot shows the average number of days per year of school attendance by US public school students every 10 years from 1870 through 1960.

Public School Attendance
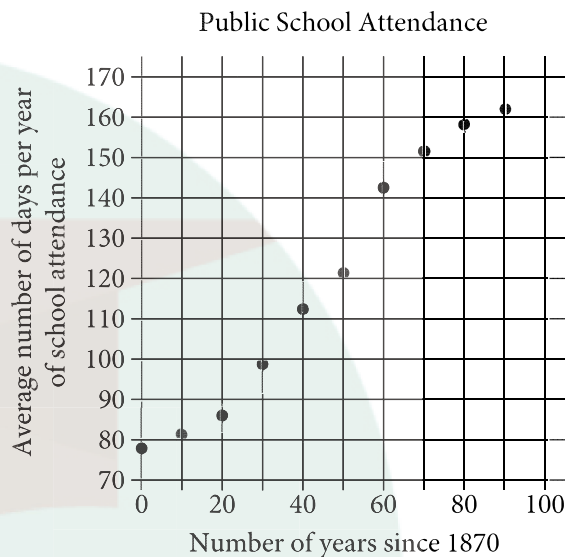
Which is the best approximation of the average number of days per year of school attendance in the year 1920?

A)   80

B)   90

C)   120

D)   160

CONTINUE

5

In the eleventh and twelfth centuries, the city of Cahokia (in what is now the state of Illinois) had a population of 20,000. The size of the city was 6 square miles. What was the population density, to the nearest hundred people per square mile, of Cahokia?

A)　　3,300

B)　　16,700

C)　　23,300

D)　120,000

6

The length of a rectangle is 3 times the width w of the rectangle. Which of the following represents the area A of the rectangle in terms of w ?

A)　$A = \dfrac{1}{9}w^2$

B)　$A = \dfrac{1}{3}w^2$

C)　$A = 3w^2$

D)　$A = 9w^2$

7

$$w = 3.71m$$

The given equation can be used to calculate the weight w, in newtons, of any object on Mars that has mass m, in kilograms. Which table shows several values of m kilograms and corresponding values of w newtons?

A)

m	0	1	2	3
w	0	3.71	7.42	11.13

B)

m	0	1	2	3
w	0	4.71	5.71	6.71

C)

m	0	3.71	7.42	11.13
w	0	1	2	3

D)

m	0	4.71	5.71	6.71
w	0	1	2	3

CONTINUE

8

$$14x + 8y = 152$$

A summer day camp separates all 152 campers into groups that each consist of either all older children or all younger children. The equation above describes this situation, where x is the number of groups of older children and y is the number of groups of younger children. Which of the following is the best interpretation of the number 8 in this context?

A) The total number of younger children at the camp

B) The number of children in each of the younger children's groups

C) The number of children in each of the older children's groups

D) The number of groups

9

Archaeologists discovered a total of 100 Roman coins featuring either Emperor Augustus or Emperor Tiberius. The ratio of coins featuring Emperor Augustus to coins featuring Emperor Tiberius was 2 to 3. How many coins featured Emperor Augustus?

A) 20

B) 40

C) 60

D) 80

10

$$\frac{1}{2}(x + c) = 10$$

In the given equation, c is a constant. If x is the solution to the equation, what is the value of $x + c$?

A) 2

B) 5

C) 12

D) 20

CONTINUE

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Questions 11 and 12 refer to the following information.

A researcher conducted a survey to identify attitudes about television. The survey included a section of 20 three-option questions and a section of true-or-false questions. After the survey, participants discussed their responses in an individual 15-minute interview session. Participant responses were assigned a certain number of points, as shown in the tables. Participants who received a total of 75 or more points on the survey were considered to have a positive attitude about television.

Three-Option Questions

Response	Points
Always	2
Sometimes	1
Never	1

True-or-False Questions

Response	Points
True	2
False	0

11

Tamika answered all the questions in the three-option section of the survey and only responded "always" and "sometimes." She received 35 points in this section. To how many questions did Tamika respond "always"?
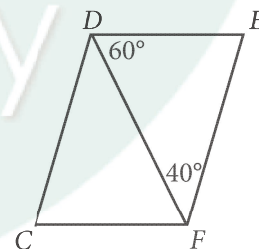
A) 5

B) 10

C) 15

D) 20

12

Diego received m points on the three-option section. If t is the number of true-or-false questions he answered with a response of "true," which of the following inequalities models the number of true-or-false questions that he must have answered as "true" to be considered to have a positive attitude about television?

