**Gary Community School Corporation**
*Doing What is Best for Students - Today - Tomorrow - Everyday*

# Grades 9-12

# Math

# Instructional Resources

# *ISTEP+* Mathematics Reference Sheet
## Grade 10

Volume of Sphere $= \frac{4}{3}\pi r^3$

Surface Area of Sphere $= 4\pi r^2$

Volume of Right Circular Cone $= \frac{1}{3}\pi r^2 h$

Volume of Regular Pyramid $= \frac{1}{3}Bh$

Pythagorean Theorem: $a^2 + b^2 = c^2$

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Standard Form of a Linear Equation: $Ax + By = C$

Slope of a Line: slope $= \dfrac{\text{rise}}{\text{run}} = \dfrac{y_2 - y_1}{x_2 - x_1}$

Standard Form of a Quadratic Function: $f(x) = ax^2 + bx + c$

Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

**Conversions**

| | | |
|---|---|---|
| 1 foot = 12 inches | 1 meter = 1,000 millimeters | 1 inch = 2.54 centimeters |
| 1 yard = 3 feet | 1 meter = 100 centimeters | 1 mile = 1.609 kilometers |
| 1 mile = 5,280 feet | 1 kilometer = 1,000 meters | 1 pound = 0.454 kilogram |
| 1 mile = 1,760 yards | | 1 gallon = 3.785 liters |
| | 1 gram = 1,000 milligrams | |
| 1 cup = 8 fluid ounces | 1 kilogram = 1,000 grams | 1 meter = 39.37 inches |
| 1 pint = 2 cups | | 1 kilometer = 0.62 mile |
| 1 quart = 2 pints | 1 liter = 1,000 milliliters | 1 kilogram = 2.2 pounds |
| 1 gallon = 4 quarts | | 1 liter = 0.264 gallon |

1 pound = 16 ounces

1 ton = 2,000 pounds
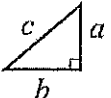
# End-of-Course Assessment

## ISTEP+: Algebra I Graduation Examination

## Reference Sheet

| Equation of a Line | | |
|---|---|---|
| **Slope-Intercept Form:** $y = mx + b$ where $m =$ slope and $b = y$-intercept | **Point-Slope Form:** $y - y_1 = m(x - x_1)$ where $m =$ slope and $(x_1, y_1)$ is a point on the line | **Standard Form of a Linear Equation:** $Ax + By = C$ where $A$ and $B$ are not both zero |

**Slope of a Line**

Let $(x_1, y_1)$ and $(x_2, y_2)$ be two points in the plane.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

where $x_2 \neq x_1$

**Standard Form of a Quadratic Function**

$$f(x) = ax^2 + bx + c$$

where $a \neq 0$

$$\text{axis of symmetry} : x = -\frac{b}{2a}$$

**Quadratic Formula**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

where $ax^2 + bx + c = 0$ and $a \neq 0$

**Pythagorean Theorem**



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

# Math Test – Calculator

## 45 MINUTES, 31 QUESTIONS

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

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**DIRECTIONS**

**For questions 1-27,** solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 28-31,** solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 28 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 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**
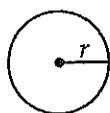
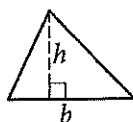$A = \pi r^2$
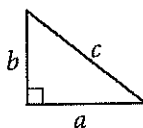$C = 2\pi r$
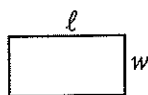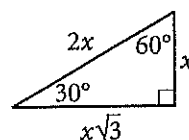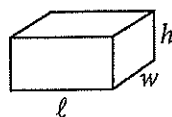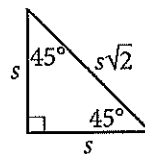
$A = \ell w$

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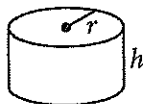
$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell w h$

$V = \pi r^2 h$
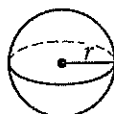
$V = \frac{4}{3}\pi r^3$
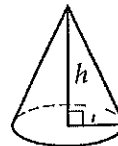
$V = \frac{1}{3}\pi r^2 h$
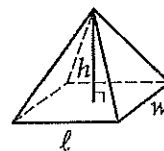
$V = \frac{1}{3}\ell w h$

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

---

**1**

A babysitter earns \$8 an hour for babysitting 2 children and an additional \$3 tip when both children are put to bed on time. If the babysitter gets the children to bed on time, what expression could be used to determine how much the babysitter earned?

A) $8x + 3$, where $x$ is the number of hours

B) $3x + 8$, where $x$ is the number of hours

C) $x(8 + 2) + 3$, where $x$ is the number of children

D) $3x + (8 + 2)$, where $x$ is the number of children

**2**

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

If $(x, y)$ is a solution to the equation above and $y \neq 0$, what is the ratio $\dfrac{x}{y}$ ?

A) $-\dfrac{4}{3}$

B) $-\dfrac{2}{3}$

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

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

**3**

$$\frac{1}{2}x - \frac{1}{4}y = 10$$
$$\frac{1}{8}x - \frac{1}{8}y = 19$$

Which ordered pair $(x, y)$ satisfies the system of equations above?

A) $(-112, -264)$

B) $(64, 88)$

C) $\left( \dfrac{232}{3}, \dfrac{224}{3} \right)$

D) $(288, 536)$

CONTINUE ⟶

**4**
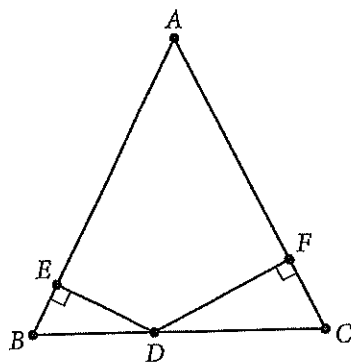


Note: Figure not drawn to scale.

Triangle $ABC$ above is isosceles with $AB = AC$ and $BC = 48$. The ratio of $DE$ to $DF$ is $5:7$. What is the length of $\overline{DC}$ ?

A) 12

B) 20

C) 24

D) 28

**5**

In a certain game, a player can solve easy or hard puzzles. A player earns 30 points for solving an easy puzzle and 60 points for solving a hard puzzle. Tina solved a total of 50 puzzles playing this game, earning 1,950 points in all. How many hard puzzles did Tina solve?

A) 10

B) 15

C) 25

D) 35

**6**

$$2x^2 + 7x - 15 = 0$$

If $r$ and $s$ are two solutions of the equation above and $r > s$, which of the following is the value of $r - s$ ?

A) $\dfrac{15}{2}$

B) $\dfrac{13}{2}$

C) $\dfrac{11}{2}$

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

**7**

To cut a lawn, Allan charges a fee of $15 for his equipment and $8.50 per hour spent cutting a lawn. Taylor charges a fee of $12 for his equipment and $9.25 per hour spent cutting a lawn. If $x$ represents the number of hours spent cutting a lawn, what are all the values of $x$ for which Taylor's total charge is greater than Allan's total charge?

A) $x > 4$

B) $3 \leq x \leq 4$

C) $4 \leq x \leq 5$

D) $x < 3$

CONTINUE

**8**

$$n = 456 - 3T$$

The equation above is used to model the relationship between the number of cups, $n$, of hot chocolate sold per day in a coffee shop and the average daily temperature, $T$, in degrees Fahrenheit. According to the model, what is the meaning of the 3 in the equation?

A) For every increase of 3°F, one more cup of hot chocolate will be sold.

B) For every decrease of 3°F, one more cup of hot chocolate will be sold.

C) For every increase of 1°F, three more cups of hot chocolate will be sold.

D) For every decrease of 1°F, three more cups of hot chocolate will be sold.

**9**

A truck enters a stretch of road that drops 4 meters in elevation for every 100 meters along the length of the road. The road is at 1,300 meters elevation where the truck entered, and the truck is traveling at 16 meters per second along the road. What is the elevation of the road, in meters, at the point where the truck passes $t$ seconds after entering the road?

A) $1,300 - 0.04t$

B) $1,300 - 0.64t$

C) $1,300 - 4t$

D) $1,300 - 16t$

**10**

If $f(x - 1) = 2x + 3$ for all values of $x$, what is the value of $f(-3)$ ?

A) $-7$

B) $-5$

C) $-3$

D) $-1$

**11**

Which of the following is equivalent to $(s - t)\left(\dfrac{s}{t}\right)$ ?

A) $\dfrac{s}{t} - s$

B) $\dfrac{s}{t} - st$

C) $\dfrac{s^2}{t} - s$

D) $\dfrac{s^2}{t} - \dfrac{s}{t^2}$

**12**

$$p(x) = 3(x^2 + 10x + 5) - 5(x - k)$$

In the polynomial $p(x)$ defined above, $k$ is a constant. If $p(x)$ is divisible by $x$, what is the value of $k$ ?

A) $-3$

B) $-2$

C) $0$

D) $3$

**13**

In the $xy$-plane, if the parabola with equation $y = ax^2 + bx + c$, where $a$, $b$, and $c$ are constants, passes through the point $(-1, 1)$, which of the following must be true?

A) $a - b = 1$

B) $-b + c = 1$

C) $a + b + c = 1$

D) $a - b + c = 1$

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36

CONTINUE

**14**

For what value of $h$ is $24 = \dfrac{h}{10} - 6$ ?

**15**

What is the value of $a$ if $(2a + 3) - (4a - 8) = 7$ ?

**16**

If $x$ is not equal to zero, what is the value

of $\dfrac{4(3x)^2}{(2x)^2}$ ?

**17**

If $x - 2$ is a factor of $x^2 - bx + b$, where $b$ is a constant, 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.**

**1**

Tyra subscribes to an online gaming service that charges a monthly fee of $5.00 and $0.25 per hour for time spent playing premium games. Which of the following functions gives Tyra's cost, in dollars, for a month in which she spends $x$ hours playing premium games?

A) $C(x) = 5.25x$

B) $C(x) = 5x + 0.25$

C) $C(x) = 5 + 0.25x$

D) $C(x) = 5 + 25x$

**2**

A grocery store sells a brand of juice in individual bottles and in packs of 6 bottles. On a certain day, the store sold a total of 281 bottles of the brand of juice, of which 29 were sold as individual bottles. Which equation shows the number of packs of bottles, $p$, sold that day?

A) $p = \dfrac{281 - 29}{6}$

B) $p = \dfrac{281 + 29}{6}$

C) $p = \dfrac{281}{6} - 29$

D) $p = \dfrac{281}{6} + 29$

**3**

Monthly Rainfall in Chestnut City
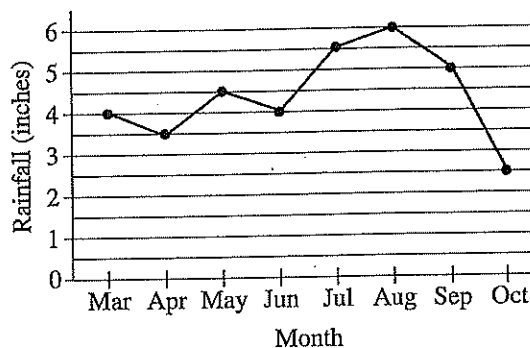


The line graph above shows the monthly rainfall from March to October last year in Chestnut City. According to the graph, what was the greatest change (in absolute value) in the monthly rainfall between two consecutive months?

A) 1.5 inches

B) 2.0 inches

C) 2.5 inches

D) 3.5 inches

CONTINUE

**4**

A rectangle has perimeter $P$, length $\ell$ and width $w$. Which of the following represents $\ell$ in terms of $P$ and $w$ ?

A) $\ell = P - w$

B) $\ell = \dfrac{2P - w}{2}$

C) $\ell = \dfrac{P - 2w}{2}$

D) $\ell = 2P - 2w$

**5**

Which ordered pair $(x, y)$ satisfies the system of equations shown below?

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

A) $(-6, 2)$

B) $(-2, 2)$

C) $(2, -2)$

D) $(4, 2)$

**6**

A soda company is filling bottles of soda from a tank that contains 500 gallons of soda. At most, how many 20-ounce bottles can be filled from the tank? (1 gallon = 128 ounces)

A)  25

B)  78

C)  2,560

D)  3,200

**7**

A car traveled at an average speed of 80 miles per hour for 3 hours and consumed fuel at a rate of 34 miles per gallon. Approximately how many gallons of fuel did the car use for the entire 3-hour trip?
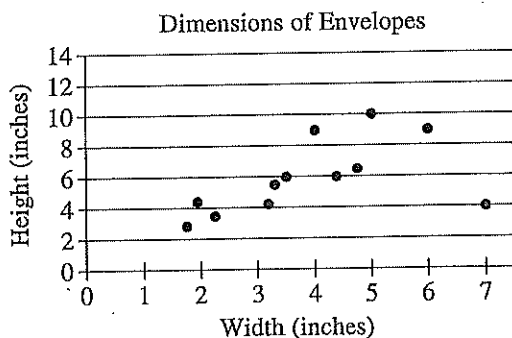
A) 2

B) 3

C) 6

D) 7

**8**

What is the slope of the line in the $xy$-plane that passes through the points $\left(-\frac{5}{2}, 1\right)$ and $\left(-\frac{1}{2}, 4\right)$ ?

A) $-1$

B) $-\frac{2}{3}$

C) $1$

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

**9**



Dimensions of Envelopes

The scatterplot above shows the widths and the heights of 12 types of rectangular envelopes. What is the width, in inches, of the envelope represented by the data point that is farthest from the line of best fit (not shown) ?

A) 2

B) 5

C) 7

D) 12

**10**

A high school basketball team won exactly 65 percent of the games it played during last season. Which of the following could be the total number of games the team played last season?

A) 22

B) 20

C) 18

D) 14

**11**

$$110x + y = 1{,}210$$

A coffee shop is running a promotion where a number of free coffee samples are given away each day. The equation above can be used to model the number of free coffee samples, $y$, that remain to be given away $x$ days after the promotion began. What does it mean that $(11, 0)$ is a solution to this equation?

A) During the promotion, 11 samples are given away each day.

B) It takes 11 days during the promotion to see 1,210 customers.

C) It takes 11 days during the promotion until none of the samples are remaining.

D) There are 11 samples available at the start of the promotion.

CONTINUE

**12**

Which scatterplot shows a negative association that is not linear? (Note: A negative association between two variables is one in which higher values of one variable correspond to lower values of the other variable, and vice versa.)

A)



B)



C)



D)



**13**



Height of pyramid (meters)
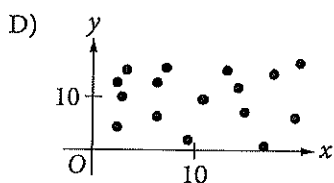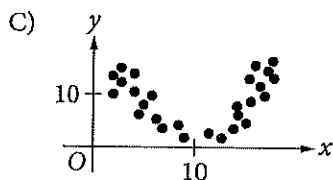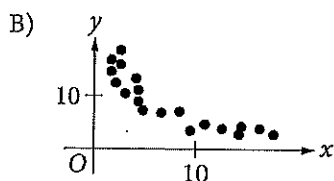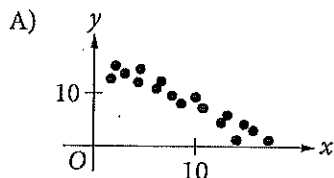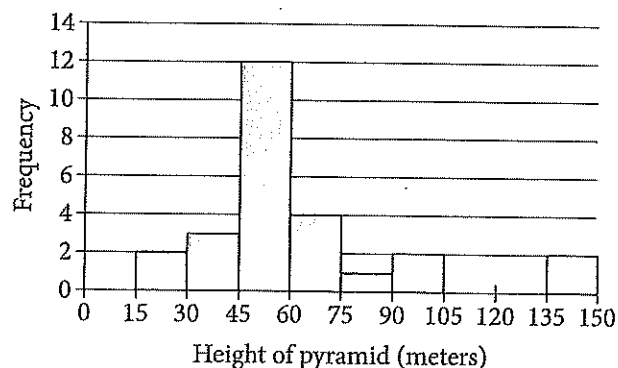
The histogram above shows the distribution of the heights, in meters, of 26 pyramids in Egypt. Which of the following could be the median height of the 26 pyramids represented in the histogram?

A) 44 meters

B) 48 meters

C) 63 meters

D) 77 meters

**Questions 14-16 refer to the following information.**

A survey of 170 randomly selected teenagers aged 14 through 17 in the United States was conducted to gather data on summer employment of teenagers. The data are shown in the table below.

|  | Have a summer job | Do not have a summer job | Total |
|---|---|---|---|
| Ages 14–15 | 20 | 69 | 89 |
| Ages 16–17 | 39 | 42 | 81 |
| Total | 59 | 111 | 170 |

**14**

Which of the following is closest to the percent of those surveyed who had a summer job?

A) 22%

B). 35%

C) 47%

D) 53%

**15**

In 2012 the total population of individuals in the United States who were between 14 and 17 years old (inclusive) was about 17 million. If the survey results are used to estimate information about summer employment of teenagers across the country, which of the following is the best estimate of the total number of individuals between 16 and 17 years old in the United States who had a summer job in 2012 ?

A) 8,200,000

B) 3,900,000

C) 2,000,000

D) 390,000

**16**

Based on the data, how many times more likely is it for a 14 year old or a 15 year old to NOT have a summer job than it is for a 16 year old or a 17 year old to NOT have a summer job? (Round the answer to the nearest hundredth.)

A) 0.52 times as likely

B) 0.65 times as likely

C) 1.50 times as likely

D) 1.64 times as likely

**17**

Percent Protein in Five Food Products
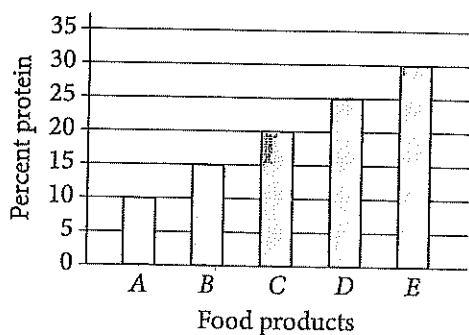


The graph above shows the amount of protein supplied by five different food products, $A$, $B$, $C$, $D$, and $E$, as a percentage of their total weights. The costs of 10 grams of products $A$, $B$, $C$, $D$, and $E$ are $2.00, $2.20, $2.50, $4.00, and $5.00, respectively. Which of the five food products supplies the most protein per dollar?

A) $A$

B) $B$

C) $C$

D) $E$

**18**
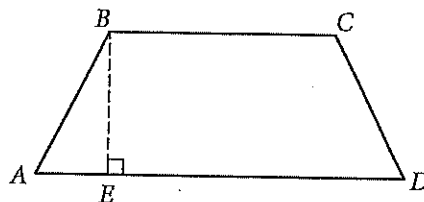


In quadrilateral $ABCD$ above, $\overline{BC}$ is parallel to $\overline{AD}$, and $AB = CD$. If $BC$ and $AD$ were each doubled and $BE$ was reduced by 50 percent, how would the area of $ABCD$ change?

A) The area of $ABCD$ would be decreased by 50 percent.

B) The area of $ABCD$ would be increased by 50 percent.

C) The area of $ABCD$ would not change.

D) The area of $ABCD$ would be multiplied by 2.

**19**

Boyd grows only tomatoes and raspberries in his garden. Last year, he grew 140 pounds of tomatoes and 60 pounds of raspberries. This year, the production, by weight, of tomatoes declined by 20 percent, and the production, by weight, of raspberries declined by 50 percent. By what percentage did the total yield, by weight, of Boyd's garden decline?

A) 29 percent

B) 30 percent

C) 35 percent

D) 70 percent

**20**
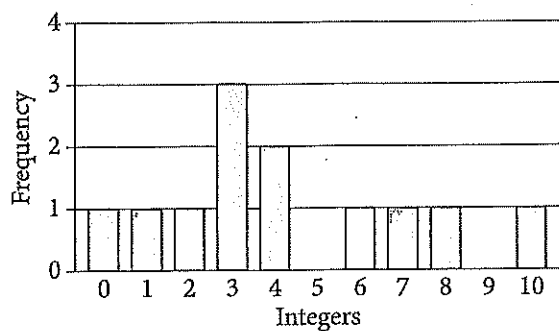


The graph above shows the frequency distribution of a list of randomly generated integers between 0 and 10. What is the mean of the list of numbers?

A)  3.0

B)  3.5

C)  4.25

D) 12.0

**21**
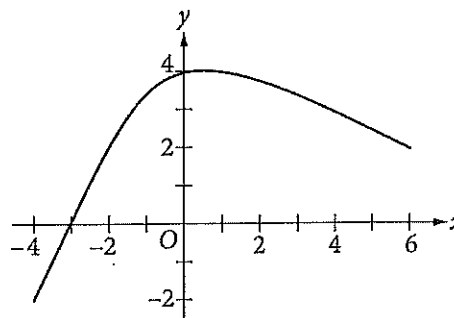


What is the minimum value of the function graphed on the $xy$-plane above, for $-4 \le x \le 6$ ?

A)  $-\infty$

B)  $-4$

C)  $-2$

D)  1

**CONTINUE**

**Questions 22-24 refer to the following information.**

In 1929, the astronomer Edwin Hubble published the data shown. The graph plots the velocity of galaxies relative to Earth against the distances of galaxies from Earth.

Velocity–Distance Relation among Galaxies
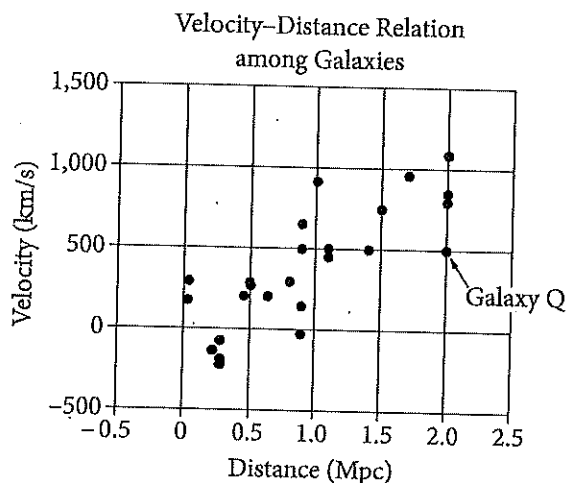


Hubble's data can be modeled by the equation $v = 500d$, where $v$ is the velocity, in kilometers per second, at which the galaxy is moving away from Earth and $d$ is the distance, in megaparsecs, of the galaxy from Earth. Assume that the relationship is valid for larger distances than are shown in the graph. (A megaparsec (Mpc) is $3.1 \times 10^{19}$ kilometers.)

**22**

According to Hubble's data, how fast, in meters per second, is Galaxy Q moving away from Earth?

A) $2 \times 10^6$ m/s

B) $5 \times 10^5$ m/s

C) $5 \times 10^2$ m/s

D) $2.5 \times 10^2$ m/s

**23**

There are four galaxies shown in the graph at approximately 0.9 Mpc from Earth. Which of the following is closest to the range of velocities of these four galaxies, in kilometers per second?

A) 100

B) 200

C) 450

D) 700

**24**

Based on the model, what is the velocity, in kilometers per second, of a galaxy that is 15 Mpc from Earth?

A) 7,500 km/s

B) 5,000 km/s

C) 1,100 km/s

D) 750 km/s

CONTINUE ➤

**25**

Janice puts a fence around her rectangular garden. The garden has a length that is 9 feet less than 3 times its width. What is the perimeter of Janice's fence if the area of her garden is 5,670 square feet?

A) 342 feet

B) 318 feet

C) 300 feet

D) 270 feet

**26**
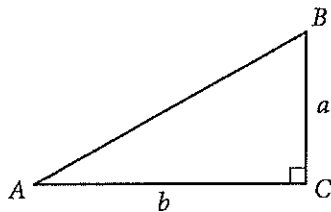


Given the right triangle $ABC$ above, which of the following is equal to $\dfrac{b}{a}$ ?

A) $\sin A$

B) $\sin B$

C) $\tan A$

D) $\tan B$

**27**

$$\begin{cases} y \le -x \\ 2y > 3x + 2 \end{cases}$$
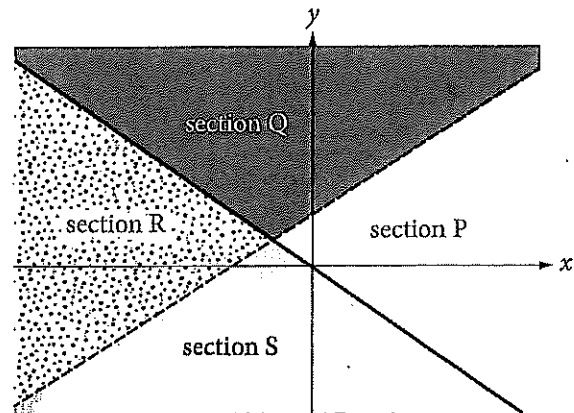


A system of inequalities and a graph are shown above. Which section or sections of the graph could represent all of the solutions to the system?

