

8.1 Writing and Graphing Inequalities

Essential Question How can you use an inequality to describe a real-life statement?

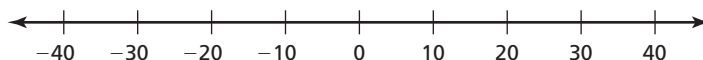
1 ACTIVITY: Writing and Graphing Inequalities

Work with a partner. Write an inequality for the statement. Then sketch the graph of all the numbers that make the inequality true.

- a. **Statement:** The temperature t in Minot, North Dakota has never been below -36°F .

Inequality:

Graph:

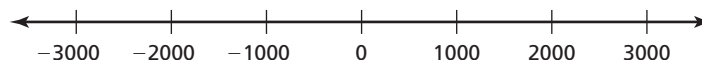


TIMM'S HILL
WISCONSIN'S HIGHEST
NATURAL POINT
ELEV. 1951.5 FT

- b. **Statement:** The elevation e in Wisconsin is at most 1951.5 feet above sea level.

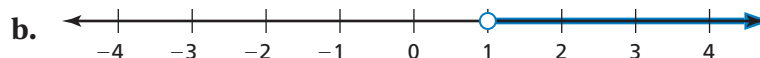
Inequality:

Graph:



2 ACTIVITY: Writing and Graphing Inequalities

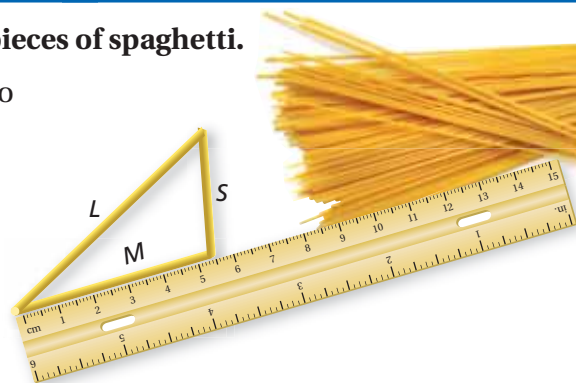
Work with a partner. Write an inequality for the graph. Then, in words, describe all the values of x that make the inequality true.



3 ACTIVITY: Triangle Inequality

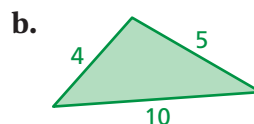
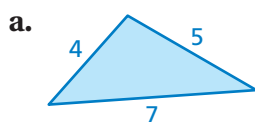
Work with a partner. Use 8 to 10 pieces of spaghetti.

- Break one piece of spaghetti into three parts that can be used to form a triangle.
- Form a triangle and use a centimeter ruler to measure each side. Round the side lengths to the nearest tenth.
- Record the side lengths in a table.
- Repeat the process with two other pieces of spaghetti.
- Repeat the experiment by breaking pieces of spaghetti into three pieces that *do not* form a triangle. Record the lengths in a table.
- **INDUCTIVE REASONING** Write a rule that uses an inequality to compare the lengths of three sides of a triangle.
- Use your rule to decide whether the following triangles are possible. Explain.



Side Lengths That Form a Triangle			
Small	Medium	Large	$S + M$

Side Lengths That Do Not Form a Triangle			
Small	Medium	Large	$S + M$



What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use an inequality to describe a real-life statement? Give two examples of real-life statements that can be represented by inequalities.

Practice

Use what you learned about writing and graphing inequalities to complete Exercises 4 and 5 on page 316.

