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Chapter 5 Resource Masters

Algebra 1



Education

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CONSUMABLE WORKBOOKS Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks in both English and Spanish.

	MHID	ISBN
<i>Study Guide and Intervention Workbook</i>	0-07-660292-3	978-0-07-660292-6
<i>Homework Practice Workbook</i>	0-07-660291-5	978-0-07-660291-9
<i>Spanish Version</i>		
<i>Homework Practice Workbook</i>	0-07-660294-X	978-0-07-660294-0

Answers For Workbooks The answers for Chapter 5 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

ConnectED All of the materials found in this booklet are included for viewing, printing, and editing at connected.mcgraw-hill.com.

Spanish Assessment Masters (MHID: 0-07-660289-3, ISBN: 978-0-07-660289-6) These masters contain a Spanish version of Chapter 5 Test Form 2A and Form 2C.

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Send all inquiries to:
McGraw-Hill Education
8787 Orion Place
Columbus, OH 43240

ISBN: 978-0-07-661384-7
MHID: 0-07-661384-4

Printed in the United States of America.

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Answers

A1–A31

Teacher's Guide to Using the Chapter 5 Resource Masters

The *Chapter 5 Resource Masters* includes the core materials needed for Chapter 5. These materials include worksheets, extensions, and assessment options. The answers for these pages appear at the back of this booklet.

All of the materials found in this booklet are included for viewing, printing, and editing at connectED.mcgraw-hill.com.

Chapter Resources

Student-Built Glossary (pages 1–2) These masters are a student study tool that presents up to twenty of the key vocabulary terms from the chapter. Students are to record definitions and/or examples for each term. You may suggest that students highlight or star the terms with which they are not familiar. Give this to students before beginning Lesson 5-1. Encourage them to add these pages to their mathematics study notebooks. Remind them to complete the appropriate words as they study each lesson.

Anticipation Guide (pages 3–4) This master, presented in both English and Spanish, is a survey used before beginning the chapter to pinpoint what students may or may not know about the concepts in the chapter. Students will revisit this survey after they complete the chapter to see if their perceptions have changed.

Lesson Resources

Study Guide and Intervention These masters provide vocabulary, key concepts, additional worked-out examples and Check Your Progress exercises to use as a reteaching activity. It can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Skills Practice This master focuses more on the computational nature of the lesson. Use as an additional practice option or as homework for second-day teaching of the lesson.

Practice This master closely follows the types of problems found in the Exercises section of the Student Edition and includes word problems. Use as an additional practice option or as homework for second-day teaching of the lesson.

Word Problem Practice This master includes additional practice in solving word problems that apply the concepts of the lesson. Use as an additional practice or as homework for second-day teaching of the lesson.

Enrichment These activities may extend the concepts of the lesson, offer an historical or multicultural look at the concepts, or widen students' perspectives on the mathematics they are learning. They are written for use with all levels of students.

Graphing Calculator, TI-Nspire, or Spreadsheet Activities These activities present ways in which technology can be used with the concepts in some lessons of this chapter. Use as an alternative approach to some concepts or as an integral part of your lesson presentation.

Assessment Options

The assessment masters in the **Chapter 5 Resource Masters** offer a wide range of assessment tools for formative (monitoring) assessment and summative (final) assessment.

Student Recording Sheet This master corresponds with the standardized test practice at the end of the chapter.

Extended Response This master provides information for teachers and students on how to assess performance on open-ended questions.

Quizzes Four free-response quizzes offer assessment at appropriate intervals in the chapter.

Mid-Chapter Test This 1-page test provides an option to assess the first half of the chapter. It parallels the timing of the Mid-Chapter Quiz in the Student Edition and includes both multiple-choice and free-response questions.

Vocabulary Test This test is suitable for all students. It includes a list of vocabulary words and 7 questions to assess students' knowledge of those words. This can also be used in conjunction with one of the leveled chapter tests.

Leveled Chapter Tests

- **Form 1** contains multiple-choice questions and is intended for use with below grade level students.
- **Forms 2A and 2B** contain multiple-choice questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- **Forms 2C and 2D** contain free-response questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- **Form 3** is a free-response test for use with above grade level students.

All of the above mentioned tests include a free-response Bonus question.

Extended-Response Test Performance assessment tasks are suitable for all students. Sample answers and a scoring rubric are included for evaluation.

Standardized Test Practice These three pages are cumulative in nature. It includes three parts: multiple-choice questions with bubble-in answer format, griddable questions with answer grids, and short-answer free-response questions.

Answers

- The answers for the Anticipation Guide and Lesson Resources are provided as reduced pages with answers appearing in bold, black.
- Full-size answer keys are provided for the assessment masters.

5 Student-Built Glossary

This is an alphabetical list of the key vocabulary terms you will learn in Chapter 5. As you study the chapter, complete each term's definition or description. Remember to add the page number where you found the term. Add these pages to your Algebra Study Notebook to review vocabulary at the end of the chapter.

Vocabulary Term	Found on Page	Definition/Description/Example
boundary		
closed half-plane		
compound inequality		
half-plane		
intersection		
open half-plane		
set-builder notation		
union		

5 Anticipation Guide

Linear Inequalities

Step 1 Before you begin Chapter 5

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

STEP 1 A, D, or NS	Statement	STEP 2 A or D
	1. According to the Addition Property of Inequalities, adding any number to each side of a true inequality will result in a true inequality.	
	2. The inequality $m + 23 \geq 35$ can be solved by adding 23 to each side.	
	3. 16 is no greater than the difference of a number and 12 can be written as $16 \leq n - 12$.	
	4. If both sides of $\frac{r}{12} < 4$ are multiplied by 12, the result is $r < 48$.	
	5. The result of dividing both sides of the inequality $-2y \geq 10$ by -2 is $y \geq -5$.	
	6. To solve an inequality involving multiplication, such as $9t > 27$, division is used.	
	7. To solve the inequality $8x - 2 < 70$, first divide by 8 and then add 2.	
	8. A compound inequality is an inequality containing more than one variable.	
	9. On a number line, a closed dot is used for an inequality containing the symbol \geq or \leq .	
	10. If $ t < 8$, then t equals all numbers between 0 and 8.	
	11. On the graph of $y > 2x - 3$, the solution set will be all numbers above the graph of the line $y = 2x - 3$.	

Step 2 After you complete Chapter 5

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.

5 Ejercicios preparatorios

Desigualdades lineales

Paso 1 Antes de comenzar el Capítulo 5

- Lee cada enunciado.
- Decide si estás de acuerdo (A) o en desacuerdo (D) con el enunciado.
- Escribe A o D en la primera columna O si no estás seguro(a) de la respuesta, escribe NS (No estoy seguro(a)).

PASO 1 A, D o NS	Enunciado	PASO 2 A o D
	1. Según la propiedad de adición de la desigualdad, sumar cualquier número a cada lado de una desigualdad verdadera dará como resultado una desigualdad verdadera.	
	2. La desigualdad $m + 23 \geq 35$ se puede resolver al sumar 23 a cada lado.	
	3. 16 no es más que la diferencia entre un número y 12 se puede escribir como $16 \leq n - 12$.	
	4. Si ambos lados de $\frac{r}{12} < 4$ se multiplican por 12, el resultado es $r < 48$.	
	5. El resultado de dividir ambos lados de la desigualdad $-2y \geq 10$ entre -2 es $y \geq -5$.	
	6. Para resolver una desigualdad que implica multiplicación, como $9t > 27$, se usa la división.	
	7. Para resolver la desigualdad $8x - 2 < 70$, primero divide entre 8 y luego suma 2.	
	8. Una desigualdad compuesta es una desigualdad que contiene más de una variable.	
	9. En una recta numérica, un punto cerrado se usa para una desigualdad con el símbolo \geq o \leq .	
	10. Si $ t < 8$, entonces t igual a todos los números entre 0 y 8.	
	11. En la gráfica de $y > 2x - 3$, el conjunto solución será el de todos los números arriba de la gráfica de la recta $y = 2x - 3$.	

Paso 2 Después de completar el Capítulo 5

- Vuelve a leer cada enunciado y completa la última columna con una A o una D.
- ¿Cambió cualquiera de tus opiniones sobre los enunciados de la primera columna?
- En una hoja de papel aparte, escribe un ejemplo de por qué estás en desacuerdo con los enunciados que marcaste con una D.

5-1 Study Guide and Intervention

Solving Inequalities by Addition and Subtraction

Solve Inequalities by Addition Addition can be used to solve inequalities. If any number is added to each side of a true inequality, the resulting inequality is also true.

Addition Property of Inequalities	For all numbers a , b , and c , if $a > b$, then $a + c > b + c$, and if $a < b$, then $a + c < b + c$.
--	---

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example 1 Solve $x - 8 \leq -6$.
Then graph the solution.

$$\begin{aligned} x - 8 &\leq -6 && \text{Original inequality} \\ x - 8 + 8 &\leq -6 + 8 && \text{Add 8 to each side.} \\ x &\leq 2 && \text{Simplify.} \end{aligned}$$

The solution in set-builder notation is $\{x \mid x \leq 2\}$.

Number line graph:

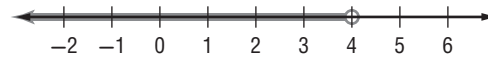


Example 2 Solve $4 - 2a > -a$. Then graph the solution.

$$\begin{aligned} 4 - 2a &> -a && \text{Original inequality} \\ 4 - 2a + 2a &> -a + 2a && \text{Add 2a to each side.} \\ 4 &> a && \text{Simplify.} \\ a &< 4 && 4 > a \text{ is the same as } a < 4. \end{aligned}$$

The solution in set-builder notation is $\{a \mid a < 4\}$.

Number line graph:

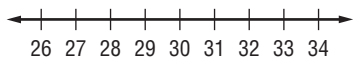


Lesson 5-1

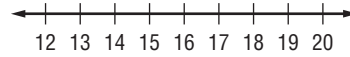
Exercises

Solve each inequality. Check your solution, and then graph it on a number line.

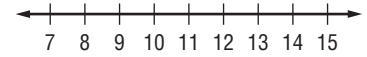
1. $t - 12 \geq 16$



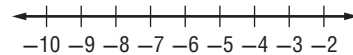
2. $n - 12 < 6$



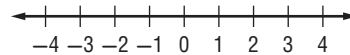
3. $6 \leq g - 3$



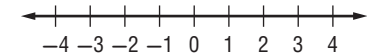
4. $n - 8 < -13$



5. $-12 > -12 + y$



6. $-6 > m - 8$



Solve each inequality. Check your solution.

7. $-3x \leq 8 - 4x$

8. $0.6n \geq 12 - 0.4n$

9. $-8k - 12 < -9k$

10. $-y - 10 > 15 - 2y$

11. $z - \frac{1}{3} \leq \frac{4}{3}$

12. $-2b > -4 - 3b$

Define a variable, write an inequality, and solve each problem. Check your solution.

13. A number decreased by 4 is less than 14.

14. The difference of two numbers is more than 12, and one of the numbers is 3.

15. Forty is no greater than the difference of a number and 2.

5-1 Study Guide and Intervention (continued)

Solving Inequalities by Addition and Subtraction

Solve Inequalities by Subtraction Subtraction can be used to solve inequalities. If any number is subtracted from each side of a true inequality, the resulting inequality is also true.

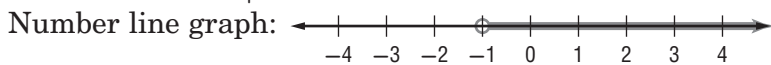
Subtraction Property of Inequalities	For all numbers a , b , and c , if $a > b$, then $a - c > b - c$, and if $a < b$, then $a - c < b - c$.
---	---

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example Solve $3a + 5 > 4 + 2a$. Then graph it on a number line.

$3a + 5 > 4 + 2a$	Original inequality
$3a + 5 - 2a > 4 + 2a - 2a$	Subtract $2a$ from each side.
$a + 5 > 4$	Simplify.
$a + 5 - 5 > 4 - 5$	Subtract 5 from each side.
$a > -1$	Simplify.

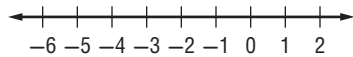
The solution is $\{a | a > -1\}$.



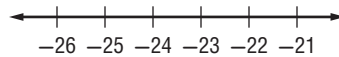
Exercises

Solve each inequality. Check your solution, and then graph it on a number line.

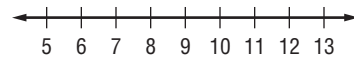
1. $t + 12 \geq 8$



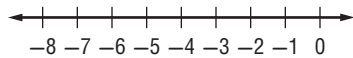
2. $n + 12 > -12$



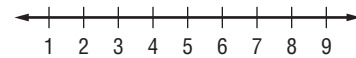
3. $16 \leq h + 9$



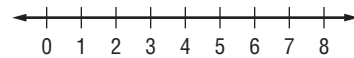
4. $y + 4 > -2$



5. $3r + 6 > 4r$



6. $\frac{3}{2}q - 5 \geq \frac{1}{2}q$



Solve each inequality. Check your solution.