A) Section R

B) Sections Q and S

C) Sections Q and P

D) Sections Q, R, and S

49

CONTINUE ▶

**1**

Which of the following is an equivalent form of the expression $15x + 24ax$ ?

A) $39ax^2$

B) $39(a + 2x)$

C) $(5 + 8a)x$

D) $(15 + 24a)x$

**2**

The formula $d = rt$ is used to calculate the distance an object travels over a period of time, $t$, at a constant rate, $r$. Based on this formula, what is the rate, $r$, in terms of $d$ and $t$ ?

A) $r = \dfrac{d}{t}$

B) $r = dt$

C) $r = \dfrac{t}{d}$

D) $r = d - t$

**3**

Which of the following ordered pairs $(x, y)$ satisfies both equations $y = x^2 + 3x - 4$ and $x = y - 4$ ?

A) $(0, -4)$

B) $(2, 6)$

C) $(3, 14)$

D) $(5, 9)$

**4**

Which of the following is a solution to the equation $2x^2 + 4x = 3 + 3x^2$ ?

A) $-1$

B) $0$

C) $3$

D) $6$

**5**
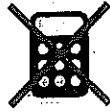
$$-3x - 4y = 20$$
$$x - 10y = 16$$

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

A) $-14$

B) $-12$

C) $-4$

D) $16$

**6**

The equation $y = 36 + 18x$ models the relationship between the height $y$, in inches, of a typical golden delicious apple tree and the number of years, $x$, after it was planted. If the equation is graphed in the $xy$-plane, what is indicated by the $y$-intercept of the graph?

A) The age, in years, of a typical apple tree when it is planted

B) The height, in inches, of a typical apple tree when it is planted

C) The number of years it takes a typical apple tree to grow

D) The number of inches a typical apple tree grows each year

**7**

Giovanni wants to buy shirts that cost $19.40 each and sweaters that cost $24.80 each. An 8% sales tax will be applied to the entire purchase. If Giovanni buys 2 shirts, which equation relates the number of sweaters purchased, $p$, and the total cost in dollars, $y$ ?

A) $1.08(38.80 + 24.80p) = y$

B) $38.80 + 24.80p = 0.92y$

C) $38.80 + 24.80p = 1.08y$

D) $0.92(38.80 + 24.80p) = y$

**8**

A line is graphed in the $xy$-plane. If the line has a positive slope and a negative $y$-intercept, which of the following points cannot lie on the line?

A) $(-3, -3)$

B) $(-3, 3)$

C) $(3, -3)$

D) $(3, 3)$

CONTINUE

**9**

A parachute design uses 18 separate pieces of rope. Each piece of rope must be at least 270 centimeters and no more than 280 centimeters long. What inequality represents all possible values of the total length of rope $x$, in centimeters, needed for the parachute?

A) $270 \le x \le 280$

B) $4{,}860 \le x \le 4{,}870$

C) $4{,}860 \le x \le 5{,}040$

D) $5{,}030 \le x \le 5{,}040$

**10**

A carpenter has \$60 with which to buy supplies. The carpenter needs to buy both nails and screws. Nails cost \$12.99 per box, and screws cost \$14.99 per box. If $n$ represents the number of boxes of nails and $s$ represents the number of boxes of screws, which of the following systems of inequalities models this situation?

A) $\begin{cases} 12.99n + 14.99s \ge 60 \\ n + s \le 1 \end{cases}$

B) $\begin{cases} 12.99n + 14.99s \le 60 \\ n + s \le 1 \end{cases}$

C) $\begin{cases} 12.99n + 14.99s \ge 60 \\ n \ge 1 \\ s \ge 1 \end{cases}$

D) $\begin{cases} 12.99n + 14.99s \le 60 \\ n \ge 1 \\ s \ge 1 \end{cases}$

**11**
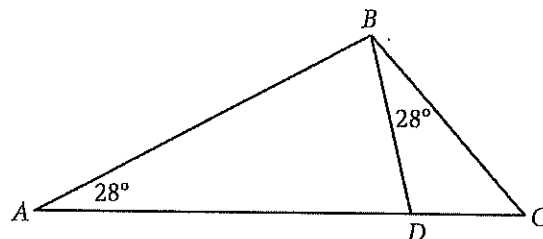


In the figure above, which of the following ratios has the same value as $\dfrac{AB}{BC}$ ?

A) $\dfrac{BD}{DC}$

B) $\dfrac{BC}{AC}$

C) $\dfrac{AD}{BD}$

D) $\dfrac{DC}{BC}$

**12**

$$\left(x^2y^3\right)^{\frac{1}{2}}\left(x^2y^3\right)^{\frac{1}{3}} = x^{\frac{a}{3}}y^{\frac{a}{2}}$$

If the equation above, where $a$ is a constant, is true for all positive values of $x$ and $y$, what is the value of $a$ ?

A)  2

B)  3

C)  5

D)  6

**13**

If the equation $y = (x - 6)(x + 12)$ is graphed in the $xy$-plane, what is the $x$-coordinate of the parabola's vertex?

A)  −6

B)  −3

C)   3

D)   6

**14**

$$21x + 14 = 7(3x + a)$$

In the equation above, $a$ is a constant. For what value of $a$ does the equation have an infinite number of solutions?

**15**

Juliene practiced her dance routine for twice as many minutes on Monday as she did on Tuesday. She practiced her routine those two days for a total of 2 hours and 15 minutes. For how many minutes did Juliene practice her dance routine on Monday?

**16**

In the expression below, $a$ is an integer.

$$12x^2 + ax - 20$$

If $3x + 4$ is a factor of the expression above, what is the value of $a$ ?

**17**

$$(ax + by)(cx - dy)$$

In the expression above, $a$, $b$, $c$, and $d$ are non-zero constants and $ad = bc$. If $ac = 18$ and $bd = 50$, what is the value of the coefficient of the $xy$ term when the expression is multiplied out and the like terms are collected?

# STOP

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

**1**

A high school counselor conducted a study over 16 consecutive quarters to determine the number of students with part-time jobs. Each student in the 2014 graduating class is surveyed once per quarter for all four years of high school. The graph below shows the data for each quarter the survey was conducted.

Number of Students with Part-Time Jobs
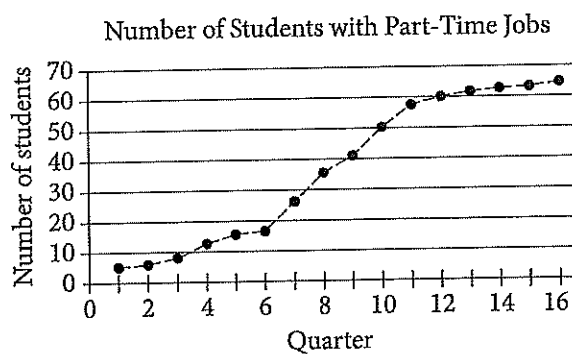


During which of the following periods is the increase in the number of students with part-time jobs largest?

A) Quarters 4 through 6

B) Quarters 7 through 10

C) Quarters 11 through 14

D) Quarters 13 through 16

**2**

Eli saves money each month to buy a new computer. The total amount he has saved, $T$, can be calculated by the equation $T = 83 + 30m$, where $m$ is the number of months since he started saving. What does the number 83 represent in the equation?

A) The amount of money Eli started with

B) The number of months Eli has been saving

C) The amount of money Eli saves each month

D) The total amount of money Eli wants to save

**3**

According to the Department of Agriculture, consuming 100 grams of banana provides 0.15 milligram of zinc. Which of the following is closest to the number of milligrams of zinc provided by 140 grams of banana?

A) 0.15

B) 0.21

C) 0.25

D) 0.93

**4**

When the equation $y = 5x + p$, where $p$ is a constant, is graphed in the $xy$-plane, the line passes through the point $(-2, 1)$. What is the value of $p$ ?

A) −9

B) −2

C) 3

D) 11

**Questions 5 and 6 refer to the following information.**

The Number of Hits
and Times at Bat by Players on
a Major League Baseball Team



Number of times at bat
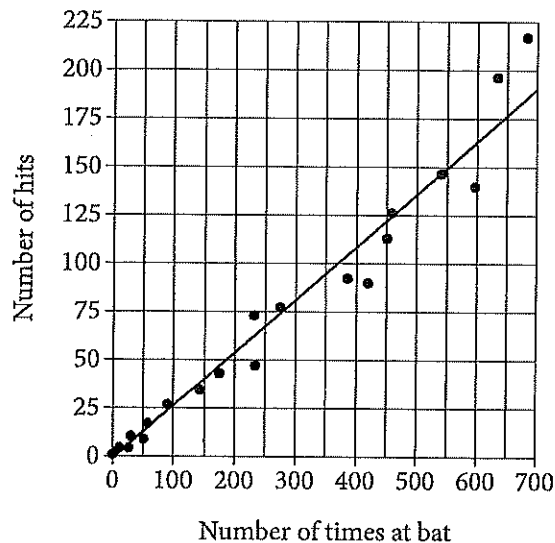
The scatterplot above shows the number of hits and the number of times at bat by each of 20 players on a major league baseball team. The line of best fit for the data is also shown.

Which of the following statements about the relationship between the number of times at bat and the number of hits is true?

A) As the number of times at bat increases, the number of hits decreases.

B) As the number of times at bat increases, the number of hits increases.

C) As the number of times at bat increases, the number of hits remains constant.

D) As the number of times at bat decreases, the number of hits increases.

For the player with 450 times at bat, the actual number of hits the player had is approximately how many fewer than the number of hits predicted by the line of best fit?

A) 10

B) 20

C) 30

D) 40

**7**

An advertisement states that the printing rate of a certain printer is 400 characters per second. According to the convention that 1 word consists of 5 characters, what would be the advertised printing rate, in <u>words per minute</u>?

A)    2,000

B)    4,800

C)    24,000

D)    120,000

**8**

| Year | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Salary | 38,000 | 39,140 | 40,314 | 41,524 | 42,769 |

The table above shows the yearly salary, in dollars, of an employee at a company. Which of the following best describes the type of model that fits the data in the table?

A)   Linear, increasing by approximately $1,140 per year

B)   Linear, increasing by approximately $1,245 per year

C)   Exponential, increasing by approximately 3% each year

D)   Exponential, increasing by approximately 9% each year

**9**

$$(x^2y - 3y^2 + 5xy^2) - (-x^2y + 3xy^2 - 3y^2)$$

Which of the following is equivalent to the expression above?

A)   $2x^2y + 2xy^2$

B)   $8xy^2 - 6y^2$

C)   $2x^2y + 8xy^2 - 6y^2$

D)   $x^4y^2 + 9xy^4 - 15xy^2$

**10**

$$4x - \frac{1}{2}x - 7 = 7\left(\frac{1}{2}x - 7\right)$$

Which of the following describes the solution to the equation above?

A)   $x = 0$

B)   $x = 10\frac{1}{2}$

C)   The equation has infinitely many solutions.

D)   The equation has no solutions.

**11**

The table below shows the monthly electricity bills of Joseph and Samuel for the first five months of a year.

Electricity Bills

| Month | Joseph | Samuel |
|---|---|---|
| January | $184.66 | $188.99 |
| February | $193.12 | $181.27 |
| March | $175.99 | $176.35 |
| April | $145.30 | $149.23 |
| May | $180.33 | $185.66 |

Based on the information in the table, which of these statements is true about the ranges and medians of the bills?

A) Both the range and median of Joseph's bills are less than the range and median of Samuel's bills.

B) Both the range and median of Joseph's bills are greater than the range and median of Samuel's bills.

C) The range of Joseph's bills is less than the range of Samuel's bills, while the median of Joseph's bills is greater than the median of Samuel's bills.

D) The range of Joseph's bills is greater than the range of Samuel's bills, while the median of Joseph's bills is less than the median of Samuel's bills.

**12**

Cars in Service on a Railroad

|  | In service less than 10 years | In service 10 or more years |
|---|---|---|
| Single level | 215 | 497 |
| Double-decker | 16 | 82 |

The table above presents information about the 810 train cars in service on a railroad. Approximately what percentage of the train cars in service are double-decker cars that have been in service for less than 10 years?

A) 2 percent

B) 7 percent

C) 10 percent

D) 16 percent

**13**

A moving company uses plastic wrap to bundle groups of boxes together. If a portion of plastic wrap that measures 900 inches in length is used to bundle each group of boxes, how many groups of boxes can be bundled using 1,500 feet of the same type of plastic wrap?

A) 15

B) 20

C) 25

D) 30

**14**

The table below shows the number of calories in a cheeseburger at six different restaurants.

Calories in a Cheeseburger

| Restaurant | Calories |
|---|---|
| Blue Jay | 810 |
| Clear Lake Cafe | 900 |
| Molly's | 740 |
| Riverside Diner | 1,120 |
| Maya's Bistro | 1,050 |
| Tom's Place | 700 |

What is the difference in the number of calories in a cheeseburger at the Riverside Diner and the median number of calories in cheeseburgers at all six restaurants?

A) 190

B) 233

C) 265

D) 390

**15**

A circle is graphed in the $xy$-plane. If the circle has a radius of 3 and the center of the circle is at $(4, -2)$, which of the following could be an equation of the circle?

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

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

C) $(x-4)^2 + (y+2)^2 = 9$

D) $(x-4)^2 - (y+2)^2 = 9$

**Questions 16-18 refer to the following information.**

A high school developed a program called Propel, which offers extra guidance and support during the 9th-grade year. Before the school year began, 327 rising 9th graders were selected at random to participate in a study; 109 of those students were randomly assigned to enroll in the Propel program and the remaining students served as a control group. A summary of the year-end grade point averages (GPA) for the 327 9th-grade students who were chosen for the study is shown in the table below.

GPA for the 327 9th-Grade Students

| GPA | Enrolled in Propel | Not enrolled in Propel |
| --- | --- | --- |
| 3.0 or greater | 61 | 95 |
| Less than 3.0 | 48 | 123 |

**16**

If a 9th-grade student at the high school is chosen at random, which of the following is closest to the probability that the student will have a GPA of 3.0 or greater?

A)  0.64

B)  0.48

C)  0.33

D)  0.19

**17**

What is the difference, to the nearest whole percent, between the percentage of students enrolled in Propel who had a GPA of 3.0 or greater and the percentage of students not enrolled in Propel who had a GPA of 3.0 or greater?

A)   4%

B)   8%

C)  10%

D)  12%

**18**

Of the students enrolled in the Propel program, the ratio of boys to girls is approximately 2:3. Which of the following is the best estimate of the number of girls enrolled in the program?

A)   44

B)   65

C)   73

D)  131

19

An artist is creating a sculpture using bendable metal rods of equal length. One rod is formed into the shape of a square and another rod into the shape of an equilateral triangle. If each side of the triangle is 2 inches longer than each side of the square, how long, in inches, is each rod?

A)  16

B)  18

C)  24

D)  30

20

$$f(x) = \frac{2x - 4}{2x^2 + 2x - 4}$$

A rational function is defined above. Which of the following is an equivalent form that displays values not included in the domain as constants or coefficients?

A)  $f(x) = \dfrac{x - 2}{x^2 + x - 2}$

B)  $f(x) = \dfrac{2(x - 2)}{2(x + 2)(x - 1)}$

C)  $f(x) = \dfrac{1}{x + 1}$

D)  $f(x) = \dfrac{1}{2x^2}$

21

A landscaper is designing a rectangular fountain with a 4-foot-wide path around it. The equation $A = 4p + 64$ will relate the area $A$, in square feet, of the path to the perimeter $p$, in feet, of the fountain. In the design, how many feet will the perimeter of the fountain increase for each additional square foot of the path's area?

A)  $\dfrac{1}{64}$

B)  $\dfrac{1}{4}$

C)  4

D)  64

CONTINUE

**22**

In the $xy$-plane the graph of the function $q$ is a parabola. The graph intersects the $x$-axis at $(-1, 0)$ and $(r, 0)$. If the vertex of $q$ occurs at the point $(2, 4)$, what is the value of $r$ ?

A) 0

B) 3

C) 4

D) 5

**23**

Liquid going through a cooling system is chilled so that its temperature decreases at a constant rate from 100°C to 25°C in 5 seconds. Which of the following functions represents the temperature $C$, in degrees Celsius, as a function of the time $t$, in seconds, after chilling began, for $0 \leq t \leq 5$ ?

A) $C = -25 + 15t$

B) $C = 25 - 15t$

C) $C = 25 + 15t$

D) $C = 100 - 15t$

**24**

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

The formula for the volume of a sphere with radius $r$ is shown above. The radius of the planet Jupiter is about 11 times the radius of planet Earth. Assuming that planets are spheres, about how many times larger is the volume of Jupiter than the volume of Earth?

A)     11

B)     121

C)  1,331

D)  1,775

**25**

The population of squirrels in a park has been doubling every 15 years. Which of the following statements describes the type of function that best models the relationship between the population of squirrels in the park and the number of 15-year time periods?

A) Exponential growth, because the population of squirrels is increasing by the same amount each 15-year time period

B) Exponential growth, because the population of squirrels is increasing by the same percentage each 15-year time period

C) Linear growth, because the population of squirrels is increasing by the same amount each 15-year time period

D) Linear growth, because the population of squirrels is increasing by the same percentage each 15-year time period

**26**

If function $f$ is defined by $f(x) = 3x^2 - 5x + 4$, what is $f(x-4)$ ?

A) $f(x-4) = 3x^2 - 5x$

B) $f(x-4) = 3x^2 - 5x + 72$

C) $f(x-4) = 3x^2 - 29x + 52$

D) $f(x-4) = 3x^2 - 29x + 72$

**27**

$$x = \frac{1}{3}y$$
$$154 - 4y = 10x$$

The equations of two lines are shown above. If the lines are graphed in the $xy$-plane, which of the following ordered pairs represents the point at which the lines would intersect?

A) $(1, 3)$

B) $(3, 9)$

C) $(5, 15)$

D) $(7, 21)$

**28**

| Type of meal | Fat (g) | Carbohydrates (g) |
|---|---|---|
| Stir-fry | 4 | 40 |
| Szechuan chicken | 5 | 35 |

A grocer carries two types of frozen meals that have the fat and carbohydrate content shown in the table above. John wants to purchase a combination of the two types of meals with no more than 350 grams of fat and no more than 2975 grams of carbohydrates. If John purchases 10 Szechuan chicken meals, what is the greatest number of stir-fry meals he can purchase so that the combination will satisfy the requirements?

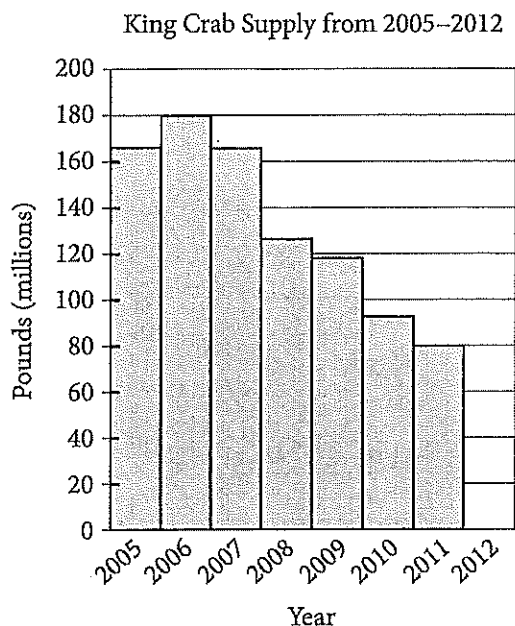**29**

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

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

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60

**Questions 30 and 31 refer to the following information.**

King Crab Supply from 2005–2012



The graph above shows the supply, in millions of pounds, of king crab harvested and sold from 2005 to 2011. The information for the year 2012 is not included in the graph.

**30**

In 2006, the price of king crab was $8 per pound at the beginning of the year and dropped to $7 per pound toward the end of the year. If 60% of the king crab supply was sold at the higher price per pound and the rest was sold at the lower price per pound, what was the total revenue generated, in millions of dollars, from the sales of king crab in 2006 ? (Disregard the $ when gridding your answer.)

**31**

In 2011, the price of king crab was $17 per pound. In 2012, $x$ million pounds of king crab were sold at $16 per pound. If the total money generated from sales each year was the same, what is the value of $x$ ?

# STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

## 1

$$51 = 7 + 2x$$

What value of $x$ satisfies the equation above?

A) 58

B) 44

C) 29

D) 22

## 2

$$3a + 4b = 25$$

A shipping company charged a customer $25 to ship some small boxes and some large boxes. The equation above represents the relationship between $a$, the number of small boxes, and $b$, the number of large boxes, the customer had shipped. If the customer had 3 small boxes shipped, how many large boxes were shipped?

A) 3

B) 4

C) 5

D) 6

## 3

On January 1, 2015, a city's minimum hourly wage was $9.25. It will increase by $0.50 on the first day of the year for the next 5 years. Which of the following functions best models the minimum hourly wage, in dollars, $x$ years after January 1, 2015, where $x = 1, 2, 3, 4, 5$ ?

A) $f(x) = 9.25 - 0.50x$

B) $f(x) = 9.25x - 0.50$

C) $f(x) = 9.25 + 0.50x$

D) $f(x) = 9.25x + 0.50$

## 4

$$F = 2.50x + 7.00y$$

In the equation above, $F$ represents the total amount of money, in dollars, a food truck charges for $x$ drinks and $y$ salads. The price, in dollars, of each drink is the same, and the price, in dollars, of each salad is the same. Which of the following is the best interpretation for the number 7.00 in this context?

A) The price, in dollars, of one drink

B) The price, in dollars, of one salad

C) The number of drinks bought during the day

D) The number of salads bought during the day

**5**
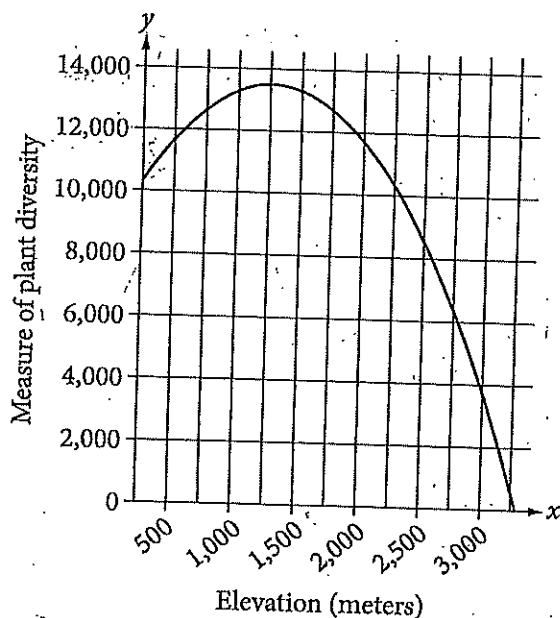


Elevation (meters)

The quadratic function graphed above models a particular measure of plant diversity as a function of the elevation in a region of Switzerland. According to the model, which of the following is closest to the elevation, in meters, at which plant diversity is greatest?

A) 13,500

B) 3,000

C) 1,250

D) 250

**6**
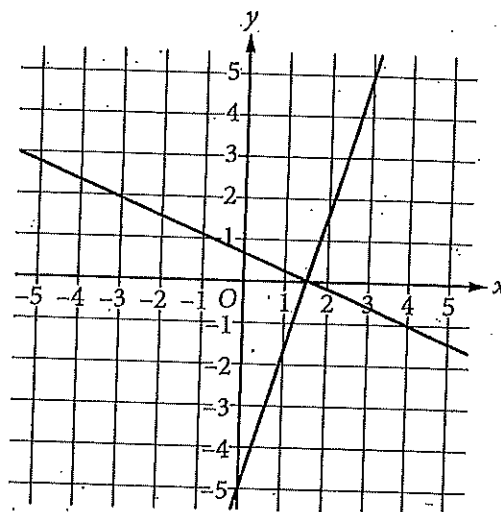


Which of the following systems of equations has the same solution as the system of equations graphed above?

A) $y = 0$

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

B) $y = \dfrac{3}{2}$

$x = 0$

C) $y = 0$

$x = 1$

D) $y = 1$

$x = 0$

CONTINUE

**7**

The function $f$ defined by $f(x) = x^2$ is graphed in the $xy$-plane. The graph of the function $g$ in the $xy$-plane is the graph of $f$ shifted 4 units upward. Which of the following defines $g(x)$ ?