A) $2m + t \geq 75$

B) $m + 2t \geq 75$

C) $m(t + 2) \geq 75$

D) $\dfrac{(m + t)}{2} \geq 75$

13

In the figure shown, $CD = EF$ and $CF = DE$. What is the measure of $\angle CDE$?

A) 40°

B) 60°

C) 100°

D) 120°

CONTINUE

14

The list of numbers shown represents the ages of 6 different children.
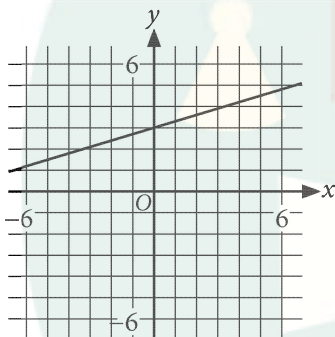
$$4, 7, 5, 9, 7, 3$$

What is the median age?
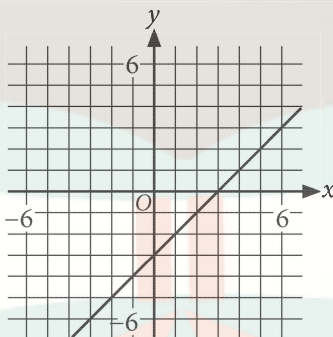
A) 5

B) 6

C) 7

D) 9

15

Which of the following could be the graph of the line with the equation $y = ax$, where a is a positive constant, in the xy-plane?
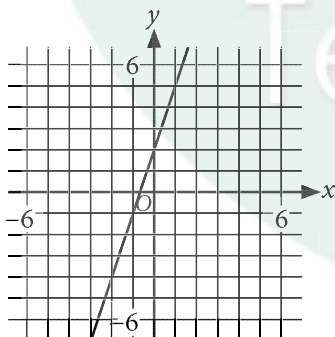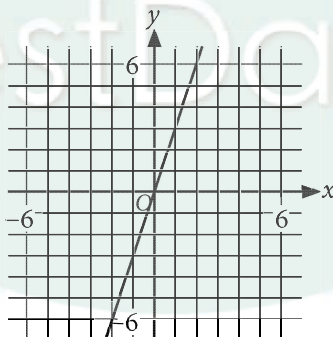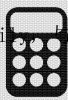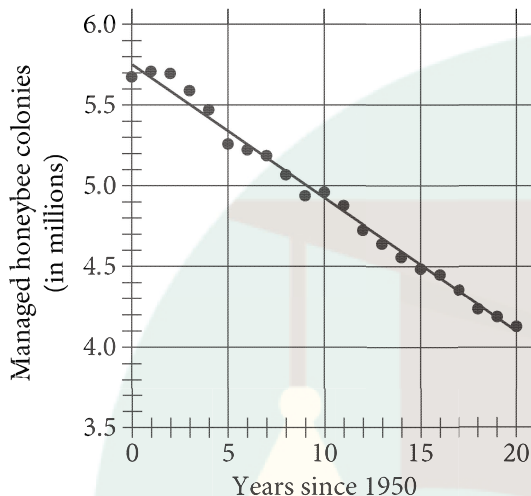
A)

B)

C)

D)

CONTINUE

16

The scatterplot shows the relationship between the number of managed honeybee colonies in the United States, in millions, and the number of years since 1950. A line of best fit is also shown.

Which of the following is the best interpretation of the slope of the line of best fit in this context?

A) The predicted number of managed honeybee colonies decreased by about 0.08 million colonies per year.

B) The predicted number of managed honeybee colonies decreased by about 0.21 million colonies per year.

C) The predicted number of managed honeybee colonies increased by about 0.72 million colonies per year.

D) The predicted number of managed honeybee colonies increased by about 1.6 million colonies per year.

17

For the linear function f, $f(-2) = -5$, and the graph of $y = f(x)$ in the xy-plane has a slope of 4. Which equation defines f?

A) $f(x) = 4x - 7$

B) $f(x) = 4x - 5$

C) $f(x) = 4x - 2$

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

18

For a data set that consists of 9 values, the median is much larger than the mean. Which of the following could explain why the median is much larger than the mean?

A) The distribution of the values from the data set is symmetric about the median.

