GOAL **Solve multi-step inequalities.**

STEPS TO SOLVE MULTI-STEP INEQUALITIES

1. Simplifying – Distributive Property , Like Terms, etc.

2. Move what is being added or subtracted to other side (Inverse Operation)

3. Move what is being multiplied or division to other side (inverse operation)

4. Simplify again – like terms, variable on left, etc.

5. Graph / Check

Common Student Errors

- Solution of an inequality may not match the graph of the solution

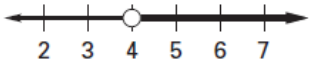
  Tip Remind students to check that their written solutions match their graphs.

- Because inequalities produce many solutions, students might think its too time-consuming to check the solution of an inequality

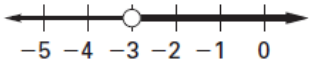
  Tip Stress to students that it is important to check the solution to an inequality and that they can do this by substituting just a few convenient values for x into the original inequality to get an indication of the validity of the solution.

Examples:

$x < 4$



$x \geq -3$



Have students check that the solution of $8 - 3x \leq 20$ is $x \geq -4$ by substituting $x = 0$ and $x = -4$ into the original inequality.

EXAMPLE 1 Solve a two-step inequality

Solve $-4x + 3 > 15$. Graph your solution.

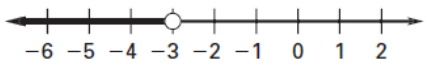
Solution

$-4x + 3 > 15$ Write original inequality.

$-4x > 12$ Subtract 3 from each side.

$x < -3$ Divide each side by -4. Reverse inequality symbol.

The solutions are all real numbers less than -3. Check by substituting a number less than -3 in the original inequality.



CHECK $-4x + 3 > 15$ Write original inequality.

$-4(-5) + 3 \stackrel{?}{>} 15$ Substitute -5 for x.

$23 > 15$ ✓ Solution checks.

Exercises for Example 1

Solve the inequality. Graph your solution.

1. $7x + 8 > 22$ **2.** $-7 \geq -2x + 9$ **3.** $2.3x - 6.9 < 7.13$

EXAMPLE 2 Solve a multi-step inequality

Solve the inequality.

a. $-\frac{1}{3}(x + 12) < 5$ **b.** $9x + 2 < 5x - 18$

Solution

a. $-\frac{1}{3}(x + 12) < 5$ Write original inequality.

$-\frac{x}{3} - 4 < 5$ Distributive property

$-\frac{x}{3} < 9$ Add 4 to each side.

$x > -27$ Multiply each side by -3. Reverse the inequality symbol.

The solutions are all real numbers greater than -27.

b. $9x + 2 < 5x - 18$ Write original inequality.

$9x < 5x - 20$ Subtract 2 from each side.

$4x < -20$ Subtract $5x$ from each side.

$x < -5$ Divide each side by 4.

The solutions are all real numbers less than -5.

Exercises for Example 2

Solve the inequality.

4. $3(2x - 7) > 15$

5. $10 - 3x \leq 5x - 14$

6. $\frac{1}{2}(8x + 6) < \frac{1}{3}(9x - 15)$

EXAMPLE 3 **Identify the number of solutions of an inequalit**

Solve the inequality, if possible.

a. $5(3x - 2) < 15x + 7$ **b.** $9 - 28x > 4(5 - 7x)$

Solution

a. $5(3x - 2) < 15x + 7$ Write original inequality.

$15x - 10 < 15x + 7$ Distributive property

$-10 < 7$ Subtract $15x$ from each side.

All real numbers are solutions because $-10 < 7$ is true.

b. $9 - 28x > 4(5 - 7x)$ Write original inequality.

$9 - 28x > 20 - 28x$ Distributive property

$9 > 20$ Add $28x$ to each side.

There are no solutions because $9 > 20$ is false.

Exercises for Example 3

Solve the inequality, if possible.

7. $2m - 7m - 4 > 1 - 5m$

8. $3n - 13 < 3(n - 2)$

9. $11p - 3p + 6 \geq 4(2p - 1)$