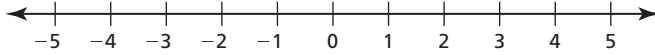


Chapter 2

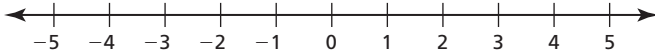
Maintaining Mathematical Proficiency

Graph the number.

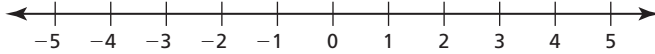
1. $|-2|$



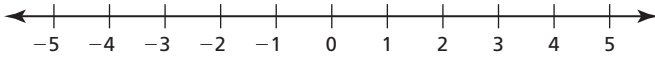
2. $-3 + |-3|$



3. $-1 - |-4|$



4. $2 + |2|$



Complete the statement with $<$, $>$, or $=$.

5. 6 _____ 5

6. -2 _____ 3

7. -4 _____ -7

8. -8 _____ -5

9. $|-5|$ _____ 5

10. -7 _____ $|-6|$

11. A number a is to the right of a number b on the number line. Which is greater, $-a$ or $-b$?

12. A number a is to the left of a number b on the number line. Which is greater, $|-a|$ or $|-b|$?

2.1**Writing and Graphing Inequalities**

For use with Exploration 2.1

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

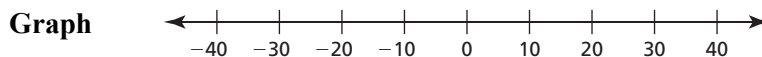
1 EXPLORATION: Writing and Graphing Inequalities

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

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

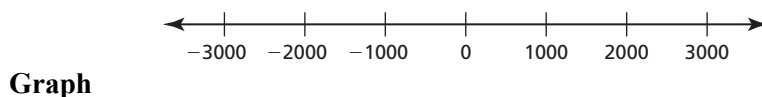
- a. **Statement** The temperature t in Sweden is at least -10°C .

Inequality



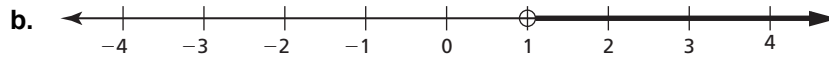
- b. **Statement** The elevation e of Alabama is at most 2407 feet.

Inequality

**2 EXPLORATION: Writing Inequalities**

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



2.1 Writing and Graphing Inequalities (continued)**2** **EXPLORATION:** Writing Inequalities (continued)**Communicate Your Answer**

3. How can you use an inequality to describe a real-life statement?

4. Write a real-life statement that involves each inequality.

a. $x < 3.5$

b. $x \leq 6$

c. $x > -2$

d. $x \geq 10$

2.1

Notetaking with Vocabulary
For use after Lesson 2.1

In your own words, write the meaning of each vocabulary term.

inequality

solution of an inequality

solution set

graph of an inequality

Core Concepts

Representing Linear Inequalities

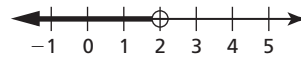
Words

Algebra

Graph

x is less than 2

$x < 2$



x is greater than 2

$x > 2$



x is less than or equal to 2

$x \leq 2$



x is greater than or equal to 2

$x \geq 2$



Notes:

2.1 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–4, write the sentence as an inequality.

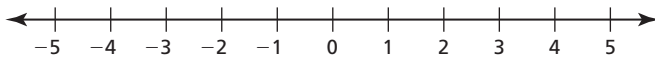
1. Twelve is greater than or equal to five times a number n .
2. One-third of a number h is less than 15.
3. Seven is less than or equal to the difference of a number q and 6.
4. The sum of a number u and 14 is more than 6.

In Exercises 5 and 6, tell whether the value is a solution of the inequality.

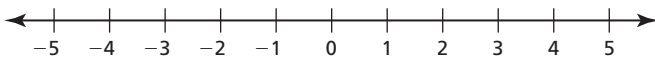
5. $d - 7 < 12$; $d = 19$ 6. $9 \geq 3n + 6$; $n = 1$

In Exercises 7–10, graph the inequality.

