

## 2-4 Solving Multi-Step Inequalities:

### **EXAMPLE 1** Solving Multi-Step Inequalities

Solve each inequality. Graph each solution.

a.  $\frac{y}{-6} + 7 < 9$

b.  $2v - 4 \geq 8$

a.  $\frac{y}{-6} + 7 < 9$

Write the inequality.

$$\frac{-7}{-6} \quad \frac{-7}{-6}$$

Subtract 7 from each side.

$$\frac{y}{-6} < 2$$

Simplify.

$$-6 \cdot \frac{y}{-6} > -6 \cdot 2$$

Multiply each side by  $-6$ . Reverse the inequality symbol.

$$y > -12$$

Simplify.

► The solution is  $y > -12$ .



b.  $2v - 4 \geq 8$

Write the inequality.

$$\frac{+4}{+4} \quad \frac{+4}{+4}$$

Add 4 to each side.

$$2v \geq 12$$

Simplify.

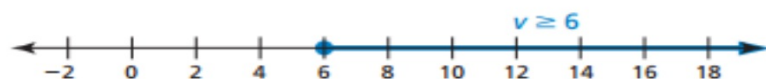
$$\frac{2v}{2} \geq \frac{12}{2}$$

Divide each side by 2.

$$v \geq 6$$

Simplify.

► The solution is  $v \geq 6$ .



**Solve the inequality. Graph the solution.**

1.  $4b - 1 < 7$

2.  $8 - 9c \geq -28$

3.  $\frac{n}{-2} + 11 > 12$

4.  $6 \geq 5 - \frac{v}{3}$

**EXAMPLE 2** Solving an Inequality with Variables on Both Sides

Solve  $6x - 5 < 2x + 11$ .

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#### SOLUTION

$$6x - 5 < 2x + 11$$

$$\quad \underline{+ 5} \qquad \quad \underline{+ 5}$$

$$6x < 2x + 16$$

$$\quad \underline{- 2x} \quad \underline{- 2x}$$

$$4x < 16$$

$$\frac{4x}{4} < \frac{16}{4}$$

$$x < 4$$

Write the inequality.

Add 5 to each side.

Simplify.

Subtract  $2x$  from each side.

Simplify.

Divide each by 4.

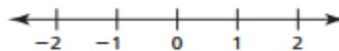
Simplify.

► The solution is  $x < 4$ .

When solving an inequality, if you obtain an equivalent inequality that is true, such as  $-5 < 0$ , the solutions of the inequality are *all real numbers*. If you obtain an equivalent inequality that is false, such as  $3 \leq -2$ , the inequality has *no solution*.



Graph of an inequality whose solutions are all real numbers



Graph of an inequality that has no solution

**EXAMPLE 3** Inequalities with Special Solutions

Solve (a)  $8b - 3 > 4(2b + 3)$  and (b)  $2(5w - 1) \leq 7 + 10w$ .

### SOLUTION

a.  $8b - 3 > 4(2b + 3)$  Write the inequality.  
 $8b - 3 > 8b + 12$  Distributive Property  
 $\underline{-8b} \quad \underline{-8b}$  Subtract  $8b$  from each side.  
 $-3 > 12$  ~~X~~ Simplify.

▶ The inequality  $-3 > 12$  is false. So, there is no solution.

b.  $2(5w - 1) \leq 7 + 10w$  Write the inequality.  
 $10w - 2 \leq 7 + 10w$  Distributive Property  
 $\underline{-10w} \quad \underline{-10w}$  Subtract  $10w$  from each side.  
 $-2 \leq 7$  Simplify.

▶ The inequality  $-2 \leq 7$  is true. So, all real numbers are solutions.

**Solve the inequality.**

**5.**  $5x - 12 \leq 3x - 4$

**6.**  $2(k - 5) < 2k + 5$

**7.**  $-4(3n - 1) > -12n + 5.2$

**8.**  $3(2a - 1) \geq 10a - 11$



## Solving Real-Life Problems

### EXAMPLE 4 Modeling with Mathematics

You need a mean score of at least 90 points to advance to the next round of the touch-screen trivia game. What scores in the fifth game will allow you to advance?



**Trivia Challenge**

**Your Scores**

- 95 Game 1: Very impressive!
- 91 Game 2: Good job!
- 77 Game 3: You can do better!
- 89 Game 4: Nice work!

The image shows a digital score display for a trivia game. It has a blue background with a yellow border. At the top, it says "Trivia Challenge" in yellow. Below that, a yellow box contains the text "Your Scores". There are four rows of scores, each with a yellow circle containing a score and a text description: 95 Game 1: Very impressive!, 91 Game 2: Good job!, 77 Game 3: You can do better!, and 89 Game 4: Nice work!.

**SOLUTION**

## SOLUTION

- 1. Understand the Problem** You know the scores of your first four games. You are asked to find the scores in the fifth game that will allow you to advance.
- 2. Make a Plan** Use the definition of the mean of a set of numbers to write an inequality. Then solve the inequality and answer the question.
- 3. Solve the Problem** Let  $x$  be your score in the fifth game.

$$\frac{95 + 91 + 77 + 89 + x}{5} \geq 90$$

Write an inequality.

$$\frac{352 + x}{5} \geq 90$$

Simplify.

$$5 \cdot \frac{352 + x}{5} \geq 5 \cdot 90$$

Multiply each side by 5.

$$352 + x \geq 450$$

Simplify.

$$\underline{-352} \quad \underline{-352}$$

Subtract 352 from each side.

$$x \geq 98$$

Simplify.

► A score of at least 98 points will allow you to advance.

