

# Inequalities



## Interactive Study Guide

See pages 181–182 for:

- Getting Started
- Real-World Link
- Notes



## Essential Question

How are equations and inequalities used to describe and solve multi-step problems?



## Common Core State Standards

Content Standards  
7.EE.4

Mathematical Practices  
1, 3, 4, 5

## What You'll Learn

- Write inequalities.
- Graph inequalities on a number line.



## Real-World Link

**Water Parks** Wisconsin Dells, Wisconsin, is known as the Water Park Capital of the World. The town has 20 water parks with more than 200 waterslides and 16 million gallons of water. Most of the water parks offer three different prices of tickets – adults, children, and seniors.



## Write Inequalities

Recall that an inequality is a mathematical sentence that compares quantities that are not equal. Inequalities contain the symbols  $<$ ,  $>$ ,  $\leq$ , or  $\geq$ . The inequality  $w > 200$  represents the number of waterslides in Wisconsin Dells.

### Example 1



Write an inequality for each sentence.

- a. The DVD costs more than \$15.

Words

The DVD costs more than \$15.



Variable

Let  $d$  = the cost of the DVD in dollars.



Inequality

$$d > 15$$

- b. A dog weighs less than 50 pounds.

Words

A dog weighs less than 50 pounds.



Variable

Let  $d$  = the weight of the dog in pounds.



Inequality

$$d < 50$$

**Got It?** Do these problems to find out.

1a. Amelia sold more than 40 magazines.  $m > 40$

1b. Gino sent less than 35 texts yesterday.  $t < 35$

The table below shows some common verbal phrases and the corresponding mathematical inequalities.

### Inequalities

Notice that  $\leq$  and  $\geq$  are a combination of the  $<$  or  $>$  symbol with part of the symbol for equals,  $=$ .

Concept Summary		Inequalities	
$<$	$>$	$\leq$	$\geq$
<ul style="list-style-type: none"> <li>• is less than</li> <li>• is fewer than</li> </ul>	<ul style="list-style-type: none"> <li>• is greater than</li> <li>• is more than</li> <li>• exceeds</li> </ul>	<ul style="list-style-type: none"> <li>• is less than or equal to</li> <li>• is no more than</li> <li>• is at most</li> </ul>	<ul style="list-style-type: none"> <li>• is greater than or equal to</li> <li>• is no less than</li> <li>• is at least</li> </ul>



### Example 2



You must be at least 18 years old to vote. Write an inequality to describe this situation.

Words	Your age is at least 18 years.
Variable	Let $a$ = your age.
Inequality	$a \geq 18$

The inequality is  $a \geq 18$ .

**Got It?** Do this problem to find out.

2. A student must have at least 10 hours of instructor-assisted driving time to pass the course. Write an inequality to describe this situation.  $h \geq 10$

Inequalities with variables are open sentences. When the variable in an open sentence is replaced with a number, the inequality may be true or false.

### Example 3



For the given value, state whether each inequality is true or false.

a.  $2t + 8 > 7$ ;  $t = -1$

$$2t + 8 > 7 \quad \text{Write the inequality.}$$

$$2(-1) + 8 \stackrel{?}{>} 7 \quad \text{Replace } t \text{ with } -1.$$

$$6 \not> 7 \quad \text{Simplify.}$$

This sentence is false.

b.  $p - 42 \leq -2$ ;  $p = 40$

$$p - 42 \leq -2 \quad \text{Write the inequality.}$$

$$40 - 42 \stackrel{?}{\leq} -2 \quad \text{Replace } p \text{ with } 40.$$

$$-2 \leq -2 \quad \text{Simplify.}$$

Although the inequality  $-2 < -2$  is false, the equation  $-2 = -2$  is true. So, this sentence is true.

**Got It?** Do these problems to find out.

3a.  $3.9 + x \leq 12$ ;  $x = 6$  **true**

3b.  $y - \frac{1}{3} < 1$ ;  $y = \frac{4}{3}$  **false**

## Graph Inequalities

Inequalities can be graphed on a number line. The graph helps you visualize the values that make the inequality true.

### Graphing Inequalities

When inequalities are graphed, an open dot means the number is not included ( $<$  or  $>$ ) and a closed dot means it is included ( $\leq$  or  $\geq$ ).

### Example 4



Graph each inequality on a number line.

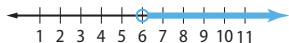
a.  $a > 6$



Locate 6 on the number line. It is a key point in the inequality.

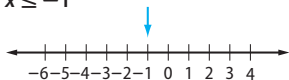


Draw an *open* circle on 6 because 6 is *not* included.

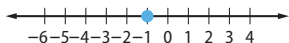


The inequality  $a > 6$  means that all numbers *greater than* 6 will make the sentence true. Draw an arrow from the dot pointing to the right.

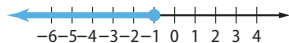
b.  $x \leq -1$



Locate  $-1$  on the number line. It is a key point in the inequality.



Draw a *closed* circle on  $-1$  because  $-1$  is included.



The inequality  $x \leq -1$  means that all numbers *less than or equal to*  $-1$  will make the sentence true. Draw an arrow from the circle pointing to the left.

**Got It?** Do these problems to find out.

4a.  $x < 5$

4b.  $x \geq -2$

4c.  $x > 0$

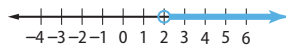
4a–4c. See Answer Appendix.

### Example 5



Write an inequality for the graph.

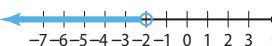
An open circle is on 2, so the point 2 is *not* included in the graph. The arrow points to the right, so the graph includes all numbers greater than 2. The inequality is  $x > 2$ .



**Got It?** Do these problems to find out.

Write an inequality for each graph.

5a.   $x \geq -3$

5b.   $x < -2$

## Guided Practice



Write an inequality for each sentence. (Example 1)

- Lacrosse practice will be no more than 45 minutes.  $x \leq 45$
- Mario is more than 60 inches tall.  $t > 60$
- More than 8000 fans attended the Wizards' opening soccer game. Write an inequality to describe the attendance. (Example 2)  $f > 8000$

For the given value, state whether the inequality is *true* or *false*. (Example 3)

- $13 - x < 4; x = 9$  **false**
- $45 > \frac{3}{4}x + 25; x = 20$  **true**

Graph each inequality on a number line. (Example 4) **6–9. See Answer Appendix.**

- $x < -1$
- $y \geq 5$
- $w > 9$
- $z \leq 2$

Write an inequality for each graph. (Example 5)