7. $x \geq 3$

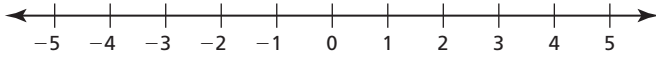


8. $x \leq 4$

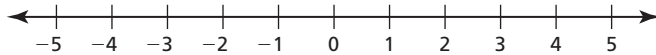


2.1 Notetaking with Vocabulary (continued)

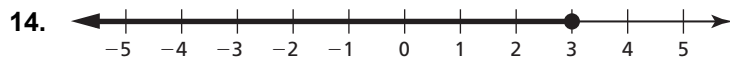
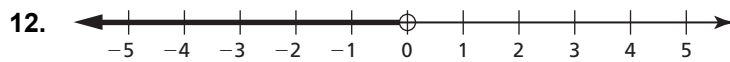
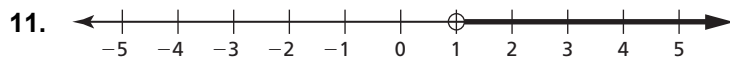
9. $x > -1$



10. $x < 1$



In Exercises 11–14, write an inequality that represents the graph.



2.2**Solving Inequalities Using Addition or Subtraction**

For use with Exploration 2.2

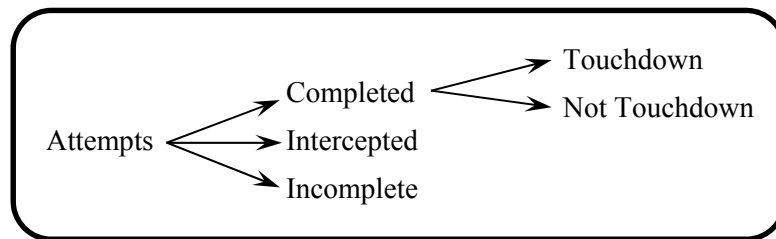
Essential Question How can you use addition or subtraction to solve an inequality?

1 EXPLORATION: Quarterback Passing Efficiency

Work with a partner. The National Collegiate Athletic Association (NCAA) uses the following formula to rank the passing efficiencies P of quarterbacks.

$$P = \frac{8.4Y + 100C + 330T - 200N}{A}$$

Y = total length of all completed passes (in Yards) C = Completed passes
 T = passes resulting in a Touchdown N = iNtercepted passes
 A = Attempted passes M = incoMplete passes



Determine whether each inequality must be true. Explain your reasoning.

- a. $T < C$
- b. $C + N \leq A$
- c. $N < A$
- d. $A - C \geq M$

2.2 Solving Inequalities Using Addition or Subtraction (continued)**2 EXPLORATION: Finding Solutions of Inequalities**

Work with a partner. Use the passing efficiency formula to create a passing record that makes each inequality true. Record your results in the table. Then describe the values of P that make each inequality true.

	Attempts	Completions	Yards	Touchdowns	Interceptions
a.					
b.					
c.					

a. $P < 0$

b. $P + 100 \geq 250$

c. $P - 250 > -80$

Communicate Your Answer

3. How can you use addition or subtraction to solve an inequality?

4. Solve each inequality.

a. $x + 3 < 4$

b. $x - 3 \geq 5$

c. $4 > x - 2$

d. $-2 \leq x + 1$

2.2**Notetaking with Vocabulary**

For use after Lesson 2.2

In your own words, write the meaning of each vocabulary term.

equivalent inequalities

Notes:**Core Concepts****Addition Property of Inequality****Words** Adding the same number to each side of an inequality produces an equivalent inequality.

Numbers	$-3 < 2$	$-3 \geq -10$
	$\underline{+4} \quad \underline{+4}$	$\underline{+3} \quad \underline{+3}$
	$1 < 6$	$0 \geq -7$

Algebra If $a > b$, then $a + c > b + c$. If $a \geq b$, then $a + c \geq b + c$.If $a < b$, then $a + c < b + c$. If $a \leq b$, then $a + c \leq b + c$.**Notes:**

2.2 Notetaking with Vocabulary (continued)**Subtraction Property of Inequality**

Words Subtracting the same number from each side of an inequality produces an equivalent inequality.

Numbers

$$\begin{array}{r} -3 \leq 1 \\ \underline{-5} \quad \underline{-5} \\ -8 \leq -4 \end{array} \qquad \begin{array}{r} 7 > -20 \\ \underline{-7} \quad \underline{-7} \\ 0 > -27 \end{array}$$

Algebra If $a > b$, then $a - c > b - c$. If $a \geq b$, then $a - c \geq b - c$.
 If $a < b$, then $a - c < b - c$. If $a \leq b$, then $a - c \leq b - c$.