7. $4p \geq 3p + 0.7$

8. $r + \frac{1}{4} > \frac{3}{8}$

9. $9k + 12 > 8k$

10. $-1.2 > 2.4 + y$

11. $4y < 5y + 14$

12. $3n + 17 < 4n$

Define a variable, write an inequality, and solve each problem. Check your solution.

13. The sum of a number and 8 is less than 12.

14. The sum of two numbers is at most 6, and one of the numbers is -2 .

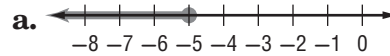
15. The sum of a number and 6 is greater than or equal to -4 .

5-1 Skills Practice

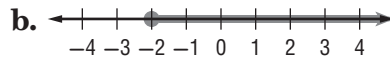
Solving Inequalities by Addition and Subtraction

Match each inequality to the graph of its solution.

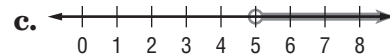
1. $x + 11 > 16$



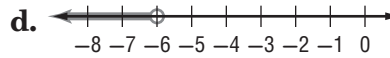
2. $x - 6 < 1$



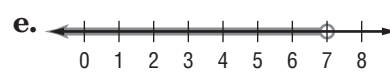
3. $x + 2 \leq -3$



4. $x + 3 \geq 1$

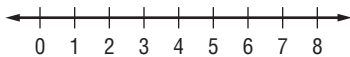


5. $x - 1 < -7$

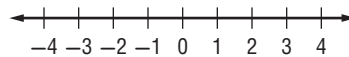


Solve each inequality. Check your solution, and then graph it on a number line.

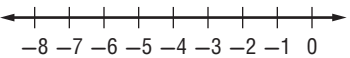
6. $d - 5 \leq 1$



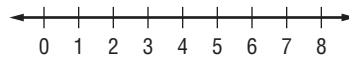
7. $t + 9 < 8$



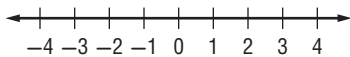
8. $a - 7 > -13$



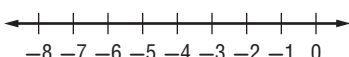
9. $w - 1 < 4$



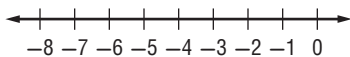
10. $4 \geq k + 3$



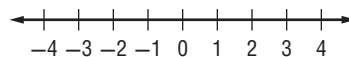
11. $-9 \leq b - 4$



12. $-2 \geq x + 4$



13. $2y < y + 2$



Define a variable, write an inequality, and solve each problem.

Check your solution.

14. A number decreased by 10 is greater than -5 .

15. A number increased by 1 is less than 9.

16. Seven more than a number is less than or equal to -18 .

17. Twenty less than a number is at least 15.

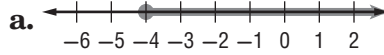
18. A number plus 2 is at most 1.

5-1 Practice

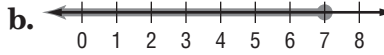
Solving Inequalities by Addition and Subtraction

Match each inequality with its corresponding graph.

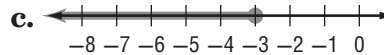
1. $-8 \geq x - 15$



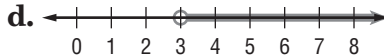
2. $4x + 3 < 5x$



3. $8x > 7x - 4$

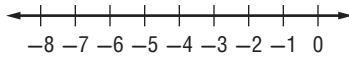


4. $12 + x \leq 9$

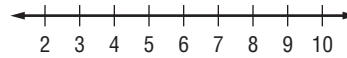


Solve each inequality. Check your solution, and then graph it on a number line.

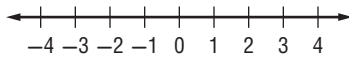
5. $r - (-5) > -2$



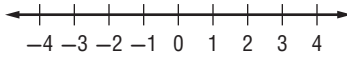
6. $3x + 8 \geq 4x$



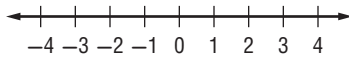
7. $n - 2.5 \geq -5$



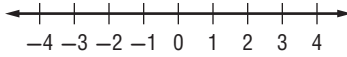
8. $1.5 < y + 1$



9. $z + 3 > \frac{2}{3}$



10. $\frac{1}{2} \leq c - \frac{3}{4}$



Define a variable, write an inequality, and solve each problem. Check your solution.

11. The sum of a number and 17 is no less than 26.
12. Twice a number minus 4 is less than three times the number.
13. Twelve is at most a number decreased by 7.
14. Eight plus four times a number is greater than five times the number.
15. **ATMOSPHERIC SCIENCE** The troposphere extends from the Earth's surface to a height of 6–12 miles, depending on the location and the season. If a plane is flying at an altitude of 5.8 miles, and the troposphere is 8.6 miles deep in that area, how much higher can the plane go without leaving the troposphere?
16. **EARTH SCIENCE** Mature soil is composed of three layers, the uppermost being topsoil. Jamal is planting a bush that needs a hole 18 centimeters deep for the roots. The instructions suggest an additional 8 centimeters depth for a cushion. If Jamal wants to add even more cushion, and the topsoil in his yard is 30 centimeters deep, how much more cushion can he add and still remain in the topsoil layer?

5-1 Word Problem Practice**Solving Inequalities by Addition and Subtraction**

1. SOUND The loudest insect on Earth is the African cicada. It produces sounds as loud as 105 decibels at 20 inches away. The blue whale is the loudest mammal on Earth. The call of the blue whale can reach levels up to 83 decibels louder than the African cicada. How loud are the calls of the blue whale?

2. GARBAGE The amount of garbage that the average American adds to a landfill daily is 4.6 pounds. If at least 2.5 pounds of a person's daily garbage could be recycled, how much will still go into a landfill?

3. SHOPPING Tyler has \$75 to spend at the mall. He purchases a music video for \$14.99 and a pair of jeans for \$18.99. He also spent \$4.75 for lunch. Tyler still wants to purchase a video game. How much money can he spend on a video game?

4. SUPREME COURT The first Chief Justice of the U.S. Supreme Court, John Jay, served 2079 days as Chief Justice. He served 10,463 days fewer than John Marshall, who served as Supreme Court Chief Justice for the longest period of time. How many days must the current Supreme Court Chief Justice John Roberts serve to surpass John Marshall's record of service?

5. WEATHER Theodore Fujita of the University of Chicago developed a classification of tornadoes according to wind speed and damage. The table shows the classification system.

Level	Name	Wind Speed Range (mph)
F0	Gale	40–72
F1	Moderate	73–112
F2	Significant	113–157
F3	Severe	158–206
F4	Devastating	207–260
F5	Incredible	261–318
F6	Inconceivable	319–379

Source: National Weather Service

- a.** Suppose an F3 tornado has winds that are 162 miles per hour. Write and solve an inequality to determine how much the winds would have to increase before the F3 tornado becomes an F4 tornado.
- b.** A tornado has wind speeds that are at least 158 miles per hour. Write and solve an inequality that describes how much greater these wind speeds are than the slowest tornado.

5-1 Enrichment

Triangle Inequalities

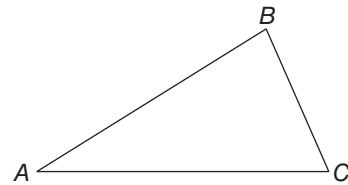
Recall that a line segment can be named by the letters of its endpoints. Line segment AB (written as \overline{AB}) has points A and B for endpoints. The *length* of AB is written without the bar as AB .

$$AB > BC \quad m\angle A < m\angle B$$

The statement on the left above shows that \overline{AB} is shorter than \overline{BC} . The statement on the right above shows that the measure of angle A is less than that of angle B .

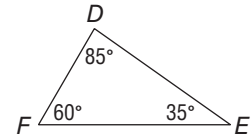
These three inequalities are true for any triangle ABC , no matter how long the sides.

- a. $AB + BC > AC$
- b. If $AB > AC$, then $m\angle C > m\angle B$.
- c. If $m\angle C > m\angle B$, then $AB > AC$.

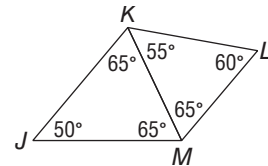


Use the three triangle inequalities for these problems.

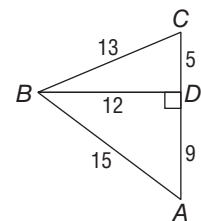
- List the sides of triangle DEF in order of increasing length.



- In the figure at the right, which line segment is the shortest?



- Explain why the lengths 5 centimeters, 10 centimeters, and 20 centimeters could not be used to make a triangle.
- Two sides of a triangle measure 3 inches and 7 inches. Between which two values must the third side be?
- In triangle XYZ , $XY = 15$, $YZ = 12$, and $XZ = 9$. Which angle has the greatest measure? Which has the least?
- List the angles $\angle A$, $\angle C$, $\angle ABC$, and $\angle ABD$, in order of increasing size.



5-2 Study Guide and Intervention

Solving Inequalities by Multiplication and Division

Solve Inequalities by Multiplication If each side of an inequality is multiplied by the same positive number, the resulting inequality is also true. However, if each side of an inequality is multiplied by the same negative number, the direction of the inequality must be reversed for the resulting inequality to be true.

Multiplication Property of Inequalities	For all numbers a , b , and c , with $c \neq 0$,
	<ol style="list-style-type: none"> 1. if c is positive and $a > b$, then $ac > bc$; if c is positive and $a < b$, then $ac < bc$; 2. if c is negative and $a > b$, then $ac < bc$; if c is negative and $a < b$, then $ac > bc$.

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example 1 Solve $-\frac{y}{8} \leq 12$.

$$-\frac{y}{8} \geq 12 \quad \text{Original inequality}$$

$$(-8)\left(-\frac{y}{8}\right) \leq (-8)12 \quad \text{Multiply each side by } -8; \text{ change } \geq \text{ to } \leq.$$

$$y \leq -96 \quad \text{Simplify.}$$

The solution is $\{y \mid y \leq -96\}$.

Example 2 Solve $\frac{3}{4}k < 15$.

$$\frac{3}{4}k < 15 \quad \text{Original inequality}$$

$$\left(\frac{4}{3}\right)\frac{3}{4}k < \left(\frac{4}{3}\right)15 \quad \text{Multiply each side by } \frac{4}{3}.$$

$$k < 20 \quad \text{Simplify.}$$

The solution is $\{k \mid k < 20\}$.

Exercises

Solve each inequality. Check your solution.

1. $\frac{y}{6} \leq 2$

2. $-\frac{n}{50} > 22$

3. $\frac{3}{5}h \geq -3$

4. $-\frac{p}{6} < -6$

5. $\frac{1}{4}n \geq 10$

6. $-\frac{2}{3}b < \frac{1}{3}$

7. $\frac{3m}{5} < -\frac{3}{20}$

8. $-2.51 \leq -\frac{2h}{4}$

9. $\frac{g}{5} \geq -2$

10. $-\frac{3}{4} > -\frac{9p}{5}$

11. $\frac{n}{10} \geq 5.4$

12. $\frac{2a}{7} \geq -6$

Define a variable, write an inequality, and solve each problem. Check your solution.

13. Half of a number is at least 14.

14. The opposite of one-third a number is greater than 9.

15. One fifth of a number is at most 30.

5-2 Study Guide and Intervention *(continued)***Solving Inequalities by Multiplication and Division**

Solve Inequalities by Division If each side of a true inequality is divided by the same positive number, the resulting inequality is also true. However, if each side of an inequality is divided by the same negative number, the direction of the inequality symbol must be reversed for the resulting inequality to be true.

Division Property of Inequalities	For all numbers a , b , and c with $c \neq 0$, 1. if c is positive and $a > b$, then $\frac{a}{c} > \frac{b}{c}$; if c is positive and $a < b$, then $\frac{a}{c} < \frac{b}{c}$; 2. if c is negative and $a > b$, then $\frac{a}{c} < \frac{b}{c}$; if c is negative and $a < b$, then $\frac{a}{c} > \frac{b}{c}$.
--	---

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example Solve $-12y \geq 48$.

$$\begin{array}{ll} -12y \geq 48 & \text{Original inequality} \\ \frac{-12y}{-12} \leq \frac{48}{-12} & \text{Divide each side by } -12 \text{ and change } \geq \text{ to } \leq. \\ y \leq -4 & \text{Simplify.} \end{array}$$

The solution is $\{y \mid y \leq -4\}$.

Exercises

Solve each inequality. Check your solution.