A) $g(x) = f(x+4)$

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

C) $g(x) = f(x) + 4$

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

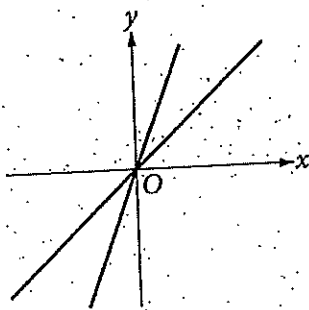**8**



In the $xy$-plane above, two lines intersect at the origin. Which of the following pairs of equations could represent these lines, where $a$ and $b$ are positive constants?

A) $y = ax$
$\quad y = bx$

B) $y = ax$
$\quad y = -bx$

C) $y = -ax$
$\quad y = -bx$

D) $y = ax$
$\quad y = ax + b$

**9**

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

Which of the following is equivalent to the expression above?

A) $2x^2 + 2x - 1$

B) $2x^2 + 6x - 3$

C) $4x^2 + 2x - 1$

D) $4x^2 + 6x - 3$

**10**

Which of the following expressions is equivalent to the sum of $(r^3 + 5r^2 + 7)$ and $(r^2 + 8r + 12)$ ?

A) $r^5 + 13r^3 + 19$

B) $2r^3 + 13r^2 + 19$

C) $r^3 + 5r^2 + 7r + 12$

D) $r^3 + 6r^2 + 8r + 19$

**CONTINUE**

**11**

According to Moore's law, the number of transistors included on microprocessors doubles every 2 years. In 1985, a microprocessor was introduced that had 275,000 transistors. Based on this information, in which of the following years does Moore's law estimate the number of transistors to reach 1.1 million?

A) 1987

B) 1989

C) 1991

D) 1994

**12**

| $x$ | $f(x)$ |
|---|---|
| 2 | 7 |
| 3 | 5 |
| 4 | 7 |

For the quadratic function $f$, the table above gives some values of $x$ and their corresponding values of $f(x)$. Which of the following could define $f$?

A) $f(x) = (x-3)^2 + 5$

B) $f(x) = (x-3)^2 + 9$

C) $f(x) = 2(x-2)^2 + 7$

D) $f(x) = 2(x-3)^2 + 5$

**13**

$$3(x-5)^2 + 11 = 59$$

What is the smallest value of $x$ that satisfies the equation above?

A) 9

B) 7

C) 5

D) 1

**14**

$$x + y = 17$$
$$xy = 72$$

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

**15**

If $\dfrac{3x + 3x}{6} = 24$, what is the value of $6x$ ?

**16**

According to a model, the head width, in millimeters, of a worker bumblebee can be estimated by adding 0.6 to four times the body weight of the bee, in grams. According to the model, what would be the head width, in millimeters, of a worker bumblebee that has a body weight of 0.5 grams?

**17**
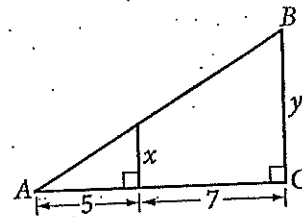


Note: Figure not drawn to scale.

The area of triangle $ABC$ above is at least 48 but no more than 60. If $y$ is an integer, what is one possible value of $x$ ?

# STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

**1**

A group of monarch butterflies migrated from Chicago, Illinois, to Michoacán, Mexico, flying a total of 2,100 miles. It took a single butterfly in the group 120 days to travel this route one way. On average, how many miles did the butterfly travel per day?

A) 0.057

B) 0.729

C) 17.5

D) 24

**2**

A chemistry experiment requires three beakers containing different amounts, in milliliters (mL), of a saline solution. The three beakers contain 120 mL, 340 mL, and 275 mL of solution, respectively. What is the approximate total number of <u>ounces</u> of saline solution contained in the three beakers? (Use 1 ounce = 29.5735 milliliters.)

A) 15.55

B) 20.80

C) 21.74

D) 24.85

**3**

$$\frac{3}{4}x + ax = 10$$

In the equation above, $a$ is a constant. If $x = 24$ is the solution to the equation, what is the value of $a$ ?

A) $-\frac{4}{3}$

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

C) $\frac{40}{99}$

D) $\frac{7}{6}$

**4**

$$C = 1.6(30w + 70)$$

The formula above can be used to approximate the daily energy requirement C, in calories, of an adult dog in terms of the dog's weight $w$, in kilograms. Based on the formula, if a dog has a daily energy requirement of at least 1,120 calories and at most 1,216 calories, which of the following inequalities represents the range of all possible values of the dog's body weight, to the nearest tenth of a kilogram?

A) $21.0 \le w \le 23.0$

B) $21.9 \le w \le 23.9$

C) $24.8 \le w \le 26.8$

D) $25.7 \le w \le 27.7$

**5**

|  | 2010 | 2050 (projected) |
|---|---|---|
| China (C) | 1,371 | 1,437 |
| India (I) | 1,150 | 1,628 |
| Brazil (B) | 193 | 260 |
| Nigeria (N) | 160 | 299 |

The table above shows the population, in millions, of four countries in 2010 and the projected population of each country in 2050. If the population of each country were to increase at a constant rate from 2010 to 2050, which of the following graphs could model the populations from 2010 to 2050?

A)


B)


C)


D)
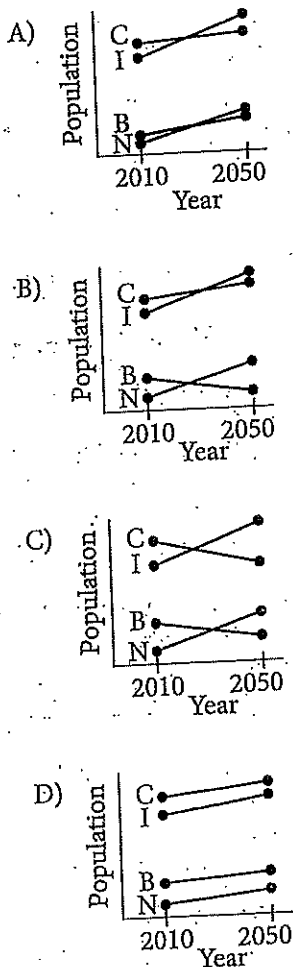

**Questions 6-8 refer to the following information.**

Results of Five Quality Control Trials
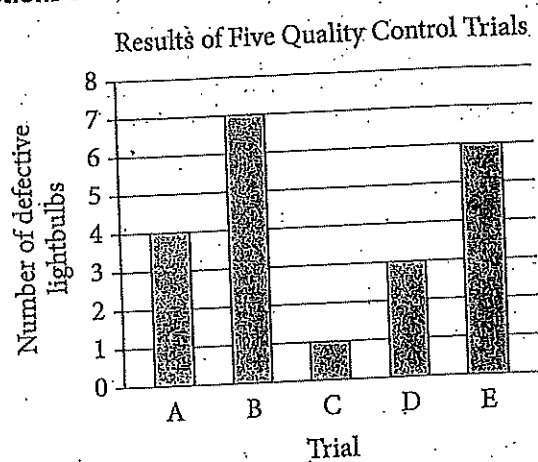


For quality control, a company that manufactures lightbulbs conducted five different trials. In each trial, 500 different lightbulbs were tested. The bar graph above shows the number of defective lightbulbs found in each trial.

**6**

What is the mean number of defective lightbulbs for the five trials?

A) 4.0

B) 4.2

C) 4.6

D) 5.0

**7**

What is the ratio of the number of defective lightbulbs in Trial D to the median number of defective lightbulbs for the five trials?

A) 1:7

B) 1:6

C) 3:5

D) 3:4

**8**

In Trial B, what percent of the lightbulbs were defective?

A) 0.70%

B) 0.84%

C) 1.40%

D) 7.00%

**9**

On a certain day, an air traffic controller determined the number of airplanes that took off from runway M was 3 times the number that took off from runway Q. And on that day, a total of 120 airplanes took off from the two runways. If $m$ and $q$ represent the number of airplanes that took off from runways M and Q, respectively, which of the following systems of equations models the situation?

A) $m = 3q$
   $m + q = 120$

B) $3m = q$
   $m + q = 120$

C) $m = q$
   $m + q = 120$

D) $3m = q$
   $m + 3q = 120$

Questions 10 and 11 refer to the following information.
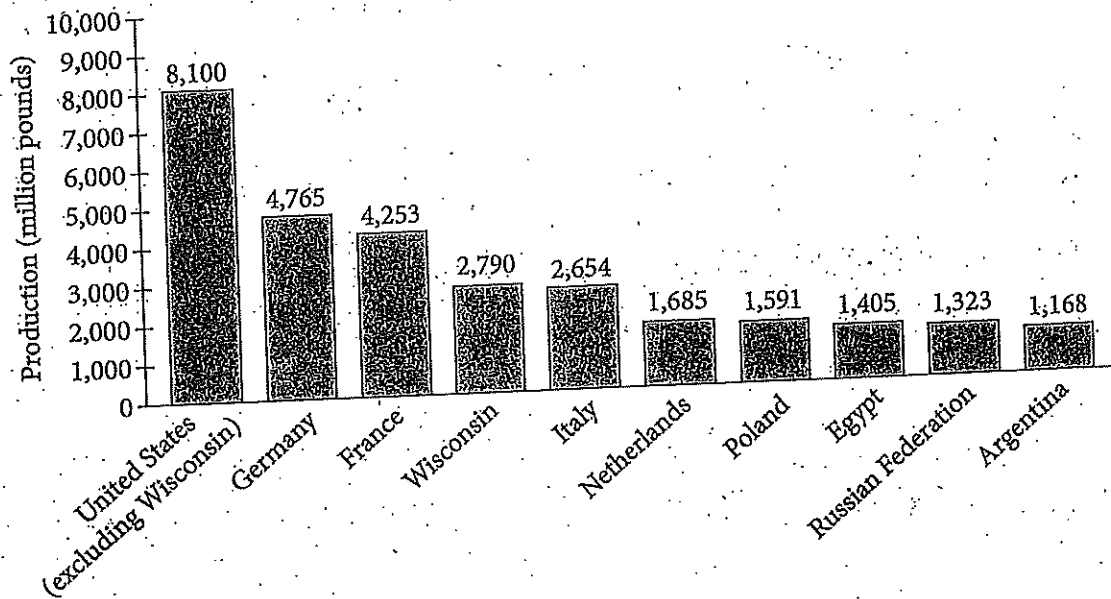


The bar graph above shows information from 2012 on the production of cheese in Wisconsin and comparative production figures for the nine top cheese-producing countries.

**10**

In 2012, Wisconsin produced 951,571,000 pounds of mozzarella cheese. Which of the following is closest to the percent of Wisconsin cheese production that was mozzarella? (1 million = 1,000,000)

A) 15%

B) 22%

C) 34%

D) 42%

**11**

Of the following, which best approximates the ratio of the cheese production in the United States (excluding Wisconsin) to that in Wisconsin in 2012?

A) 1:3

B) 2:5

C) 5:2

D) 3:1

## 12

The table below shows the number of state parks in a certain state that contain camping facilities and bicycle paths.

|  | Has bicycle paths | Does not have bicycle paths |
|---|---|---|
| Has camping facilities | 20 | 5 |
| Does not have camping facilities | 8 | 4 |

If one of these state parks is selected at random, what is the probability that it has camping facilities but does not have bicycle paths?

A) $\dfrac{5}{37}$

B) $\dfrac{5}{25}$

C) $\dfrac{8}{28}$

D) $\dfrac{5}{9}$

## 13

The results of two independent surveys are shown in the table below.

Men's Height

| Group | Sample size | Mean (centimeters) | Standard deviation (centimeters) |
|---|---|---|---|
| A | 2,500 | 186 | 12.5 |
| B | 2,500 | 186 | 19.1 |

Which statement is true based on the table?

A) The Group A data set was identical to the Group B data set.

B) Group B contained the tallest participant.

C) The heights of the men in Group B had a larger spread than the heights of the men in Group A.

D) The median height of Group B is larger than the median height of Group A.

## 14

$$p(m) = 2m + 8$$

The function $p$ above models the total price $p(m)$, in dollars, of streaming $m$ movies per month from an online movie subscription service. The subscription service charges an \$8 monthly fee plus an additional fee per movie streamed. Which of the following is the best interpretation of $p(10)$ in this context?

A) The total price for streaming 1 movie in a month is \$10.

B) The total price for streaming 2 movies in a month is \$10.

C) When 10 movies are streamed in a month, the total price that month is \$18.

D) When 10 movies are streamed in a month, the total price that month is \$28.

**15**

$$\frac{4x}{2(x^2-1)} - \frac{3x}{3(x^2-1)}$$

Which of the following is equivalent to the expression above for $x \neq -1$ and $x \neq 1$ ?

A) $\dfrac{1}{6(x-1)}$

B) $\dfrac{x}{6(x^2-1)}$

C) $\dfrac{1}{x-1}$

D) $\dfrac{x}{x^2-1}$

**16**

In the $xy$-plane, line $l$ contains the points $(2, 6)$ and $(8, 10)$. Which of the following is an equation of line $l$ ?

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

B) $y = \dfrac{3}{2}x - 2$

C) $y = 2x + 6$

D) $y = 8x + 10$

**17**

If $x \neq 0$, which of the following expressions is equivalent to $\dfrac{\sqrt{16x^4y^8}}{x^3}$ ?

A) $8x^2y^4$

B) $4xy^4$

C) $4x^{-2}y^2$

D) $4x^{-1}y^4$

**18**

Mars Rover Social Media Followers
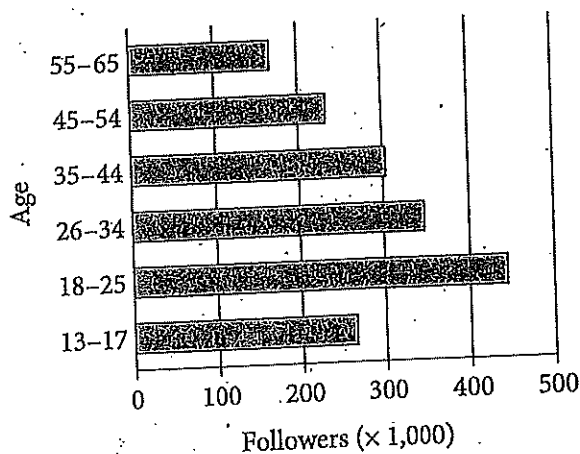


The total number of followers of a Mars rover's social media account is 1,764,000, as summarized by age in the graph above. Which of the following could be the median age of the followers?

A) 37

B) 29

C) 20

D) 16

**CONTINUE**

## 19

The height, in meters, of a golf ball $t$ seconds after it was hit is given by the function $f(t) = at^2 + bt + c$, where $a$, $b$, and $c$ are constants. The graph of $f$ is shown below.
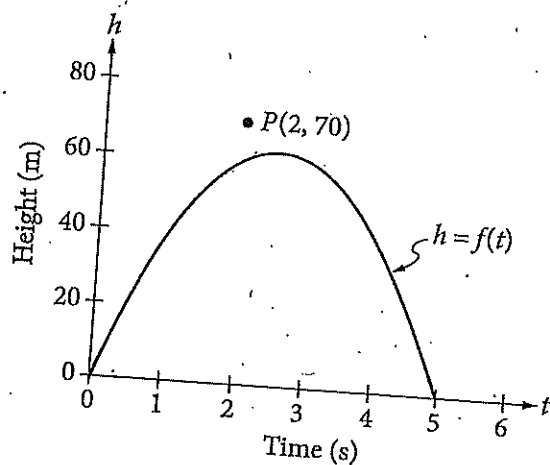


The point $P(2, 70)$ represents the height of a bird at a given point in time. Which of the following expressions correctly compares the height of the ball and the height of the bird at that point in time?

A) $f(70) > 2$

B) $f(70) < 2$

C) $f(2) > 70$

D) $f(2) < 70$

## 20

Size and Sale Price of Houses in Town H



Size (thousands of square feet)
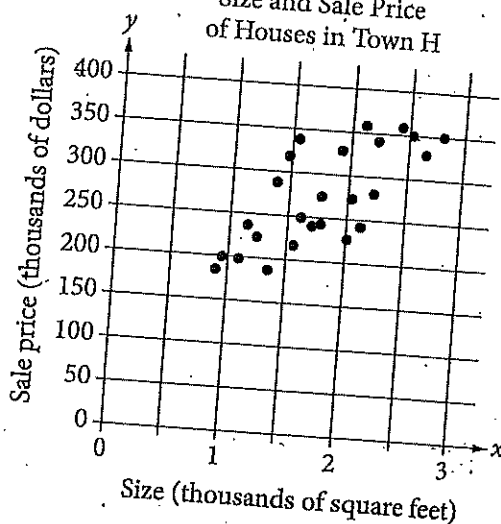
The scatterplot above shows the size $x$ and the sale price $y$ of 25 houses for sale in Town H. Which of the following could be an equation for a line of best fit for the data?

A) $y = 200x + 100$

B) $y = 100x + 100$

C) $y = 50x + 100$

D) $y = 100x$

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47

**21**

Trisha and Stacy each work at their own constant rate, whether they work alone or work together. If working alone, Trisha can finish a job 15 minutes faster than Stacy can. The equation $\frac{1}{x} + \frac{1}{x+15} = \frac{1}{18}$ can be used to find the time $x$, in minutes, it takes Trisha to finish the job working alone. Which of the following is the best interpretation of the number 18 in the equation?

A) The number of minutes it takes Trisha to finish the job working alone

B) The number of minutes it takes Stacy to finish the job working alone

C) The number of minutes it takes both of them to finish the job working together

D) The sum of the number of minutes it takes Trisha and the number of minutes it takes Stacy to each finish the job working alone

**22**

If $2y = x + 40$ and $3x = y + 20$, what is the value of $x + y$?
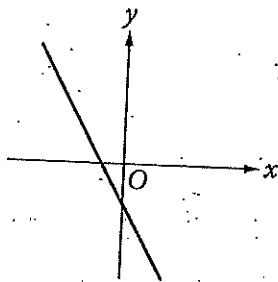
A) 28

B) 34

C) 38

D) 44

**23**

$$Ax + By = C$$

In the equation above, $A$, $B$, and $C$ are positive constants. Which of the following could be the graph of the equation in the $xy$-plane?

A)



B)
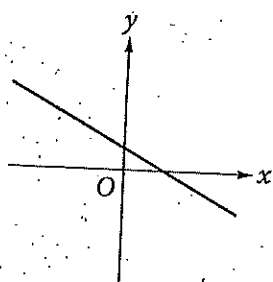


C)
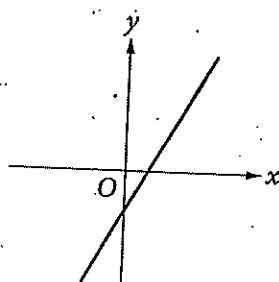


D)
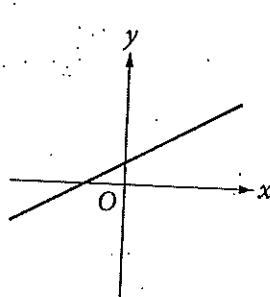


**24**
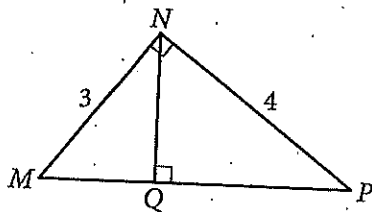


In the figure above, what is the length of $\overline{NQ}$ ?

A) 2.2

B) 2.3

C) 2.4

D) 2.5

**25**

The table below shows the distribution of US states according to whether they have a state-level sales tax and a state-level income tax.

2013 State-Level Taxes

|  | State sales tax | No state sales tax |
|---|---|---|
| State income tax | 39 | 4 |
| No state income tax | 6 | 1 |

To the nearest tenth of a percent, what percent of states with a state-level sales tax do not have a state-level income tax?

A) 6.0%

B) 12.0%

C) 13.3%

D) 14.0%

CONTINUE

**26**
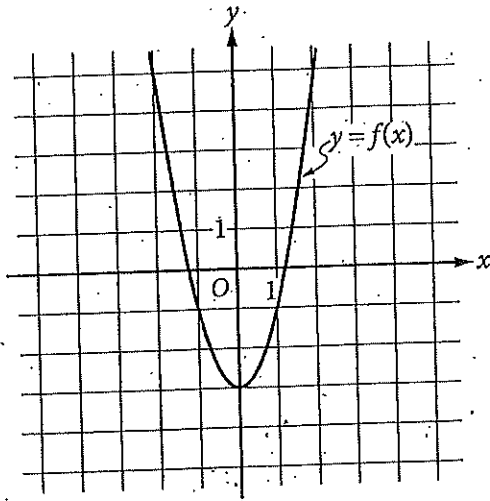


The graph of $f(x)$ is shown above. If $g(x) = (x-1)(x-5)$, what is the value of $g(0) - f(0)$ ?

A) 8

B) 2

C) 0

D) −2

**27**

$$ax + b = 3x - 4$$

In the equation above, $a$ and $b$ are constants. If the equation has no solution, which of the following statements must be true about $a$ and $b$ ?

A) $a \neq 3$ and $b \neq 4$

B) $a = 3$ and $b \neq -4$

C) $a = 3$ and $b = -4$

D) $a = -3$ and $b = 4$

**28**

| Genre | Percent of video game sales |
|---|---|
| Action | 29% |
| Family | 28% |
| Sports | 32% |
| Strategy | 6% |
| Other | 5% |

The table above shows the distribution of genres of video games sold by a gaming company in 2010. If the total number of games sold by the gaming company was 250,000, in how many of the genres were more than 40,000 games sold?

**29**

$$(x-9)(x+3) = -36$$

In the equation above, what is the value of $x+3$ ?

CONTINUE

**Questions 30 and 31 refer to the following information.**

Number of Beach Visitors versus Temperature
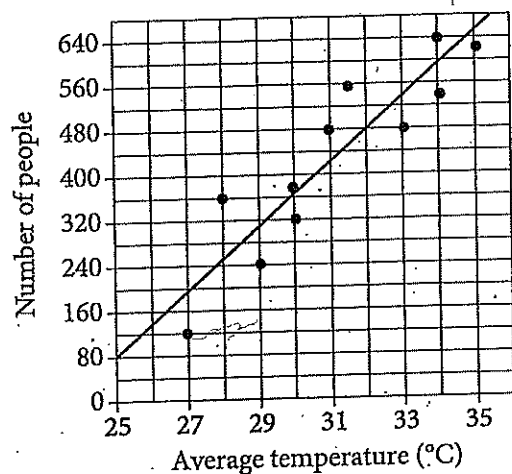


\dot in the scatterplot above represents the temperature and the number of people who visited a beach in Lagos, Nigeria, on one of eleven different days. The line of best fit for the data is also shown.

**30**

According to the line of best fit, what is the number of people, rounded to the nearest 10, predicted to visit this beach on a day with an average temperature of 32°C?

**31**

The line of best fit for the data has a slope of approximately 57. According to this estimate, how many additional people per day are predicted to visit the beach for each 5°C increase in average temperature?

# STOP

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

**1**

Aaron is staying at a hotel that charges $99.95 per night plus tax for a room. A tax of 8% is applied to the room rate, and an additional onetime untaxed fee of $5.00 is charged by the hotel. Which of the following represents Aaron's total charge, in dollars, for staying $x$ nights?

A) $(99.95 + 0.08x) + 5$

B) $1.08(99.95x) + 5$

C) $1.08(99.95x + 5)$

D) $1.08(99.95 + 5)x$

**2**

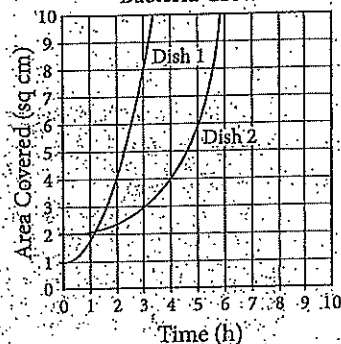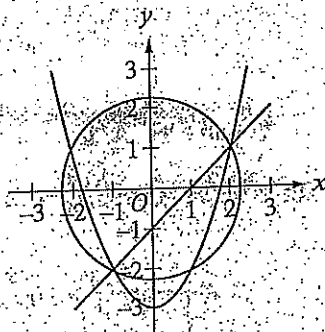Bacteria Growth



A researcher places two colonies of bacteria into two petri dishes that each have an area of 10 square centimeters. After the initial placement of the bacteria ($t = 0$), the researcher measures and records the area covered by the bacteria in each dish every ten minutes. The data for each dish were fit by a smooth curve, as shown in the graph, where each curve represents the area of a dish covered by bacteria as a function of time, in hours. Which of the following is a correct statement about the data above?

A) At time $t = 0$, both dishes are 100% covered by bacteria.

B) At time $t = 0$, bacteria covers 10% of Dish 1 and 20% of Dish 2.

