Solving Equations Using Addition or Subtraction

Goal: Use addition and subtraction to solve equations.

Vocabulary

Equation: A mathematical sentence formed by placing an equal sign between two expressions

Solution of an equation: A number you can substitute for the variable to make an equation with one variable true

Equivalent equations: Equations that have the same solution(s)

Inverse operation: An operation that "undoes" another operation

EXAMPLE 1 Checking Solutions

Tell whether the value of the variable is a solution of $25 - g = 17$.

a. $g = 12$

b. $g = 8$

Solution

a.
$$25 - g = 17$$ Write original equation.
$$25 - \boxed{12} \stackrel{?}{=} 17$$ Substitute $\boxed{12}$ for g.
$$\boxed{13} \boxed{\neq} 17$$ Simplify.

Answer: 12 $\boxed{\text{is not}}$ a solution.

b.
$$25 - g = 17$$ Write original equation.
$$25 - \boxed{8} \stackrel{?}{=} 17$$ Substitute $\boxed{8}$ for g.
$$\boxed{17} \boxed{=} 17$$ Simplify.

Answer: 8 $\boxed{\text{is}}$ a solution.

Subtraction Property of Equality

Words Subtracting the same number from each side of an equation produces an equivalent equation.

Numbers If $x + 9 = 12$, then $x + 9 - 9 = 12 - \boxed{9}$, or $x = \boxed{3}$.

Algebra If $x + a = b$, then $x + a - a = \boxed{b} - a$, or $x = \boxed{b - a}$.

EXAMPLE 2 Solving an Equation Using Subtraction

$$x + 7 = -13 \qquad \text{Original equation}$$

$$\boxed{-7} = \boxed{-7} \qquad \boxed{\text{Subtract } -7} \text{ from each side. (Subtraction property of equality)}$$

$$x = \boxed{-20} \qquad \text{Simplify.}$$

Answer: The solution is $\boxed{-20}$.

✓ **Check** $\qquad x + 7 = -13 \qquad\qquad$ Write original equation.

$$(\boxed{-20}) + \boxed{7} \stackrel{?}{=} -13 \qquad\qquad \text{Substitute } \boxed{-20} \text{ for } x.$$

$$-13 = -13 \checkmark \qquad\qquad \text{Solution checks.}$$

Addition Property of Equality

Words Adding the same number to each side of an equation produces an equivalent equation.

Numbers If $x - 6 = 1$, then $x - 6 + 6 = 1 + \boxed{6}$, or $x = \boxed{7}$.

Algebra If $x - a = b$, then $x - a + a = \boxed{b} + a$, or $x = \boxed{b + a}$.

EXAMPLE 3 **Solving an Equation Using Addition**

$$t - 5.8 = 16 \qquad \text{Original equation}$$

$$t - 5.8 \boxed{+ 5.8} = 16 \boxed{+ 5.8} \qquad \boxed{\text{Add } 5.8} \text{ to each side.}$$

(Addition property of equality)

$$t = \boxed{21.8} \qquad \text{Simplify.}$$

✓ Check $\boxed{21.8} - \boxed{5.8} \overset{?}{=} 16$ Substitute $\boxed{21.8}$ for t in original equation.

$$16 = 16 ✓$$

Guided Practice Solve the equation. Check your solution.

1. $y + 4 = 13$	**2.** $-17 = 7 + t$	**3.** $n - 11 = 14$	**4.** $-2 = s - 3.5$

EXAMPLE 4 **Using a Model**

Kites You are flying a kite. The total length of the kite's string is 275 feet. So far you have let out 153 feet of string. How much string do you have left?

Solution

Let s represent the length of string left.

$$\boxed{275} = \boxed{s} + 153 \qquad \text{Write an algebraic model.}$$

$$\boxed{275} - \boxed{153} = \boxed{s} + 153 - \boxed{153} \qquad \text{Subtract } \boxed{153} \text{ from each side.}$$

$$\boxed{122} = \boxed{s} \qquad \text{Simplify.}$$

Answer: You have $\boxed{122}$ feet of string left.

Homework