

1

A painter will paint  $n$  walls with the same size and shape in a building using a specific brand of paint. The painter's fee can be calculated by the expression  $nK\ell h$ , where  $n$  is the number of walls,  $K$  is a constant with units of dollars per square foot,  $\ell$  is the length of each wall in feet, and  $h$  is the height of each wall in feet. If the customer asks the painter to use a more expensive brand of paint, which of the factors in the expression would change?

- A)  $h$
- B)  $\ell$
- C)  $K$
- D)  $n$

2

If  $3r = 18$ , what is the value of  $6r + 3$  ?

- A) 6
- B) 27
- C) 36
- D) 39

3

Which of the following is equal to  $a^{\frac{2}{3}}$ , for all values of  $a$  ?

- A)  $\sqrt{\frac{1}{a^3}}$
- B)  $\sqrt{a^3}$
- C)  $\sqrt[3]{\frac{1}{a^2}}$
- D)  $\sqrt[3]{a^2}$

4

The number of states that joined the United States between 1776 and 1849 is twice the number of states that joined between 1850 and 1900. If 30 states joined the United States between 1776 and 1849 and  $x$  states joined between 1850 and 1900, which of the following equations is true?

- A)  $30x = 2$
- B)  $2x = 30$
- C)  $\frac{x}{2} = 30$
- D)  $x + 30 = 2$

5

If  $\frac{5}{x} = \frac{15}{x+20}$ , what is the value of  $\frac{x}{5}$  ?

- A) 10
- B) 5
- C) 2
- D)  $\frac{1}{2}$

6

$$\begin{aligned} 2x - 3y &= -14 \\ 3x - 2y &= -6 \end{aligned}$$

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

- A) -20
- B) -8
- C) -4
- D) 8

7

$x$	$f(x)$
0	3
2	1
4	0
5	-2

The function  $f$  is defined by a polynomial. Some values of  $x$  and  $f(x)$  are shown in the table above. Which of the following must be a factor of  $f(x)$  ?

- A)  $x - 2$
- B)  $x - 3$
- C)  $x - 4$
- D)  $x - 5$

8

The line  $y = kx + 4$ , where  $k$  is a constant, is graphed in the  $xy$ -plane. If the line contains the point  $(c, d)$ , where  $c \neq 0$  and  $d \neq 0$ , what is the slope of the line in terms of  $c$  and  $d$  ?

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

9

$$\begin{aligned} kx - 3y &= 4 \\ 4x - 5y &= 7 \end{aligned}$$

In the system of equations above,  $k$  is a constant and  $x$  and  $y$  are variables. For what value of  $k$  will the system of equations have no solution?

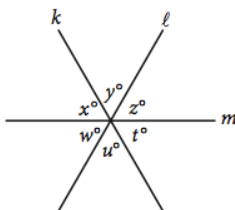
- A)  $\frac{12}{5}$
- B)  $\frac{16}{7}$
- C)  $-\frac{16}{7}$
- D)  $-\frac{12}{5}$

10

In the  $xy$ -plane, the parabola with equation  $y = (x - 11)^2$  intersects the line with equation  $y = 25$  at two points,  $A$  and  $B$ . What is the length of  $\overline{AB}$ ?

- A) 10
- B) 12
- C) 14
- D) 16

11



Note: Figure not drawn to scale.

In the figure above, lines  $k$ ,  $l$ , and  $m$  intersect at a point. If  $x + y = u + w$ , which of the following must be true?

- I.  $x = z$
  - II.  $y = w$
  - III.  $z = t$
- A) I and II only
  - B) I and III only
  - C) II and III only
  - D) I, II, and III

12

$$y = a(x - 2)(x + 4)$$

In the quadratic equation above,  $a$  is a nonzero constant. The graph of the equation in the  $xy$ -plane is a parabola with vertex  $(c, d)$ . Which of the following is equal to  $d$ ?

- A)  $-9a$
- B)  $-8a$
- C)  $-5a$
- D)  $-2a$

13

The equation  $\frac{24x^2 + 25x - 47}{ax - 2} = -8x - 3 - \frac{53}{ax - 2}$  is true for all values of  $x \neq \frac{2}{a}$ , where  $a$  is a constant.

What is the value of  $a$ ?

- A)  $-16$
- B)  $-3$
- C)  $3$
- D)  $16$

14

What are the solutions to  $3x^2 + 12x + 6 = 0$ ?

- A)  $x = -2 \pm \sqrt{2}$
- B)  $x = -2 \pm \frac{\sqrt{30}}{3}$
- C)  $x = -6 \pm \sqrt{2}$
- D)  $x = -6 \pm 6\sqrt{2}$

15

$$C = \frac{5}{9}(F - 32)$$

The equation above shows how a temperature  $F$ , measured in degrees Fahrenheit, relates to a temperature  $C$ , measured in degrees Celsius. Based on the equation, which of the following must be true?

- I. A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of  $\frac{5}{9}$  degree Celsius.
  - II. A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit.
  - III. A temperature increase of  $\frac{5}{9}$  degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius.
- A) I only
  - B) II only
  - C) III only
  - D) I and II only

**16**

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

If  $x > 0$ , what is one possible solution to the equation above?

**19**

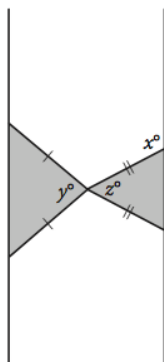
At a lunch stand, each hamburger has 50 more calories than each order of fries. If 2 hamburgers and 3 orders of fries have a total of 1700 calories, how many calories does a hamburger have?

**17**

If  $\frac{7}{9}x - \frac{4}{9}x = \frac{1}{4} + \frac{5}{12}$ , what is the value of  $x$  ?

**20**

In triangle  $ABC$ , the measure of  $\angle B$  is  $90^\circ$ ,  $BC = 16$ , and  $AC = 20$ . Triangle  $DEF$  is similar to triangle  $ABC$ , where vertices  $D$ ,  $E$ , and  $F$  correspond to vertices  $A$ ,  $B$ , and  $C$ , respectively, and each side of triangle  $DEF$  is  $\frac{1}{3}$  the length of the corresponding side of triangle  $ABC$ . What is the value of  $\sin F$  ?

**18**

Note: Figure not drawn to scale.

Two isosceles triangles are shown above. If  $180 - z = 2y$  and  $y = 75$ , what is the value of  $x$  ?