B) The data set contains a value that is unusually large relative to the other values in the data set.

C) The data set contains a value that is unusually small relative to the other values in the data set.

D) Each value in the data set is the same.

CONTINUE

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19

The value of m, where $m > 0$, was increased by 500%. What is the resulting value in terms of m ?

A) $0.6m$

B) $6m$

C) $60m$

D) $600m$

20

The scatterplot shows the heights, in inches, of 14 children measured before the school year began and after the school year ended. A line of best fit for the data is also shown.

Student Height Before and After School Year
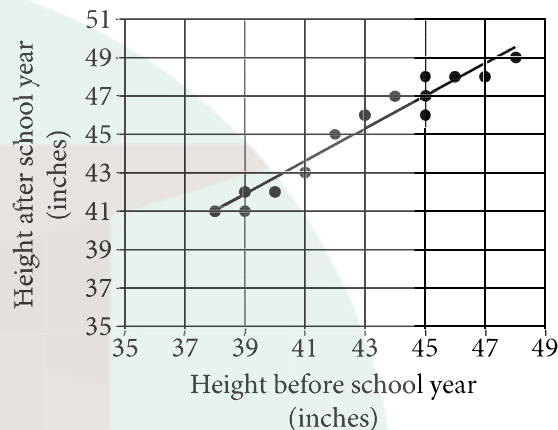
Which of the following could be an equation of the line of best fit for the data shown in the scatterplot?

A) $y = \dfrac{59}{7} + \dfrac{6}{7}x$

B) $y = -\dfrac{59}{7} + \dfrac{6}{7}x$

C) $y = -\dfrac{33}{6} + \dfrac{7}{6}x$

D) $y = \dfrac{33}{6} + \dfrac{7}{6}x$

CONTINUE ▶

21

In a collection of items, 10% are red, 25% are green, 35% are blue, and 30% are yellow. If there are 60 green items, how many blue items are in the collection?

A) 21

B) 24

C) 72

D) 84

22

$$2x + 5y = 25$$
$$nx + 3y = p$$

In the given system of equations, n and p are constants. The system has infinitely many solutions. What is the value of np ?

A) 15

B) 18

C) $\dfrac{250}{3}$

D) $\dfrac{1,250}{3}$

23

The scale on a map indicates that 2 inches on the map corresponds to an actual distance of 1 mile. Location A and location B are n inches apart on the map. What is the actual distance, in miles, between the two locations?
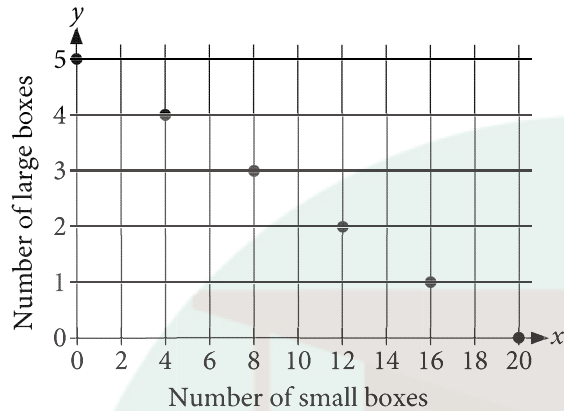
A) $3n$

B) $2n$

C) n

D) $\dfrac{n}{2}$

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24

Possible Box Combinations of 100 Pounds of Fruit

A grocer must package exactly 100 pounds of fruit for an order. The grocer has two sizes of boxes that can be used to package the fruit, and each box used will be completely filled. The graph above shows the different possible combinations of the number of small boxes, x, and the number of large boxes, y, needed to pack the order, Based on the graph, which of the following equations best models the relationship between x and y ?

A) $y = 5x + 20$

B) $y = 20x + 5$

C) $5x + 20y = 100$

D) $20x + 5y = 100$

25

$$(x + 3)(x + k) = 0$$

In the given equation, k is a constant. If the equation has exactly one solution, what is the value of k ?

A) -3

B) 0

C) 1

D) 3

26

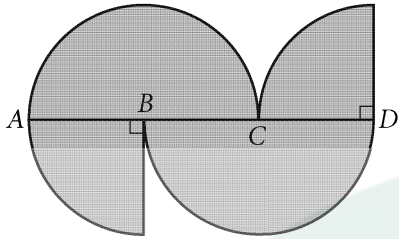$$\sqrt[3]{a^2} = \sqrt{b}$$
$$a^{2x} = b^6$$

In the equations above, a and b are constants, $a > 1$, and $b > 1$. What is the value of x ?

