

5-5 Study Guide and Intervention**Solving Multi-Step Equations and Inequalities**

Solve Equations with Grouping Symbols Equations with grouping symbols can be solved by first using the Distributive Property to remove the grouping symbols.

Example 1 Solve $2(6m - 1) = 8m$. Check your solution.

$$2(6m - 1) = 8m$$

Write the equation.

$$12m - 2 = 8m$$

Use the Distributive Property.

$$12m - 12m - 2 = 8m - 12m$$

Subtraction Property of Equality

$$-2 = -4m$$

Simplify.

$$\frac{-2}{-4} = \frac{-4m}{-4}$$

Division Property of Equality

$$\frac{1}{2} = m$$

Simplify.

CHECK $2(6m - 1) = 8m$

$$2\left[6\left(\frac{1}{2}\right) - 1\right] \stackrel{?}{=} 8\left(\frac{1}{2}\right)$$

Replace m with $\frac{1}{2}$.

$$2(3 - 1) \stackrel{?}{=} 4$$

Simplify.

$$4 = 4 \checkmark$$

The solution checks.

No Solution or All Numbers as Solutions Some equations have no solution. The solution set is the **null** or **empty set**, which is represented by \emptyset . Other equations have every number as a solution. Such an equation is called an **identity**.

Example 2 Solve each equation.

a. $2(x - 1) = 4 + 2x$

b. $-2(x - 1) = 2 - 2x$

$$2x - 2 = 4 + 2x$$

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

$$2x - 2x - 2 = 4 + 2x - 2x$$

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

$$-2 = 4$$

$$-2x = -2x$$

The solution set is \emptyset .

$$x = x$$

The solution set is all real numbers.

Exercises

Solve each equation. Check your solution.

1. $8(g - 3) = 24$ 2. $5(x + 3) = 25$ 3. $7(2c - 5) = 7$ 4. $2(3d + 7) = 5 + 6d$

5. $2(s + 11) = 5(s + 2)$ 6. $7y - 1 = 2(y + 3) - 2$ 7. $2(f + 3) - 2 = 8 + 2f$

8. $2(x - 2) + 3 = 2x - 1$ 9. $1 + 2(b + 6) = 5(b - 1)$ 10. $2x - 5 = 3(x + 3)$

5-5 Study Guide and Intervention (continued)

Solving Multi-Step Equations and Inequalities

Solve Multi-Step Inequalities Some inequalities require more than one step to solve. For such inequalities, undo the operations in reverse order, just as in solving multi-step equations. Remember to reverse the inequality symbol when multiplying or dividing each side of the inequality by a negative number. If the inequality contains parentheses, use the Distributive Property to begin simplifying the inequality.

Example Solve $12 - 2x > 24 + 2x$. Graph the solution on a number line.

$12 - 2x > 24 + 2x$	Write the inequality.
$12 - 2x - 2x > 24 + 2x - 2x$	Subtraction Property of Inequality
$12 - 4x > 24$	Simplify.
$12 - 12 - 4x > 24 - 12$	Subtraction Property of Inequality
$-4x > 12$	Simplify.
$\frac{-4x}{-4} < \frac{12}{-4}$	Division Property of Inequality
$x < -3$	Simplify.

CHECK

$12 - 2x > 24 + 2x$	Try -4 , a number less than -3 .
$12 - 2(-4) > 24 + 2(-4)$	Replace x with -4 .
$12 + 8 > 24 - 8$	Simplify.
$20 > 16$ ✓	The solution checks.

Graph the solution $x < -3$.



Exercises

Solve each inequality. Graph the solution on a number line.

1. $5c + 9 < -11$

2. $8 - 4p > 20$

3. $c + 5 \leq 4c - 1$

4. $18 - 2n \geq 6$

5. $3(d + 2) < -15$

6. $\frac{b}{3} + 9 > 8$