


## Properties of Addition and Multiplication

In math, there are certain principles or rules that will always be true. These rules are called **properties**. Knowing and following math properties will help you to solve math problems. There are several math properties.

| ADDITION PROPERTIES   | MULTIPLICATION PROPERTIES  |
|---|--|
| <p><b>Commutative Property</b><br/>Changing the order of addends does not change the sum.<br/><math>a + b = b + a</math><br/>Example: <math>3 + 7 = 7 + 3</math><br/><math>10 = 10</math></p>   | <p><b>Commutative Property</b><br/>Changing the order of factors does not change the product.<br/><math>a \times b = b \times a</math><br/>Example: <math>3 \times 7 = 7 \times 3</math><br/><math>21 = 21</math></p>  |
| <p><b>Associative Property</b><br/>Changing the grouping of the addends does not change the sum.<br/><math>(a + b) + c = a + (b + c)</math><br/>Example: <math>(5 + 6) + 4 = 5 + (6 + 4)</math><br/><math>11 + 4 = 5 + 10</math><br/><math>15 = 15</math></p>   | <p><b>Associative Property</b><br/>Changing the grouping of the factors does not change the product.<br/><math>(a \times b) \times c = a \times (b \times c)</math><br/>Example: <math>(8 \times 2) \times 3 = 8 \times (2 \times 3)</math><br/><math>16 \times 3 = 8 \times 6</math><br/><math>48 = 48</math></p> |
| <p><b>Additive Identity Property</b><br/>The sum of any number and zero is that number.<br/><math>a + 0 = a</math><br/>Example: <math>7 + 0 = 7</math></p>  | <p><b>Multiplicative Identity Property</b><br/>The product of one and any number is that number.<br/><math>a \times 1 = a</math><br/>Example: <math>5 \times 1 = 5</math></p>  |
|  <p>Zero is called the <b>additive identity</b>.<br/>One is called the <b>multiplicative identity</b>.</p>   | <p><b>Zero Property</b><br/>The product of zero and any number is zero.<br/><math>a \times 0 = 0</math><br/>Example: <math>4 \times 0 = 0</math></p>   |
| <p><b>Distributive Property</b><br/>The product of a factor and a sum is equal to the sum of the products.<br/><math>a \times (b + c) = (a \times b) + (a \times c)</math><br/>Example: <math>3 \times (5 + 8) = (3 \times 5) + (3 \times 8)</math><br/><math>3 \times 13 = 15 + 24</math><br/><math>39 = 39</math></p> |  |

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Match the Properties

Write the letter of the matching property in the blank next to the equation.

Letters may be used more than once.

G ~~A~~ 1.  $5 \times 0 = 0$

H 2.  $(6 \times 4) + (6 \times 11) = 6 \times (4 + 11)$

A 3.  $4 + 9 = 9 + 4$

C 4.  $(6 + 2) + 8 = 6 + (2 + 8)$

E 5.  $27 + 0 = 27$

F 6.  $36 \times 1 = 36$

D 7.  $(9 \times 8) \times 15 = 9 \times (8 \times 15)$

B 8.  $17 \times 33 = 33 \times 17$

D 9.  $(2 \times 7) \times 4 = 2 \times (7 \times 4)$

C 10.  $(5 + 3) + 9 = 5 + (3 + 9)$

H 11.  $2 \times (3 + 7) = (2 \times 3) + (2 \times 7)$

C 12.  $4 + (6 + 3) = 4 + (3 + 6)$

G 13.  $48 \times 0 = 0$

B 14.  $51 \times 30 = 30 \times 51$

F 15.  $42 \times 1 = 42$

C 16.  $2 + (8 + 6) = (2 + 6) + 8$

a. Commutative Property of Addition

b. Commutative Property of Multiplication

c. Associative Property of Addition

d. Associative Property of Multiplication

e. Identity Property of Addition

f. Identity Property of Multiplication

g. Zero Property of Multiplication

h. Distributive Property

## Solve One-Step Equations

+ / -  
• / ÷

- Solve equations by applying the inverse operation.
- To isolate the variable, undo addition, subtraction, ~~division~~ <sup>multiplication</sup> or division.

**Example:**

$$\begin{array}{r} x + 9 = 17 \\ -9 \quad -9 \\ \hline x = 8 \end{array}$$

$$\begin{array}{r} x - 7 = 15 \\ +7 \quad +7 \\ \hline x = 22 \end{array}$$

$$\begin{array}{r} 3x = 18 \\ \frac{3x}{3} = \frac{18}{3} \\ x = 6 \end{array}$$

$$\begin{array}{r} 3n = 15 \\ \frac{3n}{3} = \frac{15}{3} \\ n = 5 \end{array}$$

## Solve Two-Step Equations

1<sup>st</sup> undo +/-  
2<sup>nd</sup> undo \*/÷

- Solve equations by applying the inverse operation.
- To isolate the variable, undo addition or subtraction then multiplication or division.