Notes:

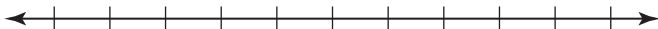
Extra Practice

In Exercises 1–6, solve the inequality. Graph the solution.

1. $x - 3 < -4$

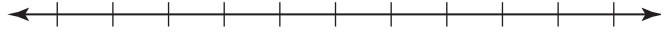


2. $-3 > -3 + h$



2.2 Notetaking with Vocabulary (continued)

3. $s - (-1) \geq 2$



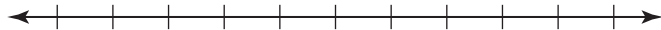
4. $6 - 9 + u < -2$



5. $12 \leq 4c - 3c + 10$



6. $15 - 7p + 8p > 15 - 2$



7. You have \$15 to spend on groceries. You have \$12.25 worth of groceries already in your cart.

a. Write an inequality that represents how much more money m you can spend on groceries.

b. Solve the inequality.

2.3

Solving Inequalities Using Multiplication or Division

For use with Exploration 2.3

Essential Question How can you use division to solve an inequality?

1 EXPLORATION: Writing a Rule

Work with a partner.

- a. Complete the table. Decide which graph represents the solution of the inequality $6 < 3x$. Write the solution of the inequality.

x	-1	0	1	2	3	4	5
$3x$	-3						
$6 < 3x$	No						



- b. Use a table to solve each inequality. Then write a rule that describes how to use division to solve the inequalities.

i. $2x < 4$

ii. $3 \geq 3x$

iii. $2x < 8$

iv. $6 \geq 3x$

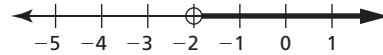
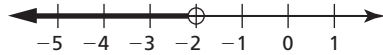
2.3 Solving Inequalities Using Multiplication or Division (continued)

2 EXPLORATION: Writing a Rule

Work with a partner.

- a. Complete the table. Decide which graph represents the solution of the inequality $6 < -3x$. Write the solution of the inequality.

x	-5	-4	-3	-2	-1	0	1
-3x							
$6 < -3x$							



- b. Use a table to solve each inequality. Then write a rule that describes how to use division to solve the inequalities.

i. $-2x < 4$

ii. $3 \geq -3x$

iii. $-2x < 8$

iv. $6 \geq -3x$

Communicate Your Answer

3. How can you use division to solve an inequality?

4. Use the rules you wrote in Explorations 1(b) and 2(b) to solve each inequality.

a. $7x < -21$

b. $12 \leq 4x$

c. $10 < -5x$

d. $-3x \leq 0$

2.3**Notetaking with Vocabulary**

For use after Lesson 2.3

Core Concepts**Multiplication and Division Properties of Inequality ($c > 0$)**

Words Multiplying or dividing each side of an inequality by the same *positive* number produces an equivalent inequality.

Numbers	$-6 < 8$	$6 > -8$
	$2 \cdot (-6) < 2 \cdot 8$	$\frac{6}{2} > \frac{-8}{2}$
	$-12 < 16$	$3 > -4$

Algebra	If $a > b$ and $c > 0$, then $ac > bc$.	If $a > b$ and $c > 0$, then $\frac{a}{c} > \frac{b}{c}$.
	If $a < b$ and $c > 0$, then $ac < bc$.	If $a < b$ and $c > 0$, then $\frac{a}{c} < \frac{b}{c}$.

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

Notes:**Multiplication and Division Properties of Inequality ($c < 0$)**

Words When multiplying or dividing each side of an inequality by the same *negative* number, the direction of the inequality symbol must be reversed to produce an equivalent inequality.

Numbers	$-6 < 8$	$6 > -8$
	$-2 \cdot (-6) > -2 \cdot 8$	$\frac{6}{-2} < \frac{-8}{-2}$
	$12 > -16$	$-3 < 4$

Algebra	If $a > b$ and $c < 0$, then $ac < bc$.	If $a > b$ and $c < 0$, then $\frac{a}{c} < \frac{b}{c}$.
	If $a < b$ and $c < 0$, then $ac > bc$.	If $a < b$ and $c < 0$, then $\frac{a}{c} > \frac{b}{c}$.