C) At time $t = 0$, Dish 2 is covered with 50% more bacteria than Dish 1.

D) For the first hour, the area covered in Dish 2 is increasing at a higher average rate than the area covered in Dish 1.

**4**



$x^2 + y^2 = 5$

$y = x^2 - 3$

$x - y = 1$

A system of three equations and their graphs in the $xy$-plane are shown above. How many solutions does the system have?

A) One

B) Two

C) Three

D) Four

**5**

If the expression $\dfrac{4x^2}{2x-1}$ is written in the equivalent form $\dfrac{1}{2x-1} + A$, what is $A$ in terms of $x$?

A) $2x + 1$

B) $2x - 1$

C) $4x^2$

D) $4x^2 - 1$

**6**

The table below classifies 103 elements as metal, metalloid, or nonmetal and as solid, liquid, or gas at standard temperature and pressure.

|  | Solids | Liquids | Gases | Total |
|---|---|---|---|---|
| Metals | 77 | 1 | 0 | 78 |
| Metalloids | 7 | 0 | 0 | 7 |
| Nonmetals | 6 | 1 | 11 | 18 |
| Total | 90 | 2 | 11 | 103 |

What fraction of all solids and liquids in the table are metalloids?

**1**

$$\frac{5(k+2)-7}{6} = \frac{13-(4-k)}{9}$$

In the equation above, what is the value of $k$?

A) $\frac{9}{17}$

B) $\frac{9}{13}$

C) $\frac{33}{17}$

D) $\frac{33}{13}$

**2**

$$4x - y = 3y + 7$$
$$x + 8y = 4$$

Based on the system of equations above, what is the value of the product $xy$?

A) $-\frac{3}{2}$

B) $\frac{1}{4}$

C) $\frac{1}{2}$

D) $\frac{11}{9}$

**3**

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

Anise needs to complete a printing job using both of the printers in her office. One of the printers is twice as fast as the other, and together the printers can complete the job in 5 hours. The equation above represents the situation described. Which of the following describes what the expression $\frac{1}{x}$ represents in this equation?

A) The time, in hours, that it takes the slower printer to complete the printing job alone

B) The portion of the job that the slower printer would complete in one hour

C) The portion of the job that the faster printer would complete in two hours

D) The time, in hours, that it takes the slower printer to complete $\frac{1}{5}$ of the printing job

**4**

The graph of $y = (2x - 4)(x - 4)$ is a parabola in the $xy$-plane. In which of the following equivalent expressions do the $x$- and $y$-coordinates of the vertex of the parabola appear as constants or coefficients?

A) $y = 2x^2 - 12x + 16$

B) $y = 2x(x - 6) + 16$

C) $y = 2(x - 3)^2 + (-2)$

D) $y = (x - 2)(2x - 8)$

**5**

If $\frac{1}{2}x + \frac{1}{3}y = 4$, what is the value of $3x + 2y$?

**6**

$$x^2 + y^2 - 6x + 8y = 144$$

The equation of a circle in the $xy$-plane is shown above. What is the *diameter* of the circle?

If $k$ is a positive constant different from 1, which of the following could be the graph of $y - x = k(x + y)$ in the $xy$-plane?

A)



B)



C)



D)
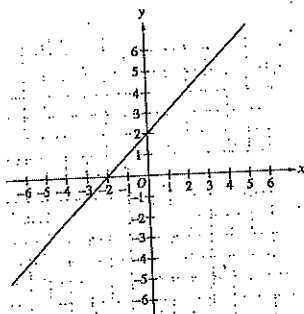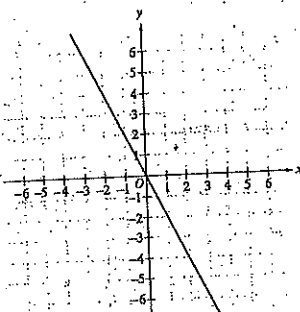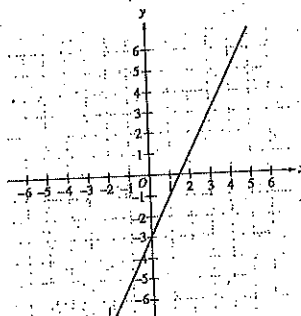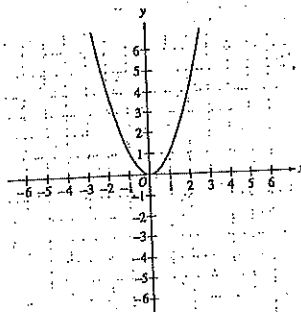
**ISTEP+ Applied Skills Sample for Classroom Use**

1. Melanie is buying professional outfits for her new job. She has $300 budgeted to spend on the new outfits. Pants cost $25 each. Skirts cost $32 each. Blouses cost $28 each. Sales tax in Indiana where she plans to purchase her outfits is 8%.

### Part A

Write an inequality that would represent the number of each item she could purchase including sales tax and still stay within her budget. Be sure to define the variables you are using for your inequality.

**Define the variables:** _____

**Inequality:** _____

### Part B

She plans to purchase at least three pairs of pants, at least two skirts and at least five blouses. She wants to use various combinations of pants, skirts and blouses to make outfits to wear for each day of the week. Can Melanie make her purchase and stay within her budget? Use words, numbers, and/or symbols to justify your answer.

**Show All Work**

**Answer** _____

2. Zach has a basic cell phone plan that does not include texting. He is going to add a multimedia texting package to his cell phone plan. He has two choices of multimedia texting packages, A and B. Package A charges $0.25 per multimedia text with no monthly fees for the multimedia texting package. Package B charges $0.20 per multimedia text, but has a $15 monthly fee for the multimedia texting package.

**Part A**

Write an equation that represents the total cost for each multimedia texting package if any amount of multimedia texts are sent. Be sure to define the variables you are using for your equation.

**Define the variables:** _____

**Package A Equation:** _____

**Package B Equation:** _____

**Part B**

How many multimedia texts will Zach have to send each month for the two multimedia texting packages to be the same cost? Use words, numbers, and/or symbols to justify your answer.

**Show all Work**

**Answer**_____texts

**Part C**

Zach plans to send 250 multimedia texts each month. Which multimedia texting package would be less expensive package for Zach to add to his cell phone plan? Show all work using words, numbers, and/or symbols to justify your answer.

**Show all Work**

**Answer** _____

3. Evan buys a new car that costs $23,740. Anna buys the same new car, only she buys the hybrid model. Anna's hybrid car costs $31,140.

## Part A

Anna pre-pays for gasoline so that the cost for her gasoline will always be $2.40 per gallon forever. Using the graph, which represents a combined city and highway driving annual fuel usage, write an equation that represents the exact cost for any amount of miles she drives. Be sure to define the variables you are using for your equation.

### Fuel Used Per Year by Anna



Graph with y-axis labeled "Gallons of Fuel Used" (marked 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 325) and x-axis labeled "Miles Driven" (marked 1000 through 13000). Points shown: (6000,125) and (12000,250).
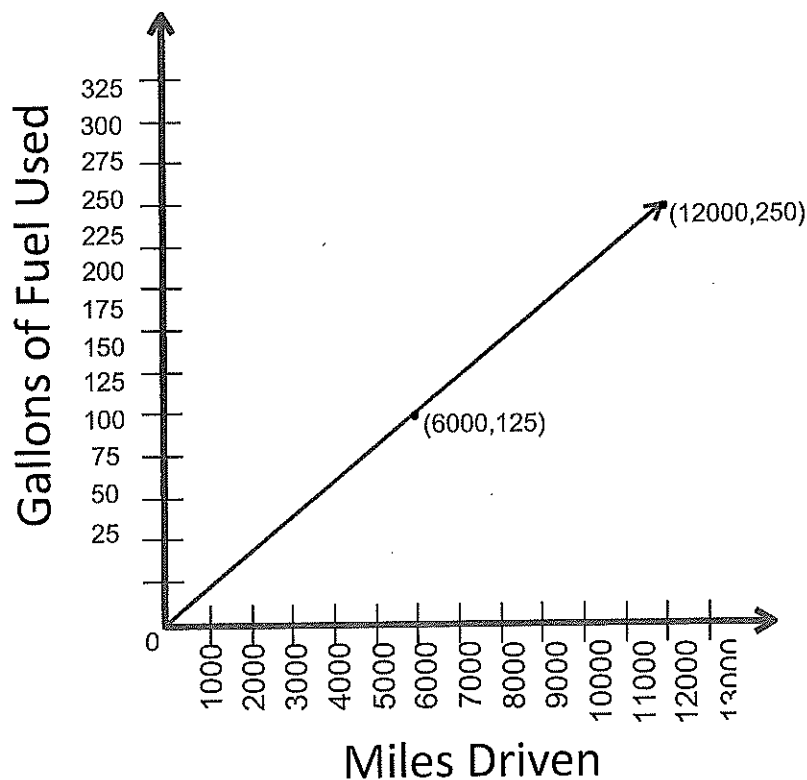
**Define the variables:** _____

**Equation:** _____

**Write the slope in the form of a ratio:** _____

## Part B

Determine the cost for Anna to drive 12,000 miles using her pre-paid gasoline.

**Show All Work**

—

**Answer $ _____**

## Part C

Like Anna, Evan also pre-pays for gasoline so that the cost for gasoline will always be $2.40 per gallon forever. Evan and Anna will each drive an average of 12,000 miles per year. Evan's gasoline car gets a combined city and highway average of 30 miles per gallon. Based on fuel costs only, to the nearest whole number, how many years will it take Anna to recover the cost of the higher purchase price she paid for her hybrid compared to the cost of Evan driving his gasoline car?

**Show All Work**

**Answer_____Years**

## Question 1

1. A physical therapist randomly selected ten patients to complete two physical fitness tests. The patients' scores on each test are shown in the scatterplot.

### Test Score
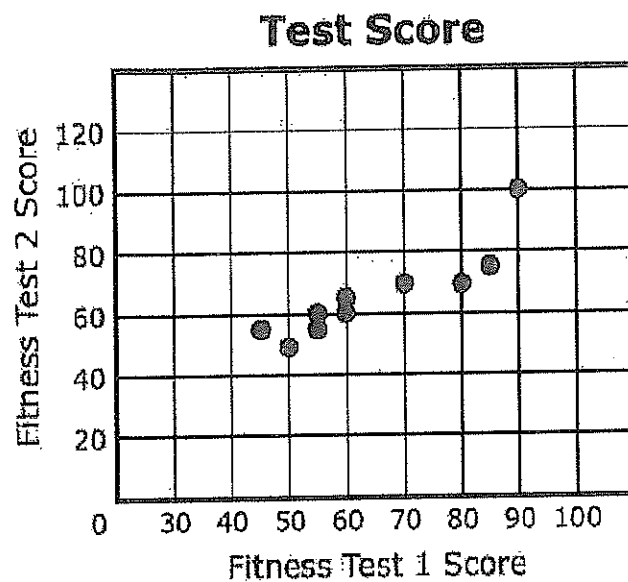


**Part A**

Do the data best represent a linear or a nonlinear association? Use words, numbers, and/or symbols to explain your answer.

_____

_____

_____

_____

Answer _____ association

## Part B

Is there a positive or a negative association represented between the two variables in the scatterplot? Use words, numbers, and/or symbols to explain your answer.

_____

_____

_____

_____

**Answer** _____ association

**Question 2**

2. A rectangle with an area of 104 square inches has a width that is 5 inches less than its length.

   **Part A**

   Write an equation representing the area of the rectangle. Use $x$ to represent the length of the rectangle. Solve your equation for all values of $x$.

   **Show All Work**

   **Part B**

   Use your solution to the equation to identify the width and length of the rectangle. Explain how you determined which value(s) of $x$ to use.

   **Show All Work**

**Constructed-Response**
**Geometry and Measurement**
**Mathematical Process**

**Question 3**

3. The coordinate grid shows the location of a school and a park. Point *K* represents the location of Kim's home, and point *T* represents the location of Tim's home.
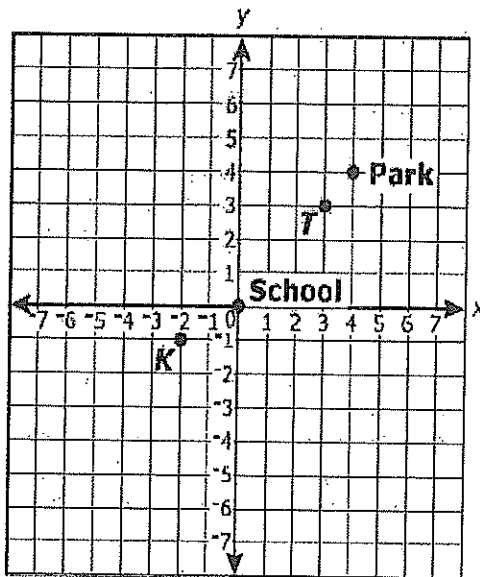


**Part A**

What is the shortest distance between the school and the park on the grid? Round your answer to the nearest tenth of a unit. Use words, numbers, and/or symbols to explain how you found your answer.

_____

_____

_____

_____

**Distance:** _____ units

**Part B**

Tim claims that the distance from the school to the park is the same as the distance from Kim's home to Tim's home. Use words, numbers, and/or symbols to explain whether he is correct.

_____

_____

_____

_____

**Question 4**

4. The table shows the price, P, for renting a car for d days from a car-rental company.

| Number of Days, d | Price, P |
|---|---|
| 1 | $115 |
| 2 | $150 |
| 3 | $185 |
| 4 | $220 |

**Part A**

Construct a linear function that models the relationship between the price, P, and the number of days, d, for which the car is rented. Show the steps that are required in order to construct the model.

**Part B**

What is the slope of the line in Part A? What does it represent in the context of the problem?

**Show All Work**

**Part C**

What is the value of this function when $d = 0$? What does this value represent in the context of the problem?

**Show All Work**

# Algebra I Math Cycle 1

**Question 1 .**

Which of the following describes the number below?

0.9

- **A.** Rational Only
- **B.** Both Rational and Irrational
- **C.** Irrational Only
- **D.** Neither Rational nor Irrational

**Question 2 .**

Which of the rhombuses described below would have a rational area and an irrational perimeter?

- **A.** A rhombus with a side length of 2.5 units and diagonals with lengths of $\sqrt{5}$ units and $\sqrt{20}$ units.

- **B.** A rhombus with a side length of $\sqrt{3}$ units and diagonals with lengths of $\sqrt{3}$ units and $\sqrt{9}$ units.

- **C.** A rhombus with a side length of 5 units and diagonals with lengths of 8 units and 6 units.

- **D.** A rhombus with a side length of $\sqrt{5}$ units and diagonals with lengths of $\sqrt{2}$ units and $\sqrt{18}$ units.

**Question 3 .**

**Directions: Select the correct answer from each drop-down menu.**

Complete the following statements.

The sum of two rational numbers is [ ▼ ] number because adding two rational numbers is equivalent to adding two fractions, which is [ ▼ ] under addition.

The product of two rational numbers is [ ▼ ] number because multiplying two rational numbers is equivalent to multiplying two fractions which is [ ▼ ] under multiplication.

**Question 4 .**

Simplify the following expression.

$$\frac{12a^5b^5c^3}{3a^4b^3c^3}$$

- **A.** $9ab^2$
- **B.** $4ab^2$
- **C.** $4ab^2c$
- **D.** $9ab^2c$

**Question 5 .**

Simplify the following expression.

$$\frac{28m^{36}n^{32}p^{14}}{4m^{18}n^{16}p^7}$$

- **A.** $24m^2n^2p^7$
- **B.** $24m^{18}n^{16}p^7$
- **C.** $7m^2n^2p$
- **D.** $7m^{18}n^{16}p^7$

**Question 6 .**

Rewrite the following expression with each variable appearing only once (at most) and with only positive exponents.

$$\frac{4x^{-2}y^6}{3x^{-5}y^{-6}}$$

- **A.** $\frac{4}{3}x^7$

- **B.** $\frac{4}{3x^3y^{12}}$

- **C.** $\frac{4}{3x^7}$

- **D.** $\frac{4}{3}x^3y^{12}$

**Question 7 .**

Simplify.

$$\left(\frac{2xy^3}{z}\right)^2$$

  A.    $\frac{2x^2y^6}{z^2}$

  B.    $\frac{4x^2y^6}{z^2}$

  C.    $\frac{2x^3y^5}{z^3}$

  D.    $\frac{4x^2y^6}{z}$

**Question 8 .**

Rewrite the following expression with each variable appearing only once and with only positive exponents.

$$\frac{8t^{29}g^{-12}}{24t^{12}g^{12}}$$

  A.    $\frac{1}{3t^{17}g^{24}}$

  B.    $\frac{t^{17}g^{24}}{3}$

  C.    $\frac{g^{24}}{3t^{17}}$

  D.    $\frac{t^{17}}{3g^{24}}$

**Question 9 .**

To which real number subset(s) do the following real numbers belong?

-3, -1, 1, 3, 4

  A.    whole numbers

  B.    natural numbers

  C.    integers and rational numbers

  D.    natural and irrational numbers

**Question 10 .**

$$\{-18, -17, -14, -11, -10, -4, 2\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Natural Numbers
    II. Rational Numbers
    III. Integers
    IV. Whole Numbers
    V. Irrational Numbers

  **A.**  II and III only

  **B.**  I, II, III, and IV only

  **C.**  I, III, and IV only

  **D.**  III only

**Question 11 .**

$$\left\{-\frac{17}{11}, -\frac{6}{11}, -\frac{4}{11}, \frac{1}{11}, \frac{6}{11}, 1, \frac{16}{11}\right\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Natural Numbers
    II. Rational Numbers
    III. Integers
    IV. Whole Numbers
    V. Irrational Numbers

  **A.**  V only

  **B.**  II only

  **C.**  I, II and V only

  **D.**  II and V only

**Question 12 .**

Simplify:

$$36^{\left(\frac{1}{2}\right)}$$

  **A.**  18

  **B.**  12

  **C.**  −72

  **D.**  6

**Question 13 .**

Which of the following shows that $\sqrt{3} = 3^{\frac{1}{2}}$?

A.  $\left(3^{\frac{1}{2}}\right)^2 = 3^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} = 3^{\frac{1 \cdot 1}{2 \cdot 2}} = 3^{\frac{2}{2}} = 3^1 = 3$

B.  $\left(3^{\frac{1}{2}}\right)^2 = 3^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} = 2 \cdot 3^{\frac{1}{2}} = 2 \cdot \frac{1}{2} \cdot 3 = 3$

C.  $\left(3^{\frac{1}{2}}\right)^2 = 3^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} = 3^{\frac{1}{2} + \frac{1}{2}} = 3^{\frac{2}{2}} = 3^1 = 3$

D.  $\left(3^{\frac{1}{2}}\right)^2 = 3^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} = 3 \cdot \left(\frac{1}{2} + \frac{1}{2}\right) = 3^{\frac{2}{2}} = 3$

**Question 14 .**

$$\sqrt{5} = ?$$

A.  $\frac{5}{2}$

B.  $2^{\frac{1}{5}}$

C.  $\frac{1}{5^2}$

D.  $5^{\frac{1}{2}}$

**Question 15 .**

$$(27 \cdot 81)^{\frac{1}{3}}$$

Which of the following is equal to the expression above?

A.  $9$

B.  $27$

C.  $3\sqrt[3]{3}$

D.  $9\sqrt[3]{3}$

**Question 16 .**

### Directions: Drag each expression to the correct location on the table.

$$4^{\frac{1}{4}} \cdot 64^{\frac{5}{4}}$$

Classify each expression as equivalent or not equivalent to the expression above.

$$4^4 \qquad 4^{\frac{15}{4}} \qquad 64^{\frac{4}{3}} \qquad 16 \qquad 256 \qquad 256^{\frac{6}{4}}$$

**Question 17 .**

### Directions: Select the correct answer from each drop-down menu.

Consider the following expression to complete the sentences.

$$7^{\frac{3}{2}}$$

To write $7^{\frac{3}{2}}$ as a radical expression, the [ ▼ ] will be the index of the radical, and the [ ▼ ] will be the exponent of the radical. So, the radical expression will be read as the [ ▼ ] root of [ ▼ ] .

**Question 18 .**

Which expression is equivalent to $\sqrt[7]{8}$ ?

   A.   $8^{\frac{1}{7}}$

   B.   $\frac{7}{8}$

   C.   $\frac{7}{7}$

   D.   $8^7$

**Question 19 .**

Simplify.

$$\sqrt{112}$$

A.   $7\sqrt{4}$

B.   $28\sqrt{4}$

C.   $16\sqrt{7}$

D.   $4\sqrt{7}$

**Question 20 .**

Simplify.

$$\sqrt{847}$$

A.   $121\sqrt{7}$

B.   $7\sqrt{11}$

C.   $77\sqrt{11}$

D.   $11\sqrt{7}$

**Question 21 .**

Simplify the following algebraic expression.

$$\sqrt{675x^{11}}$$

A.   $45|x|^5\sqrt{2x}$

B.   $15|x|^9\sqrt{3}$

C.   $45|x|^9\sqrt{2}$

D.   $15|x|^5\sqrt{3x}$

# Algebra I Math Cycle 2

**Question 1 .**

Factor the following polynomial completely.

$$0.5x^2 - 5x + 8$$

A.   $0.5(x - 2)(x - 8)$

B.   $0.5(x^2 - 10x + 16)$

C.   $0.5(x - 2)(x + 8)$

D.   $-0.5(x^2 + 10x + 16)$

**Question 2 .**

What is the factored form of the following expression?

$$x^2 - 40x + 400$$

A.   $(x + 20)^2$

B.   $(x + 20)(x - 20)$

C.   $20(x - 20)^2$

D.   $(x - 20)^2$

**Question 3 .**

Factor the following expression completely.

$$196x^{10} - x^8$$

A.   $\left(14x^5 - x^4\right)^2$

B.   $x^8(14x - 1)(14x + 1)$

C.   $x^8(14x - 1)^2$

D.   $x^8(196x^2 - 1)$

**Question 4 .**

Richard shot a homemade rocket from a field behind his house. The height of the rocket, in feet, $t$ seconds after it left the ground is shown by the function below.

$$r(t) = -31t^2 + 403t$$

What is the domain of the height function?

A.    $(-\infty, \infty)$

B.    $[0, 13]$

C.    $[0, \infty)$

D.    $[13, \infty)$

**Question 5 .**

**Directions: Select the correct answer from each drop-down menu.**

For a project, Mr. Green's physics students made rockets. During class last week, the students launched their rockets from the bleachers of the school's outdoor football stadium. The bleacher location where Martin launched his rocket was 48 feet off the ground. The height of Martin's rocket in feet, $t$ seconds after launch, is shown by the function below.

$$h(t) = -16t^2 + 88t + 48$$

Fill in the values below for the domain of this height function.

[ [    ▼ ] , [    ▼ ] ]

For this situation, the domain represents the rocket's [        ▼ ] .

**Question 6 .**

**Directions: Select the correct answer from each drop-down menu.**

A clothing company uses the function $f(x) = -2x^2 + 5x + 13$ to model their weekly production cost. The company can produce a maximum of 720 shirts in a seven-day period.

The domain of the function is [     ▼ ] .

In this situation, the domain represents the [        ▼ ] .

**Question 7 .**

Directions: Select all the correct locations on the graph.

The functions $f(x)$ and $g(x)$ are shown.

First, choose the point(s) where $f(x) = 2$. Then, choose the point(s) where $g(x) = 0$. Last, choose the point(s) where $f(x) > g(x)$.

**Question 8 .**

Directions: Select ALL the correct answers.

Given that a function, $f(x)$, has a domain of $-15 \le x \le 45$ and a range of $-65 \le f(x) \le -5$ and that $f(5) = -17$ and $f(-15) = -65$, select each statement that could be true for $f(x)$.

- $f(20) = -10$
- $f(45) = -65$
- $f(5) = -42$
- $f(25) = -10$
- $f(50) = -35$

**Question 9 .**

Directions: Select the correct answer from each drop-down menu.

Let $f(t)$ be the tons of fish, in millions, commercially caught $t$ years after 1950. In the function $f(t)$, the independent variable is [ ▼ ] and the dependent variable is [ ▼ ]. When $f(60) = 63.7$, the 60 represents [ ▼ ] and the 63.7 represents [ ▼ ].

