

# The Four Basic Rules for Solving an Equation

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1. Addition Property of Equality
2. Subtraction Property of Equality
3. Multiplication Property of Equality
4. Division Property of Equality

## Addition Property of Equality

If the same quantity is added to both sides of an equation, the resulting equation is equivalent to the original equation.

**Example:**  $m - 9 = 12 \longrightarrow$  add (9) to both sides

$$m - 9 + 9 = 12 + 9 \longrightarrow -9 + 9 = 0$$

$$\mathbf{m = 21}$$

# Subtraction Property of Equality

If the same quantity is subtracted from both sides of an equation, the resulting equation is equivalent to the original equation.

Example:  $g + 10 = 11 \rightarrow$  subtract both sides by 10  
 $g + 10 - 10 = 11 - 10 \rightarrow 10 - 10 = 0$   
 $g = 1$

## Multiplication Property of Equality

If both sides of an equation are multiplied by the same (nonzero) quantity, the resulting equation is equivalent to the original equation.

**Example:**  $\frac{x}{2} = 12 \longrightarrow$  multiply both sides by 2

$$\frac{x}{2} = 12 \times 2$$
$$x = 24$$

## Division Property of Equality

If both sides of an equation are divided by the same (nonzero) quantity, the resulting equation is equivalent to the original equation.

Example:  $6n = 30 \rightarrow$  divide both sides by 6

$$\frac{6n}{6} = \frac{30}{6}$$
$$n = 5$$

Let's try to translate and solve the following equation:

I am 9 years older than twice the age of my younger brother.

If I were 49 years old. How old is my younger brother?

Let  $y$  be her younger brother's age.

Algebraic Equation is:  $9 + 2y = 49$

Let us solve:  $9 + 2y = 49$

$-9 + 9 + 2y = 49 - 9 \longrightarrow$  Subtraction Property of Equality

$$\frac{2y}{2} = \frac{40}{2} \longrightarrow$$
 Division Property of Equality

$$y = 20$$

Therefore, her youngest brother is **20 years old**.