1. $25g \geq -100$

2. $-2x \geq 9$

3. $-5c > 2$

4. $-8m < -64$

5. $-6k < \frac{1}{5}$

6. $18 < -3b$

7. $30 < -3n$

8. $-0.24 < 0.6w$

9. $25 \geq -2m$

10. $-30 > -5p$

11. $-2n \geq 6.2$

12. $35 < 0.05h$

13. $-40 > 10h$

14. $-\frac{2}{3n} \geq 6$

15. $-3 < \frac{p}{4}$

16. $4 > \frac{-x}{2}$

Define a variable, write an inequality, and solve each problem. Then check your solution.

17. Four times a number is no more than 108.

18. The opposite of three times a number is greater than 12.

19. Negative five times a number is at most 100.

5-2 Skills Practice***Solving Inequalities by Multiplication and Division*****Match each inequality with its corresponding statement.**

- | | |
|--------------------------|--|
| 1. $3n < 9$ | a. Three times a number is at most nine. |
| 2. $\frac{1}{3}n \geq 9$ | b. One third of a number is no more than nine. |
| 3. $3n \leq 9$ | c. Negative three times a number is more than nine. |
| 4. $-3n > 9$ | d. Three times a number is less than nine. |
| 5. $\frac{1}{3}n \leq 9$ | e. Negative three times a number is at least nine. |
| 6. $-3n \geq 9$ | f. One third of a number is greater than or equal to nine. |

Solve each inequality. Check your solution.

- | | | | |
|----------------------------|-----------------------|----------------------------|----------------------------|
| 7. $14g > 56$ | 8. $11w \leq 77$ | 9. $20b \geq -120$ | 10. $-8r < 16$ |
| 11. $-15p \leq -90$ | 12. $\frac{x}{4} < 9$ | 13. $\frac{a}{9} \geq -15$ | 14. $-\frac{p}{7} > -9$ |
| 15. $-\frac{t}{12} \geq 6$ | 16. $5z < -90$ | 17. $-13m > -26$ | 18. $\frac{k}{5} \leq -17$ |
| 19. $-y < 36$ | 20. $-16c \geq -224$ | 21. $-\frac{h}{10} \leq 2$ | 22. $12 > \frac{d}{12}$ |

Define a variable, write an inequality, and solve each problem.**Check your solution.**

23. Four times a number is greater than -48 .
24. One eighth of a number is less than or equal to 3 .
25. Negative twelve times a number is no more than 84 .
26. Negative one sixth of a number is less than -9 .
27. Eight times a number is at least 16 .

5-2 Practice**Solving Inequalities by Multiplication and Division**

Match each inequality with its corresponding statement.

- | | |
|--------------------------|---|
| 1. $-4n \geq 5$ | a. Negative four times a number is less than five. |
| 2. $\frac{4}{5}n > 5$ | b. Four fifths of a number is no more than five. |
| 3. $4n \leq 5$ | c. Four times a number is fewer than five. |
| 4. $\frac{4}{5}n \leq 5$ | d. Negative four times a number is no less than five. |
| 5. $4n < 5$ | e. Four times a number is at most five. |
| 6. $-4n < 5$ | f. Four fifths of a number is more than five. |

Solve each inequality. Check your solution.

- | | | | |
|--------------------------|--------------------------|-----------------------------|------------------------------|
| 7. $-\frac{a}{5} < -14$ | 8. $-13h \leq 52$ | 9. $\frac{b}{16} \geq -6$ | 10. $39 > 13p$ |
| 11. $\frac{2}{3}n > -12$ | 12. $-\frac{5}{9}t < 25$ | 13. $-\frac{3}{5}m \leq -6$ | 14. $\frac{10}{3}k \geq -10$ |
| 15. $-3b \leq 0.75$ | 16. $-0.9c > -9$ | 17. $0.1x \geq -4$ | 18. $-2.3 < \frac{j}{4}$ |
| 19. $-15y < 3$ | 20. $2.6v \geq -20.8$ | 21. $0 > -0.5u$ | 22. $\frac{7}{8}f \leq -1$ |

Define a variable, write an inequality, and solve each problem. Check your solution.

23. Negative three times a number is at least 57.
24. Two thirds of a number is no more than -10 .
25. Negative three fifths of a number is less than -6 .
26. **FLOODING** A river is rising at a rate of 3 inches per hour. If the river rises more than 2 feet, it will exceed flood stage. How long can the river rise at this rate without exceeding flood stage?
27. **SALES** Pet Supplies makes a profit of \$5.50 per bag on its line of natural dog food. If the store wants to make a profit of no less than \$5225 on natural dog food, how many bags of dog food does it need to sell?

5-2 Word Problem Practice**Solving Inequalities by Multiplication and Division**

1. PIZZA Tara and friends order a pizza. Tara eats 3 of the 10 slices and pays \$4.20 for her share. Assuming that Tara has paid at least her fair share, write an inequality for how much the pizza could have cost.

2. AIRLINES On average, at least 25,000 pieces of luggage are lost or misdirected each day by United States airlines. Of these, 98% are located by the airlines within 5 days. From a given day's lost luggage, at least how many pieces of luggage are still lost after 5 days?

3. SCHOOL Gil earned these scores on the first three tests in biology this term: 86, 88, and 78. What is the lowest score that Gil can earn on the fourth and final test of the term if he wants to have an average of at least 83?

4. EVENT PLANNING The Downtown Community Center does not charge a rental fee as long as a rentee orders a minimum of \$5000 worth of food from the center. Antonio is planning a banquet for the Quarterback Club. If he is expecting 225 people to attend, what is the minimum he will have to spend on food per person to avoid paying a rental fee?

5. PHYSICS The density of a substance determines whether it will float or sink in a liquid. The density of water is 1 gram per milliliter. Any object with a greater density will sink and any object with a lesser density will float. Density is given by the formula $d = \frac{m}{v}$, where m is mass and v is volume. Here is a table of common chemical solutions and their densities.

Solution	Density (g/mL)
concentrated calcium chloride	1.40
70% isopropyl alcohol	0.92

Source: American Chemistry Council

a. Plastics vary in density when they are manufactured; therefore, their volumes are variable for a given mass. A tablet of polystyrene (a manufactured plastic) sinks in water and in alcohol solution and floats in calcium chloride solution. The tablet has a mass of 0.4 gram. What is the most its volume can be?

b. What is the least its volume can be?

5-2 Enrichment

Quadratic Inequalities

Like linear inequalities, inequalities with higher degrees can also be solved. Quadratic inequalities have a degree of 2. The following example shows how to solve quadratic inequalities.

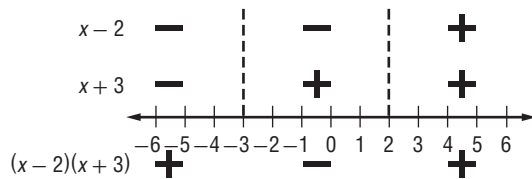
Example Solve $(x + 3)(x - 2) > 0$.

Step 1 Determine what values of x will make the left side 0. In other words, what values of x will make either $x + 3 = 0$ or $x - 2 = 0$?

$$x = -3 \text{ or } 2$$

Step 2 Plot these points on a number line. Above the number line, place a + if $x + 3$ is positive for that region or a - if $x + 3$ is negative for that region. Next, above the signs you have just entered; do the same for $x - 2$.

Step 3 Below the chart, enter the product of the two signs. Your sign chart should look like the following:



The final positive regions correspond to values for which the quadratic expression is greater than 0. So, the answer is

$$x < -3 \text{ or } x > 2.$$

Exercises

Solve each inequality.

1. $(x - 1)(x + 2) > 0$

2. $(x + 5)(x + 2) > 0$

3. $(x - 1)(x - 5) < 0$

4. $(x + 2)(x - 4) \leq 0$

5. $(x - 3)(x + 2) \geq 0$

6. $(x + 3)(x - 4) \leq 0$

5-3 Study Guide and Intervention**Solving Multi-Step Inequalities**

Solve Multi-Step Inequalities To solve linear inequalities involving more than one operation, undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example 1 Solve $6x - 4 \leq 2x + 12$.

$$\begin{array}{ll} 6x - 4 \leq 2x + 12 & \text{Original inequality} \\ 6x - 4 - 2x \leq 2x + 12 - 2x & \text{Subtract } 2x \text{ from} \\ & \text{each side.} \\ 4x - 4 \leq 12 & \text{Simplify.} \\ 4x - 4 + 4 \leq 12 + 4 & \text{Add 4 to each side.} \\ 4x \leq 16 & \text{Simplify.} \\ \frac{4x}{4} \leq \frac{16}{4} & \text{Divide each side by 4.} \\ x \leq 4 & \text{Simplify.} \end{array}$$

The solution is $\{x \mid x \leq 4\}$.

Example 2 Solve $3a - 15 > 4 + 5a$.

$$\begin{array}{ll} 3a - 15 > 4 + 5a & \text{Original inequality} \\ 3a - 15 - 5a > 4 + 5a - 5a & \text{Subtract } 5a \text{ from} \\ & \text{each side.} \\ -2a - 15 > 4 & \text{Simplify.} \\ -2a - 15 + 15 > 4 + 15 & \text{Add 15 to each side.} \\ -2a > 19 & \text{Simplify.} \\ \frac{-2a}{-2} < \frac{19}{-2} & \text{Divide each side by } -2 \\ & \text{and change } > \text{ to } <. \\ a < -9\frac{1}{2} & \text{Simplify.} \end{array}$$

The solution is $\{a \mid a < -9\frac{1}{2}\}$.

Exercises

Solve each inequality. Check your solution.

1. $11y + 13 \geq -1$

2. $8n - 10 < 6 - 2n$

3. $\frac{q}{7} + 1 > -5$

4. $6n + 12 < 8 + 8n$

5. $-12 - d > -12 + 4d$

6. $5r - 6 > 8r - 18$

7. $\frac{-3x + 6}{2} \leq 12$

8. $7.3y - 14.4 > 4.9y$

9. $-8m - 3 < 18 - m$

10. $-4y - 10 > 19 - 2y$

11. $9n - 24n + 45 > 0$

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

Define a variable, write an inequality, and solve each problem. Check your solution.

13. Negative three times a number plus four is no more than the number minus eight.

14. One fourth of a number decreased by three is at least two.

15. The sum of twelve and a number is no greater than the sum of twice the number and -8 .

5-3 Study Guide and Intervention *(continued)***Solving Multi-Step Inequalities**

Solve Inequalities Involving the Distributive Property When solving inequalities that contain grouping symbols, first use the Distributive Property to remove the grouping symbols. Then undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example Solve $3a - 2(6a - 4) > 4 - (4a + 6)$.

$3a - 2(6a - 4) > 4 - (4a + 6)$	Original inequality
$3a - 12a + 8 > 4 - 4a - 6$	Distributive Property
$-9a + 8 > -2 - 4a$	Combine like terms.
$-9a + 8 + 4a > -2 - 4a + 4a$	Add $4a$ to each side.
$-5a + 8 > -2$	Combine like terms.
$-5a + 8 - 8 > -2 - 8$	Subtract 8 from each side.
$-5a > -10$	Simplify.
$a < 2$	Divide each side by -5 and change $>$ to $<$.

The solution in set-builder notation is $\{a \mid a < 2\}$.

Exercises

Solve each inequality. Check your solution.

1. $2(t + 3) \geq 16$

2. $3(d - 2) - 2d > 16$

3. $4h - 8 < 2(h - 1)$

4. $6y + 10 > 8 - (y + 14)$

5. $4.6(x - 3.4) > 5.1x$

6. $-5x - (2x + 3) \geq 1$

7. $3(2y - 4) - 2(y + 1) > 10$

8. $8 - 2(b + 1) < 12 - 3b$

9. $-2(k - 1) > 8(1 + k)$

10. $0.3(y - 2) > 0.4(1 + y)$

11. $m + 17 \leq -(4m - 13)$

12. $3n + 8 \leq 2(n - 4) - 2(1 - n)$

13. $2(y - 2) > -4 + 2y$

14. $k - 17 \leq -(17 - k)$

15. $n - 4 \leq -3(2 + n)$

Define a variable, write an inequality, and solve each problem. Check your solution.

16. Twice the sum of a number and 4 is less than 12.

17. Three times the sum of a number and six is greater than four times the number decreased by two.

18. Twice the difference of a number and four is less than the sum of the number and five.

5-3 Skills Practice**Solving Multi-Step Inequalities****Justify each indicated step.**

1. $\frac{3}{4}t - 3 \geq -15$

$\frac{3}{4}t - 3 + 3 \geq -15 + 3$ **a.** ?

$\frac{3}{4}t \geq -12$

$\frac{4}{3}\left(\frac{3}{4}\right)t \geq \frac{4}{3}(-12)$ **b.** ?

