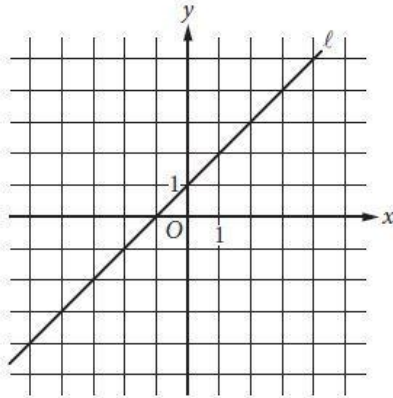


Test 5: Math, No Calculator

1



Which of the following is an equation of line ℓ in the xy -plane above?

- A) $x = 1$
- B) $y = 1$
- C) $y = x$
- D) $y = x + 1$

The Slope-intercept formula of a line is:

$$y = mx + b$$

Slope: $m = \frac{y_1 - y_2}{x_1 - x_2}$

Y-intercept: b

Here slope is equal to 1

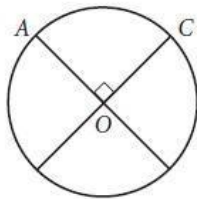
Y-intercept is at 1

Therefore, formula is:

$$y = x + 1$$

D)

2



The circle above with center O has a circumference of 36. What is the length of minor arc \widehat{AC} ?

- A) 9
- B) 12
- C) 18
- D) 36

There are 360 degrees in a circle, so the length of the arc is

$$\frac{90}{360} * 36 = 9$$

A)

3

What are the solutions of the quadratic equation

$$4x^2 - 8x - 12 = 0 ?$$

- A) $x = -1$ and $x = -3$
- B) $x = -1$ and $x = 3$
- C) $x = 1$ and $x = -3$
- D) $x = 1$ and $x = 3$

Two methods:

1. Quadratic Formula:

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

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(4)(-12)}}{2(4)}$$

$$x = 1 \pm \frac{\sqrt{64 + 192}}{8}$$

$$x = 1 \pm 2$$

$$x = -1, x = 3$$

2. Factoring

$$4x^2 - 8x - 12 = 0$$

Dividing both sides by 4

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

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

$$x(x - 3) + 1(x - 3) = 0$$

$$(x - 3)(x + 1) = 0$$

$$x = 3, x = -1$$

B)

4

Which of the following is an example of a function whose graph in the xy -plane has no x -intercepts?

- A) A linear function whose rate of change is not zero
- B) A quadratic function with real zeros
- C) A quadratic function with no real zeros
- D) A cubic polynomial with at least one real zero

- A) If the line is not zero it will not be parallel to the x -axis and therefore will eventually have an x -intercept
- B) Zeros are the same as x -intercepts
- C) Correct Answer, (Zeros and x -intercepts are the same)
- D) One Zero, One x -intercept

C)

5

$$\sqrt{k+2} - x = 0$$

In the equation above, k is a constant. If $x = 9$, what is the value of k ?

- A) 1
- B) 7
- C) 16
- D) 79

$$\begin{aligned}\sqrt{k+2} - 9 &= 0 \\ \sqrt{k+2} &= 9\end{aligned}$$

Square bot sides

$$\begin{aligned}k + 2 &= 81 \\ k &= 79\end{aligned}$$

D)

6

Which of the following is equivalent to the sum of the expressions $a^2 - 1$ and $a + 1$?

- A) $a^2 + a$
- B) $a^3 - 1$
- C) $2a^2$
- D) a^3

$$\begin{aligned}(a^2 - 1) + (a + 1) \\ a^2 + a - 1 + 1 \\ a^2 + a\end{aligned}$$

A)

7

Jackie has two summer jobs. She works as a tutor, which pays \$12 per hour, and she works as a lifeguard, which pays \$9.50 per hour. She can work no more than 20 hours per week, but she wants to earn at least \$220 per week. Which of the following systems of inequalities represents this situation in terms of x and y , where x is the number of hours she tutors and y is the number of hours she works as a lifeguard?

- A) $12x + 9.5y \leq 220$
 $x + y \geq 20$
- B) $12x + 9.5y \leq 220$
 $x + y \leq 20$
- C) $12x + 9.5y \geq 220$
 $x + y \leq 20$
- D) $12x + 9.5y \geq 220$
 $x + y \geq 20$

Pair **the dollar per hour amount** with the correct **hour amount**

One inequality for amount of money
Another for number of hours

\$12 /hour for tutoring
\$9.50 /hour for lifeguard

x-tutor hours
y-lifeguard hours

So,

$$\begin{aligned}12x + 9.5y &\geq 220 \\ x + y &\leq 20\end{aligned}$$

C)

8

In air, the speed of sound S , in meters per second, is a linear function of the air temperature T , in degrees Celsius, and is given by $S(T) = 0.6T + 331.4$. Which of the following statements is the best interpretation of the number 331.4 in this context?

- A) The speed of sound, in meters per second, at 0°C
- B) The speed of sound, in meters per second, at 0.6°C
- C) The increase in the speed of sound, in meters per second, that corresponds to an increase of 1°C
- D) The increase in the speed of sound, in meters per second, that corresponds to an increase of 0.6°C

Using formula $y = mx + b$

$$331.4 = b$$

$$S(T) = 331.4, \text{ when } T=0$$

A)

9

$$y = x^2$$

$$2y + 6 = 2(x + 3)$$

If (x, y) is a solution of the system of equations above and $x > 0$, what is the value of xy ?

