

# 3.1

## Solve One-Step Equations

**Goal** • Solve one-step equations using algebra.

**Your Notes**

### VOCABULARY

**Inverse operations** Two operations that undo each other, such as addition and subtraction

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

### ADDITION PROPERTY OF EQUALITY

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

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

### SUBTRACTION PROPERTY OF EQUALITY

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

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

## Your Notes

### Example 1 Solve an equation using subtraction

Solve  $y + 3 = 10$ .

#### Solution

$$y + 3 = 10$$

$$y + 3 - \underline{3} = 10 - \underline{3}$$

$$y = \underline{7}$$

The solution is  $\underline{7}$ .

#### CHECK

$$y + 3 = 10$$

$$\underline{7} + 3 \stackrel{?}{=} 10$$

$$\underline{10} = 10 \checkmark$$

Write original equation.

Use subtraction property of equality: Subtract  $\underline{3}$  from each side.

Simplify.

Write original equation.

Substitute  $\underline{7}$  for  $y$ .

Solution checks.

Remember to check your solution in the original equation for accuracy.

### Example 2 Solve an equation using addition

Solve  $t - 9 = 11$ .

#### Solution

$$t - 9 = 11$$

$$t - 9 + \underline{9} = 11 + \underline{9}$$

$$t = \underline{20}$$

The solution is  $\underline{20}$ .

#### CHECK

$$t - 9 = 11$$

$$\underline{20} - 9 \stackrel{?}{=} 11$$

$$\underline{11} = 11 \checkmark$$

Write original equation.

Use addition property of equality: Add  $\underline{9}$  to each side.

Simplify.

Write original equation.

Substitute  $\underline{20}$  for  $t$ .

Solution checks.

## Your Notes

✔ **Checkpoint** Solve each equation. Check your solution.

1. $a + 6 = 17$ $a = 11$	2. $b - 17 = 12$ $b = 29$
3. $-3 = x + 2$ $x = -5$	4. $y - 4 = -6$ $y = -2$

### MULTIPLICATION PROPERTY OF EQUALITY

**Words** Multiplying each side of an equation by the same non-zero number produces an equivalent equation.

**Algebra** If  $\frac{x}{a} = b$  and  $a \neq 0$ , then  $a \cdot \frac{x}{a} = \underline{a} \cdot \underline{b}$   
or  $x = \underline{ab}$ .

### DIVISION PROPERTY OF EQUALITY

**Words** Dividing each side of an equation by the same non-zero number produces an equivalent equation.

**Algebra** If  $ax = b$ , and  $a \neq 0$ , then  $\frac{ax}{a} = \frac{\boxed{b}}{\boxed{a}}$  or  $x = \frac{\boxed{b}}{\boxed{a}}$ .

## Your Notes

The *division property of equality* can be used to solve equations involving multiplication.

### Example 3 Solve an equation using division

Solve  $8x = 56$ .

#### Solution

$$8x = 56$$

$$\frac{8x}{8} = \frac{56}{8}$$

$$x = 7$$

The solution is 7.

#### CHECK

$$8x = 56$$

$$8(\underline{7}) \stackrel{?}{=} 56$$

$$\underline{56} = 56 \checkmark$$

Write original equation.

Use division property of equality:  
Divide each side by 8.

Simplify.

Write original equation.

Substitute 7 for  $x$ .

Solution checks.

### Example 4 Solve an equation using multiplication

Solve  $\frac{a}{5} = 12$ .

#### Solution

$$\frac{a}{5} = 12$$

$$\underline{5} \cdot \frac{a}{5} = \underline{5} \cdot 12$$

$$a = \underline{60}$$

The solution is 60.

#### CHECK

$$\frac{a}{5} = 12$$

$$\frac{\underline{60}}{5} \stackrel{?}{=} 12$$

$$\underline{12} = 12 \checkmark$$

Write original equation.

Use multiplication property of equality:  
Multiply each side by 5.

Simplify.

Write original equation.

Substitute 60 for  $a$ .

Solution checks.

The *multiplication property of equality* can be used to solve equations involving division.

**Your Notes**

**Example 5** Solve an equation by multiplying by a reciprocal

Solve  $\frac{3}{5}t = 6$ .

**Solution**

The coefficient of  $t$  is  $\frac{3}{5}$ . The reciprocal of  $\frac{3}{5}$  is  $\frac{5}{3}$ .

$\frac{3}{5}t = 6$  Write original equation.

$\left(\frac{5}{3}\right) \cdot \frac{3}{5}t = \left(\frac{5}{3}\right) \cdot 6$  Multiply each side by the reciprocal  $\frac{5}{3}$ .

$t = 10$  Simplify.

The solution is  $10$ .

**CHECK**

$\frac{3}{5}t = 6$  Write original equation.

$\frac{3}{5}(10) \stackrel{?}{=} 6$  Substitute  $10$  for  $t$ .

$6 = 6 \checkmark$  Solution checks.

**Checkpoint** Solve each equation. Check your solution.

5.  $3x = 39$

$x = 13$

6.  $\frac{b}{4} = 13$

$b = 52$

7.  $-24 = 4x$

$x = -6$

8.  $-\frac{3}{8}m = 21$

$m = -56$

**Homework**