Name _____

# Write and Graph Inequalities

( I Can ) write and graph the solution of an inequality to represent a condition in a real-world or mathematical problem.

## Step it Out

You can write inequalities using inequality symbols and variables to describe quantities that have many values.
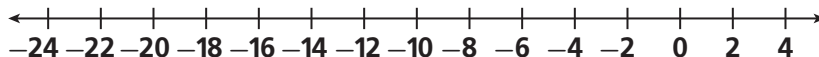
| Symbol | Meaning | Word phrases |
|---|---|---|
| $<$ | Is less than | Fewer than, below |
| $>$ | Is greater than | More than, above |
| $\leq$ | Is less than or equal to | At most, no more than |
| $\geq$ | Is greater than or equal to | At least, no less than |

**1** ▷ A record-breaking low temperature of $-23$ °F was recorded in Seminole, Texas, on February 8, 1933.

A. Find $-23$ and graph it on the number line.

$$\xleftarrow{\quad}\ \overset{-24}{|}\ \overset{-22}{|}\ \overset{-20}{|}\ \overset{-18}{|}\ \overset{-16}{|}\ \overset{-14}{|}\ \overset{-12}{|}\ \overset{-10}{|}\ \overset{-8}{|}\ \overset{-6}{|}\ \overset{-4}{|}\ \overset{-2}{|}\ \overset{0}{|}\ \overset{2}{|}\ \overset{4}{|}\ \xrightarrow{\quad}$$

B. The temperatures 4 °F, $-3$ °F, $-14$ °F, 1 °F, and $-19$ °F have also been recorded in Texas. How do these temperatures compare to $-23$ °F?

_____

C. Give examples of other numbers that are greater than $-23$. How many of these numbers exist?

_____

_____

D. Let x represent the temperatures greater than $-23$ °F. Complete the inequality to describe these temperatures.

$x\ \boxed{\phantom{x}}\ -23$

**Turn and Talk** How is a number line not like a thermometer? Explain.

The solution of the inequality $x > 2$ is all numbers greater than 2, not including 2.
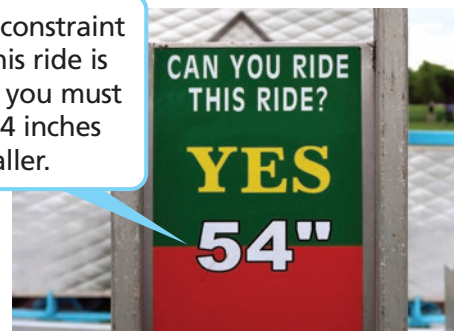
An inequality such as $x > 2$ represents a **constraint**. A constraint is a condition that restricts the values of a quantity or variable to a given value or range of values. For the inequality $x > 2$, the values of $x$ must be greater than 2. So, 2 and numbers less than 2 are not solutions of $x > 2$.

For the inequality $x \leq 4$, the values of x must be less than or equal to 4. So, 4 is a solution of $x \leq 4$, but numbers greater than 4 are not solutions.

**2** Graph the inequalities.

**A.** $y \leq -3$

**Step 1** Draw a solid circle at −3 to show that −3 is a solution.

$$\overset{\longleftarrow\!\!\!\!|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\!\!\!\!\longrightarrow}{\;-5\;-4\;-3\;-2\;-1\;\;0\;\;1\;\;2\;\;3\;\;4\;\;5}$$

The constraint of this ride is that you must be 54 inches or taller.

CAN YOU RIDE THIS RIDE?
YES
54"
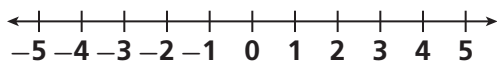
**Step 2** Shade the number line to the left of −3 to show that numbers less than −3 are also solutions.

**Step 3** Check your solution. Choose a number that is on the shaded section of the number line, such as −4. Substitute −4 for $y$. Since the inequality $-4 \leq -3$ is true, the solution graphed on the number line appears to be correct. You can never check all the possible values for the variable but checking one or two values helps assure you have shaded the correct side of the number line.

**B.** $1 < m$

**Step 1** Draw an open circle at 1 to show that 1 is *not* a solution.

$$\overset{\longleftarrow\!\!\!\!|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\!\!\!\!\longrightarrow}{\;-5\;-4\;-3\;-2\;-1\;\;0\;\;1\;\;2\;\;3\;\;4\;\;5}$$
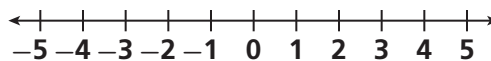
**Step 2** Shade the number line to the right of 1 to show that numbers greater than 1 are solutions.