**Question 10 .**

Simplify: $(4x^2 - 2x - 3)(x - 7)$

A.   $4x^3 - 30x^2 + 11x + 21$

B.   $4x^3 - 26x^2 - 17x + 21$

C.   $4x^3 + 26x^2 - 17x - 21$

D.   $4x^3 - 30x^2 + 11x - 21$

**Question 11 .**

Simplify.

$$(8x + 2) + (-3x - 7)$$

A.   $11x + 5$

B.   $5x - 5$

C.   $11x - 9$

D.   $5x + 9$

**Question 12 .**

Simplify the following expression.

$$(7x^2 - 8x - 3) - (4x^2 + 9)$$

A.   $3x^2 - 8x + 12$

B.   $11x^2 - 8x - 6$

C.   $11x^2 - 8x + 12$

D.   $3x^2 - 8x - 12$

**Question 13 .**

The total cost of a plane ride, $C$, is given below as a function of the time flown, $m$, in minutes.
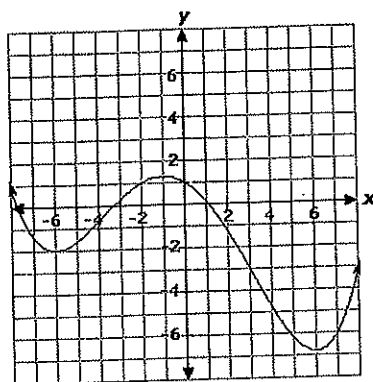
$$C = \$34.00 + \$1.20m$$

If a customer spends $304.00 on a plane ride, how many minutes does the ride last?

A.   375

B.   253

C.   225

D.   282

**Question 14 .**

Which answer correctly describes the function on an interval for the given graph?



   **A.**    The function is decreasing when -1 < x < 8.

   **B.**    The function is increasing when -6 < x < 6.

   **C.**    The function is increasing when -6 < x < 1.

   **D.**    The function is decreasing when -1 < x < 6.

**Question 15 .**
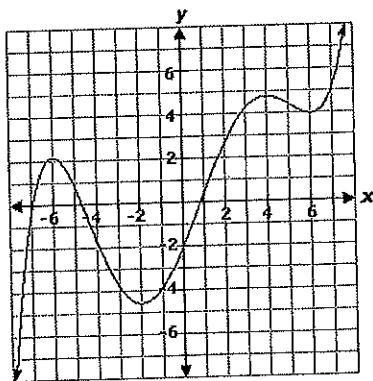
Which answer correctly describes the function on an interval for the given graph?



   **A.**    The function is increasing when -7 < x < -6 and -2 < x < 6.

   **B.**    The function is increasing when -2 < x < 4 and 5 < x < 7.

   **C.**    The function is decreasing when -5 < x < -3 and 4 < x < 7.

   **D.**    The function is decreasing when -6 < x < -2 and 4 < x < 6.

**Question 16 .**

Which graph is increasing when -3 < $x$ < 1 and $x$ > 3 and decreasing for all other values of $x$?
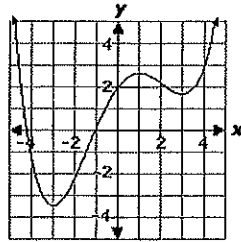


W.
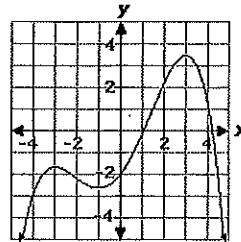
X.
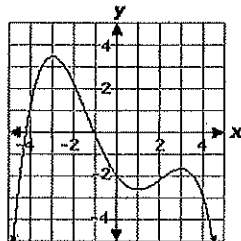
Y.
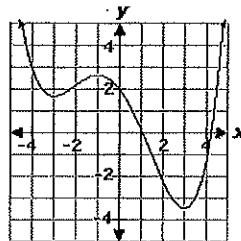
Z.

A.   X

B.   Z

C.   W

D.   Y

**Question 17 .**

Which of the following graphs represent a nonlinear function?
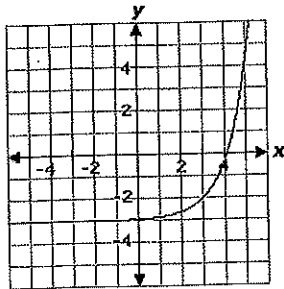


W.
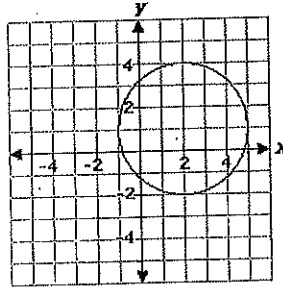
X.
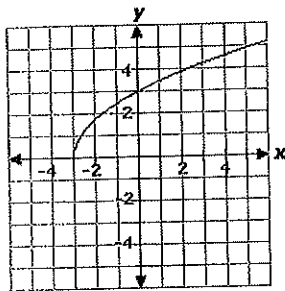
Y.
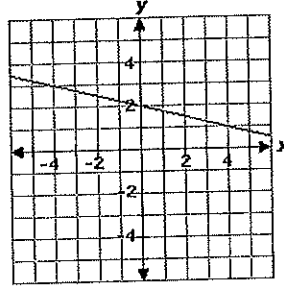
Z.

     **A.**    W and Y

     **B.**    Y, X, and W

     **C.**    W and Z

     **D.**    X, W, and Z

**Question 18 .**

**Directions: Select the correct answer from each drop-down menu.**

Using the graph below, determine the interval where the function is linear and the interval where the function is nonlinear.
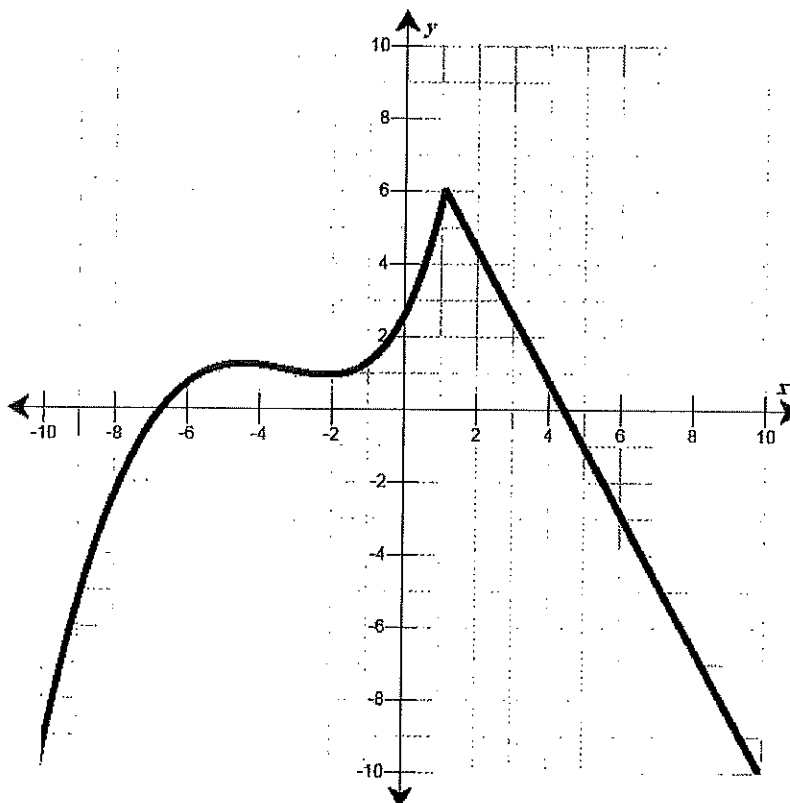


On the graph, the function is linear on the interval [      ▽ ] , and nonlinear on the interval [      ▽ ] .

**Question 19 .**

**Directions: Select the correct answer from each drop-down menu.**

The graph shows the change in Felix's hiking journey over time.

**Felix's Hiking Trail**
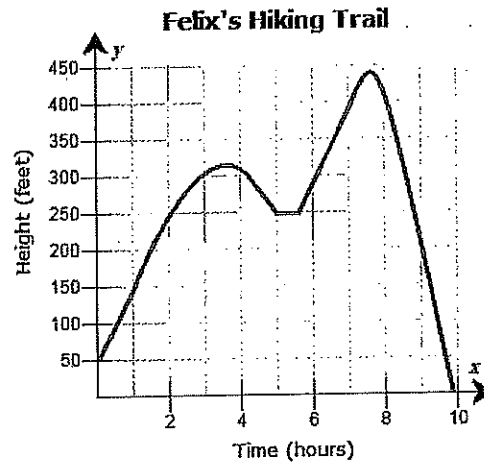


Based on the graph, determine whether each statement is true or false.

Felix's height is ascending at a constant rate during the first hour. ▼

Felix's height is descending at a constant rate between hour 6 and hour 7. ▼

Felix's height is ascending, then descending between hour 2 and hour 5. ▼

Felix's height is descending at a constant rate during the last 3 hours of his hike. ▼

**Question 20 .**

### Directions: Select the correct answer from each drop-down menu.

Match each function below with the correct behavior of the function's associated graph.

*Function A:*

| $x$ | $y$ |
|---|---|
| 0 | 3 |
| 2 | −1 |
| 4 | 4 |
| 6 | 8 |

*Function B:* $y = -2x + 5$
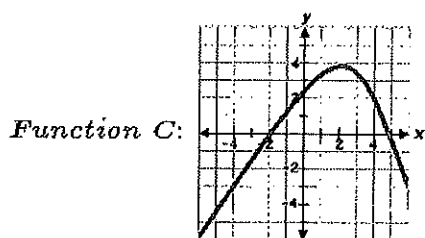
*Function C:*



*Function D:*    *y* is equal to ten less than nine times *x* divided by five

The graph of function [ ▾ ] is decreasing for all values of *x*.

The graph of function [ ▾ ] has an interval of decrease when *x* < 2 and an interval of increase when *x* > 2.

The graph of function [ ▾ ] has an interval of increase when *x* < 2 and an interval of decrease when *x* > 2.

The graph of function [ ▾ ] is increasing for all values of *x*.

**Question 21 .**

A manager at a factory recorded the cumulative number of bolts made during the first 10 days of a month on the following graph.
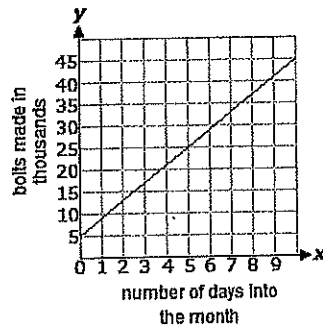


Which of the following would be the best prediction for the value of the independent variable for when a total of 57,000 bolts have been produced?

- **A.** 11 days

- **B.** 14 days

- **C.** 12 days

- **D.** 13 days

**Question 22 .**

Kayla set up an outdoor digital thermometer to record the temperature overnight as part of her science fair project. She began recording the temperature, in degrees Fahrenheit, at 10:00 p.m. Kayla modeled the overnight temperature with function $t$, where $h$ represents the number of hours since 10:00 p.m.

$$t(h) = 0.5h^2 - 5h + 27.5$$
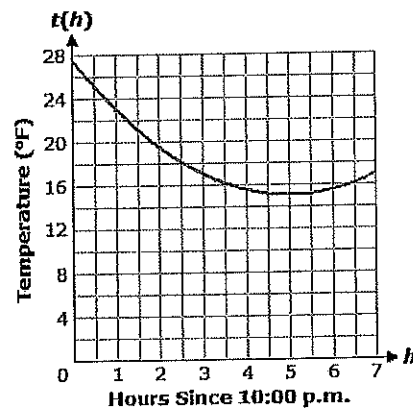


What is the lowest temperature and at what time did it occur?

- **A.** 15°F at 5:00 a.m.

- **B.** 5°F at 3:00 a.m.

- **C.** 5°F at 5:00 a.m.

- **D.** 15°F at 3:00 a.m.

# Algebra I Math Cycle 3

**Question 1 .**

Heather had to collect insects for her biology project. She was able to collect 150 total insects.

She collected 5 times as many insects that could fly as insects that couldn't fly.

How many flying insects did she catch for her project?

- **A.** 30
- **B.** 126
- **C.** 125
- **D.** 25

**Question 2 .**

Solve the following algebraic proportion.

$$\frac{12x + 12}{12 - 6x} = \frac{3}{2}$$

- **A.** $x = \frac{7}{2}$
- **B.** $x = -\frac{2}{7}$
- **C.** $x = -\frac{7}{2}$
- **D.** $x = \frac{2}{7}$

**Question 3 .**

Solve for *n*.

$$\frac{45}{n \times 5} = \frac{15}{35}$$

- **A.** $n = 7$

- **B.** $n = 15$

- **C.** $n = 105$

- **D.** $n = 21$

**Question 4 .**

| x | y |
|---|---|
| 0 | 2 |
| 7 | 6 |
| 14 | 10 |

Which of the following linear equations corresponds to the table above?

A. $y = \frac{7}{4}x - 2$

B. $y = \frac{4}{7}x + 2$

C. $y = \frac{7}{4}x + 2$

D. $y = \frac{4}{7}x - 2$

**Question 5 .**

Which of the following tables corresponds to the equation below?

$$y = \tfrac{3}{7}x + 1$$

A.

| x | 0 | 7 | 14 |
|---|---|---|----|
| y | 1 | 5 | 9  |

B.

| x | 0  | 7 | 14 |
|---|----|---|----|
| y | -1 | 2 | 5  |

C.

| x | 0 | 7 | 14 |
|---|---|---|----|
| y | 1 | 4 | 7  |

D.

| x | 0  | 7 | 14 |
|---|----|---|----|
| y | -1 | 3 | 7  |

**Question 6 .**

$$y = -\tfrac{2}{5}x + 2$$

Which of the following graphs represents the equation above?
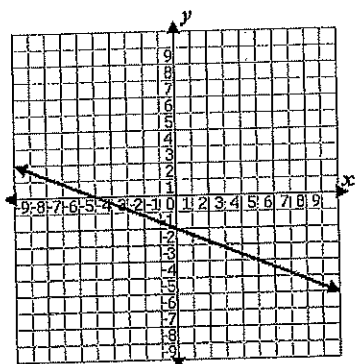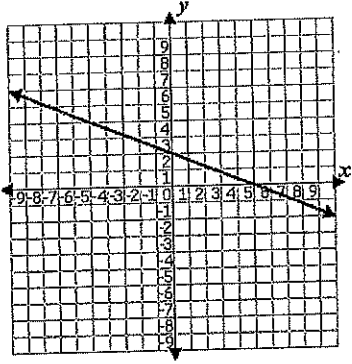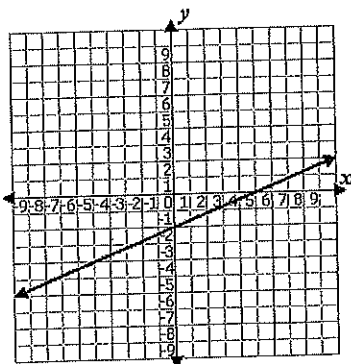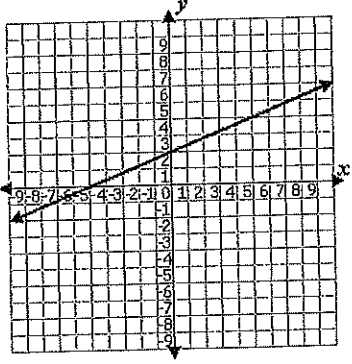


W.



X.



Y.



Z.

**A.  X**

- **B.** Z

- **C.** Y

- **D.** W

**Question 7 .**

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

Which of the following graphs represents the equation above?



**W.**



**X.**



**Y.**



**Z.**

.. **A.** X
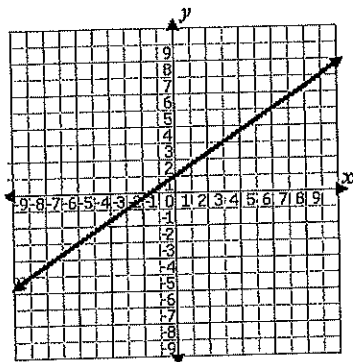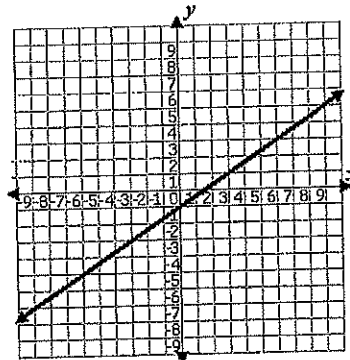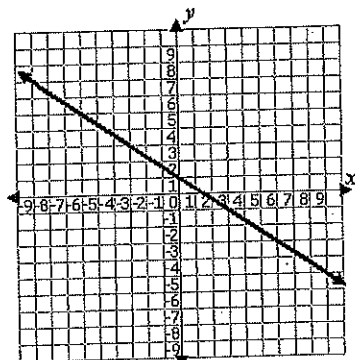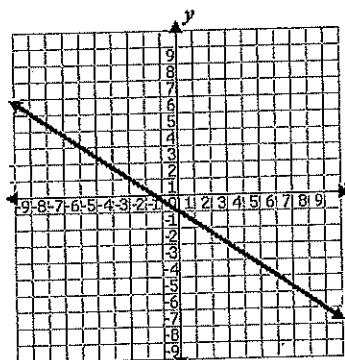
- **B.** W

- **C.** Y

- **D.** Z

**Question 8 .**

Given (5,-24) is a point on the following line, convert the equation to point-slope form.

$$12x + 2y = 12$$

- **A.** $y + 24 = -12(x - 5)$
- **B.** $y - 24 = -12(x - 5)$
- **C.** $y + 24 = -6(x - 5)$
- **D.** $y - 24 = -6(x - 5)$

**Question 9 .**

Given (7,-6) is a point on the following line, convert the equation to point-slope form.

$$4x + 7y = 10$$

A. $y + 6 = 4(x - 7)$

B. $y + 6 = -\frac{4}{7}(x - 7)$

C. $y - 6 = -\frac{4}{7}(x - 7)$

D. $y - 6 = -\frac{7}{4}(x - 7)$

**Question 10 .**

Convert the following linear equation to standard form.

$$y - 3 = -\frac{5}{4}(x - 8)$$

A. $\frac{5}{4}x + y = 13$

B. $-5x - 4y = 52$

C. $5x + 4y = 52$

D. $\frac{5}{4}x + y = -5$

**Question 11 .**

Convert the following linear equation to slope—intercept form.

$$6x - 5y = -9$$

A.   $y = \frac{6}{5}x + \frac{9}{5}$

B.   $y = \frac{6}{5}x - \frac{9}{5}$

C.   $y = -\frac{6}{5}x - \frac{9}{5}$

D.   $y = -\frac{6}{5}x + \frac{9}{5}$

**Question 12 .**

Laura retired from her job recently, and she has saved about $346,866.00 over the course of her career. She plans to withdraw $1,346.00 each month to pay for living expenses. After a certain amount of time, the balance in Laura's account is $301,102.00. How many months have passed since Laura retired?

A.   120

B.   30

C.   34

D.   37

**Question 13 .**

Solve for x.

$$3x + \frac{x + 4}{5} = 5$$

A. $x = \frac{1}{4}$

B. $x = \frac{5}{4}$

C. $x = \frac{21}{16}$

D. $x = -1$

**Question 14 .**

Solve for *x*.

$$\frac{x}{3} - \frac{x+5}{7} = 2$$

A.  $x = \frac{21}{2}$

B.  $x = \frac{57}{7}$

C.  $x = \frac{57}{4}$

D.  $x = 9$

**Question 15 .**

John is trying to solve the following equation.

$$\tfrac{1}{4}(8x + 4) = 7x$$

Explain and justify the first step John could use to solve the equation.

- **A.** John could divide the 8x by 4 to eliminate the need for the set of parenthesis.

- **B.** John could multiply each side of the equation by 4 to keep the equation balanced and to simplify the equation.

- **C.** John could subtract 7x from the right side of the equation in order to combine like terms.

- **D.** John could subtract 4 from the right side of the equation to isolate the variable on the left side.

**Question 16 .**

Carly is comparing cell phone rate plans. Each plan has an initial monthly charge plus cost per minute.

What are the initial monthly charges for plans A and B?
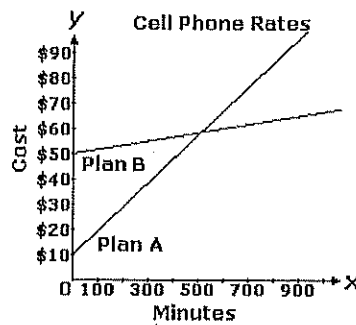


A.   Plan A has an initial monthly charge of $10. Plan B has an initial monthly charge of $50.

B.   Both Plan A and Plan B have an initial monthly charge of $50.

C.   Plan A has an initial monthly charge of $5. Plan B has an initial monthly charge of $40.

D.   Plan A has an initial monthly charge of $50. Plan B has an initial monthly charge of $10.

**Question 17 .**

**Directions: Select all the correct answers.**

Lana has a $20.00 gift card that she can use to purchase songs to download to her computer. If each song costs $1.25, which equation(s) and graph(s) would represent the gift card balance, $B$, after Lana purchases $n$ songs using her gift card?



$B = 20n - 1.25$



$B = 20 - 1.25n$ .

$B$
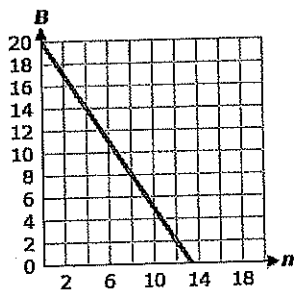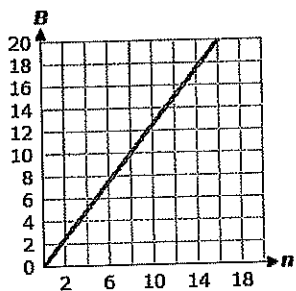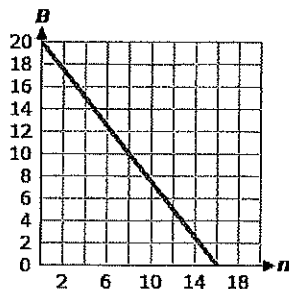


$B = 1.25n - 20$

## Question 18 .

A laundromat has a wash-and-fold service for a monthly fee of $28.00. The laundromat will wash and fold clothes at $0.70 per pound for those customers with a laundry service. One customer paid $43.40 total for the month.

Which equation can be used to determine the pounds of laundry the customer brought in to be washed and folded that month?

A.  $0.70x + 28.00 = 43.40$

B.  $0.70x + 43.40 = 28.00$

C.  $43.40 + 28.00 = 0.70x$

D.  $28.00 - 0.70x = 43.40$

**Question 19 .**

Macy babysits the children in her neighborhood. For each family, she charges a flat fee plus a per hour charge as described by the data in the table.

| Babysitting Pricing | | | | |
|---|---|---|---|---|
| Number of Hours | 5 | 6 | 12 | 18 |
| Total Charged | 52 | 61 | 115 | 169 |

Which equation represents the total amount Macy charges for each family where $x$ represents the number of hours she babysits?

A. $y = x + 9$

B. $y = 13x + 117$

C. $y = 9x + 7$

D. $y = x + 44$

**Question 20 .**

The city of Cartesianville is sponsoring an event to collect food for those in need in their community. A local church has already donated 348 pounds of food. The event is expecting 161 attendees. Based on the inequality below, how many pounds of food, $f$, should each attendee donate in order to collect at least 831 pounds of food?

$$348 + 161f \geq 831$$

**A.** $f \geq 6$

**B.** $f \geq 3$

**C.** $f \geq 7$

**D.** $f \geq 10$

**Question 21 .**

Solve the inequality below for $q$.

$$-4q - 9 > -6q + 5$$

**A.** $q < -\frac{7}{5}$

**B.** $q > 7$

**C.** $q < 7$

**D.** $q > -\frac{7}{5}$

**Question 22 .**

Cassie received a 20%-off coupon and a $5.00-off coupon from a department store. She visits the department store during a tax-free sale and plans to spend no more than $49.40. She also plans to use both of the coupons she received on her purchase. If this situation is modeled by the inequality below, what must be the original purchase total, $x$, before the discounts are applied?

$$0.8x - \$5.00 \leq \$49.40$$

    **A.**   $x \leq \$56.75$

    **B.**   $x \leq \$68.00$

    **C.**   $x \leq \$54.40$

    **D.**   $x \leq \$55.50$

**Question 23 .**

**Directions: Select the correct answer from each drop-down menu.**

The following statement describes the number of marbles, $n$, in a bag.

Ten less than eight times the number of marbles is greater than or equal to the sum of six times the number of marbles and fourteen.

Create an inequality to represent this statement, and solve for $n$. Then, complete the following sentences about the solution.

To graph the solution of the inequality on a horizontal number line, first place
[ ▾ ] . Then, shade the number line to the [ ▾ ] .

The solution inequality represents that the number of marbles in the bag is [ ▾ ]
[ ▾ ] .

# Algebra I Math Cycle 4

**Question 1 .**

Given the following formula, solve for *r*.