**Example:**

1<sup>st</sup> undo addition  
2<sup>nd</sup> undo ~~division~~ multiplication

$$\begin{array}{r} 5x + 8 = 23 \\ -8 \quad -8 \\ \hline 5x = 15 \\ \frac{5x}{5} = \frac{15}{5} \\ x = 3 \end{array}$$

$$\begin{array}{r} 7n - 6 = 8 \\ +6 \quad +6 \\ \hline 7n = 14 \\ \frac{7n}{7} = \frac{14}{7} \\ n = 2 \end{array}$$

1<sup>st</sup> undo subtraction  
2<sup>nd</sup> undo division

## Solve a Two-step Equation by Combining Like Terms

- Combine like terms, then isolate the variable by using inverse operations.

**Example:**

$$\begin{array}{r} 5x - 6 + 4x = 12 \\ 9x - 6 = 12 \\ +6 \quad +6 \\ \hline 9x = 18 \\ \frac{9x}{9} = \frac{18}{9} \\ x = 2 \end{array}$$

combine like terms  
undo ~~addition~~ subtraction  
undo multiplication

One-Step Equations

Solve each equation.

$$1) 26 = 8 + v$$

$$\begin{array}{r} -8 \quad | \quad -8 \\ \hline 18 = v \end{array}$$

$$2) 3 + p = 8$$

$$\begin{array}{r} -3 \quad | \quad -3 \\ \hline p = 5 \end{array}$$

$$3) 15 + b = 23$$

$$\begin{array}{r} -15 \quad | \quad -15 \\ \hline 8 = b \end{array}$$

$$4) -1 + n = -9$$

$$\begin{array}{r} +1 \quad | \quad +1 \\ \hline n = -8 \end{array}$$

$$5) m + 4 = -12$$

$$\begin{array}{r} -4 \quad | \quad -4 \\ \hline m = -16 \end{array}$$

$$6) x - 7 = 13$$

$$\begin{array}{r} +7 \quad | \quad +7 \\ \hline x = 20 \end{array}$$

$$7) m - 9 = -13$$

$$\begin{array}{r} +9 \quad | \quad +9 \\ \hline m = -4 \end{array}$$

$$8) p - 6 = -5$$

$$\begin{array}{r} +6 \quad | \quad +6 \\ \hline p = 1 \end{array}$$

$$9) v - 15 = -27$$

$$\begin{array}{r} +15 \quad | \quad +15 \\ \hline v = -12 \end{array}$$

$$10) n + 16 = 9$$

$$\begin{array}{r} -16 \quad | \quad -16 \\ \hline n = -7 \end{array}$$

$$11) -104 = 8x$$

$$\begin{array}{r} \frac{-104}{8} \quad \frac{8}{8} \\ \hline -13 = x \end{array}$$

$$12) 14b = -56$$

$$\begin{array}{r} \frac{14b}{14} \quad \frac{-56}{14} \\ \hline b = -4 \end{array}$$

$$13) -6 = \frac{b}{18} \cdot 18$$

$$14) 10n = 40$$

$$\begin{array}{r} \frac{10n}{10} \quad \frac{40}{10} \\ \hline n = 4 \end{array}$$

$$-108 = b$$

## Two-Step Equations

Solve each equation.