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

Notes:

2.3 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–8, solve the inequality. Graph the solution.

1. $6x < -30$



2. $48 \leq 16f$



3. $-\frac{6}{7} \leq \frac{3}{7}f$



4. $-4m \geq -16$



5. $\frac{x}{-6} > \frac{1}{3}$



2.3 Notetaking with Vocabulary (continued)

6. $1 \leq -\frac{1}{4}y$



7. $-\frac{2}{3} < -4x$



8. $-\frac{4}{5}x \geq -2$



9. There are at most 36 red and blue marbles in a bag. The number of red marbles is twice the number of blue marbles. Write and solve an inequality that represents the greatest number of red marbles r in the bag.

2.4**Solving Multi-Step Inequalities**

For use with Exploration 2.4

Essential Question How can you solve a multi-step inequality?**1 EXPLORATION:** Solving a Multi-Step InequalityGo to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner.

- Use what you already know about solving equations and inequalities to solve each multi-step inequality. Justify each step.

a. $2x + 3 \leq x + 5$

b. $-2x + 3 > x + 9$

c. $27 \geq 5x + 4x$

d. $-8x + 2x - 16 < -5x + 7x$

e. $3(x - 3) - 5x > -3x - 6$

f. $-5x - 6x \leq 8 - 8x - x$

2.4 Solving Multi-Step Inequalities (continued)

1 EXPLORATION: Solving a Multi-Step Inequality (continued)

- Match each inequality with its graph. Use a graphing calculator to check your answer.

a. $2x + 3 \leq x + 5$

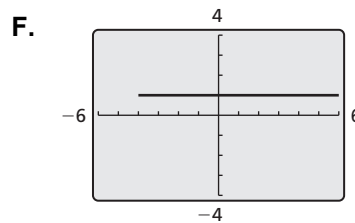
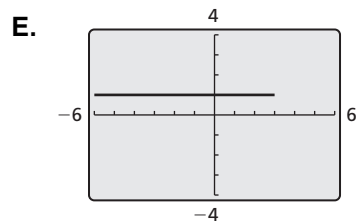
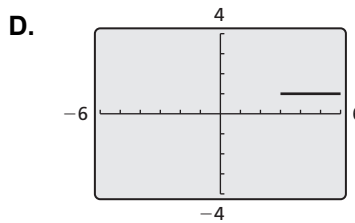
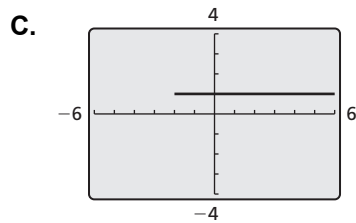
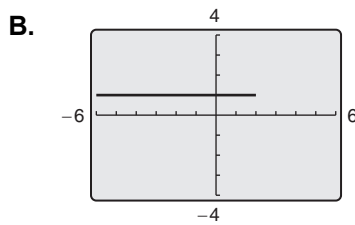
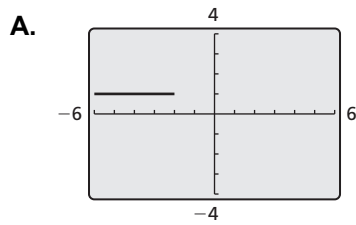
b. $-2x + 3 > x + 9$

c. $27 \geq 5x + 4x$

d. $-8x + 2x - 16 < -5x + 7x$

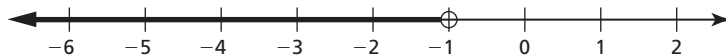
e. $3(x - 3) - 5x > -3x - 6$

f. $-5x - 6x \leq 8 - 8x - x$



Communicate Your Answer

- How can you solve a multi-step inequality?
- Write two different multi-step inequalities whose solutions are represented by the graph.



Name _____ Date _____

2.4

Notetaking with Vocabulary

For use after Lesson 2.4

Notes:

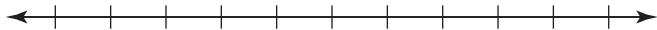
2.4 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–5, solve the inequality. Graph the solution.

1. $3x - 2 < 10$



2. $4a + 8 \geq 0$



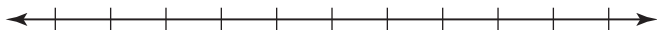
3. $2 + \frac{b}{-3} \leq 3$



4. $-\frac{c}{2} - 6 > -8$



5. $8 \leq -4(d + 1)$



2.4 Notetaking with Vocabulary (continued)

In Exercises 6–10, solve the inequality.