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

  A.   $r = \frac{A - P}{Pt}$

  B.   $r = \frac{A - P}{t}$

  C.   $r = \frac{A - 1}{Pt}$

  D.   $r = \frac{A - 1}{t}$

**Question 2 .**

Given the following formula, solve for *w*.

$$S = 2lw + 2lh + 2wh$$

  A.   $w = \frac{S}{2l + 2lh + 2h}$

  B.   $w = \frac{2(S - 2lh)}{l + h}$

  C.   $w = \frac{S + 2lh}{2l + 2h}$

  D.   $w = \frac{S - 2lh}{2l + 2h}$

**Question 3 .**

The area of a trapezoid is given by the formula below, where *h* is the height of the trapezoid and $b_1$ and $b_2$ are the lengths of its bases.

$$A = \tfrac{1}{2}h(b_1 + b_2)$$

A trapezoid has a height of 7 in, one base that is 6 in long, and an area of 87.5 sq in. What is the length of the trapezoid's other base?

  A.   2.1 in

  B.   19 in

  C.   24.1 in

  D.   6.5 in

**Question 4 .**

### Directions: Select all the correct answers.

The formula for the volume, $V$, of a right cone is one-third of pi times its radius, $r$, squared, times its height, $h$.

Which of the equations below are equivalent to the formula described above?

$\quad r = \sqrt{\frac{V}{3\pi h}}$

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

$\quad r = \sqrt{\frac{\pi h}{3V}}$

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

$\quad r = \sqrt{\frac{3V}{\pi h}}$

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

**Question 5 .**

### Directions: Select all the correct answers.

The value of $m$ is equal to three times $n$ divided by the difference of $4p$ and $5n$.

Which of the equations below is equivalent to the equation described above?

$\quad p = \frac{3n - 5mn}{4m}$

$\quad n = \frac{4mp}{3 - 5m}$

$\quad n = \frac{4mp}{3m + 5}$

$\quad p = \frac{3mn + 5n}{4m}$

$\quad p = \frac{3n + 5mn}{4m}$

$\quad n = \frac{4mp}{3 + 5m}$

**Question 6 .**

Given the following formula, solve for $r$.

$$C = 2\pi r$$

A. $\quad r = \frac{C - \pi}{2}$

B. $\quad r = C - 2\pi$

C. $\quad r = 2\pi C$

D. $\quad r = \frac{C}{2\pi}$

**Question 7 .**

Given the following formula, solve for $l$.

$$P = 2(l + b)$$

A.   $l = \dfrac{P - l}{2}$

B.   $l = \dfrac{P - 2b}{2}$

C.   $l = \dfrac{P - l}{4}$

D.   $l = 4(P + b)$

**Question 8 .**

Solve the following inequalities.

$$80 < 10(x + 3) < 230$$

A.   $5 < x < 26$

B.   $11 < x < 26$

C.   $11 < x < 20$

D.   $5 < x < 20$

**Question 9 .**

**Directions: Use the drawing tool(s) to form the correct answers on the provided number line.**

Yeast, a key ingredient in bread, thrives within the temperature range of 90°F to 95°F. Write and graph an inequality that represents the temperatures where yeast will NOT thrive.

**Question 10 .**

**Directions: Use the drawing tool(s) to form the correct answer on the provided number line.**

A rectangle with a width of 30 cm has a perimeter from 100 cm to 160 cm. Graph a compound inequality that shows the possible lengths of the rectangle.

| Drawing Tools | | ◀ Click on a tool to begin drawing. | Delete | Undo | Reset |
|---|---|---|---|---|---|
| Select | ⚲ | | | | |
| Point | ● | | | | |
| Open Point | ○ | | | | |
| Line Segment | ✐ | | | | |
| Ray | ✐ | | | | |

◀———┼———┼———┼———┼———┼———┼———┼———┼———┼———┼———▶
    0    10   20   30   40   50   60   70   80   90   100
                          Length (cm)

**Question 11 .**

Solve the following compound inequality.

$$5x - 1 > -1 \text{ OR } -4x \leq -24$$

   **A.**   $0 < x \leq 6$

   **B.**   $x > 0$

   **C.**   $x < 0 \text{ OR } x \geq 6$

   **D.**   $x \geq 6$

**Question 12 .**

Which of the following compound inequalities is graphed below?

◀———————●        ●———————▶
  -3  -2  -1  0   1   2   3   4   5   6   7   8   9
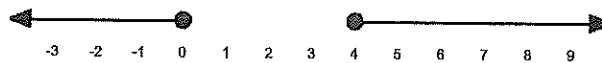
   **A.**   $x \leq 0 \text{ AND } x \geq 4$

   **B.**   $x < 0 \text{ AND } x > 4$

   **C.**   $x < 0 \text{ OR } x > 4$

   **D.**   $x \leq 0 \text{ OR } x \geq 4$

**Question 13 .**

Which of the following absolute value equations fits the given graph?
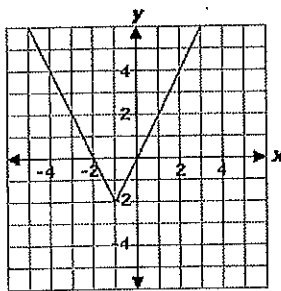


- A.   $y = -2|x + 1| - 2$
- B.   $y = 2|x - 1| - 2$
- C.   $y = 2|x + 1| - 2$
- D.   $y = \frac{1}{2}|x - 1| - 2$

**Question 14 .**

**Directions: Use the drawing tool(s) to form the correct answer on the provided graph.**

Graph the following function.

$$f(x) = |x - 5| - 2$$

| Drawing Tools | ◀ Click on a tool to begin drawing. | ❮ Delete | Undo | Reset |
|---|---|---|---|---|
| Select | | | | |
| Ray | | | | |
| Line | | | | |
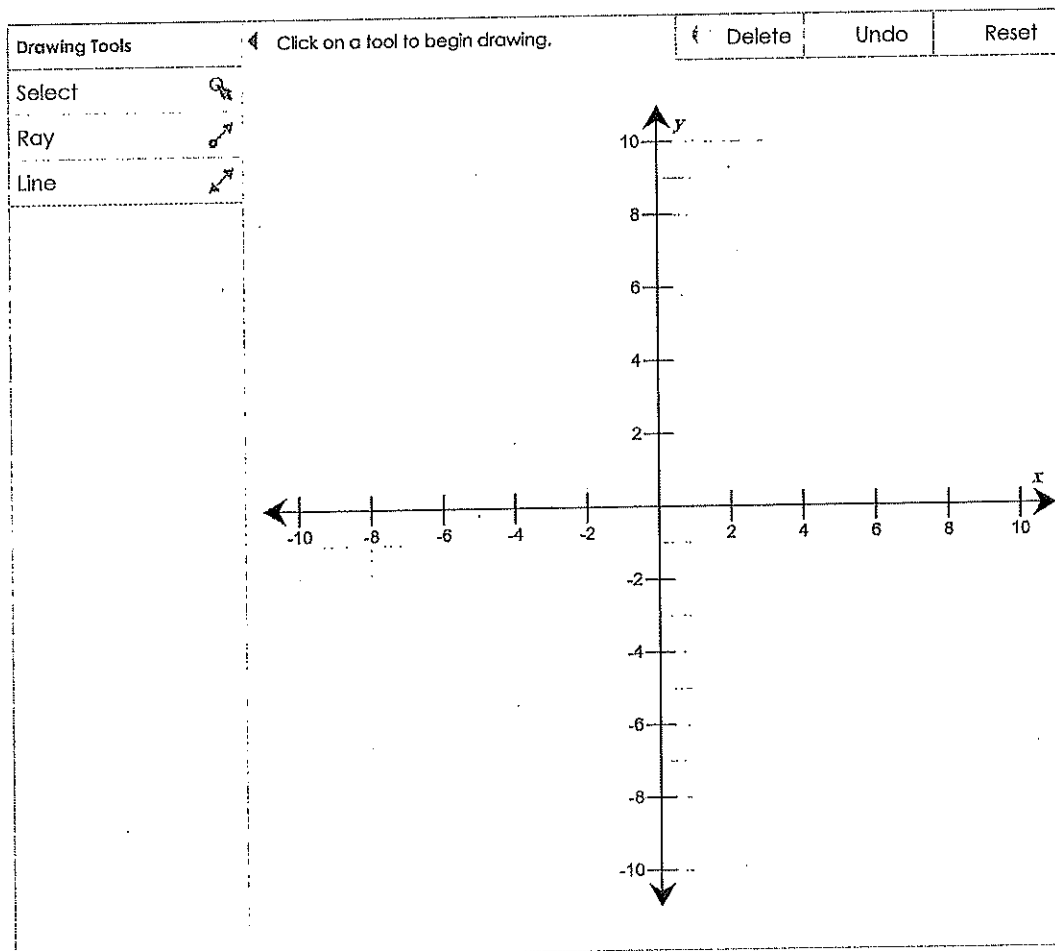
**Question 15 .**

Sarah is planning a party for her friends and has a budget of $40.00 for food. At the party, she wants to serve pizza and soda. One pizza costs $8.00, and one bottle of soda costs $2.00.

Which of the following graphs represents the number of pizzas and sodas that Sarah can purchase?
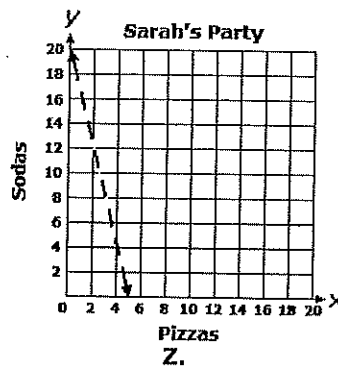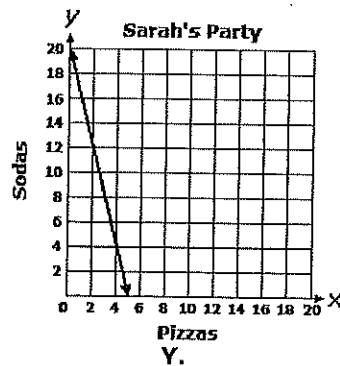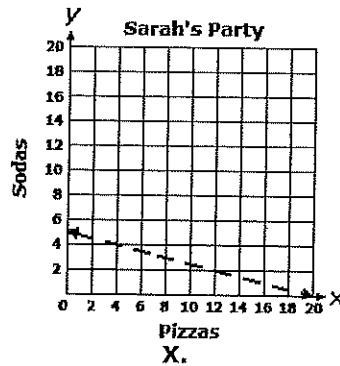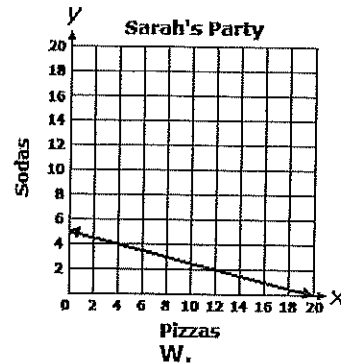


- **A.**   X
- **B.**   Z
- **C.**   W
- **D.**   Y

**Question 16 .**

Jeffrey is working over the summer to earn enough money to purchase a used car at the end of July. He needs to have at least $y$ dollars to purchase the car. He earns $10.50 per hour at his job. At the end of June, he had already earned $1,680. If $x$ represents the number of hours he works in July, which of the following inequalities represents this situation?

- **A.**   $\$10.50 + \$1,680x \leq y$
- **B.**   $\$10.50 + \$1,680x \geq y$
- **C.**   $\$1,680 + \$10.50x \geq y$
- **D.**   $\$1,680 + \$10.50x \leq y$

**Question 17 .**

**Directions: Use the drawing tool(s) to form the correct answer on the provided graph.**

Plot a point that represents an ordered pair that is part of the solution set of the following inequality.

$$2x + 5y > 25$$
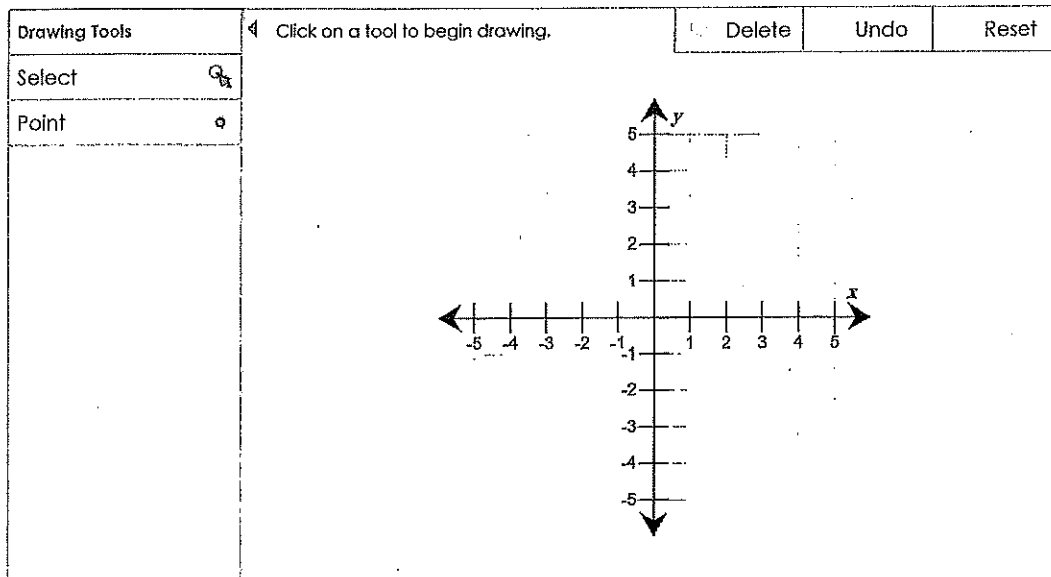
| Drawing Tools | ◁ Click on a tool to begin drawing. | Delete | Undo | Reset |
|---|---|---|---|---|
| Select | | | | |
| Point | | | | |



**Question 18 .**

**Directions: Use the drawing tool(s) to form the correct answers on the provided graph.**

Blake received a gift certificate for $30 to her local movie theater. Matinees are $4.50 each and evening shows are $7.50 each.

Graph the inequality that models the situation. Let *x* be equal to the number of matinee tickets and *y* be equal to the number of evening tickets.

Plot a point that represents a possible combination of tickets Blake can purchase without spending the entire gift certificate. Assume that Blake purchases at least one ticket.

| Drawing Tools | ◁ Click on a tool to begin drawing. | Delete | Undo | Reset |
|---|---|---|---|---|
| Select | | | | |
| Point | | | | |
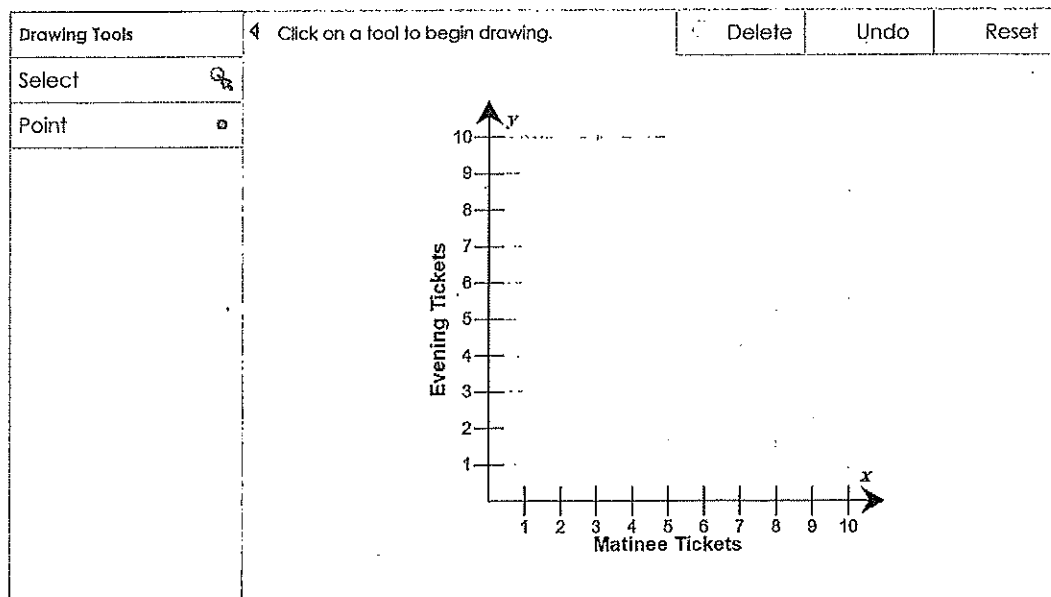
**Question 19 .**

Mrs. Brown has a reward program in her classroom for students who have perfect or good weekly conduct. Each student that earns perfect conduct for a week gets three gold stars, and each student that earns good conduct for a week gets two gold stars. At the end of each six-weeks, Mrs. Brown provides breakfast for all students that have earned more than 12 gold stars.

Which of the following graphs represents the number of perfect conduct weeks and good conduct weeks students need?



**W.**

**X.**

**Y.**

**Z.**
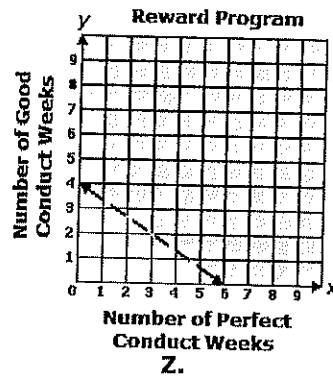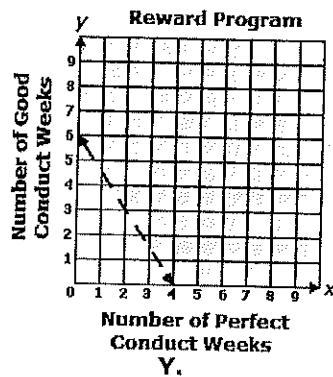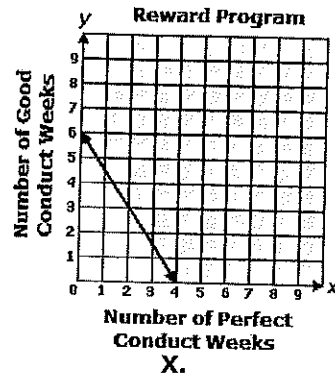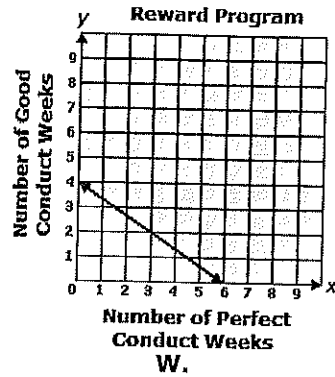
A. X

B. Z

C. Y

D. W

# Algebra I Math Cycle 5

**Question 1.**

**Directions: Select all the correct answers.**

Patricia works at a grocery store part time and earns $9 per hour. In addition to working at the grocery store, she tutors middle school students and earns $15 per hour. Her grocery store job requires her to work more than twice the number of hours she tutors. If Patricia wants to earn more than $500 total from both jobs this week, which inequalities can be used to find the number of hours, $g$, she should work at the grocery store and the number of hours, $t$, she should tutor?

- $15g + 9t > 500$
- $g \geq 2t$
- $g > 2t$
- $9g + 15t \geq 500$
- $9g + 15t > 500$
- $2g > t$

**Question 2.**

**Directions: Select the correct location on the graph.**

Jenna is making bracelets and necklaces to sell to raise money for the field trip her class is taking next month. If she raises more than the $108 required to go on the field trip, she will donate the additional money raised to the local animal shelter. She is selling each bracelet for $6 and each necklace for $9. She is hoping to sell at least 16 total bracelets and necklaces.

Let $b$ represent the number of bracelets she sells, and let $n$ represent the number of necklaces she sells.

The two lines and the four sections on the graph below represent the constraints of this situation. Which arrow points to the solution region for the system of inequalities modeled by this situation?

**Question 3 .**

**Directions: Select all the correct locations on the graph.**

A school is selling tickets to their Spring theater production.  Student tickets cost $6 each and non-student tickets cost $9 each.  There are a total of 250 seats available in the auditorium where the production will be held, and there are two different show times that people can choose to attend.  The school is hoping to sell enough tickets to raise at least $2,700 for the theater department.
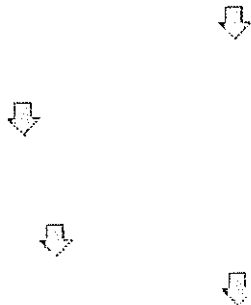
Let *s* represent the number of student tickets sold and let *n* represent the number of non-student tickets sold.

Which points on the graph would lie within the solution region for the system of inequalities modeled by this situation?

**Question 4 .**

**Directions: Select the correct answer from each drop-down menu.**

Felix is selling hats and T-shirts to raise money to pay for his summer camp registration, and he will use any additional money he raises as spending money while at camp. He plans to sell each hat for $8 and each T-shirt for $12. In order to pay for his summer camp registration, Felix must raise at least $288, and he wants to sell at least 32 hats and T-shirts altogether.

Let $h$ represent the number of hats Felix sells, and let $t$ represent the number of T-shirts he sells.

One of the graphs below shows the system of inequalities that represents this situation, with it's solution region shaded in.
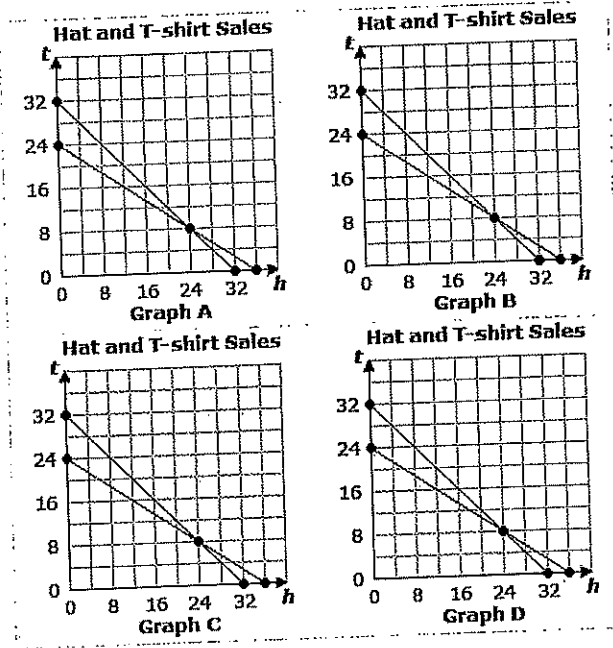


Answer the following questions.

Which graph shows the system of inequalities that represents this situation with the solution region shaded in? [ ▼ ]

If Felix sells 28 hats and 5 T-shirts, is it enough to cover the cost of his summer camp registration?

[ ▼ ]

**Question 5 .**

Sydney needs to earn $35 so she can buy her father a birthday present. Her mom said she can make $6 per hour cleaning around the house and $5 per hour raking leaves. There are 6 hours available before Sydney's father's birthday party where she can either clean or rake leaves.

Which system of equations can be used to find how many hours Sydney should spend cleaning and raking leaves so that she will earn exactly enough money to buy her father a birthday present? Let $x$ represent the number of hours spent cleaning and $y$ represent the number of hours spent raking leaves.

A.  $6x + 5y + 6 = 0$
    $x + y + 35 = 0$

B.  $x + 5y + 35 = 0$
    $6x + y + 6 = 0$

C.  $6x + 5y - 6 = 0$
    $x + y - 35 = 0$

D.  $6x + 5y - 35 = 0$
    $x + y - 6 = 0$

**Question 6 .**

James takes 75 minutes to complete a writing assignment, and 15 minutes to complete a science assignment. James is required to spend more than 300 minutes on his assignments. According to his schedule, he can complete at most 20 assignments this week.

Which system of inequalities can be used to determine the number of writing assignments ($w$) and the number of science assignments ($s$) James can complete this week?

A.  $75w + 15s \geq 300$
    $w + s \geq 20$

B.  $15w + 75s < 300$
    $w + s \leq 20$

C.  $15w + 75s > 300$
    $w + s \leq 20$

D.  $75w + 15s > 300$
    $w + s \leq 20$

**Question 7 .**

Jonah is going to the store to buy candles. Small candles cost $3.50 and large candles cost $5.00. He needs to buy at least 20 candles, and he cannot spend more than $80.

Which system of inequalities can be used to determine the number of small candles ($s$) and the number of large candles ($l$) Jonah can buy?

A. $$s + l \leq 20$$
$$3.5s + 5l \leq 80$$

B. $$s + l \geq 20$$
$$3.5s + 5l \leq 80$$

C. $$s + l \geq 20$$
$$5s + 3.5l \leq 80$$

D. $$s + l \leq 20$$
$$5s + 3.5l \leq 80$$

**Question 8 .**

Ella is cooking a turkey and a ham. It takes 15 minutes per pound to cook a turkey and 23 minutes per pound to cook a ham.