8.1 Lesson

Key Vocabulary

inequality, p. 314
solution of an inequality, p. 314
solution set, p. 314
graph of an inequality, p. 315

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

Inequality Symbols				
Symbol	$<$	$>$	$\leq$	$\geq$
Key Phrases	• is less than	• is greater than	• is less than or equal to	• is greater than or equal to
	• is fewer than	• is more than	• is at most	• is at least
			• is no more than	• is no less than

EXAMPLE 1 Writing an Inequality

A number w minus 3.5 is less than or equal to -2 . Write this sentence as an inequality.

$$\underbrace{\text{A number } w \text{ minus } 3.5}_{w - 3.5} \underbrace{\text{is less than or equal to}}_{\leq} \underbrace{-2}_{-2}$$

∴ An inequality is $w - 3.5 \leq -2$.

On Your Own

Now You're Ready
Exercises 6–9

Write the word sentence as an inequality.

1. A number b is fewer than 30.4.
2. Twice a number k is at least $-\frac{7}{10}$.

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	$x + 5 \geq -2$	Is the inequality true?
-6	$-6 + 5 \stackrel{?}{\geq} -2$ $-1 \geq -2$ ✓	yes
-7	$-7 + 5 \stackrel{?}{\geq} -2$ $-2 \geq -2$ ✓	yes
-8	$-8 + 5 \stackrel{?}{\geq} -2$ $-3 \not\geq -2$ ✗	no

Reading

The symbol $\nlessgtr$ means "is not greater than or equal to."

EXAMPLE 2 Checking Solutions

Tell whether -4 is a solution of the inequality.

a. $x + 8 < -3$

$$x + 8 < -3$$

$$-4 + 8 \stackrel{?}{<} -3$$

$$4 \nless -3$$

4 is *not* less than -3 .

∴ So, -4 is *not* a solution of the inequality.

b. $-4.5x > -21$

$$-4.5x > -21$$

$$-4.5(-4) \stackrel{?}{>} -21$$

$$18 > -21$$

18 is greater than -21 .

∴ So, -4 is a solution of the inequality.

Write the inequality.

Substitute -4 for x .

Simplify.

Now You're Ready
Exercises 11–16

On Your Own

Tell whether -6 is a solution of the inequality.

3. $c + 4 < -1$

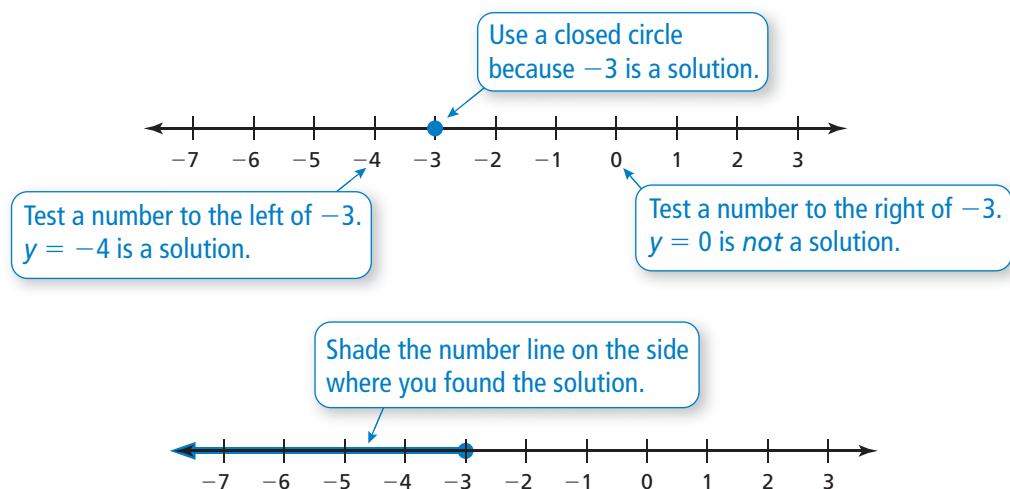
4. $5 - m \leq 10$

5. $21 \div x \geq -3.5$

The **graph of an inequality** shows all of the solutions of the inequality on a number line. An open circle $\circ$ is used when a number is *not* a solution. A closed circle $\bullet$ 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 $y \leq -3$.



