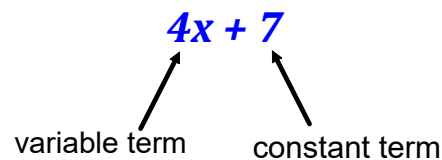


MTH1W Grade 9 Mathematics

## 4.9 Solving Equations with Variables on Both Sides

- Goal(s)**
- To solve equations with constant and variable terms on both sides
  - Write and solve equations representing statements

To solve an equation involving multiple terms, collect variable terms on one side of the equation and constant terms on the other.



Use **opposite operations** to collect terms on either side of the equation.

Whenever possible, try to keep the coefficient of the variable term positive.

$$3x - 4 = 9 + 2x$$

$$3x - 4 - 2x = 9 + 2x - 2x$$

$$x - 4 = 9$$

$$x - 4 + 4 = 9 + 4$$

$$x = 13$$

Isolate the variable terms on the side of the equation where its coefficient will remain positive.

Isolate the constant terms on the other side of the equation.

Solve each equation.

$$3x + 7 = 10x$$

$$3x + 7 - 3x = 10x - 3x$$

$$\frac{7}{7} = \frac{7x}{7}$$

$$1 = x$$

Check

$$3(1) + 7 = 10(1)$$

$$3 + 7 = 10$$

$$10 = 10$$

$$LS = RS \checkmark$$

Solve each equation.

$$w - 12 = -3w$$

$$w - 12 - w = -3w - w$$

$$\frac{-12}{-4} = \frac{-4w}{-4}$$

$$3 = w$$

Check

$$3 - 12 = -3(3)$$

$$-9 = -9$$

$$LS = RS \checkmark$$

Solve each equation.

$$5.2g + 10.4 = 1.2g$$

$$5.2g + 10.4 - 5.2g = 1.2g - 5.2g$$

$$\frac{10.4}{-4} = \frac{-4g}{-4}$$

$$-2.6 = g$$

Check

$$\begin{aligned} 5.2(-2.6) + 10.4 &= 1.2(-2.6) \\ -13.52 + 10.4 &= -3.12 \\ -3.12 &= -3.12 \checkmark \end{aligned}$$

Solve each equation.

$$123m - 27 = 87m + 45$$

$$123m - 27 - 87m = 87m + 45 - 87m$$

$$36m - 27 = 45$$

$$36m - 27 + 27 = 45 + 27$$

$$\frac{36m}{36} = \frac{72}{36}$$

$$m = 2$$

Check

$$\begin{aligned} 123(2) - 27 &= 87(2) + 45 \\ 246 - 27 &= 174 + 45 \\ 219 &= 219 \\ LS &= RS \checkmark \end{aligned}$$

Solve each equation.

$$x^2 - 7 = 2x^2 - 32$$

$$x^2 - 7 - x^2 = 2x^2 - 32 - x^2$$

$$-7 = x^2 - 32$$

$$-7 + 32 = x^2 - 32 + 32$$

$$25 = x^2$$

$$\sqrt{25} = \sqrt{x^2}$$

$$5 = x$$

Check

$$(5)^2 - 7 = 2(5)^2 - 32$$

$$25 - 7 = 2(25) - 32$$

$$18 = 50 - 32$$

$$18 = 18$$

$$LS = RS \checkmark$$

Write an equation to model the following statement.

***Doubling a number and decreasing it by 8 results in the same value as increasing the number by 12.***

Let  $n$  = the unknown number

$$\Rightarrow 2n - 8 = n + 12$$

number is  
doubled and  
then decreased  
by 8

"results in  
the same  
value as"

number  
increased  
by 12

Solve the equation from the previous example.

$$2n - 8 = n + 12$$

$$2n - 8 - n = n + 12 - n$$

$$n - 8 = 12$$

$$n - 8 + 8 = 12 + 8$$

$$n = 20$$

Check

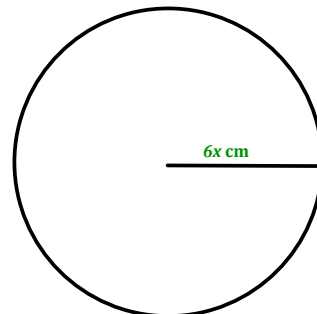
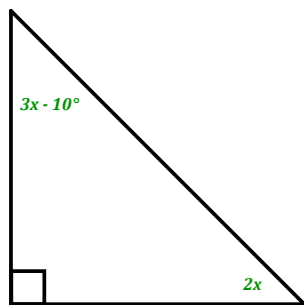
$$2(20) - 8 = (20) + 12$$

$$40 - 8 = 32$$

$$32 = 32$$

$$LS = RS \checkmark$$

Determine the value of  $x$ . Use this value to determine the area of the circle shown.



Angles in  $\Delta$  total 180

$$3x - 10 + 2x + 90 = 180$$

$$5x + 80 = 180$$

$$5x + 80 - 80 = 180 - 80$$

$$\frac{5x}{5} = \frac{100}{5}$$

$$x = 20$$

$$\text{Radius} = 6x$$

$$= 6(20)$$

$$= 120 \text{ cm}$$

$$\text{Area} = \pi r^2$$

$$= \pi (120)^2$$

$$= 45238.934$$

$$\Rightarrow \text{Area of circle} = 45,239 \text{ cm}^2$$