**Step 3** Check your solution. Pick any number for $m$ that falls on the shaded section of the number line. $1 < \boxed{\phantom{00}}$. If the inequality you have just written is true, then you have shaded the correct side of the number line.

**Turn and Talk** Think of a situation you have faced where something must be greater than a certain amount. Think of a second situation where something must be greater than or equal to a certain amount. Explain each scenario and then write an inequality to represent each situation.

You can write inequalities to represent certain real-world situations.

**3** ▶ Use inequalities to solve these problems.

**A.** The temperature is at most −2 °F. What could be the temperature *t*?

Are numbers less than −2 part of the solution? _____

Are numbers greater than −2 part of the solution? _____

Is −2 included as a solution? _____

Write the inequality. *t* ☐ −2

**B.** Raphael needs to buy more than 4 concert tickets. How many tickets *t* could he buy?
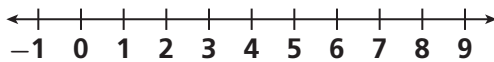
Are numbers less than 4 part of the solution? _____

Are numbers greater than 4 part of the solution? _____

Is 4 included as a solution? _____

Write the inequality. *t* ☐ 4

Graph the inequality. Use an open circle because the value 4 is not part of the solution.



How many tickets can Raphael buy?

```
←—+—+—+—+—+—+—+—+—+—+—+→
  −1  0  1  2  3  4  5  6  7  8  9
```
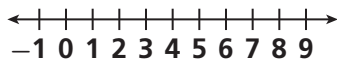
# Check Understanding

**1.** Camille wants to become a pilot. A pilot needs to log at least 500 flying hours before earning a pilot's license. Write and graph an inequality to show the number of flying hours *h* Camille needs to get a license.
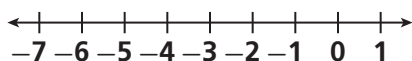
```
←—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+—+→
  −100    0    100  200  300  400  500  600  700  800
```

_____
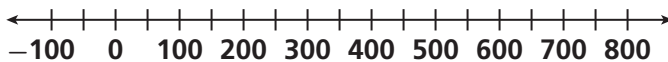
**For Problems 2–3, graph each inequality.**

**2.** $r \le 8$

```
←—+—+—+—+—+—+—+—+—+—+—+→
  −1 0 1 2 3 4 5 6 7 8 9
```

**3.** $z < -3$
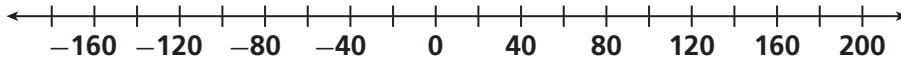
```
←—+—+—+—+—+—+—+—+—+—+—+→
  −7 −6 −5 −4 −3 −2 −1  0  1
```

## On Your Own

4. When cooking chicken, the recommended internal temperature of the chicken is shown. A lower internal temperature will undercook the chicken. Write an inequality to describe the temperatures $t$ at which the chicken will be undercooked. _____

   internal temp. 165 °F

   Graph the inequality.

   <!-- number line -->
   ```
   ←―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―+―→
        −160  −120  −80   −40    0    40    80   120   160   200
   ```

5. **STEM** The speed of sound is approximately 761 miles per hour. For an object to produce a sonic boom, it must travel faster than the speed of sound. Write an inequality to describe the speeds $s$ at which a moving object will produce a sonic boom. _____

6. To find the area $A$ of a rectangle, the length $\ell$ must be multiplied by the width $w$. A farmer needs to build a fence to enclose a chicken pen with an area greater than or equal to 50 square feet. The length of the fence must be 10 feet.

   $\ell = 10$ feet
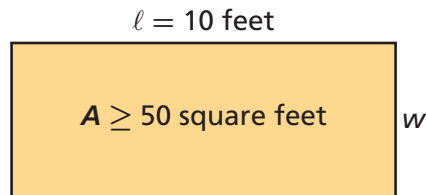
   $A \geq 50$ square feet  $w$

   A. Write an inequality to describe the widths $w$ that will yield a fenced-in area of at least 50 square feet. _____

   B. Graph the inequality.

   <!-- number line -->
   ```
   ←―+―+―+―+―+―+―+―+―+―+―+―+→
      −1  0  1  2  3  4  5  6  7  8  9
   ```
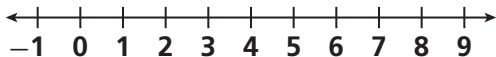
7. The temperature in Minneapolis was −9 °F. The next day, the temperature in Minneapolis was warmer than −9 °F.