A) 2

B) 3

C) 4

D) 12

CONTINUE

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27

In the figure above, points A, B, C, and D are collinear. Arcs $\overset{\frown}{AC}$ and $\overset{\frown}{BD}$ are semicircles centered at B and C. The other two arcs are each half of a semicircle. If $AB = r$, what is the area of the shaded region?

A) $6\pi r^2$

B) $\dfrac{5}{2}\pi r^2$

C) $2\pi r^2$
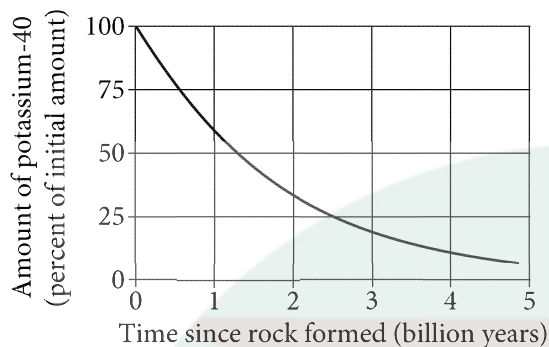
D) $\dfrac{3}{2}\pi r^2$

28

$$x^2 + bx - 12 = 0$$

In the given equation, b is a positive integer constant. Which value could be a solution to the equation?

A)   3

B)   4

C)   6

D)   12

CONTINUE

29

Time since rock formed (billion years)

The amount of the radioactive isotope potassium-40 in a rock decreases by half every 1.28 billion years. The relationship between the time t, in billions of years, since the rock formed and the percentage of potassium-40 that remains in the rock, $A(t)$, is shown in the graph. Which equation best models this relationship?

A) $A(t) = 100 + \left(\dfrac{1}{2}\right)^{\left(\frac{t}{1.28}\right)}$

B) $A(t) = 100 + \left(\dfrac{1}{2}\right)^{\left(\frac{1.28}{t}\right)}$

C) $A(t) = 100\left(\dfrac{1}{2}\right)^{\left(\frac{1.28}{t}\right)}$

D) $A(t) = 100\left(\dfrac{1}{2}\right)^{\left(\frac{t}{1.28}\right)}$

30

Data set X	7	7	8	8	9	10	10	11	11
Data set Y	1	1	2	2	3	4	4	5	5

The standard deviation of data set X is q, and the standard deviation of data set Y is s. Which of the following statements about the standard deviation of the data sets is true?

A) $q > s$

B) $q = s$

C) $q < s$

D) The relationship between q and s cannot be determined.

CONTINUE

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. → Fraction line ← ... Grid in result. ... Decimal point ←

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.

31

What is the average speed, in meters per second, of a person who runs 200 meters in 25 seconds?

32

The function V is defined by $V(w) = w(w + 1)(w + 2)$. What is the value of $V(2)$?

33

$$x + y = 105$$
$$x + y + y = 145$$

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

34

What is the y-coordinate of the y-intercept of the graph of $y = 5^x + 1$ in the xy-plane?

35

	Red	Blue	Total
Small	20	30	50
Large	30	20	50
Total	50	50	100

The table shows the distribution of color and size for 100 items. If a red item is selected at random from the 100 items, what is the probability that the selected item is small? (Express your answer as a fraction or decimal, not as a percent.)

36

The length of a diagonal of a square is $\dfrac{\sqrt{2}}{2}$. What is the length of a side of the square?

CONTINUE ▶

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Questions 37 and 38 refer to the following information.

The table shows the numbers of certain types of households in Nassau County. New York, as reported in the US Census in 2000 and 2010.

	2000	2010
Households with individuals under 18 (in thousands)	173	165
Households with individuals 65 and older (in thousands)	139	145

37

The number of households with individuals 65 and older in Nassau County in 2010 was $p\%$ greater than the number of households with individuals 65 and older in Nassau County in 2000. What is the value of p, to the nearest tenth?

38

There was a total of 447,000 households in Nassau County in 2000. If one of these households was selected at random, what is the probability that the selected household did not have an individual under age 18 ? (Express your answer as a decimal rounded to the nearest thousandth.)

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STOP

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