1.3 Lesson

Key Idea

Solving Equations with Variables on Both Sides

To solve equations with variables on both sides, collect the variable terms on one side and the constant terms on the other side.

EXAMPLE 1 Solving an Equation with Variables on Both Sides

Solve $15 - 2x = -7x$. Check your solution.

	$15 - 2x = -7x$	Write the equation.
Undo the subtraction. →	$+ 2x \quad + 2x$	Addition Property of Equality
	$15 = -5x$	Simplify.
Undo the multiplication. →	$\frac{15}{-5} = \frac{-5x}{-5}$	Division Property of Equality
	$-3 = x$	Simplify.

The solution is $x = -3$.

Check

$15 - 2x = -7x$

$15 - 2(-3) \stackrel{?}{=} -7(-3)$

$21 = 21$ ✓

Try It Solve the equation. Check your solution.

1. $-3x = 2x + 20$

2. $2.5y + 6 = 4.5y - 1$

EXAMPLE 2 Using the Distributive Property to Solve an Equation

Solve $-2(x - 5) = 6(2 - 0.5x)$.

	$-2(x - 5) = 6(2 - 0.5x)$	Write the equation.
	$-2x + 10 = 12 - 3x$	Distributive Property
Undo the subtraction. →	$+ 3x \qquad + 3x$	Addition Property of Equality
	$x + 10 = 12$	Simplify.
Undo the addition. →	$- 10 \quad - 10$	Subtraction Property of Equality
	$x = 2$	Simplify.

The solution is $x = 2$.

Try It Solve the equation. Check your solution.

3. $6(4 - z) = 2z$

4. $5(w - 2) = -2(1.5w + 5)$

Some equations do not have one solution. Equations can also have no solution or infinitely many solutions.

When solving an equation that has no solution, you will obtain an equivalent equation that is not true for any value of the variable, such as $0 = 2$.

EXAMPLE 3 Solving an Equation with No Solution

Math Practice

Look for Structure

How can you use the structure of the original equation to recognize that there is no solution?

Solve $3 - 4x = -7 - 4x$.

$3 - 4x = -7 - 4x$ Write the equation.

$\underline{+\,4x} \qquad \underline{+\,4x}$ Addition Property of Equality

$3 = -7$ ✗ Simplify.

The equation $3 = -7$ is never true. So, the equation has no solution.

Try It **Solve the equation.**

5. $2x + 1 = 2x - 1$

6. $6(5 - 2v) = -4(3v + 1)$

When solving an equation that has infinitely many solutions, you will obtain an equivalent equation that is true for all values of the variable, such as $-5 = -5$.

EXAMPLE 4 Solving an Equation with Infinitely Many Solutions

Solve $6x + 4 = 4\left(\frac{3}{2}x + 1\right)$.

$6x + 4 = 4\left(\frac{3}{2}x + 1\right)$ Write the equation.

$6x + 4 = 6x + 4$ Distributive Property

$\underline{-\,6x} \qquad \underline{-\,6x}$ Subtraction Property of Equality

$4 = 4$ Simplify.

The equation $4 = 4$ is always true. So, the equation has infinitely many solutions.

Check Choose any value of x, such as $x = 2$.

$6x + 4 = 4\left(\frac{3}{2}x + 1\right)$

$6(2) + 4 \stackrel{?}{=} 4\left[\frac{3}{2}(2) + 1\right]$

$12 + 4 \stackrel{?}{=} 4(3 + 1)$

$16 = 16$ ✓

Try It **Solve the equation.**

7. $\frac{1}{2}(6t - 4) = 3t - 2$

8. $\frac{1}{3}(2b + 9) = \frac{2}{3}\left(b + \frac{9}{2}\right)$