



11

The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

- A) 11
- B) 22
- C) 44
- D) 66

12

Which of the following is equivalent to  $9^{\frac{3}{4}}$ ?

- A)  $\sqrt[3]{9}$
- B)  $\sqrt[4]{9}$
- C)  $\sqrt{3}$
- D)  $3\sqrt{3}$

13

At a restaurant,  $n$  cups of tea are made by adding  $t$  tea bags to hot water. If  $t = n + 2$ , how many additional tea bags are needed to make each additional cup of tea?

- A) None
- B) One
- C) Two
- D) Three



11

The expression  $\frac{x^{-2}y^{\frac{1}{2}}}{x^{\frac{1}{3}}y^{-1}}$ , where  $x > 1$  and  $y > 1$ , is

equivalent to which of the following?

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

12

The function  $f$  is defined by  $f(x) = (x+3)(x+1)$ . The graph of  $f$  in the  $xy$ -plane is a parabola. Which of the following intervals contains the  $x$ -coordinate of the vertex of the graph of  $f$ ?

- A)  $-4 < x < -3$
- B)  $-3 < x < 1$
- C)  $1 < x < 3$
- D)  $3 < x < 4$



13

Which of the following expressions is equivalent to

$$\frac{x^2 - 2x - 5}{x - 3} ?$$

- A)  $x - 5 - \frac{20}{x - 3}$   
 B)  $x - 5 - \frac{10}{x - 3}$   
 C)  $x + 1 - \frac{8}{x - 3}$   
 D)  $x + 1 - \frac{2}{x - 3}$

14

A shipping service restricts the dimensions of the boxes it will ship for a certain type of service. The restriction states that for boxes shaped like rectangular prisms, the sum of the perimeter of the base of the box and the height of the box cannot exceed 130 inches. The perimeter of the base is determined using the width and length of the box. If a box has a height of 60 inches and its length is 2.5 times the width, which inequality shows the allowable width  $x$ , in inches, of the box?

- A)  $0 < x \leq 10$   
 B)  $0 < x \leq 11\frac{2}{3}$   
 C)  $0 < x \leq 17\frac{1}{2}$   
 D)  $0 < x \leq 20$

15

The expression  $\frac{1}{3}x^2 - 2$  can be rewritten as

$$\frac{1}{3}(x - k)(x + k), \text{ where } k \text{ is a positive constant.}$$

What is the value of  $k$  ?

- A) 2  
 B) 6  
 C)  $\sqrt{2}$   
 D)  $\sqrt{6}$



13

If  $x > 3$ , which of the following is equivalent

to  $\frac{1}{\frac{1}{x+2} + \frac{1}{x+3}}$  ?

- A)  $\frac{2x+5}{x^2+5x+6}$
- B)  $\frac{x^2+5x+6}{2x+5}$
- C)  $2x+5$
- D)  $x^2+5x+6$

14

If  $3x - y = 12$ , what is the value of  $\frac{8^x}{2^y}$  ?

- A)  $2^{12}$
- B)  $4^4$
- C)  $8^2$
- D) The value cannot be determined from the information given.

15

If  $(ax+2)(bx+7) = 15x^2 + cx + 14$  for all values of  $x$ , and  $a+b=8$ , what are the two possible values for  $c$  ?

- A) 3 and 5
- B) 6 and 35
- C) 10 and 21
- D) 31 and 41



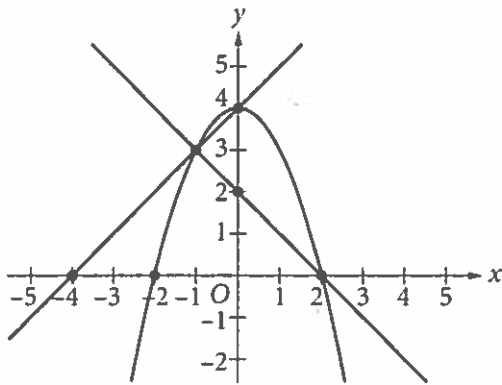
8

$$2ax - 15 = 3(x + 5) + 5(x - 1)$$

In the equation above,  $a$  is a constant. If no value of  $x$  satisfies the equation, what is the value of  $a$ ?

- A) 1
- B) 2
- C) 4
- D) 8

9



A system of three equations is graphed in the  $xy$ -plane above. How many solutions does the system have?

- A) None
- B) One
- C) Two
- D) Three

10

$$(ax + 3)(5x^2 - bx + 4) = 20x^3 - 9x^2 - 2x + 12$$

The equation above is true for all  $x$ , where  $a$  and  $b$  are constants. What is the value of  $ab$ ?

- A) 18
- B) 20
- C) 24
- D) 40

11

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

Which of the following represents all the possible values of  $x$  that satisfy the equation above?

- A) 0 and 2
- B) 0 and 4
- C) -4 and 4
- D) 4



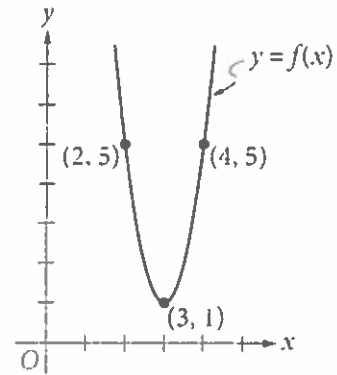
12.

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

Which of the following is equivalent to the expression above for  $x > 0$ ?