- A) 1
- B) 2
- C) 3
- D) 9

$$2(x^2) + 6 = 2(x + 3)$$

$$2x^2 + 6 = 2x + 6$$

$$2x^2 = 2x$$

$$x^2 = x$$

$$x = 1$$

$$y = 1$$

$$xy = 1$$

A)

10

If $a^2 + b^2 = z$ and $ab = y$, which of the following is equivalent to $4z + 8y$?

- A) $(a + 2b)^2$
- B) $(2a + 2b)^2$
- C) $(4a + 4b)^2$
- D) $(4a + 8b)^2$

$$\begin{aligned} a^2 + b^2 &= z \\ ab &= y \\ 4z + 8y &= 4(a^2 + b^2) + 8(ab) \\ &= 4a^2 + 4b^2 + 8ab \end{aligned}$$

$$(a + b)^2 = a^2 + 2ab + b^2$$

Therefore,

$$(2a + 2b)^2 = 4a^2 + 8ab + 4b^2$$

B)

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

$$\begin{aligned} v &= \pi r^2 h \\ 22 &= \pi r^2 h \end{aligned}$$

$$\text{Ratio} = \frac{\pi(2r)^2 \left(\frac{1}{2}h\right)}{\pi r^2 h} = \frac{4}{2} = 2$$

$$2 * 22 = 44$$

C)

12

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

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

$$9^{\frac{1}{4}} = \left(9^{\frac{1}{2}}\right)^{\frac{1}{2}} = (3)^{\frac{1}{2}}$$

So,

$$9^{\frac{3}{4}} = \left((3)^{\frac{1}{2}}\right)^3 = 3\sqrt{3}$$

D)

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

$$n = t - 2$$

T	n
3	1
4	2
5	3
6	4

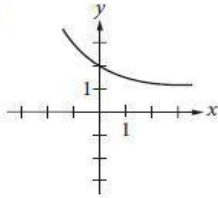
One
B)

14

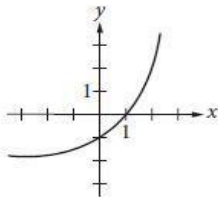
$$f(x) = 2^x + 1$$

The function f is defined by the equation above. Which of the following is the graph of $y = -f(x)$ in the xy -plane?

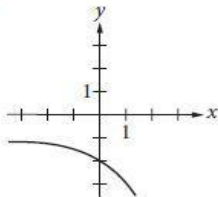
A)



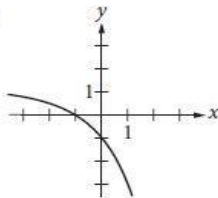
B)



C)



D)



$$-f(x) = -(2^x + 1)$$

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

x	Y
-1	-1.5
0	-2
1	-3
2	-5
3	-9

C)

15

Alan drives an average of 100 miles each week. His car can travel an average of 25 miles per gallon of gasoline. Alan would like to reduce his weekly expenditure on gasoline by \$5. Assuming gasoline costs \$4 per gallon, which equation can Alan use to determine how many fewer average miles, m , he should drive each week?

- A) $\frac{25}{4}m = 95$
- B) $\frac{25}{4}m = 5$
- C) $\frac{4}{25}m = 95$
- D) $\frac{4}{25}m = 5$

- 100 miles per week
- 25 miles per gallon
- Wants to cut \$5 dollars
- Gas costs \$4 per gallon

$$5 = \frac{m}{25}(4)$$

D)

16

Maria plans to rent a boat. The boat rental costs \$60 per hour, and she will also have to pay for a water safety course that costs \$10. Maria wants to spend no more than \$280 for the rental and the course. If the boat rental is available only for a whole number of hours, what is the maximum number of hours for which Maria can rent the boat?

$$\begin{aligned}60x + 10 &\leq 280 \\60x &\leq 270 \\x &\leq \frac{27}{6} = \frac{9}{2} = 4.5\end{aligned}$$

4

17

$$2(p + 1) + 8(p - 1) = 5p$$

What value of p is the solution of the equation above?

$$\begin{aligned}2(p + 1) + 8(p - 1) &= 5p \\2p + 2 + 8p - 8 &= 5p \\10p - 6 &= 5p \\10p - 5p &= 6 \\5p &= 6 \\p &= \frac{6}{5} = 1.2\end{aligned}$$

1.2

18

$$\frac{1}{2}(2x + y) = \frac{21}{2}$$

$$y = 2x$$

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

$$\frac{1}{2}(2x + y) = \frac{21}{2}$$

$$y = 2x$$

We can replace $2x$ with y

$$\frac{1}{2}(y + y) = \frac{21}{2}$$

$$y = \frac{21}{2}$$

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

$$x = \frac{21}{4} = 5.25$$

5.25

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 ?

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

Multiply both sides by $(x + 2)^2$

$$2x + 6 - 2(x + 2) = a$$

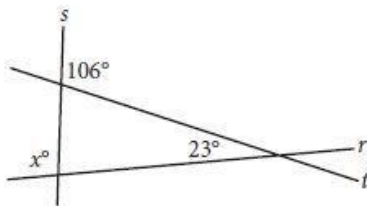
$$2x + 6 - 2x - 4 = a$$

$$a = 2$$

2

20

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



What is the value of x ?

Two angles that share a line are supplementary (add to 180°)

$$180^\circ - 106^\circ = 74^\circ$$

Adding together the two known interior angles

$$74^\circ + 23^\circ = 97^\circ$$

Interior angles add to 180°

$$180^\circ - 97^\circ = 83^\circ$$

Collinear angles are supplementary

$$x = 180^\circ - 83^\circ = 97^\circ$$

**Notice: Sum of two interior angles is equal to the exterior angle

97