   A. Write an inequality which is true only for temperatures $t$ that are warmer than −9 °F.

   _____

   B. Could the temperature have been −12 °F in Minneapolis on the next day? Why or why not?

   _____

   _____

**8.** **A.** Graph the inequality $d \leq -2$.

```
←—+——+——+——+——+——+——+——+——+——+——+—→
  -5  -4  -3  -2  -1   0   1   2   3   4   5
```
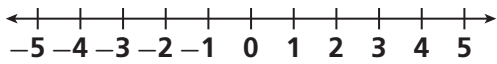
**B.** (MP) **Reason** Name three solutions for $d$. How many possible solutions does this inequality have?

_____

**9.** Write an inequality to represent the graph. Use $y$ for the solution.

```
←—+——○——+——+——+——+——+——+——+——+——+—→
  -5  -4  -3  -2  -1   0   1   2   3   4   5
```

_____

**10.** To have enough orange juice for all the campers, the camp cook will need at least 9 gallons.

**A.** Write an inequality that is true only for the number of gallons $g$ the cook needs.

_____

**B.** Graph the inequality.

```
←—+——+——+——+——+——+——+——+——+——+——+—→
   2   3   4   5   6   7   8   9  10  11  12  13
```
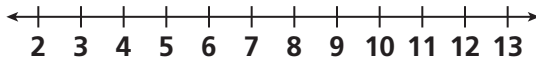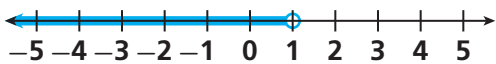
**C.** If the cook buys 4 gallons, will there be enough orange juice? _____

**11.** According to government guidelines, drones are limited to how high they can legally fly above the ground as shown.

Drones may not fly higher than 400 feet.

**A.** Write an inequality that is true only for the height $h$ a drone can fly above the ground.

_____

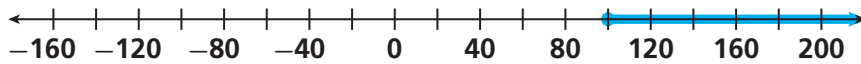**B.** If a drone flies 430 feet above the ground, will it violate government guidelines? Explain.

_____

_____

**12.** Write an inequality that represents the graph. Use $x$ for the variable.

```
←—+——+——+——+——+——○——+——+——+——+——+—→
  -5  -4  -3  -2  -1   0   1   2   3   4   5
```

_____

**13. A.** Write an inequality that represents the graph. Use *x* for the variable.

```
←—+—+—+—+—+—+—+—+—+—+—+—+—+—+→
 −160 −120  −80  −40   0   40   80  120  160  200
```
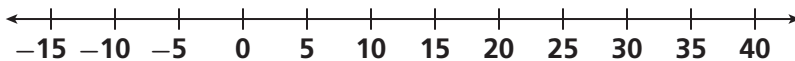
_____

**B.** Choose a number from the shaded area of the graph to check your inequality. State the number you picked and explain why it is a possible solution.

_____

_____

**14.** Graph the inequality on the number line: $b \geq -14$.

```
←—+—+—+—+—+—+—+—+—+—+—+→
 −16 −14 −12 −10 −8  −6  −4  −2   0   2   4
```
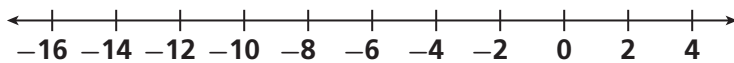
**15.** Graph the inequality on the number line: $d < 25$.

```
←—+—+—+—+—+—+—+—+—+—+—+→
 −15 −10 −5   0   5   10  15  20  25  30  35  40
```

**16.** A dog weighs less than 15 pounds.

**A.** List three possible weights for the dog.

_____

**B.** Write an inequality that describes the possible weights *w* the dog can weigh. _____

**C.** Some puppies can be born with a weight of $\frac{1}{5}$ of a pound. Can any dog ever weigh 0 pounds or less? _____

**D.** An inequality can be written with a variable between two numbers if that variable must be greater than one number and less than another number. Write a new, more accurate inequality to describe the dog's possible weight by writing an inequality symbol in each blank.