- A)  $\frac{2x+5}{2x+1}$   
 B)  $\frac{2x+6}{2x+1}$   
 C)  $\frac{10x+5}{2x+1}$   
 D)  $\frac{10x+6}{2x+1}$

13.



The graph of the function  $f$  in the  $xy$ -plane above is a parabola. Which of the following defines  $f$ ?

- A)  $f(x) = 4(x-3)^2 + 1$   
 B)  $f(x) = 4(x+3)^2 + 1$   
 C)  $f(x) = (x-3)^2 + 1$   
 D)  $f(x) = 3(x+3)^2 + 1$



19

$$\frac{2x+6}{(x+2)^2} - \frac{2}{x+2}$$

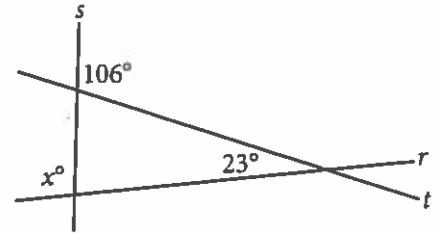
The expression above is equivalent to  $\frac{a}{(x+2)^2}$ ,

where  $a$  is a positive constant and  $x \neq -2$ .

What is the value of  $a$  ?

20

Intersecting lines  $r$ ,  $s$ , and  $t$  are shown below.



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.**



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





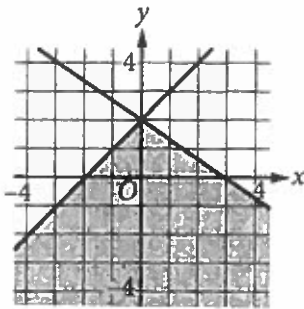
14

$$y \geq x + 2$$

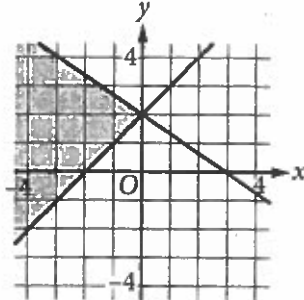
$$2x + 3y \leq 6$$

In which of the following does the shaded region represent the solution set in the  $xy$ -plane to the system of inequalities above?

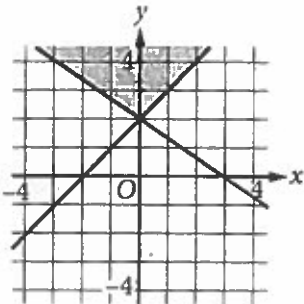
A)



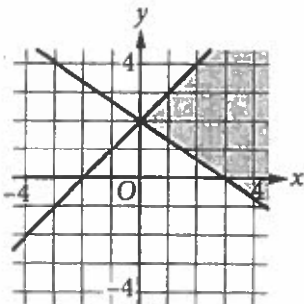
B)



C)



D)



15

What is the set of all solutions to the equation

$$\sqrt{x+2} = -x?$$

- A)  $\{-1, 2\}$
- B)  $\{-1\}$
- C)  $\{2\}$
- D) There are no solutions to the given equation.



13

In the  $xy$ -plane, the graph of the function  $f(x) = x^2 + 5x + 4$  has two  $x$ -intercepts. What is the distance between the  $x$ -intercepts?

- A) 1
- B) 2
- C) 3
- D) 4

14

$$\sqrt{4x} = x - 3$$

What are all values of  $x$  that satisfy the given equation?

- I. 1
- II. 9

- A) I only
- B) II only
- C) I and II
- D) Neither I nor II

15

$$-3x + y = 6$$

$$ax + 2y = 4$$

In the system of equations above,  $a$  is a constant. For which of the following values of  $a$  does the system have no solution?

- A)  $-6$
- B)  $-3$
- C)  $3$
- D)  $6$

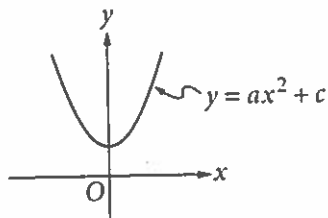


10

Jaime is preparing for a bicycle race. His goal is to bicycle an average of at least 280 miles per week for 4 weeks. He bicycled 240 miles the first week, 310 miles the second week, and 320 miles the third week. Which inequality can be used to represent the number of miles,  $x$ , Jaime could bicycle on the 4th week to meet his goal?

- A)  $\frac{240 + 310 + 320}{3} + x \geq 280$
- B)  $240 + 310 + 320 \geq x(280)$
- C)  $\frac{240}{4} + \frac{310}{4} + \frac{320}{4} + x \geq 280$
- D)  $240 + 310 + 320 + x \geq 4(280)$

11



The vertex of the parabola in the  $xy$ -plane above is  $(0, c)$ . Which of the following is true about the parabola with the equation  $y = -a(x - b)^2 + c$ ?

- A) The vertex is  $(b, c)$  and the graph opens upward.
- B) The vertex is  $(b, c)$  and the graph opens downward.
- C) The vertex is  $(-b, c)$  and the graph opens upward.
- D) The vertex is  $(-b, c)$  and the graph opens downward.

12

Which of the following is equivalent to  $\frac{4x^2 + 6x}{4x + 2}$ ?

- A)  $x$
- B)  $x + 4$
- C)  $x - \frac{2}{4x + 2}$
- D)  $x + 1 - \frac{2}{4x + 2}$

13

$$2x^2 - 4x = t$$

In the equation above,  $t$  is a constant. If the equation has no real solutions, which of the following could be the value of  $t$ ?

- A)  $-3$
- B)  $-1$
- C)  $1$
- D)  $3$