$t \geq -16$

2. $5(k + 8) - 7 \leq 23$

$5k + 40 - 7 \leq 23$ **a.** ?

$5k + 33 \leq 23$

$5k + 33 - 33 \leq 23 - 33$ **b.** ?

$5k \leq -10$

$\frac{5k}{5} \leq \frac{-10}{5}$ **c.** ?

$k \leq -2$

Solve each inequality. Check your solution.

3. $-2b + 4 > -6$

4. $3x + 15 \leq 21$

5. $\frac{d}{2} - 1 \geq 3$

6. $\frac{2}{5}a - 4 < 2$

7. $-\frac{t}{5} + 7 > -4$

8. $\frac{3}{4}j - 10 \geq 5$

9. $-\frac{2}{3}f + 3 < -9$

10. $2p + 5 \geq 3p - 10$

11. $4k + 15 > -2k + 3$

12. $2(-3m - 5) \geq -28$

13. $-6(w + 1) < 2(w + 5)$

14. $2(q - 3) + 6 \leq -10$

Define a variable, write an inequality, and solve each problem.**Check your solution.**

15. Four more than the quotient of a number and three is at least nine.

16. The sum of a number and fourteen is less than or equal to three times the number.

17. Negative three times a number increased by seven is less than negative eleven.

18. Five times a number decreased by eight is at most ten more than twice the number.

19. Seven more than five sixths of a number is more than negative three.

20. Four times the sum of a number and two increased by three is at least twenty-seven.

5-3 Practice**Solving Multi-Step Inequalities****Justify each indicated step.**

1. $x > \frac{5x - 12}{8}$
 $8x > (8) \frac{5x - 12}{8}$ a. ?
 $8x > 5x - 12$
 $8x - 5x > 5x - 12 - 5x$ b. ?
 $3x > -12$
 $\frac{3x}{3} > \frac{-12}{3}$ c. ?
 $x > -4$

2. $2(2h + 2) < 2(3h + 5) - 12$
 $4h + 4 < 6h + 10 - 12$ a. ?
 $4h + 4 < 6h - 2$
 $4h + 4 - 6h < 6h - 2 - 6h$ b. ?
 $-2h + 4 < -2$
 $-2h + 4 - 4 < -2 - 4$ c. ?
 $-2h < -6$
 $\frac{-2h}{-2} > \frac{-6}{-2}$ d. ?
 $h > 3$

Solve each inequality. Check your solution.

3. $-5 - \frac{t}{6} \geq -9$

4. $4u - 6 \geq 6u - 20$

5. $13 > \frac{2}{3}a - 1$

6. $\frac{w + 3}{2} < -8$

7. $\frac{3f - 10}{5} > 7$

8. $h \leq \frac{6h + 3}{5}$

9. $3(z + 1) + 11 < -2(z + 13)$

10. $3r + 2(4r + 2) \leq 2(6r + 1)$

11. $5n - 3(n - 6) \geq 0$

Define a variable, write an inequality, and solve each problem. Check your solution.

12. A number is less than one fourth the sum of three times the number and four.

13. Two times the sum of a number and four is no more than three times the sum of the number and seven decreased by four.

14. **GEOMETRY** The area of a triangular garden can be no more than 120 square feet. The base of the triangle is 16 feet. What is the height of the triangle?15. **MUSIC PRACTICE** Nabuko practices the violin at least 12 hours per week. She practices for three fourths of an hour each session. If Nabuko has already practiced 3 hours in one week, how many sessions remain to meet or exceed her weekly practice goal?

5-3 Word Problem Practice**Solving Multi-Step Inequalities**

1. BEACHCOMBING Jay has lost his mother's favorite necklace, so he will rent a metal detector to try to find it. A rental company charges a one-time rental fee of \$15 plus \$2 per hour to rent a metal detector. Jay has only \$35 to spend. What is the maximum amount of time he can rent the metal detector?

2. AGES Bobby, Billy, and Barry Smith are each one year apart in age. The sum of their ages is greater than the age of their father, who is 60. How old can the oldest brother can be?

3. TAXI FARE Jamal works in a city and sometimes takes a taxi to work. The taxicabs charge \$1.50 for the first $\frac{1}{5}$ mile and \$0.25 for each additional $\frac{1}{5}$ mile. Jamal has only \$3.75 in his pocket. What is the maximum distance he can travel by taxi if he does not tip the driver?

4. PLAYGROUND The perimeter of a rectangular playground must be no greater than 120 meters, because that is the total length of the materials available for the border. The width of the playground cannot exceed 22 meters. What are the possible lengths of the playground?

5. MEDICINE Clark's Rule is a formula used to determine pediatric dosages of over-the-counter medicines.

$$\frac{\text{weight of child (lb)}}{150} \times \text{adult dose} = \text{child dose}$$

a. If an adult dose of acetaminophen is 1000 milligrams and a child weighs no more than 90 pounds, what is the recommended child's dose?

b. This label appears on a child's cold medicine. What is the adult minimum dosage in milliliters?

Weight (lb)	Age (yr)	Dose
under 48	under 6	call a doctor
48-95	6-11	2 tsp or 10 mL

c. What is the maximum adult dosage in milliliters?

5-3 Enrichment

Carlos Montezuma

During his lifetime, Carlos Montezuma (1866–1923) was one of the most influential Native Americans in the United States. He was recognized as a prominent physician and was also a passionate advocate of the rights of Native American peoples. The exercises that follow will help you learn some interesting facts about Dr. Montezuma's life.

Solve each inequality. The word or phrase next to the equivalent inequality will complete the statement correctly.

1. $-2k > 10$

Montezuma was born in the state of ? .

- a. $k < -5$ Arizona
- b. $k > -5$ Montana
- c. $k > 12$ Utah

2. $5 \geq r - 9$

He was a Native American of the Yavapais, who are a ? people.

- a. $r \leq -4$ Navajo
- b. $r \geq -4$ Mohawk
- c. $r \leq 14$ Mohave-Apache

3. $-y \leq -9$

Montezuma received a medical degree from ? in 1889.

- a. $y \geq 9$ Chicago Medical College
- b. $y \geq -9$ Harvard Medical School
- c. $y \leq 9$ Johns Hopkins University

4. $-3 + q > 12$

As a physician, Montezuma's field of specialization was ? .

- a. $q > -4$ heart surgery
- b. $q > 15$ internal medicine
- c. $q < -15$ respiratory diseases

5. $5 + 4x - 14 \leq x$

For much of his career, he maintained a medical practice in ? .

- a. $x \leq 9$ New York City
- b. $x \leq 3$ Chicago
- c. $x \geq -9$ Boston

6. $7 - t < 7 + t$

In addition to maintaining his medical practice, he was also a(n) ? .

- a. $t > 7$ director of a blood bank
- b. $t > 0$ instructor at a medical college
- c. $t < -7$ legal counsel to physicians

7. $3a + 8 \geq 4a - 10$

Montezuma founded, wrote, and edited ? , a monthly newsletter that addressed Native American concerns.

- a. $a \leq -2$ *Yavapai*
- b. $a \geq 18$ *Apache*
- c. $a \leq 18$ *Wassaja*

8. $6n > 8n - 12$

Montezuma testified before a committee of the United States Congress concerning his work in treating ? .

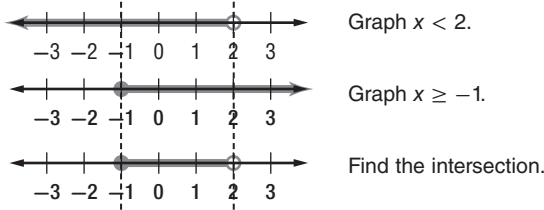
- a. $n < 6$ appendicitis
- b. $n > -6$ asthma
- c. $n > -10$ heart attacks

5-4 Study Guide and Intervention

Solving Compound Inequalities

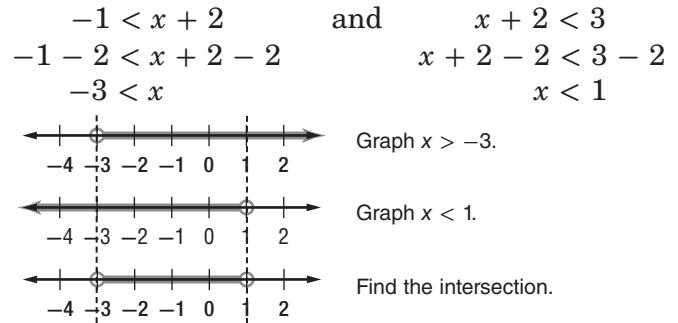
Inequalities Containing *and* A compound inequality containing *and* is true only if both inequalities are true. The graph of a compound inequality containing *and* is the **intersection** of the graphs of the two inequalities. Every solution of the compound inequality must be a solution of both inequalities.

Example 1 Graph the solution set of $x < 2$ and $x \geq -1$.



The solution set is $\{x \mid -1 \leq x < 2\}$.

Example 2 Solve $-1 < x + 2 < 3$. Then graph the solution set.

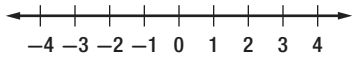


The solution set is $\{x \mid -3 < x < 1\}$.

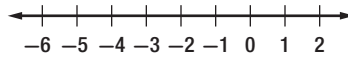
Exercises

Graph the solution set of each compound inequality.

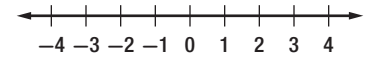
1. $b > -1$ and $b \leq 3$



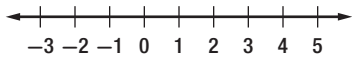
2. $2 \geq q \geq -5$



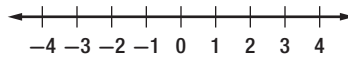
3. $x > -3$ and $x \leq 4$



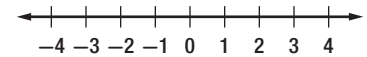
4. $-2 \leq p < 4$



5. $-3 < d$ and $d < 2$

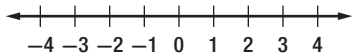


6. $-1 \leq p \leq 3$

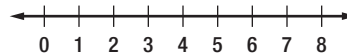


Solve each compound inequality. Then graph the solution set.

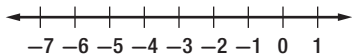
7. $4 < w + 3 \leq 5$



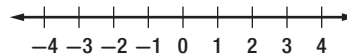
8. $-3 \leq p - 5 < 2$



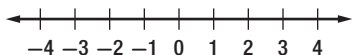
9. $-4 < x + 2 \leq -2$



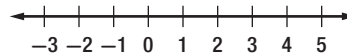
10. $y - 1 < 2$ and $y + 2 \geq 1$



11. $n - 2 > -3$ and $n + 4 < 6$



12. $d - 3 < 6d + 12 < 2d + 32$



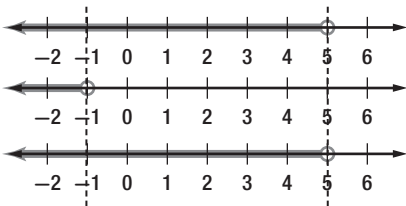
5-4 Study Guide and Intervention *(continued)*

Solving Compound Inequalities

Inequalities Containing or A compound inequality containing *or* is true if one or both of the inequalities are true. The graph of a compound inequality containing *or* is the **union** of the graphs of the two inequalities. The union can be found by graphing both inequalities on the same number line. A solution of the compound inequality is a solution of either inequality, not necessarily both.

Example Solve $2a + 1 < 11$ or $a > 3a + 2$. Then graph the solution set.

$$\begin{array}{lcl}
 2a + 1 < 11 & \text{or} & a > 3a + 2 \\
 2a + 1 - 1 < 11 - 1 & & a - 3a > 3a - 3a + 2 \\
 2a < 10 & & -2a > 2 \\
 \frac{2a}{2} < \frac{10}{2} & & \frac{-2a}{-2} < \frac{2}{-2} \\
 a < 5 & & a < -1
 \end{array}$$



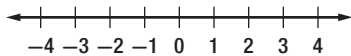
Graph $a < 5$.
Graph $a < -1$.
Find the union.

The solution set is $\{a \mid a < 5\}$.

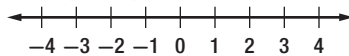
Exercises

Graph the solution set of each compound inequality.

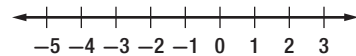
1. $b > 2$ or $b \leq -3$



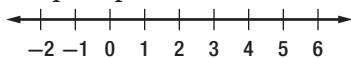
2. $3 \geq q$ or $q \leq 1$



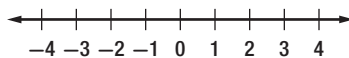
3. $y \leq -4$ or $y > 0$



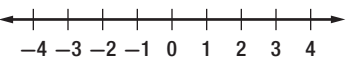
4. $4 \leq p$ or $p < 8$



5. $-3 < d$ or $d < 2$

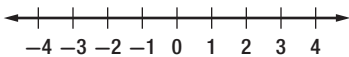


6. $-2 \leq x$ or $3 \leq x$

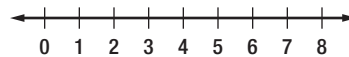


Solve each compound inequality. Then graph the solution set.