Ella is able to cook the turkey and the ham in 5 hours and 18 minutes. If the turkey weighs twice as much as the ham, how much do the turkey and the ham weigh?

A. The turkey weighs 6 pounds, and the ham weighs 6 pounds.

B. The turkey weighs 24 pounds, and the ham weighs 12 pounds.

C. The turkey weighs 6 pounds, and the ham weighs 12 pounds.

D. The turkey weighs 12 pounds, and the ham weighs 6 pounds.

**Question 9 .**

Kevin and his friends are at a baseball game. Kevin decides to buy sandwiches and bottled water for his friends. Each sandwich costs $4.77, and each bottle of water costs $1.66. Kevin spends a total of $40.03 on sandwiches and water for his friends, and he purchases three more sandwiches than bottles of water.

Create a system of equations to model the situation above, and use it to determine if the solution of the system is viable.

- **A.** Kevin purchases seven sandwiches and four bottles of water; therefore, the solution is viable for the given situation.

- **B.** Kevin purchases four sandwiches and seven bottles of water; therefore, the solution is viable for the given situation.

- **C.** Kevin cannot purchase a negative number of bottles of water; therefore, the solution is not viable for the given situation.

- **D.** Kevin cannot purchase a negative number of sandwiches; therefore, the solution is not viable for the given situation.

**Question 10 .**

**Directions: Drag each number and phrase to the correct location on the table. Each number can be used more than once, but not all phrases will be used.**

Jason and Shawn both begin riding their bikes from different points away from the ranger station. They both ride their bikes in the direction away from the station along the same trail.

Jason starts biking 1 mile away from the station. Jason rides at a constant speed of 20 miles per hour.

Shawn starts biking 2 miles away from the station. Shawn rides at the same constant speed as Jason.

Let $y$ represent the total miles away from the station.

At how many hours, $x$, will it take Shawn to catch up with Jason?

Based on the information provided, complete each expression below and determine the number of solutions.

| 20 | No Solution | 1 | One Solution | Many Solutions | 2 | 17 | 27 |

| 3 | 0 |

**Question 11 .**

**Directions: Select the correct answer from each drop-down menu.**

Andrew planted a tree and Joseph planted a seed in their backyard. The growth of Andrew's tree is represented by the graph shown.

**Tree Growth Over Years**
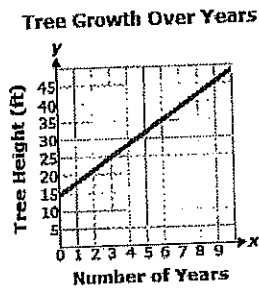


Joseph's seed became a tree that grew 17 feet every 2 years since it was planted. Graph the growth of the tree Joseph planted. Then, determine how many years it takes for the two trees to be the same height. Round to the nearest whole number.

Approximately [ ▼ ] years after Joseph tree was planted, both trees will be the same height of approximately [ ▼ ] feet.

**Question 12 .**

**Directions: Select ALL the correct answers.**

Select all the statements that are true for the following systems of equations.

| System A | System B | System C |
|---|---|---|
| $y = 4x - 6$ | $y = 4x - 6$ | $y = 4x + 3$ |
| $y = -2x + 1$ | $2y = -4x + 2$ | $y = -2x + 1$ |

☐ Systems A and B have the same solution.

☐ System B simplifies to $y = 4x - 6$ and $y = -2x + 1$ by dividing the second equation by two.

☐ Systems B and C have the same solution.

☐ All three systems have different solutions.

☐ Systems A and C have different solutions.

**Question 13 .**

**Directions: Use the drawing tool(s) to form the correct answer on the provided graph.**

Four students are participating in a school fundraiser selling candy. Each student's total sales, in dollars, $p$, can be determined with the following equations, where $t$ represents the number of hours they sold candy.

$$\text{Tony: } p = 12.50t$$

$$\text{Alicia: } p = 25 + 25t$$

$$\text{Bobby: } p = \frac{25}{3}t + 50$$

$$\text{Karen: } p = \frac{25}{4}t + 100$$

Plot the point on the graph that represents when Tony and Karen will earn the same amount in candy sales.
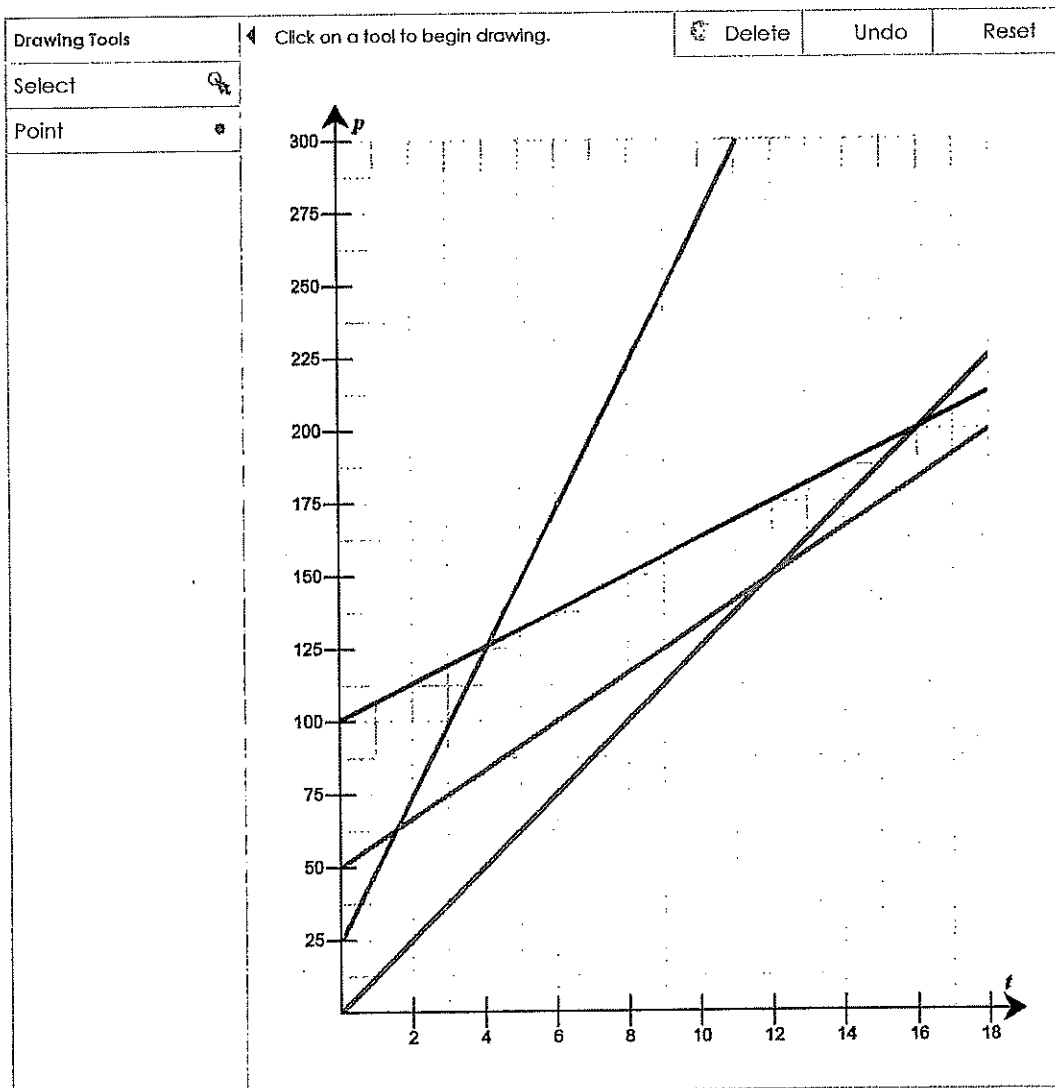
**Question 14 .**

**Directions: Select the correct answer from each drop-down menu.**

A system of equations and its solution are given below.

$$x - y = 7$$

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

Solution: $(2, -5)$

Complete the sentences to explain what steps were followed to obtain the equation below.

$$6x = 12$$

The [ ▼ ] equation was multiplied by [ ▼ ], and the equations were added. The solution will be [ ▼ ] if this system is solved using a different method.

**Question 15 .**

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

$$-3x - 2y = -7$$

Find the solution to the system of equations shown above by graphing.

- A. $x = 3, y = 2$
- B. $x = 5, y = 3$
- C. $x = -2, y = 5$
- D. $x = 1, y = 2$

**Question 16 .**

Graph the following system of inequalities.

$$y < \tfrac{1}{2}x + 2$$
$$y \geq 1$$
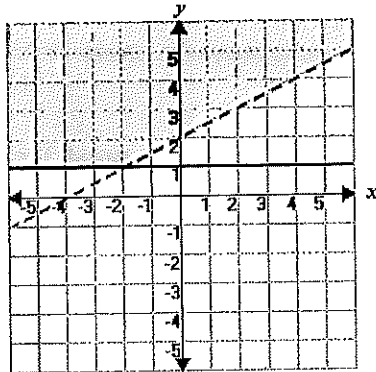
**W.**
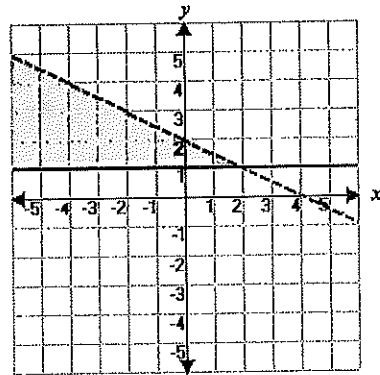
**X.**
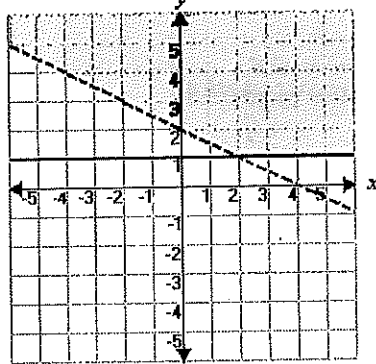
**Y.**
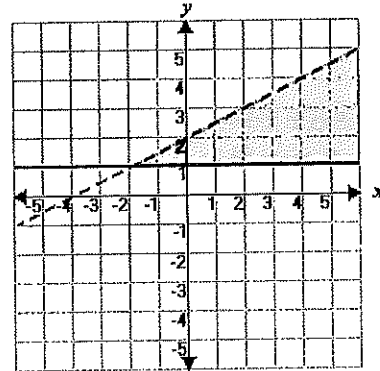
**Z.**

A.   W

B.   Y

C.   Z

D.   X

**Question 17 .**

Graph the following system of inequalities.

$$y < -\frac{3}{4}x - 1$$

$$x \geq -4$$
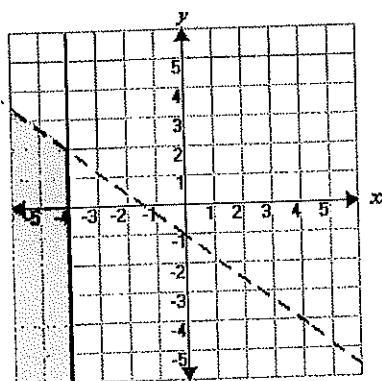
**W.**
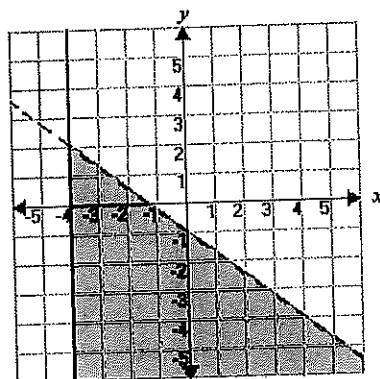
**X.**
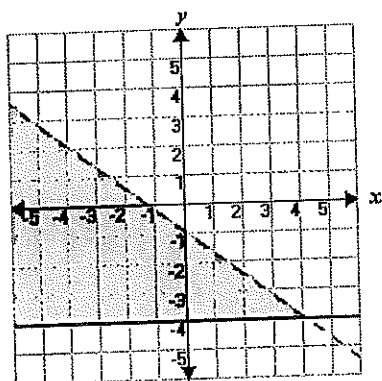
**Y.**

**Z.**
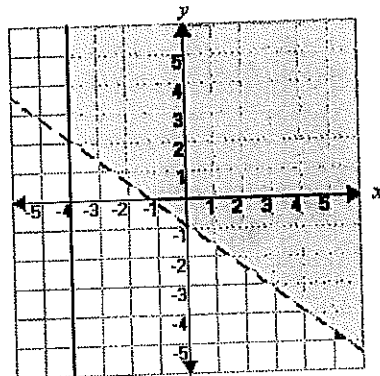
A. Y

B. X

C. Z

D. W

**Question 18 .**

**Directions: Use the drawing tool to form the correct answers on the provided graph.**

The lines on the provided graph represent the boundary lines of the following system of inequalities..

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

$$y \le -3x + 9$$

Plot the points from the list below that are a solution to this system on the provided graph.

$$(0, 4), (1, 2), (5, 6), (-2, -4), (0, 0)$$
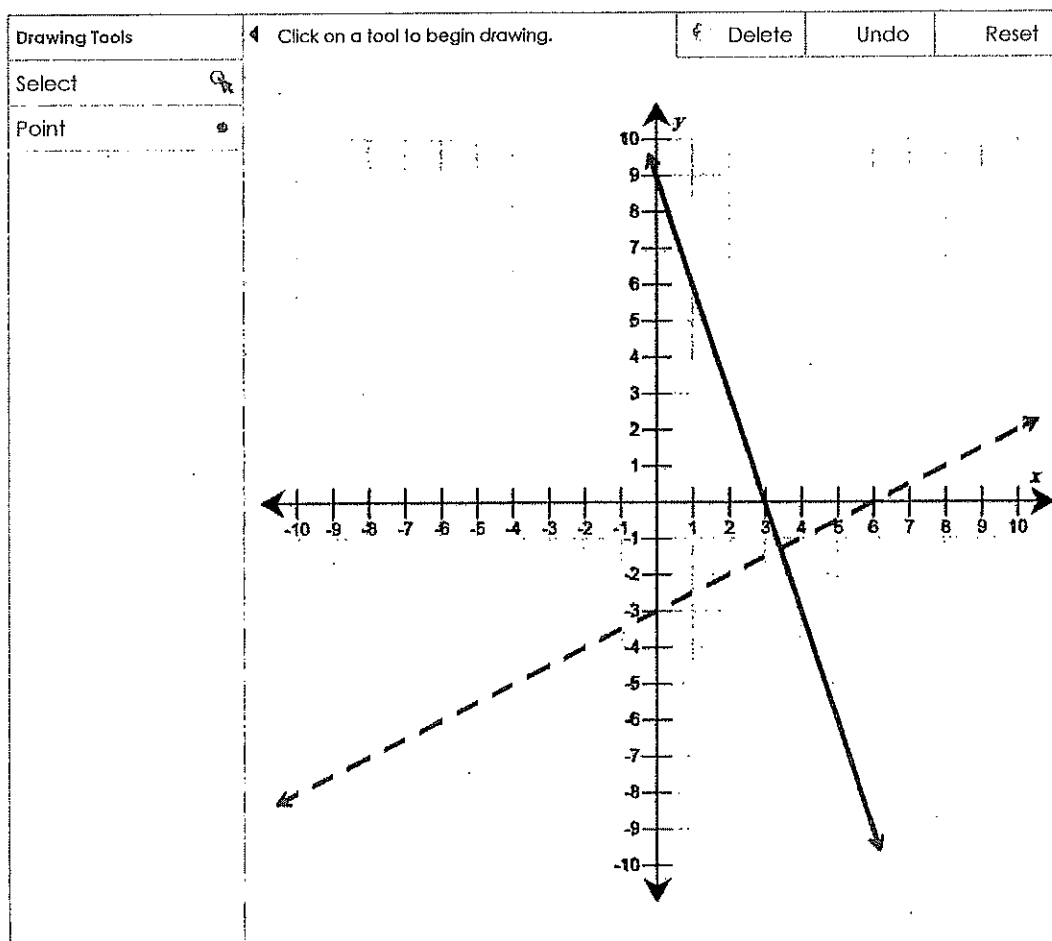
**Question 19 .**

**Directions: Use the drawing tool(s) to form the correct answers on the provided graph.**

Chris is buying supplies for a school fundraiser and has $56 to spend. He buys popcorn for $3 per bag and cotton candy for $7 per bag. He needs at least 7 bags of popcorn.

Graph the boundary lines of the linear inequalities on the graph below.

Also, plot the points that are part of the solution set from the list below.

$(3, 7), (2, 2), (8, 1), (10, 2), (5, 5)$

| Drawing Tools | | Click on a tool to begin drawing. | Delete | Undo | Reset |
|---|---|---|---|---|---|
| Select | | | | | |
| Point | a | | | | |
| Line | | | | | |

Bags of Cotton Candy (y-axis)
Bags of Popcorn (x-axis)
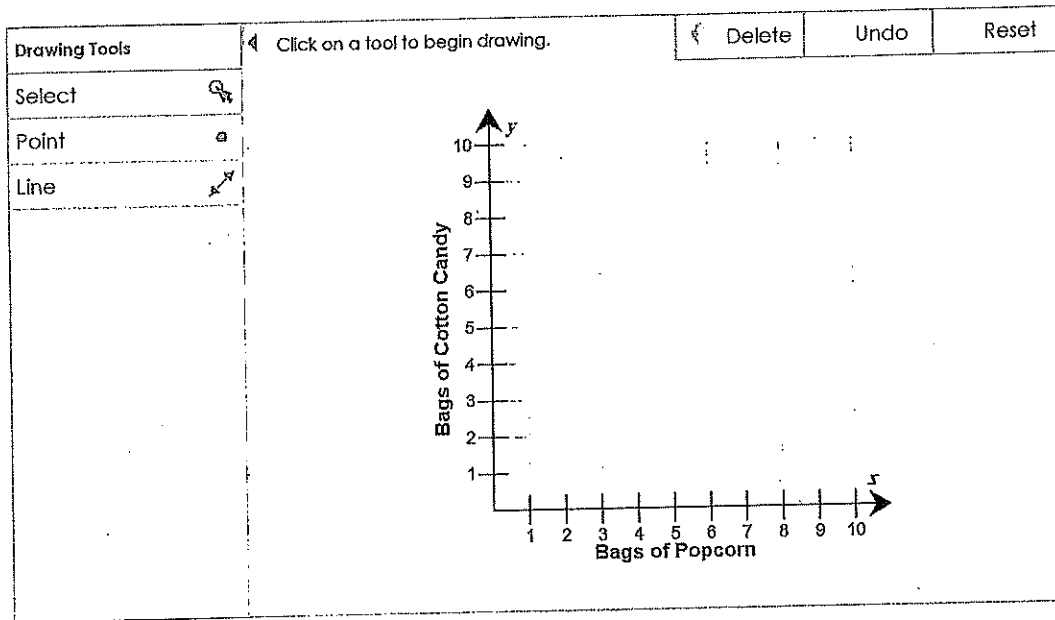
**Question 20 .**

**Directions: Type the correct answer in each box. Use numerals instead of words.**

The table below represents the rabbit population growth in a rural area x years from 2000.

| $x$ | $S(x)$ |
|---|---|
| 0 | 320 |
| 1 | 640 |
| 2 | 1,280 |
| 3 | 2,560 |
| 4 | 5,120 |
| 5 | 10,240 |

Use this table to construct the equations of the functions described below.

If the x-values of the table shown above stay the same and the y-values are doubled, it represents the function $T(x)$. Construct the equation for $T(x)$.

$$T(x) = \boxed{\phantom{0}} \cdot (\boxed{\phantom{0}})^{x}$$

If the x-values of the table shown above are increased by 1 and the y-values stay the same, it represents the function $V(x)$. Construct the equation for $V(x)$.

$$V(x) = \boxed{\phantom{0}} \cdot (\boxed{\phantom{0}})^{x}$$

**Question 21 .**

**Directions: Type your response in the box.**

Steve signs up for his first credit card and is reading about interest rates. After buying a laptop for school with the card, he builds the following function to model how much he will owe if he makes no payments on the card after $t$ years.

$$f(t) = 1,000 \, (1.2)^t$$

Part A: Is the amount of money Steve owes growing or shrinking? What portion of the function indicates this?
Part B: What interest rate is Steve paying on his card? What portion of the function indicates this?
Part C: Steve has heard that credit card interest rates are very high. How much money will he owe after 5 years? How does this amount differ from the $1,000 he spent on the laptop?

| Rubric |

**Response:**

Score: [        ] / 3

**Question 22 .**

**Directions: Type your response in the box.**

Springfield is a small town with a changing population. As a class project, Jason decided to use some data he found on the internet to build a function, $f(t)$, which will predict Springfield's population in the next $t$ years.

$$f(t) = 2,000 \, (0.97)^t$$

Part A: Is Springfield's population growing or shrinking? What about the function Jason composed indicates this?
Part B: What is the percentage change in the population of Springfield for each year that passes? What portion of the function indicates this? What calculations need to be made in order to arrive at this number?
Part C: If instead Springfield started to grow at a rate of 5% per year. How many people would live in Springfield after 3 years?

| Rubric |

**Response:**

Score: [        ] / 3

# Diagnostic Test

**Question 1 .**

What is the equation for the line that passes through the points (-5, 2) and (5, -6)?

- **A.** $y = \frac{4}{5}x + 2$
- **B.** $y = -\frac{4}{5}x - 2$
- **C.** $y = \frac{5}{4}x + 2$
- **D.** $y = -\frac{5}{4}x - 2$

**Question 2 .**

At a conference, there are 7 men for every 4 women. If there are 700 women at the conference, how many men are at the conference?

- **A.** 4,900
- **B.** 1,225
- **C.** 1,925
- **D.** 400

**Question 3 .**

The function $E(t)$ represents the elk population, in hundreds, in New Mexico $t$ years after the year 2000.

What does the statement, $E(14) - E(9) = -18$, represent?

- **A.** There will be 1,800 elk in New Mexico between the years 2009 and 2014.

- **B.** There will be 1,800 more elk in New Mexico in the year 2014 than in 2009.

- **C.** There will be 1,800 less elk in New Mexico in the year 2014 than in 2009.

- **D.** Between the years 2009 and 2014, the population of elk in New Mexico dropped to 1,800.

**Question 4 .**

The following system of equations is graphed below.

$$-2x + 3y = -3$$
$$2x + 5y = 27$$

Find the solution to the system.
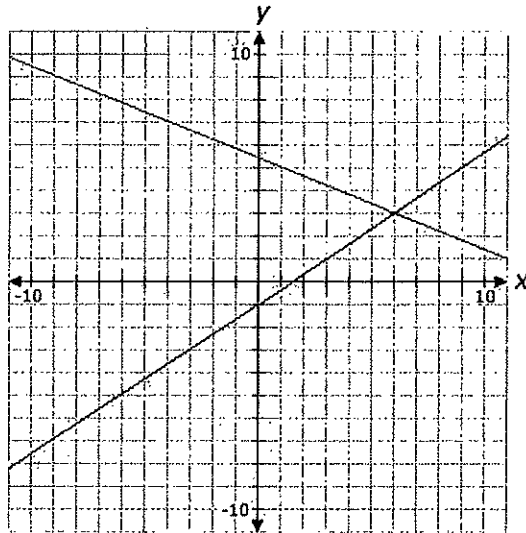


   **A.**   $x = -3, y = -6$

( **B.**   $x = 3, y = 6$

   **C.**   $x = 6, y = 3$

   **D.**   $x = 6, y = -3$

**Question 5 .**

Simplify the following expression.

$$(2x - 5)(6x^2 - 6x - 11)$$

   **A.**   $12x^3 - 42x^2 + 8x - 55$

   **B.**   $12x^3 + 18x^2 - 52x - 55$

   **C.**   $12x^3 - 42x^2 + 8x + 55$

   **D.**   $12x^3 - 18x^2 - 52x + 55$

**Question 6 .**

Use the quadratic formula to solve the equation below.

$$x(-2x - 13) = -1$$

A.   $x = \dfrac{13 \pm \sqrt{177}}{4}$

B.   $x = \dfrac{-13 \pm \sqrt{177}}{4}$

C.   $x = \dfrac{-13 \pm \sqrt{177}}{2}$

D.   $x = \dfrac{-11 \pm \sqrt{177}}{4}$

**Question 7 .**

The following system of equations is graphed below.

$$y = \tfrac{7}{11}x + 1$$
$$y = -2x + 3$$

Estimate the solution to the system of equations.
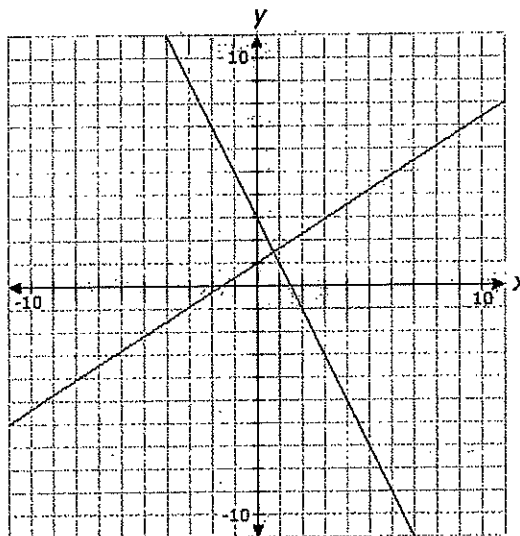


A.   $\left(\dfrac{3}{4}, \dfrac{7}{4}\right)$

B.   $\left(\dfrac{1}{2}, \dfrac{7}{4}\right)$

C.   $\left(\dfrac{1}{2}, \dfrac{3}{2}\right)$

D.   $\left(\dfrac{3}{4}, \dfrac{3}{2}\right)$

**Question 8 .**

Jose ran a concession stand last Saturday and made $71.80 from selling a total of 41 hot dogs and hamburgers. Each hot dog sold for $1.40 and each hamburger sold for $2.60. Which system of equations can be used to determine the number of hot dogs, $x$, and hamburgers, $y$, that were sold?