0 ☐ *w* ☐ 15

less than 15 pounds

**E.** Graph this new inequality.

```
←—+—+—+—+—+—+—+—+—+—+—+→
 −2   0   2   4   6   8  10  12  14  16  18
```
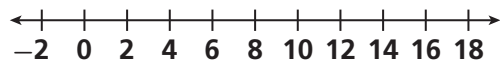
**17. Open Ended** Write a situation that can be modeled by $x < 7$.

_____

_____

Name _____

LESSON 9.5
**More Practice/
Homework**

ONLINE
Ed
**Video Tutorials and
Interactive Examples**

# Write and Graph Inequalities
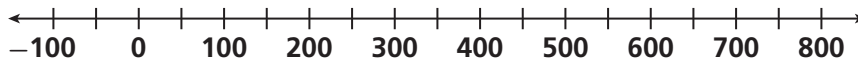
**1.** Regan won the grand prize at a store giveaway. The grand prize winner is guaranteed to win at least $500 in cash and prizes.

   **A.** List three possible dollar amounts in cash and prizes Regan can win.

   _____

   **B.** Write an inequality to represent the dollar amounts $d$ in cash and prizes Regan can win. _____

   **C.** Graph the inequality.

   ← + + + + + + + + + + + + + + + + + + →
   −100   0   100   200   300   400   500   600   700   800

**2.** **STEM** Alonso uses the table to help him identify an unknown mineral. He finds the specific gravity of the mineral and discovers it is less than 3.
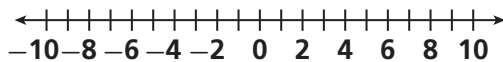
   **A.** List three possible minerals the unknown mineral could be.

   _____

   **B.** Write an inequality to represent the specific gravity $g$ of the unknown mineral. _____

| Specific gravity | Mineral |
|---|---|
| 2.16 | halite |
| 2.31 to 2.33 | gypsum |
| 2.65 | quartz |
| 2.7 | calcite |
| 3.0 to 3.3 | fluorite |
| 3.4 to 3.6 | topaz |
| 3.5 to 4 | chalcopyrite |
| 4.9 to 5.2 | pyrite |

**Math on the Spot** For Problems 3–4, graph each inequality on a number line.

**3.** $x > -7$

   ← + + + + + + + + + + + + + + + + + + + + + →
   −10 −8 −6 −4 −2   0   2   4   6   8   10

**4.** $y \leq -5$

   ← + + + + + + + + + + + + + + + + + + + + + →
   −10 −8 −6 −4 −2   0   2   4   6   8   10

**5.** (MP) **Reason** When two numbers are added together, the sum is at least 100. One of the numbers is 77.

   **A.** Which of these could be the other number? Circle the correct number or numbers.

   15      9      23      41      50      20      25

   **B.** Write an inequality to represent the possible values of the other number $n$.

   _____

## Test Prep

**6.** Children 12 and under eat free at a local restaurant. If *x* represents age, write an inequality to represent the ages of people who do **not** get a discount.

_____

**7.** It is colder than $-7\,^{\circ}$F outside. Which inequality represents the temperature *t*?

Ⓐ $7 < t$      Ⓑ $t > -7$      Ⓒ $-7 > t$      Ⓓ $t < 7$

**8.** An online retailer charges an additional fee to ship orders that weigh over 48 pounds. Write and graph an inequality which represents the weight *x* of online orders that result in an additional fee.



$-12$   0   12   24   36   48   60   72   84     _____
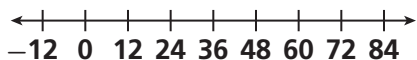
**9.** Draw a line to match each graph with the inequality that it represents.

$-5 > x$ ●      ● 

$x < -3$ ●      ● 

$x > 4$ ●      ● 

$x > 2$ ●      ● 

## Spiral Review

**10.** Benjamin bought 4 goldfish. Each goldfish cost $1.29. How much did Benjamin spend? _____

**11.** A youth league soccer team has 20 students who play defender positions and 23 students who play midfielder positions. Write a ratio of students who play defender positions to the total number of students who play defender or midfielder positions. _____

**For Problems 12–15, find each quotient or product.**

**12.** $0.2 \div 4$    ☐      **13.** $3.1 \div 4$    ☐

**14.** $0.2 \times 0.25$    ☐      **15.** $3.1 \times 0.25$    ☐