6. $5 - 2n > 8 - 4n$

7. $6h - 18 < 6h + 1$

8. $3p + 4 \geq -4p + 25$

9. $7j - 4j + 6 < -2 + 3j$

10. $12\left(\frac{1}{4}w + 3\right) \leq 3(w - 4)$

11. Find the value of k for which the solution of the inequality $k(4r - 5) \geq -12r - 9$ is all real numbers.

12. Find the value of k that makes the inequality $2kx - 3k < 2x + 4 + 3kx$ have no solution.

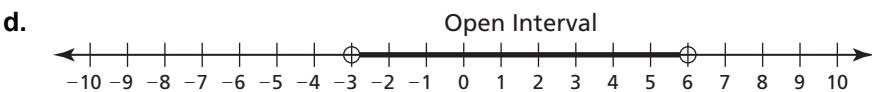
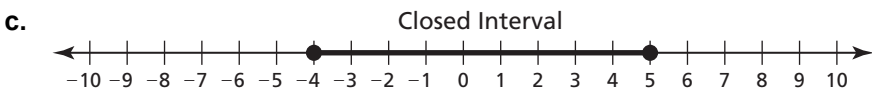
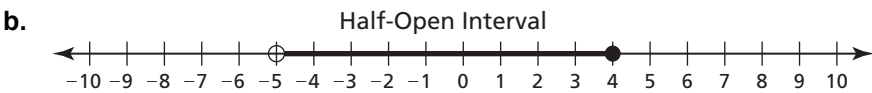
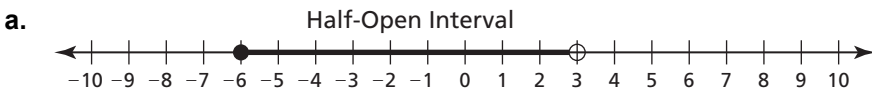
2.5**Solving Compound Inequalities**

For use with Exploration 2.5

Essential Question How can you use inequalities to describe intervals on the real number line?

1 EXPLORATION: Describing Intervals on the Real Number Line

Work with a partner. In parts (a)–(d), use two inequalities to describe the interval.

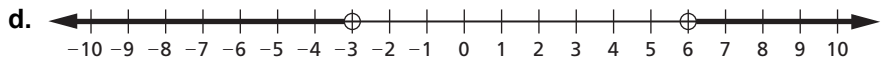
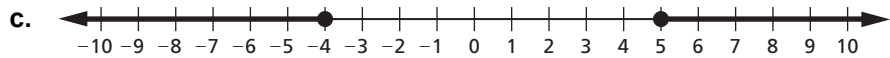
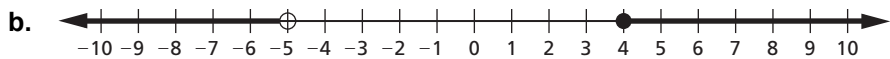
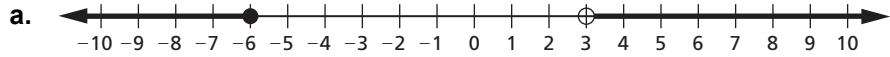


- e. Do you use “and” or “or” to connect the two inequalities in parts (a)–(d)? Explain.

2.5 Solving Compound Inequalities (continued)

2 EXPLORATION: Describing Two Infinite Intervals

Work with a partner. In parts (a)–(d), use two inequalities to describe the interval.



e. Do you use “and” or “or” to connect the two inequalities in parts (a)–(d)? Explain.

Communicate Your Answer

3. How can you use inequalities to describe intervals on the real number line?

2.5

Notetaking with Vocabulary

For use after Lesson 2.5

In your own words, write the meaning of each vocabulary term.

compound inequality

Notes:

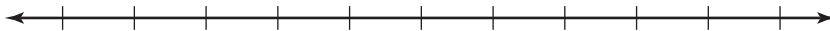
2.5 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–5, write the sentence as an inequality. Graph the inequality.

1. A number u is less than 7 and greater than 3.



2. A number d is less than -2 or greater than or equal to 2.



3. A number s is no less than -2.4 and fewer than 4.2.



4. A number c is more than -4 or at most $-6\frac{1}{2}$.



5. A number c is no less than -1.5 and less than 5.3.



2.5 Notetaking with Vocabulary (continued)

In Exercises 6–10, solve the inequality. Graph the solution.