   **A.**    $1.4x + 2.6y = 71.8$

           $29x + 12y = 41$

   **B.**    $1.4x + 2.6y = 71.8$

           $x + y = 41$

   **C.**    $2.8x + 5.2y = 4$

           $x + y = 348$

   **D.**    $0.7x + 1.3y = 71.8$

           $x + y = 4$

**Question 9 .**

Simplify the following expression.

$$\frac{96x^{15}y^3}{12x^5y^3}$$

   **A.**    $8x^3$

   **B.**    $8x^3y$

   **C.**    $8x^{10}$

   **D.**    $8x^{10}y$

**Question 10 .**

Which of the following statements is false?

   **A.**    The sum of a rational number and an irrational number is irrational.

   **B.**    The product of a nonzero rational number and an irrational number is rational.

   **C.**    The sum of two rational numbers is rational.

   **D.**    The product of two rational numbers is rational.

**Question 11 .**

Archer wants to find the average number of the 25,000 passengers on a national airline that check one item of luggage. He randomly selects 1,000 passengers in his home state of North Carolina who flew in the past year, and he found that 70% of the passengers checked one item of luggage. Which of the following statements is true?

- **A.** This method of sampling can be considered both biased and unbiased.

- **B.** This method of sampling is neither biased nor unbiased.

- **C.** This method of sampling is biased.

- **D.** This method of sampling is unbiased.

**Question 12 .**

According to the table below, what is the range of the data?

| input | output |
|-------|--------|
| 5 | 20 |
| 6 | 31 |
| 7 | 44 |
| 8 | 59 |
| 9 | 76 |

- **A.** 20, 31, 44, 59, 76

- **B.** 35, 46, 59, 74, 91

- **C.** 5, 7, 9, 11, 13

- **D.** 5, 6, 7, 8, 9

**Question 13 .**

A model of a sculpture is 28 cm tall. The model uses the scale 3 cm : 0.1 ft. Which of the following proportions can be used to find $S$, the height in feet of the actual sculpture?

- **A.** $\frac{3\ cm}{28\ ft} = \frac{S}{0.1\ ft}$

- **B.** $\frac{3\ cm}{0.1\ ft} = \frac{S}{28\ cm}$

- **C.** $\frac{28\ cm}{0.1\ ft} = \frac{3\ cm}{S}$

- **D.** $\frac{28\ cm}{S} = \frac{3\ cm}{0.1\ ft}$

**Question 14 .**

Simplify.

$$\sqrt{216}$$

A.   108

B.   $6\sqrt{6}$

C.   $72\sqrt{3}$

D.   $36\sqrt{6}$

**Question 15 .**
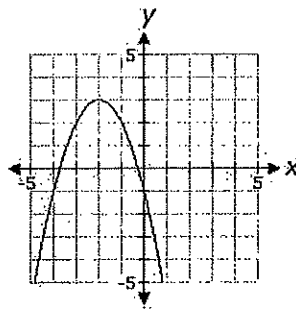


The graph of the equation $y = -x^2 - 4x - 1$ is shown above.

Which coordinate pair represents the maximum of the graph?

A.   (-1, 2)

B.   (-3, 2)

C.   (-2, 3)

D.   (0, -1)

**Question 16 .**

What is the factored form of the following expression?
$$9x^2 + 18x + 9$$

A.   $(9x + 1)(x + 9)$

B.   $9(x + 1)^2$

C.   $3(x + 1)^2$

D.   $3(x + 3)(3x + 1)$

**Question 17 .**

The owner of a pastry shop has found that when he charges $5 per pie, he sells an average of 30 pies per day. He noticed that for every dollar increase in pie price, the number of pies sold decreased by an average of 7 pies per day. Which of the following equations could be used to find the profit the pastry shop owner could expect to make if he charges $5 + x per pie?

A. $P(x) = -6x^2 - 5x + 6$

B. $P(x) = -6x^2 - x + 150$

C. $P(x) = -7x^2 - 5x + 150$

D. $P(x) = -7x^2 + x - 6$

**Question 18 .**

A company opened in 1998 and turned a profit its first year. The company's revenues increased annually thereafter. Which of the following functions could model this situation where $x$ represents the number of years in operation, and $f(x)$ represents the company's annual revenue [in millions]?

A. $f(x) = 9,263 \cdot 0.785^x$

B. $f(x) = 9,484 \cdot x^{0.868}$

C. $f(x) = 65x^2 - 1,386x + 8,161$

D. $f(x) = 884 \cdot 1.22^x$

**Question 19 .**

All of the situations below imply correlation. Which situation most likely implies causation?

A.   As outdoor temperatures increased, residents' electric bills increased.

B.   As lake water levels increased, boats on the lake increased.

C.   As a company's advertising budget increased, the company's sales increased.

D.   As gasoline prices increased, the number of bikes purchased increased.

**Question 20 .**

Find the zeros of the following quadratic function.

$$P(x) = 5x^2 + 19x + 12$$

A. $x = -\frac{4}{5}$ ; $x = -3$

B. $x = \frac{4}{5}$ ; $x = 3$

C. $x = \frac{4}{5}$ ; $x = -3$

D. $x = -\frac{4}{5}$ ; $x = 3$

**Question 21 .**

Alan has a chart at his house where he records the amount of time he spends studying for each of his math tests and his score on each test. In a separate column, he also writes what he ate for dinner the night after each test. What is the dependent variable on Alan's chart?

A. There is no dependent variable on Alan's chart.

B. time spent studying

C. Alan's dinner choice

D. Alan's test score

**Question 22 .**

The graph below shows the amount of food puppies at a pet store eat on a daily basis.

**Puppy Data**
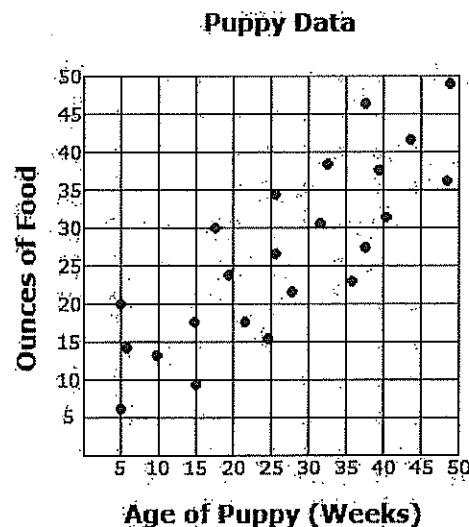


Which of the following is a valid conclusion based on the graph?

A. As a puppy gets older, it eats less food.

B. There is no relationship between the age of a puppy and the amount of food it eats.

C. As a puppy gets older, it eats the same amount of food.

D. As a puppy gets older, it eats more food.

**Question 23 .**

Wanda is purchasing fabric. She bought 7 square yards of one fabric pattern for $22.47 before tax. If her friend Sheila wants to purchase some of the same fabric pattern, how much will it cost to purchase 5 square yards before tax?

    **A.**   $3.21

    **B.**   $6.42

    **C.**   $16.05

    **D.**   $12.84

**Question 24 .**

From 1985 to 1989, the number of cellular phone subscribers in the U.S. about doubled each year. What type of function appropriately models this situation?

    **A.**   quadratic

    **B.**   linear

    **C.**   absolute value

    **D.**   exponential

**Question 25 .**

Li and Jen went shopping.

• Li bought 4 pairs of earrings and 1 necklace for a total of $50.
• Jen bought 1 pair of earrings and 3 necklaces for a total of $51.

Each pair of earrings cost $e$ dollars and each necklace cost $n$ dollars. Which system of equations can be used to find the cost, in dollars, of each pair of earrings and each necklace?

    **A.**   $4e + n = \$50$
            $3e + n = \$51$

    **B.**   $4e + 3n = \$50$
            $e + n = \$51$

    **C.**   $e + 4n = \$50$
            $e + 3n = \$51$

    **D.**   $4e + n = \$50$
            $e + 3n = \$51$

**Question 26 .**

Find the solution to the system of equations given below using elimination by addition.

$$4x + 3y = -20$$
$$6x + 12y = -10$$

A.    $x = -6,\ y = \frac{13}{6}$

B.    $x = 3,\ y = -\frac{32}{3}$

C.    $x = -\frac{41}{3},\ y = 6$

D.    $x = -7,\ y = \frac{8}{3}$

**Question 27 .**

A study was done to investigate the population of bald eagle breeding pairs over time. The correlating regression model is shown below, where *x* represents the number of years after 1986, and *y* represents the number of bald eagle breeding pairs. Interpret the *y*-intercept.

$$y = 1{,}772 + 334x$$

A.    There were approximately 1,772 additional eagle breeding pairs each year after 1986.

B.    There were approximately 334 eagle breeding pairs in 1986.

C.    There were approximately 334 additional eagle breeding pairs each year after 1986.

D.    There were approximately 1,772 eagle breeding pairs in 1986.

**Question 28 .**

Which of the following relations is a function?

A.    (-9, 2), (-3, 3), (4, 7), (6, 2)

B.    (-3, -2), (-9, -5), (4, 8), (4, 2)

C.    (-9, 0), (-3, 5), (-9, -3), (4, 9)

D.    (6, -10), (-9, 7), (6, 6), (-9, 12)

**Question 29 .**

|  | New Students | Returning Students | TOTAL |
|---|---|---|---|
| 10th Grade | 5 | 170 | 175 |
| 11th Grade | 3 | 162 | 165 |
| 12th Grade | 2 | 158 | 160 |
| TOTAL | 10 | 490 | 500 |

Choose the two-way relative frequency table which represents the two-way frequency table above.

|  | New Students | Returning Students | TOTAL |
|---|---|---|---|
| 10th Grade | 0.5 | 0.347 | 0.35 |
| 11th Grade | 0.3 | 0.331 | 0.33 |
| 12th Grade | 0.2 | 0.233 | 0.32 |
| TOTAL | 1 | 1 | 1 |

**W.**

|  | New Students | Returning Students | TOTAL |
|---|---|---|---|
| 10th Grade | 0.0286 | 0.9714 | 1 |
| 11th Grade | 0.018 | 0.982 | 1 |
| 12th Grade | 0.125 | 0.9875 | 1 |
| TOTAL | 0.02 | 0.98 | 1 |

**X.**

|  | New Students | Returning Students | TOTAL |
|---|---|---|---|
| 10th Grade | 100 | 2.94 | 2.86 |
| 11th Grade | 166.67 | 3.09 | 3.03 |
| 12th Grade | 250 | 3.16 | 3.125 |
| TOTAL | 50 | 1.02 | 1 |

**Y.**

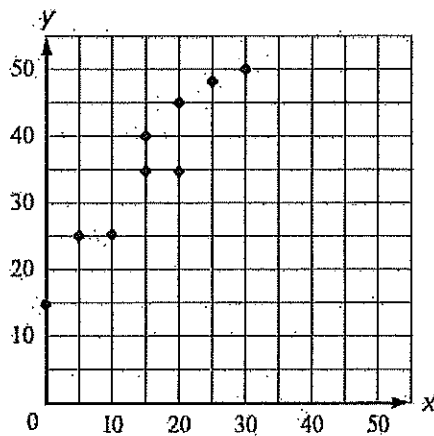|  | New Students | Returning Students | TOTAL |
|---|---|---|---|
| 10th Grade | 0.01 | 0.34 | 0.35 |
| 11th Grade | 0.006 | 0.324 | 0.33 |
| 12th Grade | 0.004 | 0.316 | 0.32 |
| TOTAL | 0.02 | 0.98 | 1 |

**Z.**

A. Y

B. X

C. Z

D. W

**Question 30 .**

Which of the following equations best represents the line of best fit for the scatterplot below?



**A.** $y = \frac{4}{3}x + 15$

**( B.** $y = \frac{3}{4}x + 15$

**( C.** $y = -\frac{4}{3}x + 15$

**D.** $y = -\frac{3}{4}x + 15$

# Real Numbers

**Question 1 .**

Which of the following groups listed below are subsets of the real numbers?

I. Natural Numbers
II. Rational Numbers
III. Integers
IV. Whole Numbers
V. Irrational Numbers

- **A.** I, II, III, and IV only

- **B.** I and III only

- **C.** I, III, and IV only

- **D.** All of the groups listed are subsets of the real numbers.

**Question 2 .**

$$\left\{ \frac{12}{5}, \frac{16}{5}, 6, 8, \sqrt{49}, \sqrt{100} \right\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

I. Rational Numbers
II. Whole Numbers
III. Natural Numbers
IV. Irrational Numbers
V. Integers

- **A.** I and IV only

- **B.** I only

- **C.** All of the numbers do not belong to any one group.

- **D.** IV only

**Question 3 .**

$\{0, 6, 11, 22, 32, 44, 56\}$

The numbers shown above belong to which of the following subsets of the real numbers?

I. Integers
II. Natural Numbers
III. Irrational Numbers
IV. Rational Numbers
V. Whole Numbers

- **A.** V only

- **B.** I, II, IV, and V only

- **C.** I, II, and V only

- **D.** I, IV, and V only

**Question 4 .**

$$\frac{\pi}{2} \approx 1.570796326794896661923...$$

To which subset of the real numbers does $\frac{\pi}{2}$ belong?

I. Natural Numbers
II. Rational Numbers
III. Integers
IV. Whole Numbers
V. Irrational Numbers

    **A.** V only

    **B.** II only

    **C.** I, II, and V only

    **D.** II and V only

**Question 5 .**

{12, 18, 24, 35, 40, 43, 46}

The numbers shown above belong to which of the following subsets of the real numbers?

I. Natural Numbers
II. Rational Numbers
III. Integers
IV. Whole Numbers
V. Irrational Numbers

    **A.** I, III, and IV only

    **B.** III only

    **C.** I and IV only

    **D.** I, II, III, and IV only

**Question 6 .**

Which of the following groups listed below are subsets of the irrational numbers?

I. Natural Numbers
II. Rational Numbers
III. Integers
IV. Whole Numbers
V. Real Numbers

    **A.** None of the groups listed are subsets of the irrational numbers.

    **B.** All of the subsets listed are subsets of the irrational numbers.

    **C.** II only

    **D.** I, II, III, and IV only

**Question 7 .**

$$\left\{-\frac{7}{2}, -\frac{5}{2}, \frac{1}{2}, \frac{5}{4}, \frac{3}{2}, \frac{13}{4}, \frac{15}{4}\right\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Natural Numbers
    II. Rational Numbers
    III. Integers
    IV. Whole Numbers
    V. Irrational Numbers

    **A.**  II only

    **B.**  I, II and V only

    **C.**  II and V only

    **D.**  V only

**Question 8 .**

$$\left\{\frac{\pi}{4}, \frac{\pi}{2}, \sqrt{20}, \sqrt{30}, \sqrt{42}\right\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Irrational Numbers
    II. Integers
    III. Whole Numbers
    IV. Natural Numbers
    V. Rational Numbers

    **A.**  I, IV, and V only

    **B.**  I only

    **C.**  I and V only

    **D.**  V only

**Question 9 .**

{0, 1, 12, 23, 25, 29, 34}

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Rational Numbers
    II. Whole Numbers
    III. Natural Numbers
    IV. Irrational Numbers
    V. Integers

    **A.**  I, II, III, and V only

    **B.**  II, III, and V only

    **C.**  II only

    **D.**  I, II, and V only

**Question 10 .**

$$\left\{\tfrac{12}{11},\ 2,\ 6,\ 11,\ \sqrt{49},\ \sqrt{169}\right\}$$

The numbers shown above belong to which of the following subsets of the real numbers?

    I. Natural Numbers
    II. Rational Numbers
    III. Integers
    IV. Whole Numbers
    V. Irrational Numbers

    **A.**    V only

    **B.**    All of the numbers do not belong to any one group.

    **C.**    II only

    **D.**    I, II and V only

# Systems of Equations

**Question 1 .**

Describe the solution to the system of equations below.

$$4x - y = 9$$
$$8x - 2y = 18$$

**A.** The system has no solution.

**B.** The system has the unique solution (-6, -33).

**C.** The system has the unique solution (4, 7).

**D.** The system has infinitely many solutions of the form $y = 4x - 9$, where $x$ is any real number.

**Question 2 .**

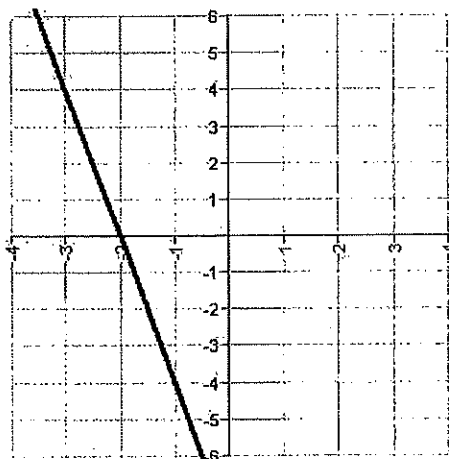Use elimination to find the solution to the system of equations.

$$9x + 2y = 1$$
$$4x + 6y = -20$$

**A.** $x = -\frac{1}{3}, y = 2$

**B.** $x = -2, y = -2$

**C.** $x = 1, y = -4$

**D.** $x = -\frac{31}{2}, y = 7$

**Question 3 .**

Describe the solution to the system of equations graphed below.

$$4x + y = -8$$
$$12x + 3y = -24$$



A.  The system has the unique solution (4, 6).

ᶜ  B.  The system has no solution.

C.  The system has infinitely many solutions of the form $y = -4x - 8$ where $x$ is any real number.

D.  The system has the unique solution (3, 24).

**Question 4 .**

**Directions: Select the correct answer from each drop-down menu.**

The solution to a system of two linear equations in two variables corresponds to the [ ▼ ] of their graphs, because the [ ▼ ].

[ ▼ ]

**Question 5 .**

$$-2x - 4y = 6$$
$$-3x + 4y = -11$$

Find the solution to the system of equations shown above by graphing.

A.  $x = 1, y = -1$

B.  $x = 1, y = -2$

ᶜ  C.  $x = 2, y = -2$

D.  $x = -2, y = 1$

**Question 6 .**

Describe the solution to the system of equations below.

$$5x - y = 8$$
$$15x - 3y = 16$$

**A.** The system has infinitely many solutions of the form $y = 5x - 8$, where $x$ is any real number.

**B.** The system has no solution.

**C.** The system has the unique solution (-5, -33).

**D.** The system has the unique solution (3, 7).

**Question 7 .**

Solve the two equations below.

$$3x - 6y = 9$$
$$-3x + 2y = 7$$

**A.** $x = 7; y = 2$

**B.** $x = -5; y = -4$

**C.** $x = -\frac{5}{3}; y = -4$

**D.** $x = 8; y = \frac{31}{2}$

**Question 8 .**

Find the solution to the system of equations given below using elimination by addition.

$$4x + 4y = -24$$
$$8x + 20y = -12$$

**A.** $x = -9, y = 3$

**B.** $x = -24, y = 9$

**C.** $x = -9, y = 4$

**D.** $x = 4, y = -10$

**Question 9 .**

Estimate the solution to the following system of equations by graphing.

$$\begin{cases} 5x - 4y = -20 \\ 4x + y = 7 \end{cases}$$

A.    $x = \frac{1}{3}, y = \frac{11}{3}$

( B.    $x = \frac{1}{3}, y = \frac{11}{2}$

C.    $x = \frac{11}{2}, y = \frac{1}{3}$

D.    $x = \frac{11}{3}, y = \frac{1}{3}$

**Question 10 .**

Solve for *y* in the two equations below using substitution.

$$4x - 20y = 12$$
$$4x + 20y = 132$$

A.    $y = 6$

B.    $y = 3$

C.    $y = \frac{18}{5}$

D.    $y = 18$

# Algebraic Rational Expressions

**Question 1 .**

Rewrite the following expression with variables only in the numerator.

$$\frac{5n^{12}}{4g^{10}}$$

A. $\frac{5}{4}n^{-12}g^{-10}$

B. $\frac{5}{4}n^{12}g^{10}$

C. $\frac{5}{4}n^{-12}g^{10}$

D. $\frac{5}{4}n^{12}g^{-10}$

**Question 2 .**

Rewrite the following expression with each variable appearing only once and with only positive exponents.

$$\frac{20t^{23}g^{-9}}{34t^{8}g^{9}}$$

A. $\frac{10t^{15}}{17g^{18}}$

B. $\frac{10}{17t^{15}g^{18}}$

C. $\frac{10t^{15}g^{18}}{17}$

D. $\frac{10g^{18}}{17t^{15}}$

**Question 3 .**

Rewrite the following expression with variables only in the numerator.

$$\frac{5m^6}{50n^{11}}$$

A.  $\frac{1}{10}m^5n^{-11}$

B.  $\frac{1}{10}m^5n^{11}$

C.  $\frac{1}{10}m^{-5}n^{-11}$

D.  $\frac{1}{10}m^{-5}n^{11}$

**Question 4 .**

Simplify the following expression.

$$\frac{12a^5b^4c^4}{3a^4b^2c^4}$$

A.  $9a^2b^3c$
B.  $4ab^2$
C.  $4ab^2c$
D.  $9ab^2$

**Question 5 .**

Rewrite the following expression with each variable appearing only once (at most) and with only positive exponents.

$$\frac{8x^{-4}y^6}{7x^{-7}y^{-6}}$$

A.  $\frac{8}{7}x^{11}$

B.  $\frac{8}{7x^{11}}$

C.  $\frac{8}{7}x^3y^{12}$

D.  $\frac{8}{7x^3y^{12}}$

**Question 6 .**

Rewrite the following expression with each variable appearing only once (at most) and with only positive exponents.

$$\frac{8x^{-2}y^5}{7x^{-5}y^{-5}}$$

A.    $\frac{8}{7}x^7$

B.    $\frac{8}{7x^3y^{10}}$

C.    $\frac{8}{7}x^3y^{10}$

D.    $\frac{8}{7x^7}$

**Question 7 .**

Rewrite the following expression with each variable appearing only once and with only positive exponents.

$$\frac{16t^{24}g^{-7}}{30t^9g^7}$$

A.    $\frac{8g^{14}}{15t^{15}}$

B.    $\frac{8t^{15}}{15g^{14}}$

C.    $\frac{8}{15t^{15}g^{14}}$

D.    $\frac{8t^{15}g^{14}}{15}$

**Question 8 .**

Simplify the following expression.

$$\frac{12m^{24}n^{28}p^{16}}{4m^{12}n^{14}p^8}$$

A.    $8m^2n^2p^8$

B.    $3m^{12}n^{14}p^8$

C.    $3m^2n^2p$

D.    $8m^{12}n^{14}p^8$

**Question 9 .**

Rewrite the following expression with variables only in the numerator.

$$\frac{6m^6}{42n^{12}}$$

     **A.**   $\frac{1}{7}m^{-6}n^{-12}$

     **B.**   $\frac{1}{7}m^6n^{-12}$

     **C.**   $\frac{1}{7}m^6n^{12}$

     **D.**   $\frac{1}{7}m^{-6}n^{12}$

**Question 10 .**

Simplify the following expression.

$$\frac{28m^{36}n^{28}p^{14}}{4m^{18}n^{14}p^7}$$

     **A.**   $24m^{18}n^{14}p^7$

     **B.**   $7m^{18}n^{14}p^7$

     **C.**   $24m^2n^{14}p^7$

     **D.**   $7m^2n^2p$