

### 3-3 Using Several Transformations

**Objective:** To solve equations by using more than one transformation.

#### Vocabulary

**Inverse operations** Operations that “undo” each other. For example, multiplication and division are inverse operations. Likewise, addition and subtraction are inverse operations.

**Tips for solving an equation in which the variable is on one side.**

1. Simplify each side of the equation as needed.
2. Use inverse operations to “undo” the operations in the equation.

**Example 1** Solve  $3n - 7 = 8$ .

**Solution**

$$3n - 7 + 7 = 8 + 7$$

$$3n = 15$$

$$\frac{3n}{3} = \frac{15}{3}$$

$$n = 5$$

Use inverse operations:

To undo the subtraction of 7 from  $3n$ , add 7 to each side.

To undo the multiplication of  $n$  by 3, divide each side by 3.

The solution set is  $\{5\}$ .

**Example 2** Solve  $\frac{1}{2}x + 1 = 7$ .

**Solution**

$$\frac{1}{2}x + 1 - 1 = 7 - 1$$

$$\frac{1}{2}x = 6$$

$$2\left(\frac{1}{2}x\right) = 6 \cdot 2$$

$$x = 12$$

Use inverse operations:

Subtract 1 from each side.

Multiply each side by 2, the reciprocal of  $\frac{1}{2}$ .

The solution set is  $\{12\}$ .

**Solve.**

1.  $2y + 1 = 15$

2.  $2x - 7 = 13$

3.  $26 = 5y + 1$

4.  $58 = 3y - 2$

5.  $-11 + 4y = 25$

6.  $13 + 6y = -23$

7.  $\frac{1}{2}x - 3 = 5$

8.  $\frac{1}{3}x + 5 = 7$

9.  $3 = \frac{1}{4}x - 1$

10.  $6 = \frac{1}{5}x + 2$

11.  $\frac{x}{2} + 7 = 1$

12.  $\frac{x}{5} - 2 = 4$

**Example 3** Solve  $\frac{x - 2}{3} = 4$ .

**Solution**

$$3\left(\frac{x - 2}{3}\right) = 3 \cdot 4$$

$$x - 2 = 12$$

$$x - 2 + 2 = 12 + 2$$

$$x = 14$$

Multiply each side by 3.

Add 2 to each side.

The solution set is  $\{14\}$ .

**3-3 Using Several Transformations** (continued)

Solve.

13.  $\frac{x-1}{2} = 5$

14.  $\frac{3-x}{4} = 2$

15.  $\frac{x-6}{6} = -1$

16.  $-3 = \frac{x-1}{5}$

17.  $\frac{2-x}{3} = -4$

18.  $-2 = \frac{1-x}{7}$

**Example 4** Solve  $28 = 9a + 5a$ .

**Solution**

$28 = 9a + 5a$	Combine $9a$ and $5a$ .
$28 = 14a$	
$\frac{28}{14} = \frac{14a}{14}$	Divide each side by 14.
$2 = a$	The solution set is $\{2\}$ .

Solve.

19.  $4w - w = -12$

20.  $20 = 2a + 3a$

21.  $y - 4y = -18$

22.  $5t + 3t = -16$

23.  $-7v + 3v = -12$

24.  $24 = -3n + 9n$

**Example 5** Solve  $3(y + 2) - 1 = 11$ .

**Solution**

$3(y + 2) - 1 = 11$	{	Use the distributive property to rewrite the left side.
$3y + 6 - 1 = 11$		
$3y + 5 = 11$		
$3y + 5 - 5 = 11 - 5$		Subtract 5 from each side.
$3y = 6$		
$\frac{3y}{3} = \frac{6}{3}$		Divide each side by 3.
$y = 2$		The solution set is $\{2\}$ .

Solve.

25.  $2(x - 1) = 16$

26.  $3(y - 5) = 12$

27.  $20 = 4(x + 3)$

28.  $5(n + 2) - 3 = -18$

29.  $6(x - 4) + 5 = 11$

30.  $-3 = 7(h - 2) + 11$

**Mixed Review Exercises**

Solve.

1.  $\frac{1}{4}x = -17$

2.  $\frac{x}{6} = \frac{2}{3}$

3.  $\frac{1}{4}x = 2\frac{1}{4}$

4.  $-4 + x = -1$

5.  $x + 7 = 16$

6.  $30 = y + 12$

7.  $-10 + x = -18$

8.  $24 - x = 26$

9.  $0.5x = -5$

10.  $3.2 = n + 3$

11.  $0 = 5x$

12.  $14y = 280$