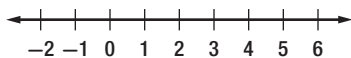
7. $3 < 3w$ or $3w \geq 9$



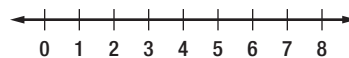
8. $-3p + 1 \leq -11$ or $p < 2$



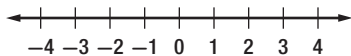
9. $2x + 4 \leq 6$ or $x \geq 2x - 4$



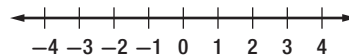
10. $2y + 2 < 12$ or $y - 3 \geq 2y$



11. $\frac{1}{2}n > -2$ or $2n - 2 < 6 + n$



12. $3a + 2 \geq 5$ or $7 + 3a < 2a + 6$

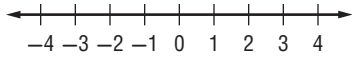


5-4 Skills Practice

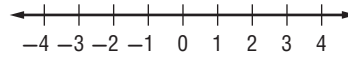
Solving Compound Inequalities

Graph the solution set of each compound inequality.

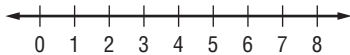
1. $b > 3$ or $b \leq 0$



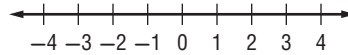
2. $z \leq 3$ and $z \geq -2$



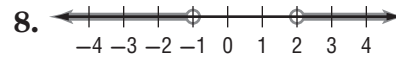
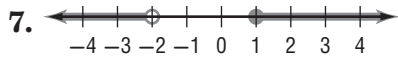
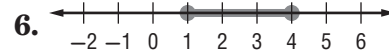
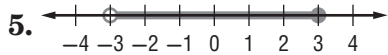
3. $k > 1$ and $k > 5$



4. $y < -1$ or $y \geq 1$

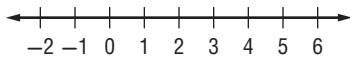


Write a compound inequality for each graph.

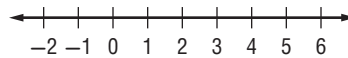


Solve each compound inequality. Then graph the solution set.

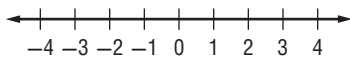
9. $m + 3 \geq 5$ and $m + 3 < 7$



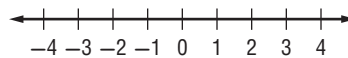
10. $y - 5 < -4$ or $y - 5 \geq 1$



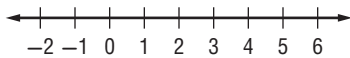
11. $4 < f + 6$ and $f + 6 < 5$



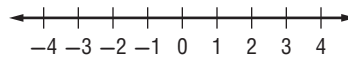
12. $w + 3 \leq 0$ or $w + 7 \geq 9$



13. $-6 < b - 4 < 2$



14. $p - 2 \leq -2$ or $p - 2 > 1$



Define a variable, write an inequality, and solve each problem.

Check your solution.

15. A number plus one is greater than negative five and less than three.

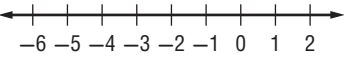
16. A number decreased by two is at most four or at least nine.

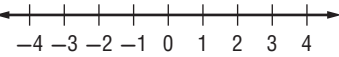
17. The sum of a number and three is no more than eight or is more than twelve.

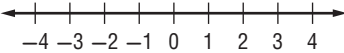
5-4 Practice

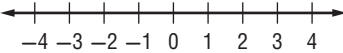
Solving Compound Inequalities

Graph the solution set of each compound inequality.

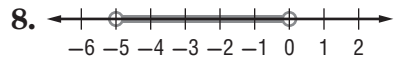
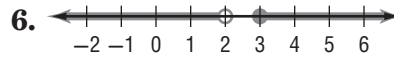
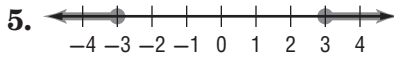
1. $-4 \leq n \leq 1$ 

2. $x > 0$ or $x < 3$ 

3. $g < -3$ or $g \geq 4$


4. $-4 \leq p \leq 4$


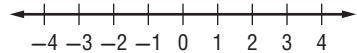
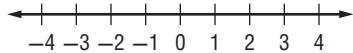
Write a compound inequality for each graph.



Solve each compound inequality. Then graph the solution set.

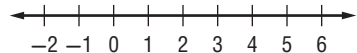
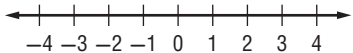
9. $k - 3 < -7$ or $k + 5 \geq 8$

10. $-n < 2$ or $2n - 3 > 5$



11. $5 < 3h + 2 \leq 11$

12. $2c - 4 > -6$ and $3c + 1 < 13$



Define a variable, write an inequality, and solve each problem. Check your solution.

13. Two times a number plus one is greater than five and less than seven.

14. A number minus one is at most nine, or two times the number is at least twenty-four.

15. **METEOROLOGY** Strong winds called the prevailing westerlies blow from west to east in a belt from 40° to 60° latitude in both the Northern and Southern Hemispheres.

a. Write an inequality to represent the latitude of the prevailing westerlies.

b. Write an inequality to represent the latitudes where the prevailing westerlies are *not* located.

16. **NUTRITION** A cookie contains 9 grams of fat. If you eat no fewer than 4 and no more than 7 cookies, how many grams of fat will you consume?

5-4 Word Problem Practice

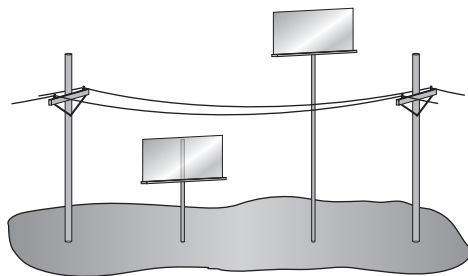
Solving Compound Inequalities

- 1. WEATHER** Ken saw this graph in the newspaper weather forecast. It shows the predicted temperature range for the following day. Write an inequality to represent the number line graph.



- 2. POOLS** The pH of a person's eyes is 7.2. Therefore, the ideal pH for the water in a swimming pool is between 7.0 and 7.6. Write a compound inequality to represent pH levels that could cause physical discomfort to a person's eyes.

- 3. STORE SIGNS** In Randy's town, street-side signs themselves must be exactly 8 feet high. When mounted on poles, the signs must be shorter than 20 feet or taller than 35 feet so that they do not interfere with the power and phone lines. Write a compound inequality to represent the possible height of the poles.



- 4. HEALTH** The human heart circulates from 770,000 to 1,600,000 gallons of blood through a person's body every year. How many gallons of blood does the heart circulate through the body in one day?

- 5. HEALTH** Body mass index (BMI) is a measure of weight status. The BMI of a person over 20 years old is calculated using the following formula.

$$\text{BMI} = 703 \times \frac{\text{weight in pounds}}{(\text{height in inches})^2}$$

The table below shows the meaning of different BMI measures.

BMI	Weight Status
less than 18.5	underweight
18.5 – 24.9	normal
25 – 29.9	overweight
more than 30	obese

Source: Centers for Disease Control

- Write a compound inequality to represent the normal BMI range.
- Write a compound inequality to represent an adult weight that is within the healthy BMI range for a person 6 feet tall.

5-4 Enrichment

Some Properties of Inequalities

The two expressions on either side of an inequality symbol are sometimes called the *first* and *second* members of the inequality.

If the inequality symbols of two inequalities point in the same direction, the inequalities have the same sense. For example, $a < b$ and $c < d$ have the same sense; $a < b$ and $c > d$ have opposite senses.

In the problems on this page, you will explore some properties of inequalities.

Three of the four statements below are true for all numbers a and b (or a, b, c , and d). Write each statement in algebraic form. If the statement is true for all numbers, prove it. If it is not true, give an example to show that it is false.

1. Given an inequality, a new and equivalent inequality can be created by interchanging the members and reversing the sense.
2. Given an inequality, a new and equivalent inequality can be created by changing the signs of both terms and reversing the sense.
3. Given two inequalities with the same sense, the sum of the corresponding members are members of an equivalent inequality with the same sense.
4. Given two inequalities with the same sense, the difference of the corresponding members are members of an equivalent inequality with the same sense.

5-5 Study Guide and Intervention

Inequalities Involving Absolute Value

Inequalities Involving Absolute Value (<) When solving inequalities that involve absolute value, there are two cases to consider for inequalities involving < (or ≤).

If $|x| < n$, then $x > -n$ and $x < n$.

Remember that inequalities with *and* are related to intersections.

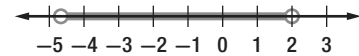
Example

Solve $|3a + 4| < 10$. Then graph the solution set.

Write $|3a + 4| < 10$ as $3a + 4 < 10$ and $3a + 4 > -10$.

$3a + 4 < 10$	and	$3a + 4 > -10$
$3a + 4 - 4 < 10 - 4$		$3a + 4 - 4 > -10 - 4$
$3a < 6$		$3a > -14$
$\frac{3a}{3} < \frac{6}{3}$		$\frac{3a}{3} > \frac{-14}{3}$
$a < 2$		$a > -4\frac{2}{3}$

Now graph the solution set.

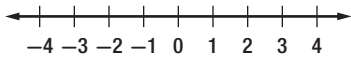


The solution set is $\left\{a \mid -4\frac{2}{3} < a < 2\right\}$.

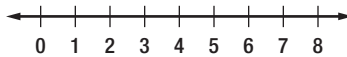
Exercises

Solve each inequality. Then graph the solution set.

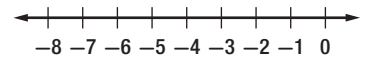
1. $|y| < 3$



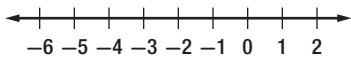
2. $|x - 4| < 4$



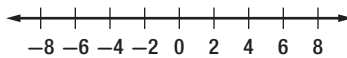
3. $|y + 3| \leq 2$



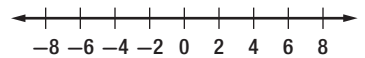
4. $|b + 2| \leq 3$



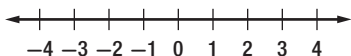
5. $|w - 2| \leq 5$



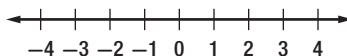
6. $|t + 2| \leq 4$



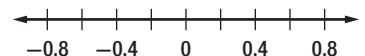
7. $|2x| \leq 8$



8. $|5y - 2| \leq 7$



9. $|p - 0.2| < 0.5$



5-5 Study Guide and Intervention *(continued)*

Inequalities Involving Absolute Value

Solve Absolute Value Inequalities ($>$) When solving inequalities that involve absolute value, there are two cases to consider for inequalities involving $>$ (or \geq). Remember that inequalities with *or* are related to unions.

Example Solve $|2b + 9| > 5$. Then graph the solution set.

Write $|2b + 9| > 5$ as $|2b + 9| > 5$ or $|2b + 9| < -5$.

$$2b + 9 > 5 \quad \text{or} \quad 2b + 9 < -5$$

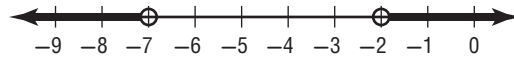
$$2b + 9 - 9 > 5 - 9 \quad 2b + 9 - 9 < -5 - 9$$

$$2b > -4 \quad 2b < -14$$

$$\frac{2b}{2} > \frac{-4}{2} \quad \frac{2b}{2} < \frac{-14}{2}$$

$$b > -2 \quad b < -7$$

Now graph the solution set.

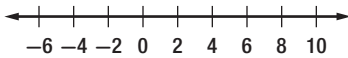


The solution set is $\{b \mid b > -2 \text{ or } b < -7\}$.

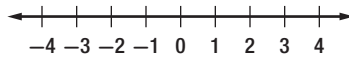
Exercises

Solve each inequality. Then graph the solution set.