$$1) 6 = \frac{a}{4} + 2$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

$$4 \cdot 4 = \frac{a}{4} \cdot 4$$

$$\boxed{16 = a}$$

$$3) 9x - 7 = -7$$

$$\begin{array}{r} +7 \\ +7 \end{array}$$

$$\frac{9x}{9} = \frac{0}{9}$$

$$\boxed{x = 0}$$

$$5) -4 = \frac{r}{20} - 5$$

$$\begin{array}{r} +5 \\ +5 \end{array}$$

$$20 \cdot 1 = \frac{r}{20} \cdot 20$$

$$\boxed{20 = r}$$

$$37) \frac{v+9}{2} = 8 \cdot 3$$

$$v + 9 = 24$$

$$\begin{array}{r} -9 \\ -9 \end{array}$$

$$\boxed{v = 15}$$

$$9) -9x + 1 = -80$$

$$\begin{array}{r} -1 \\ -1 \end{array}$$

$$\frac{-9x}{-9} = \frac{-81}{-9}$$

$$\boxed{x = 9}$$

$$11) -2 = 2 + \frac{v}{4}$$

$$\begin{array}{r} -2 \\ -2 \end{array} \quad 4 \cdot -4 = \frac{v}{4} \cdot 4$$

$$\boxed{v = -16}$$

$$40 = \dots$$

$$\boxed{-16 = v}$$

$$2) -6 + \frac{x}{4} = -5$$

$$\begin{array}{r} +6 \\ +6 \end{array}$$

$$\frac{x}{4} = 1 \cdot 4$$

$$\boxed{x = 4}$$

$$4) 0 = 4 + \frac{n}{5}$$

$$\begin{array}{r} -4 \\ -4 \end{array}$$

$$5) -4 = \frac{n}{5} \cdot 5$$

$$\boxed{-20 = n}$$

$$6) -1 = \frac{5+x}{6} \cdot 6$$

$$-6 = 5 + x$$

$$\begin{array}{r} -5 \\ -5 \end{array}$$

$$\boxed{-11 = x}$$

$$8) 2(n+5) = -2$$

$$2n + 10 = -2$$

$$\begin{array}{r} -10 \\ -10 \end{array}$$

$$\frac{2n}{2} = \frac{-12}{2}$$

$$\boxed{n = -6}$$

$$10) -6 = \frac{n}{2} - 10$$

$$\begin{array}{r} +10 \\ +10 \end{array}$$

$$2 \cdot 4 = \frac{n}{2} \cdot 2$$

$$\boxed{8 = n}$$

$$12) 144 = -12(x+5)$$

$$144 = -12x - 60$$

$$\begin{array}{r} +60 \\ +60 \end{array}$$

$$204 = -12x$$

$$\begin{array}{r} -12 \\ -12 \end{array}$$

$$\boxed{-17 = x}$$

$$13) \begin{array}{r} -15 = -4m + 5 \\ -5 \quad -5 \end{array}$$

$$\begin{array}{r} -20 = -4m \\ -4 \quad -4 \end{array}$$

$$\boxed{5 = m}$$

$$15) \begin{array}{r} 8n + 7 = 31 \\ -7 \quad -7 \end{array}$$

$$\begin{array}{r} 8n = 24 \\ 8 \quad 8 \end{array}$$

$$\boxed{n = 3}$$

$$17) \begin{array}{r} n + 5 = -1 \cdot -16 \\ -16 \end{array}$$

$$\begin{array}{r} n + 5 = 16 \\ -5 \quad -5 \end{array}$$

$$\boxed{n = 11}$$

$$19) -10 = 10(k - 9)$$

$$\begin{array}{r} -10 = 10k - 90 \\ +90 \quad +90 \end{array}$$

$$\begin{array}{r} 80 = 10k \\ 10 \quad 10 \end{array}$$

$$\boxed{8 = k}$$

$$21) \begin{array}{r} 9 + 9n = 9 \\ -9 \quad -9 \end{array}$$

$$\begin{array}{r} 9n = 0 \\ 9 \quad 9 \end{array}$$

$$\boxed{n = 0}$$

$$23) \begin{array}{r} 8 + \frac{b}{4} = 5 \\ -8 \quad -8 \end{array}$$

$$4) \begin{array}{r} \frac{b}{4} = -3 \cdot -4 \\ -4 \end{array}$$

$$\boxed{b = 12}$$

$$14) \begin{array}{r} 10 - 6v = -104 \\ -10 \quad -10 \end{array}$$

$$\begin{array}{r} -6v = -114 \\ -6 \quad -6 \end{array}$$

$$\boxed{v = +19}$$

$$16) \begin{array}{r} -9x - 13 = -103 \\ +13 \quad +13 \end{array}$$

$$\begin{array}{r} -9x = -90 \\ -9 \quad -9 \end{array}$$

$$\boxed{x = 10}$$

$$18) \begin{array}{r} -10 = -10 + 7m \\ +10 \quad +10 \end{array}$$

$$\begin{array}{r} 0 = 7m \\ 7 \quad 7 \end{array}$$

$$\boxed{0 = m}$$

$$20) \begin{array}{r} \frac{m}{9} - 1 = -2 \\ +1 \quad +1 \end{array}$$

$$9) \begin{array}{r} \frac{m}{9} = -1 \cdot 9 \end{array}$$

$$\boxed{m = -9}$$

$$22) 7(9 + k) = 84$$

$$\begin{array}{r} 63 + 7k = 84 \\ -63 \quad -63 \end{array}$$

$$\begin{array}{r} 7k = 21 \\ 7 \quad 7 \end{array}$$

$$\boxed{k = 3}$$

$$24) -243 = -9(10 + x)$$

$$\begin{array}{r} -243 = -90 - 9x \\ +90 \quad +90 \end{array}$$

$$\begin{array}{r} -153 = -9x \\ -9 \quad -9 \end{array}$$

$$\boxed{x = 17}$$