On Your Own

Now You're Ready
Exercises 17–20

Graph the inequality on a number line.

6. $b > -8$

7. $g \leq 1.4$

8. $r < -\frac{1}{2}$

9. $v \geq \sqrt{0.09}$

8.1 Exercises



Vocabulary and Concept Check

- VOCABULARY** Would an open circle or a closed circle be used in the graph of the inequality $k < 250$? Explain.
- DIFFERENT WORDS, SAME QUESTION** Which is different? Write “both” inequalities.

w is greater than or equal to -7 .

w is no less than -7 .

w is no more than -7 .

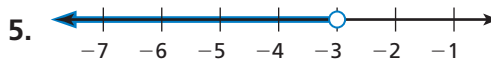
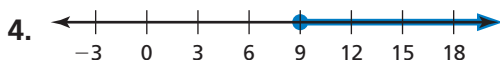
w is at least -7 .

- REASONING** Do $x \geq -9$ and $-9 \geq x$ represent the same inequality? Explain.



Practice and Problem Solving

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



Write the word sentence as an inequality.

6. A number x is no less than -4 .
7. A number y added to 5.2 is less than 23 .
8. A number b multiplied by -5 is at most $-\frac{3}{4}$.
9. A number k minus 8.3 is greater than 48 .
10. **ERROR ANALYSIS** Describe and correct the error in writing the word sentence as an inequality.

X Twice a number c is at least $-\frac{4}{9}$.
 $2c \leq -\frac{4}{9}$

Tell whether the given value is a solution of the inequality.

11. $s + 6 \leq 12$; $s = 4$
12. $15n > -3$; $n = -2$
13. $a - 2.5 \leq 1.6$; $a = 4.1$
14. $-3.3q > -13$; $q = 4.6$
15. $\frac{4}{5}h \geq -4$; $h = -15$
16. $\frac{1}{12} - p < \frac{1}{3}$; $p = \frac{1}{6}$

Graph the inequality on a number line.

17. $g \geq -6$
18. $q > 1.25$
19. $z < 11\frac{1}{4}$
20. $w \leq -\sqrt{289}$

21. **DRIVING** When you are driving with a learner's license, a licensed driver who is 21 years of age or older must be with you. Write an inequality that represents this situation.

Tell whether the given value is a solution of the inequality.

22. $3p > 5 + p$; $p = 4$

23. $\frac{y}{2} \geq y - 11$; $y = 18$

24. **VIDEO GAME RATINGS** Each rating is matched with the inequality that represents the recommended ages of players. Your friend is old enough to play “E 10+” games. Is your friend old enough to play “T” games? Explain.



$x \geq 3$

$x \geq 6$

$x \geq 10$

$x \geq 13$

$x \geq 17$

The ESRB rating icons are registered trademarks of the Entertainment Software Association.

25. **SCUBA DIVING** Three requirements for a scuba diving training course are shown.

- Write and graph three inequalities that represent the requirements.
- You can swim 10 lengths of a 25-yard pool. Do you satisfy the swimming requirement of the course? Explain.

26. **LUGGAGE** On an airplane, the maximum sum of the length, width, and height of a carry-on bag is 45 inches. Find three different sets of dimensions that are reasonable for a carry-on bag.

27. **Critical Thinking** A number m is less than another number n . The number n is less than or equal to a third number p .

- Write two inequalities representing these relationships.
- Describe the relationship between m and p .
- Can m be equal to p ? Explain.



Fair Game Review What you learned in previous grades & lessons

Solve the equation. Check your solution.

28. $r - 12 = 3$

29. $4.2 + p = 2.5$

30. $n - 3\pi = 7\pi$

31. **MULTIPLE CHOICE** Which linear function relates y to x ?

(A) $y = -0.5x - 3$ (B) $y = 2x + 3$

(C) $y = 0.5x - 3$ (D) $y = 2x - 3$

x	-1	0	1	2
y	-5	-3	-1	1