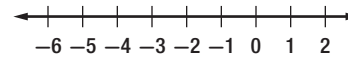
1. $|c - 2| > 6$



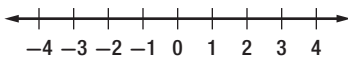
2. $|x - 3| > 0$



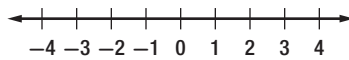
3. $|3f + 10| \geq 4$



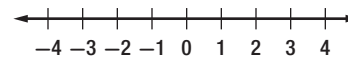
4. $|x| \geq 2$



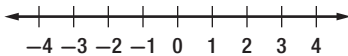
5. $|x| \geq 3$



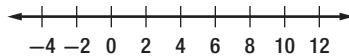
6. $|2x + 1| \geq -2$



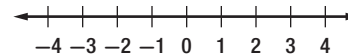
7. $|2d - 1| \geq 4$



8. $|3 - (x - 1)| \geq 8$



9. $|3r + 2| > -5$

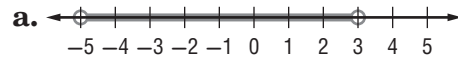


5-5 Skills Practice

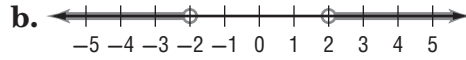
Inequalities Involving Absolute Value

Match each open sentence with the graph of its solution set.

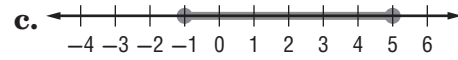
1. $|x| > 2$



2. $|x - 2| \leq 3$



3. $|x + 1| < 4$



Express each statement using an inequality involving absolute value.

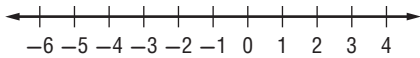
4. The weatherman predicted that the temperature would be within 3° of 52°F .

5. Serena will make the B team if she scores within 8 points of the team average of 92.

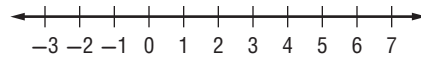
6. The dance committee expects attendance to number within 25 of last year's 87 students.

Solve each inequality. Then graph the solution set.

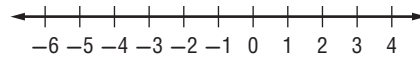
7. $|x + 1| < 0$



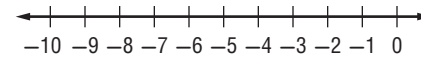
8. $|c - 3| < 1$



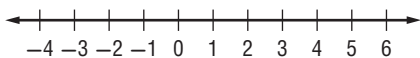
9. $|n + 2| \geq 1$



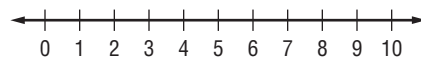
10. $|t + 6| > 4$



11. $|w - 2| < 2$



12. $|k - 5| \leq 4$

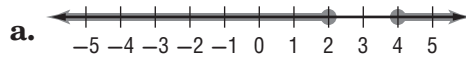


5-5 Practice

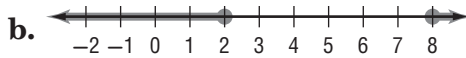
Inequalities Involving Absolute Value

Match each open sentence with the graph of its solution set.

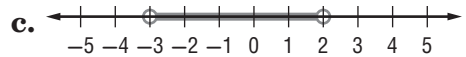
1. $|x - 3| \geq 1$



2. $|2x + 1| < 5$



3. $|5 - x| \geq 3$

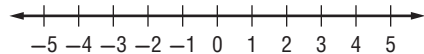


Express each statement using an inequality involving absolute value.

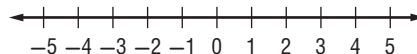
- The height of the plant must be within 2 inches of the standard 13-inch show size.
- The majority of grades in Sean's English class are within 4 points of 85.

Solve each inequality. Then graph the solution set.

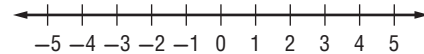
6. $|2z - 9| \leq 1$



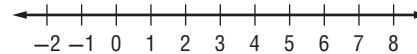
7. $|3 - 2r| > 7$



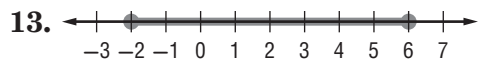
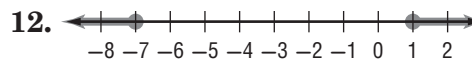
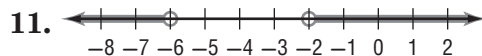
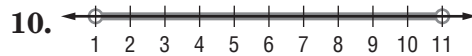
8. $|3t + 6| < 9$



9. $|2g - 5| \geq 9$



Write an open sentence involving absolute value for each graph.

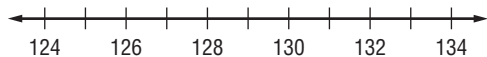


14. **RESTAURANTS** The menu at Jeanne's favorite restaurant states that the roasted chicken with vegetables entree typically contains 480 Calories. Based on the size of the chicken, the actual number of Calories in the entree can vary by as many as 40 Calories from this amount.

- Write an absolute value inequality to represent the situation.
- What is the range of the number of Calories in the chicken entree?

5-5 Word Problem Practice***Inequalities Involving Absolute Value***

- 1. SPEEDOMETERS** The government requires speedometers on cars sold in the United States to be accurate within $\pm 2.5\%$ of the actual speed of the car. If your speedometer reads 60 miles per hour while you are driving on a highway, what is the range of possible actual speeds at which your car could be traveling?
- 2. BAKING** Pete is making muffins for a bake sale. Before he starts baking, he goes online to research different muffin recipes. The recipes that he finds all specify baking temperatures between 350°F and 400°F , inclusive. Write an absolute value inequality to represent the possible temperatures t called for in the muffin recipes Pete is researching.
- 3. ARCHERY** In an Olympic archery event, the center of the target is set exactly 130 centimeters off the ground. To get the highest score of ten points, an archer must shoot an arrow no further than 3.05 centimeters from the exact center of the target.
- Write an absolute value inequality to represent the possible distances d from the ground an archer can hit the target and still score ten points.
 - Graph the solution set of the inequality you wrote in part **a**.

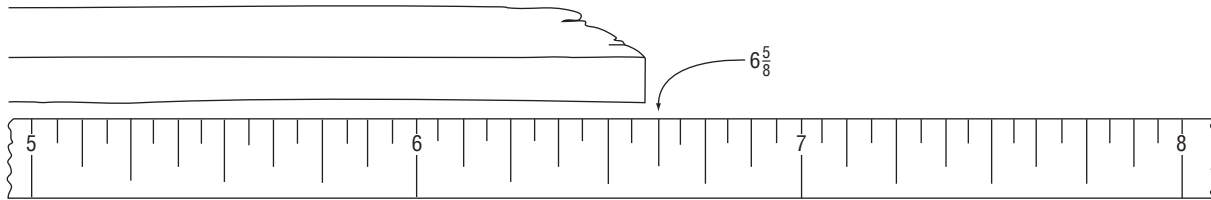


- 4. CATS** During a recent visit to the veterinarian's office, Mrs. Van Allen was informed that a healthy weight for her cat is approximately 10 pounds, plus or minus one pound. Write an absolute value inequality that represents unhealthy weights w for her cat.
- 5. STATISTICS** The most familiar statistical measure is the arithmetic mean, or average. A second important statistical measure is the standard deviation, which is a measure of how far the individual scores deviate from the mean. For example, in a recent year the mean score on the mathematics section of the SAT test was 515 and the standard deviation was 114. This means that people within one deviation of the mean have SAT math scores that are no more than 114 points higher or 114 points lower than the mean.
- Write an absolute value inequality to find the range of SAT mathematics test scores within one standard deviation of the mean.
 - What is the range of SAT mathematics test scores ± 2 standard deviation from the mean?

5-5 Enrichment

Precision of Measurement

The precision of a measurement depends both on your accuracy in measuring and the number of divisions on the ruler you use. Suppose you measured a length of wood to the nearest one-eighth of an inch and got a length of $6\frac{5}{8}$ inches.



The drawing shows that the actual measurement lies somewhere between $6\frac{9}{16}$ and $6\frac{11}{16}$ inches. This measurement can be written using the symbol \pm , which is read *plus or minus*. It can also be written as a compound inequality.

$$6\frac{5}{8} \pm \frac{1}{16} \text{ in.} \quad 6\frac{9}{16} \text{ in.} \leq m \leq 6\frac{11}{16} \text{ in.}$$

In this example, $\frac{1}{16}$ inch is the absolute error. The absolute error is one-half the smallest unit used in a measurement.

Write each measurement as a compound inequality. Use the variable m .

1. $5\frac{1}{2} \pm \frac{1}{4} \text{ in.}$

2. $3.78 \pm 0.005 \text{ kg}$

3. $7.11 \pm 0.005 \text{ g}$

4. $16 \pm \frac{1}{2} \text{ yd}$

5. $22 \pm 0.5 \text{ cm}$

6. $\frac{9}{16} \pm \frac{1}{32} \text{ in.}$

For each measurement, give the smallest unit used and the absolute error.

7. $9.5 \text{ in.} \leq m \leq 10.5 \text{ in.}$

8. $4\frac{1}{4} \text{ in.} \leq m \leq 4\frac{3}{4} \text{ in.}$

9. $23\frac{1}{2} \text{ cm} \leq m \leq 24\frac{1}{2} \text{ cm}$

10. $7.135 \text{ mm} \leq m \leq 7.145 \text{ mm}$

5-5 Graphing Calculator Activity

Absolute Value Inequalities

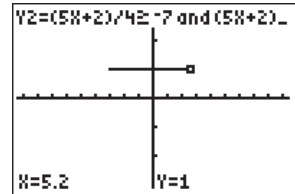
The **TEST** menu can be used to solve and graph absolute value inequalities by using the equivalent compound inequalities related to absolute value.

Example Graph and solve each inequality.

a. $|x + 4| \geq 8$

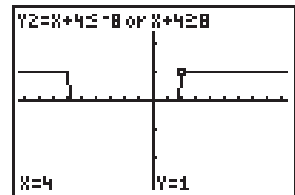
Enter the inequality into **Y1**. Then enter the equivalent compound inequality into **Y2** and graph to view the results. Be sure to choose appropriate settings for the view window.

Keystrokes: **MATH** **▶** **ENTER** **X,T,θ,n** **+** **4** **)** **2nd** **[TEST]** **4** **8**
ENTER **X,T,θ,n** **+** **4** **2nd** **[TEST]** **6** **(-)** **8** **2nd** **[TEST]** **▶** **2**
X,T,θ,n **+** **4** **2nd** **[TEST]** **4** **8** **ENTER** **GRAPH** .



[-18.8, 18.8] scl:2 by [-3.1, 3.1] scl:1

Use **TRACE** to confirm the solution. When $y = 1$ the statement is true, and when $y = 0$ the statement is false. Thus, the solution is $x \leq -12$ or $x \geq 4$.

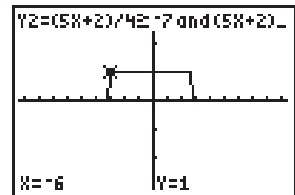


[-18.8, 18.8] scl:2 by [-3.1, 3.1] scl:1

b. $\left| \frac{5x + 2}{4} \right| \leq 7$

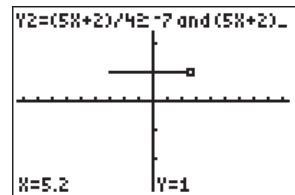
Enter the inequality into **Y1** and the equivalent compound inequalities into **Y2**. Then graph the solution set.

Keystrokes: **MATH** **▶** **ENTER** **(** **5** **X,T,θ,n** **+** **2** **)** **÷** **4** **)**
2nd **[TEST]** **6** **7** **ENTER** **(** **5** **X,T,θ,n** **+** **2** **)** **÷** **4** **2nd**
[TEST] **4** **(-)** **7** **2nd** **[TEST]** **▶** **ENTER** **(** **5** **X,T,θ,n** **+** **2** **)**
÷ **4** **2nd** **[TEST]** **6** **7** **ENTER** **GRAPH** .



[-18.8, 18.8] scl:2 by [-3.1, 3.1] scl:1

The statement is true between -6 and 5.2 . Thus the solution is $-6 \leq x \leq 5.2$.



[-18.8, 18.8] scl:2 by [-3.1, 3.1] scl:1

Exercises

Graph and solve each inequality.

1. $|x + 3| \geq 2$

2. $|2x + 6| \leq 4$

3. $\left| \frac{2 - 4x}{5} \right| > 2$

4. $|x + 8| < -3$

5-6 Study Guide and Intervention

Graphing Inequalities in Two Variables

Graph Linear Inequalities The solution set of an inequality that involves two variables is graphed by graphing a related linear equation that forms a boundary of a **half-plane**. The graph of the ordered pairs that make up the solution set of the inequality fill a region of the coordinate plane on one side of the half-plane.

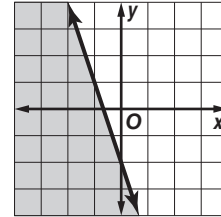
Example Graph $y \leq -3x - 2$.

Graph $y = -3x - 2$.

Since $y \leq -3x - 2$ is the same as $y < -3x - 2$ and $y = -3x - 2$, the boundary is included in the solution set and the graph should be drawn as a solid line.

