Lesson



Key Vocabulary

inequality, p. 126 solution of an inequality, p. 126 solution set, p. 126 graph of an inequality, p. 127

An **inequality** is a mathematical sentence that compares expressions. It contains the symbols <, >, \le , or \ge . To write an inequality, look for the following phrases to determine where to place the inequality symbol.

Inequality Symbols					
Symbol	<	>	≤	≥	
Key Phrases	• is less than • is fewer than	is greater thanis more than	 is less than or equal to is at most is no more than 	 is greater than or equal to is at least is no less than	

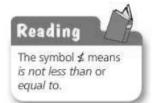
EXAMPLE

Writing an Inequality

A number q plus 5 is greater than or equal to -7.9. Write this word sentence as an inequality.

A number q plus 5 is greater than or equal to
$$-7.9$$
.

A solution of an inequality is a value that makes the inequality true. An inequality can have more than one solution. The set of all solutions of an inequality is called the solution set.



Value of x	x + 2 ≤ -1	Is the inequality true?	
-2	$-2+2\stackrel{?}{\leq}-1$ $0\nleq-1$	no	
-3	$-3 + 2 \stackrel{?}{\leq} -1$ $-1 \leq -1$	yes	
-4	$-4 + 2 \stackrel{?}{\leq} -1$ $-2 \leq -1$	yes	

Tell whether -2 is a solution of each inequality.

a.
$$y - 5 \ge -6$$

b.
$$-5.5y < 14$$

The graph of an inequality shows all the solutions of the inequality on a number line. An open circle O is used when a number is *not* a solution. A closed circle • is used when a number is a solution. An arrow to the left or right shows that the graph continues in that direction.

EXAMPLE 3 Graphing an Inequality

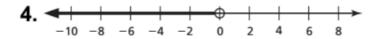
Graph y > -8.



Write an inequality for the graph. Then, in words, describe all the values of x that make the inequality true.







Start Thinking! For use before Activity 4.2

An elevator can carry at most 15 people. Write an inequality that models this statement.

Explain to a friend what the inequality means.



Graph the inequality on a number line.

1.
$$x \le 13$$

2.
$$x \ge -4$$

2.
$$x \ge -4$$
 3. $x < -15$

4.
$$x > 6$$

5.
$$x \le -1$$
 6. $x \ge 0$

6.
$$x \ge 0$$





You can solve inequalities in the same way you solve equations. Use inverse operations to get the variable by itself.

60 Key Ideas

Addition Property of Inequality

Words When you add the same number to each side of an inequality, the inequality remains true.

Numbers
$$-4 < 3$$
 Algebra If $a < b$, then $a + c < b + c$.
 $+2 + 2$ If $a > b$, then $a + c > b + c$.
 $-2 < 5$

Subtraction Property of Inequality

Words When you subtract the same number from each side of an inequality, the inequality remains true.

Numbers
$$-2 < 2$$
 Algebra If $a < b$, then $a - c < b - c$.
 $-3 \quad -3$ If $a > b$, then $a - c > b - c$.
 $-5 < -1$

These properties are also true for \leq and \geq .

EXAMPLE 1 Solving an Inequality Using Addition

Solve x - 5 < -3. Graph the solution.

Solve $13 \le x + 14$. Graph the solution.

EXAMPLE 3 Real-Life Application

A person can be no taller than 6.25 feet to become an astronaut pilot for NASA. Your friend is 5 feet 9 inches tall. Write and solve an inequality that represents how much your friend can grow and still meet the requirement.

Words	Current	plus	amount your	is no	the height
	height		friend can grow	more than	limit.

Solve the inequality. Graph the solution.

1.
$$x - 9 < 8$$

3.
$$10 > v - 3$$

5.
$$t - 4 > -2$$

2.
$$6 + h > 9$$

3.
$$10 \ge y - 3$$
 4. $y - 2 \ge 14$

5.
$$t - 4 > -2$$
 6. $x + 7 \le 10$

60 Key Idea

Remember

Multiplication and division are inverse operations.

Multiplication and Division Properties of Inequality (Case 1)

Words When you multiply or divide each side of an inequality by the same positive number, the inequality remains true.

Numbers
$$-4 < 6$$

$$4 > -6$$

$$2 \cdot (-4) < 2 \cdot 6$$

$$\frac{4}{2} > \frac{-6}{2}$$

$$-8 < 12$$

Algebra If a < b and c is positive, then

$$a \cdot c < b \cdot c$$
 and

If a > b and c is positive, then

$$a \cdot c > b \cdot c$$

$$\frac{a}{c} > \frac{b}{c}$$

These properties are also true for \leq and \geq .

EXAMPLE 1



Solving an Inequality Using Multiplication

Solve $\frac{x}{5} \le -3$. Graph the solution.

€ Key Idea

Multiplication and Division Properties of Inequality (Case 2)

Words When you multiply or divide each side of an inequality by the same negative number, the direction of the inequality symbol must be reversed for the inequality to remain true.

Common Error

A negative sign in an inequality does not necessarily mean you must reverse the inequality symbol.

Only reverse the inequality symbol when you multiply or divide both sides by a negative number.

Numbers
$$-4 < 6$$

$$4 > -6$$

$$-2 \cdot (-4) > -2 \cdot 6$$
 $\frac{4}{-2} < \frac{-6}{-2}$

$$\frac{4}{-2} < \frac{-6}{-2}$$

$$8 > -12$$

$$-2 < 3$$

Algebra If a < b and c is negative, then

$$a \cdot c > b \cdot c$$
 and

$$\frac{a}{c} > \frac{b}{c}$$
.

If a > b and c is negative, then

$$a \cdot c < b \cdot c$$
 and

$$\frac{a}{c} < \frac{b}{c}$$
.

These properties are also true for \leq and \geq .

EXAMPLE 3 Solving an Inequality Using Multiplication

Solve $-\frac{3}{2}n \le 6$. Graph the solution.

EXAMPLE 4 Solving an Inequality Using Division

Solve -3z > -4.5. Graph the solution.

Solve the inequality.

1.
$$x + 9 < 12$$

3.
$$x - 2 > -5$$

5.
$$4x > -16$$

2.
$$x - 3 \ge 1$$

4.
$$-3x > 5$$

6.
$$-5x \le -21$$



You can solve two-step inequalities in the same way you solve two-step equations.

EXAMPLE 1 Solving Two-Step Inequalities

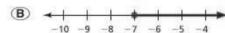
a. Solve $5x - 4 \ge 11$. Graph the solution.

b. Solve $\frac{b}{-3} + 4 < 13$. Graph the solution.

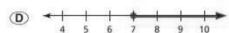
EXAMPLE 2 Graphing an Inequality

Which graph represents the solution of $-7(x + 3) \le 28$?









EXAMPLE 3 Real-Life Application

Progress Report		
Month	Pounds Lost	
1	12	
2	9	
3	5	
4	8	

A contestant in a weight-loss competition wants to lose an average of at least 8 pounds per month during a 5-month period. How many pounds must the contestant lose in the fifth month to meet the goal?

Remember