6. $4 < x - 3 \leq 7$



7. $15 \geq -5g \geq -10$



8. $z + 4 < 2$ or $-3z < -27$



9. $2t + 6 < 10$ or $-t + 7 \leq 2$



10. $-8 \leq \frac{1}{3}(6x + 24) \leq 12$



11. A certain machine operates properly when the relative humidity h satisfies the inequality $-60 \leq 2(h - 50) \leq 60$. Solve for h to find the range of values for which the machine operates properly.

2.6**Solving Absolute Value Inequalities**

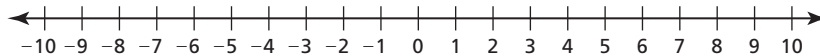
For use with Exploration 2.6

Essential Question How can you solve an absolute value inequality?**1 EXPLORATION: Solving an Absolute Value Inequality Algebraically****Work with a partner.** Consider the absolute value inequality $|x + 2| \leq 3$.

- Describe the values of $x + 2$ that make the inequality true. Use your description to write two linear inequalities that represent the solutions of the absolute value inequality.
- Use the linear inequalities you wrote in part (a) to find the solutions of the absolute value inequality.
- How can you use linear inequalities to solve an absolute value inequality?

2 EXPLORATION: Solving an Absolute Value Inequality Graphically**Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.****Work with a partner.** Consider the absolute value inequality $|x + 2| \leq 3$.

- On a real number line, locate the point for which $x + 2 = 0$.



- Locate the points that are within 3 units from the point you found in part (a). What do you notice about these points?
- How can you use a number line to solve an absolute value inequality?

2.6 Solving Absolute Value Inequalities (continued)**3 EXPLORATION: Solving an Absolute Value Inequality Numerically**

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Consider the absolute value inequality $|x + 2| \leq 3$.

- a. Use a spreadsheet, as shown, to solve the absolute value inequality.

	A	B
1	x	$ x + 2 $
2	-6	4 ← $\text{abs}(A2 + 2)$
3	-5	
4	-4	
5	-3	
6	-2	
7	-1	
8	0	
9	1	
10	2	
11		

- b. Compare the solutions you found using the spreadsheet with those you found in Explorations 1 and 2. What do you notice?

- c. How can you use a spreadsheet to solve an absolute value inequality?

Communicate Your Answer

4. How can you solve an absolute value inequality?
5. What do you like or dislike about the algebraic, graphical, and numerical methods for solving an absolute value inequality? Give reasons for your answers.

2.6**Notetaking with Vocabulary**

For use after Lesson 2.6

In your own words, write the meaning of each vocabulary term.

absolute value inequality

absolute deviation

Notes:

Core Concepts**Solving Absolute Value Inequalities**

To solve $|ax + b| < c$ for $c > 0$, solve the compound inequality

$$ax + b > -c \quad \text{and} \quad ax + b < c.$$

To solve $|ax + b| > c$ for $c > 0$, solve the compound inequality

$$ax + b < -c \quad \text{or} \quad ax + b > c.$$

In the inequalities above, you can replace $<$ with \leq and $>$ with \geq .

Notes:

2.6 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–9, solve the inequality. Graph the solution, if possible.

1. $|y + 2| < 8$



2. $\left|\frac{q}{3}\right| > 2$



3. $3|2a + 5| + 10 \leq 37$



4. $|y - 3| \leq 4$

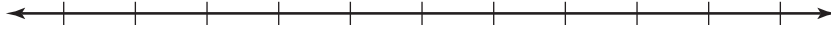


5. $|3 + r| - 4 < 0$



2.6 Notetaking with Vocabulary (continued)

6. $|f + 12| > -4$



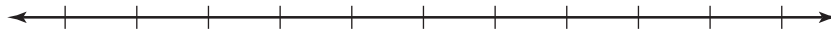
7. $\left| \frac{x}{4} - 7 \right| < -2$



8. $|4x - 7| + 8 \geq 17$



9. $6|3 - k| + 14 > 14$



10. At a certain company, the average starting salary s for a new worker is \$25,000. The actual salary has an absolute deviation of at most \$1800. Write and solve an inequality to find the range of the starting salaries.