Select a point in each half plane and test it. Choose $(0, 0)$ and $(-2, -2)$.

$y \leq -3x - 2$	$y \leq -3x - 2$
$0 \leq -3(0) - 2$	$-2 \leq -3(-2) - 2$
$0 \leq -2$ is false.	$-2 \leq 6 - 2$
	$-2 \leq 4$ is true.

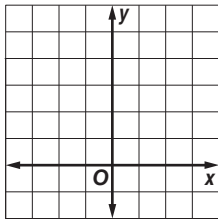


The half-plane that contains $(-2, -2)$ contains the solution. Shade that half-plane.

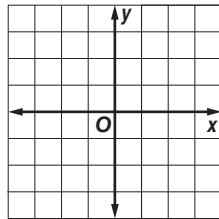
Exercises

Graph each inequality.

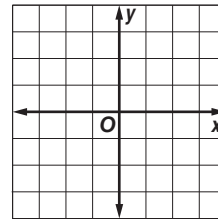
1. $y < 4$



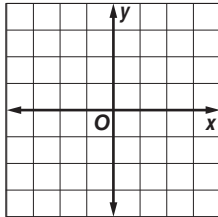
2. $x \geq 1$



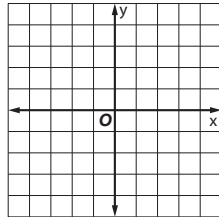
3. $3x \leq y$



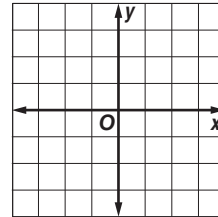
4. $-x > y$



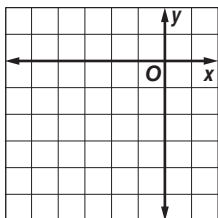
5. $x - y \geq 1$



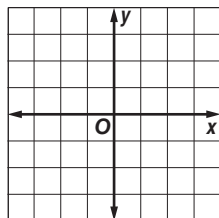
6. $2x - 3y \leq 6$



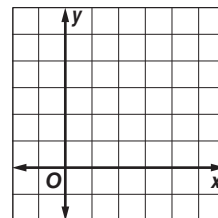
7. $y < -\frac{1}{2}x - 3$



8. $4x - 3y < 6$



9. $3x + 6y \geq 12$



5-6 Study Guide and Intervention *(continued)*

Graphing Inequalities in Two Variables

Solve Linear Inequalities We can use a coordinate plane to solve inequalities with one variable.

Example Use a graph to solve $2x + 2 > -1$.

Step 1 First graph the boundary, which is the related function. Replace the inequality sign with an equals sign, and get 0 on a side by itself.

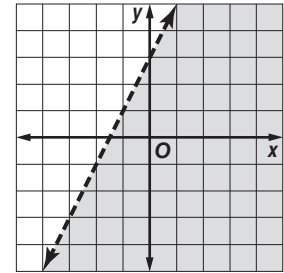
$2x + 2 > -1$ Original inequality

$2x + 2 = -1$ Change $>$ to $=$.

$2x + 2 + 1 = -1 + 1$ Add 1 to each side.

$2x + 3 = 0$ Simplify.

Graph $2x + 3 = y$ as a dashed line.



Step 2 Choose $(0, 0)$ as a test point, substituting these values into the original inequality give us $3 > -5$.

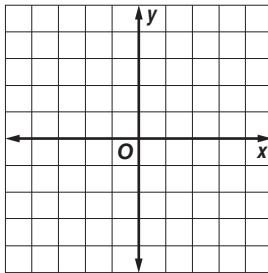
Step 3 Because this statement is true, shade the half plane containing the point $(0, 0)$.

Notice that the x -intercept of the graph is at $-1\frac{1}{2}$. Because the half-plane to the right of the x -intercept is shaded, the solution is $x > -1\frac{1}{2}$.

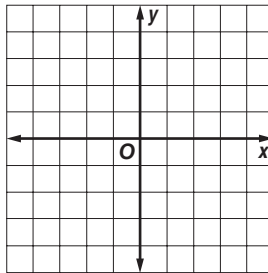
Exercises

Use a graph to solve each inequality.

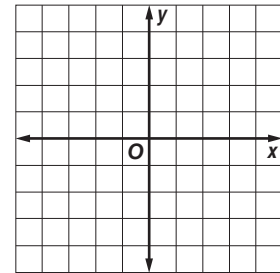
1. $x + 7 \leq 5$



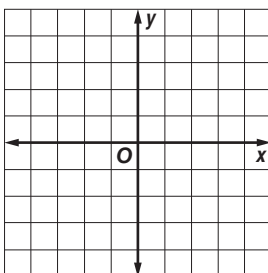
2. $x - 2 > 2$



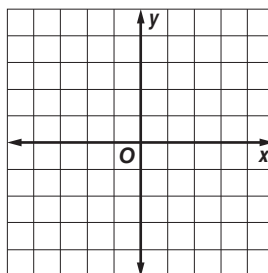
3. $-x + 1 < -3$



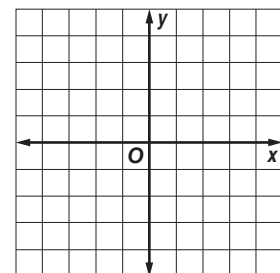
4. $-x - 7 \geq -6$



5. $3x - 20 < -17$



6. $-2x + 11 \geq 15$



5-6 Skills Practice

Graphing Inequalities in Two Variables

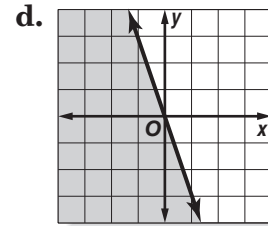
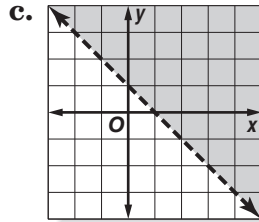
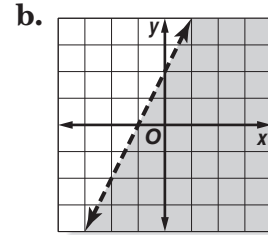
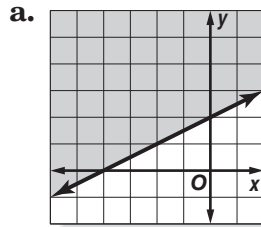
Match each inequality to the graph of its solution.

1. $y - 2x < 2$

2. $y \leq -3x$

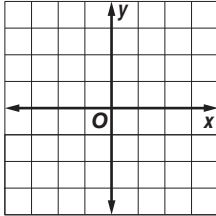
3. $2y - x \geq 4$

4. $x + y > 1$

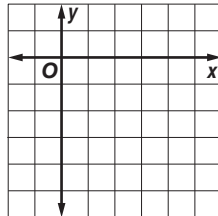


Graph each inequality.

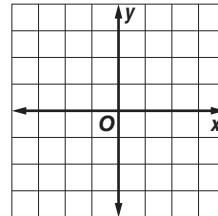
5. $y < -1$



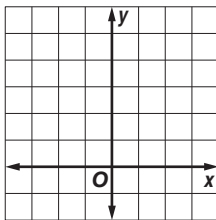
6. $y \geq x - 5$



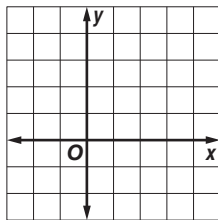
7. $y > 3x$



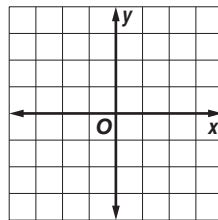
8. $y \leq 2x + 4$



9. $y + x > 3$

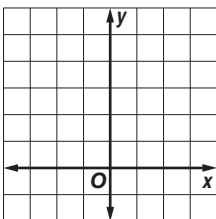


10. $y - x \geq 1$

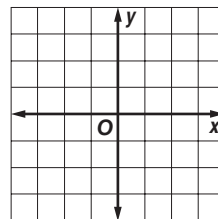


Use a graph to solve each inequality.

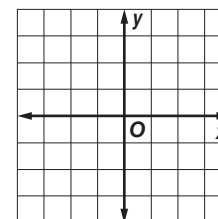
11. $1 > 2x + 5$



12. $7 \leq 3x + 4$



13. $-\frac{1}{2} < -\frac{1}{2}x + 1$



5-6 Practice

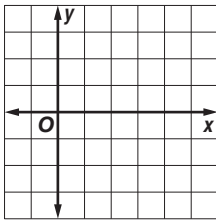
Graphing Inequalities in Two Variables

Determine which ordered pairs are part of the solution set for each inequality.

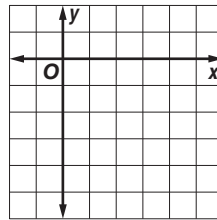
1. $3x + y \geq 6$, $\{(4, 3), (-2, 4), (-5, -3), (3, -3)\}$
2. $y \geq x + 3$, $\{(6, 3), (-3, 2), (3, -2), (4, 3)\}$
3. $3x - 2y < 5$, $\{(4, -4), (3, 5), (5, 2), (-3, 4)\}$

Graph each inequality.

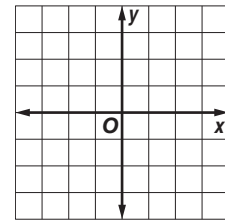
4. $2y - x < -4$



5. $2x - 2y \geq 8$

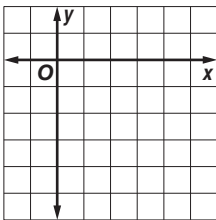


6. $3y > 2x - 3$

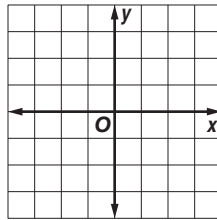


Use a graph to solve each inequality.

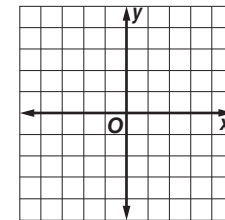
7. $-5 \leq x - 9$



8. $6 > \frac{2}{3}x + 5$



9. $\frac{1}{2} > -2x + \frac{7}{2}$



10. MOVING A moving van has an interior height of 7 feet (84 inches). You have boxes in 12 inch and 15 inch heights, and want to stack them as high as possible to fit. Write an inequality that represents this situation.

11. BUDGETING Satchi found a used bookstore that sells pre-owned DVDs and CDs. DVDs cost \$9 each, and CDs cost \$7 each. Satchi can spend no more than \$35.

- a. Write an inequality that represents this situation.
- b. Does Satchi have enough money to buy 2 DVDs and 3 CDs?

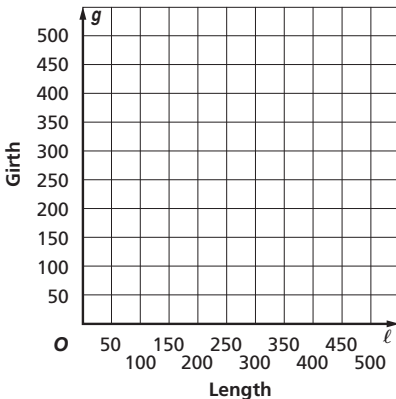
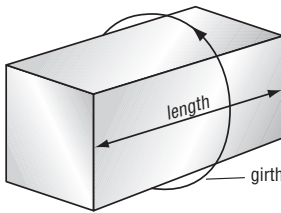
5-6 Word Problem Practice

Graphing Inequalities in Two Variables

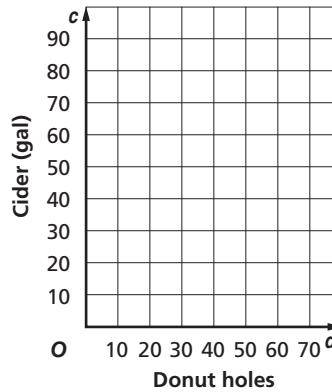
- 1. FAMILY** Tyrone said that the ages of his siblings are all part of the solution set of $y > 2x$, where x is the age of a sibling and y is Tyrone's age. Which of the following ages is possible for Tyrone and a sibling?
 Tyrone is 23; Maxine is 14.
 Tyrone is 18; Camille is 8.
 Tyrone is 12; Francis is 4.
 Tyrone is 11; Martin is 6.
 Tyrone is 19; Paul is 9.

- 2. FARMING** The average value of U.S. farm cropland has steadily increased in recent years. In 2000, the average value was \$1490 per acre. Since then, the value has increased at least an average of \$77 per acre per year. Write an inequality to show land values above the average for farmland.

- 3. SHIPPING** An international shipping company has established size limits for packages with all their services. The total of the length of the longest side and the girth (distance completely around the package at its widest point perpendicular to the length) must be less than or equal to 419 centimeters. Write and graph an inequality that represents this situation.

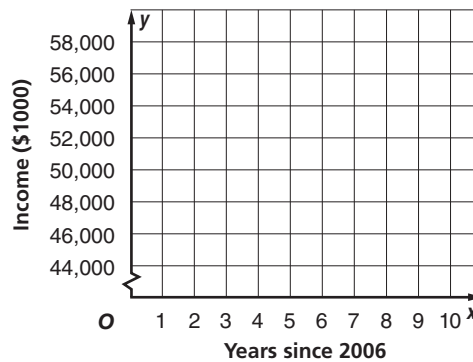


- 4. FUNDRAISING** Troop 200 sold cider and donuts to raise money for charity. They sold small boxes of donut holes for \$1.25 and cider for \$2.50 a gallon. In order to cover their expenses, they needed to raise at least \$100. Write and graph an inequality that represents this situation.



- 5. INCOME** In 2006 the median yearly family income was about \$48,200 per year. Suppose the average annual rate of change since then is \$1240 per year.

- a. Write and graph an inequality for the annual family incomes y that are less than the median for x years after 2006.



- b. Determine whether each of the following points is part of the solution set.

- (2, 51,000) (8, 69,200)
 (5, 50,000) (10, 61,000)

5-6 Enrichment

Linear Programming

Linear programming can be used to maximize or minimize costs. It involves graphing a set of linear inequalities and using the region of intersection. You will use linear programming to solve the following problem.

Example Layne's Gift Shoppe sells at most 500 items per week. To meet her customers' demands, she sells at least 100 stuffed animals and 75 greeting cards. If the profit for each stuffed animal is \$2.50 and the profit for each greeting card is \$1.00, the equation $P(a, g) = 2.50a + 1.00g$ can be used to represent the profit. How many of each should she sell to maximize her profit?

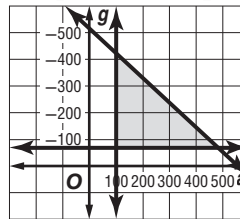
Write the inequalities:

$$a + g \leq 500$$

$$a \geq 100$$

$$g \geq 75$$

Graph the inequalities:



Find the vertices of the triangle formed: (100, 75), (100, 400), and (425, 75) Substitute the values of the vertices into the equation found above:

$$2.50(100) + 1(75) = 325$$

$$2.50(100) + 1(400) = 650$$

$$2.50(425) + 1(75) = 1137.50$$

The maximum profit is \$1137.50.

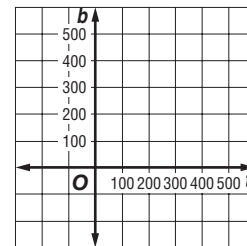
Exercises

The Spirit Club is selling shirts and banners. They sell at most 400 of the two items. To meet the demands of the students, they must sell at least 50 T-shirts and 100 banners. The profit on each shirt is \$4.00 and the profit on each banner is \$1.50, the equation $P(t, b) = 4.00t + 1.50b$ can be used to represent the profit. How many should they sell of each to maximize the profit?

1. Write the inequalities to represent this situation.

2. Graph the inequalities from Exercise 1.

3. Find the vertices of the figure formed.



4. What is the maximum profit the Spirit Club can make?

5-6 Spreadsheet Activity

Inequalities in Two Variables

You can use a spreadsheet to determine whether ordered pairs satisfy an inequality.

Example Use a spreadsheet to determine which ordered pairs from the set $\{(2, 3), (4, 1), (-1, 2), (0, 7), (-8, -10)\}$ are part of the solution set for $5x - 2y > 12$.

Step 1 Use columns A and B of the spreadsheet for the replacement set. Enter the x -coordinates in column A and the y -coordinates in column B.

Step 2 Column C contains the formula for the inequality. Use the names of the cells containing the x - and y -coordinates of each ordered pair to determine whether that ordered pair is part of the solution set. The formula will return **TRUE** or **FALSE**.

	A	B	C
1	x	y	$5x - 2y > 12$
2	2	3	$=5*A2-2*B2>12$
3	4	1	$=5*A3-2*B3>12$
4	-1	2	$=5*A4-2*B4>12$
5	0	7	$=5*A5-2*B5>12$
6	-8	-10	$=5*A6-2*B6>12$

The solution set contains the ordered pairs for which the inequality is true. The ordered pair $\{(4, 1)\}$ is part of the solution set of $5x - 2y > 12$.

The spreadsheet can also evaluate inequalities involving absolute value. Enter an absolute value expression like $|x|$ using the function **ABS(x)**.

	A	B	C
1	x	y	$5x - 2y > 12$
2	2	3	FALSE
3	4	1	TRUE
4	-1	2	FALSE
5	0	7	FALSE
6	-8	-10	FALSE

Exercises

Use a spreadsheet to determine which ordered pairs are part of the solution set for each inequality.

- $2x + 3y > 1$; $\{(0, 3), (1, -3), (-2, -1), (6, 8)\}$
- $7x - y < 8$; $\{(1, 2), (-3, -1), (0, -10), (6, 9)\}$
- $y \geq 3x$; $\{(3, 1), (-4, 5), (-1, 0), (7, -1), (2, 7)\}$
- $y \leq -4x$; $\{(9, 3), (-3, 5), (0, 0), (12, 1), (3, 9)\}$
- $y > 12 - 2x$; $\{(-3, -3), (-1, 9), (12, 13), (-4, 11)\}$
- $y > 2 + 6x$; $\{(0, -4), (-4, 8), (9, 17), (-2, 18), (-5, -5)\}$
- $|x + 1| \leq y$; $\{(1, -8), (0, 4), (5, 16), (-2, -8), (11, -2)\}$
- $|y - 7| < x$; $\{(5, 8), (-1, 3), (2, 19), (-6, -6), (10, -22)\}$

5 Student Recording Sheet

Use this recording sheet with pages 330–331 of the Student Edition.

Multiple Choice

Read each question. Then fill in the correct answer.

1. A B C D

4. F G H I

7. A B C D

2. F G H I

5. A B C D

8. F G H I

3. A B C D

6. F G H I

Short Response/Gridded Response

Record your answer in the blank.

For gridded response questions, also enter your answer in the grid by writing each number or symbol in a box. Then fill in the corresponding circle for that number or symbol.

9. _____

10.

	⊗	⊗	⊗	
⊖	⊖	⊖	⊖	⊖
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

13.

	⊗	⊗	⊗	
⊖	⊖	⊖	⊖	⊖
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

10. _____ (grid in)

11. _____

12. _____

13. _____ (grid in)

14. _____

15. _____

16. _____

Extended Response

Record your answers for Question 17 on the back of this paper.

5 Rubric for Scoring Extended Response

General Scoring Guidelines

- If a student gives only a correct numerical answer to a problem but does not show how he or she arrived at the answer, the student will be awarded only 1 credit. All extended response questions require the student to show work.
- A fully correct answer for a multiple-part question requires correct responses for all parts of the question. For example, if a question has three parts, the correct response to one or two parts of the question that required work to be shown is *not* considered a fully correct response.
- Students who use trial and error to solve a problem must show their method. Merely showing that the answer checks or is correct is not considered a complete response for full credit.

Exercise 17 Rubric

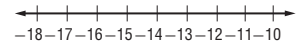
Score	Specific Criteria
4	The inequality written in part a shows that Theresa's savings after w weeks is $35w$ and that she can take a vacation after saving at least \$640 ($35w \geq 640$). In part b, both sides of the inequality should be divided by 35 to get $w \geq 18\frac{2}{7}$, and it should be noted that Theresa must save for 19 weeks (the mixed number should be rounded up to the next largest integer). In part c, the inequality $45w \geq 640$ should be solved for w ($w \geq 14\frac{2}{9}$). The student should then show that the minimum time will be decreased by $19 - 5$ or 4 weeks.
3	A generally correct solution, but may contain minor flaws in reasoning or computation.
2	A partially correct interpretation and/or solution to the problem.
1	A correct solution with no evidence or explanation.
0	An incorrect solution indicating no mathematical understanding of the concept or task, or no solution is given.

5 Chapter 5 Quiz 1

SCORE _____

(Lessons 5-1 and 5-2)

1. Solve $w + 9 \leq -5$. Then graph your solution on a number line. 1. _____



2. Define a variable, write an inequality, and solve:
A number decreased by 7 is at least 15. 2. _____

Solve each inequality.

3. $\frac{m}{13} > -6$ 3. _____

4. $-3n \leq 84$ 4. _____

5. **MULTIPLE CHOICE** Which inequality does *not* have the solution $\{x|x < -2\}$?

A $-3x > 6$

C $7x < -14$

B $-\frac{x}{2} < 1$

D $\frac{4}{3}x < -\frac{8}{3}$

5. _____

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5 Chapter 5 Quiz 2

SCORE _____

(Lesson 5-3)

For Questions 1 and 3, solve each inequality.

1. $-\frac{d}{5} - 12 \geq 8$ 1. _____

2. $23 - t \leq 2(t - 9) - 3(t + 2)$ 2. _____

3. $16 < 3t - 2$ 3. _____

4. Define a variable, write an inequality, and solve: *The sum of a number and three is less than nineteen less the number.* 4. _____

5. **MULTIPLE CHOICE** Connor is mailing some letters at the post office. Stamps cost 44 cents each. He also needs to mail a package that costs \$7.65. Which expression shows how many letters Connor can mail if he has \$10.00 to spend in total? 5. _____

A $7.65 + 0.44x > 10.00$

C $7.65 + 0.44x \geq 10.00$

B $7.65 + 0.44x < 10.00$

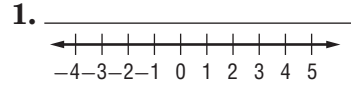
D $7.65 + 0.44x \leq 10.00$

5 Chapter 5 Quiz 3

SCORE _____

(Lessons 5-4 and 5-5)

1. Solve $-1 < 2x - 1 \leq 5$. Then graph the solution set.

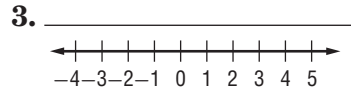


2. **MULTIPLE CHOICE** Which value of x is not a solution to $3x - 1 < 5$ or $7 - x \leq 3$?

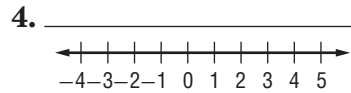
- A 0 B 2 C 4 D 5

2. _____

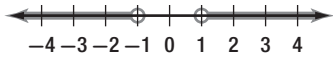
3. Solve $\left| \frac{x-1}{2} \right| \leq 1$. Then graph the solution set.



4. Solve $|2x - 1| \geq 3$. Then graph the solution set.



5. Write an open sentence involving absolute value for the graph shown.



5. _____

5 Chapter 5 Quiz 4

SCORE _____

(Lesson 5-6)

1. **MULTIPLE CHOICE** Which is *not* true about the graph of $2x + y \geq 1$?

- A The point (2, 2) is located inside the shaded region.
 B The boundary is graphed as a solid line.
 C The boundary is graphed along $y = -2x + 1$.
 D The origin is located inside the shaded region.

1. _____

2. Determine whether the test point (3, 3) is in the shaded half-plane of the graph of $y + 2 \leq 3x$.

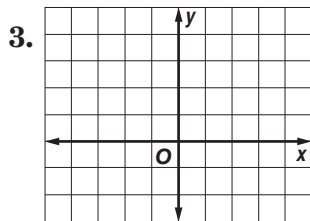
2. _____

3. Use a graph to solve $\frac{1}{3}x + 4 \leq 3$.

3. _____

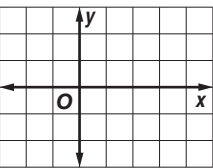
For Questions 4 and 5, graph each inequality.

4. $x < 3$

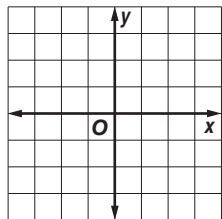


5. $-2(x - y) \leq 4$

4. _____



5. _____



5 Chapter 5 Mid-Chapter Test

(Lessons 5-1 through 5-3)

Part I Write the letter for the correct answer in the blank at the right of each question.

For Questions 1–5, solve each inequality.

1. $r - \frac{7}{8} > 1$

- A $\{r \mid r > \frac{1}{8}\}$ B $\{r \mid r < \frac{1}{8}\}$ C $\{r \mid r > 1\frac{7}{8}\}$ D $\{r \mid r < 1\frac{7}{8}\}$ 1. _____

2. $12x + 5 \geq 17x - 10$

- F $\{x \mid x \leq -3\}$ G $\{x \mid x \geq 3\}$ H $\{x \mid x \geq -3\}$ J $\{x \mid x \leq 3\}$ 2. _____

3. $6m - 2(7 + 3m) > 5(2m - 3) - m$

- A $\{m \mid m < 1\}$ B $\{m \mid m < \frac{1}{9}\}$ C $\{m \mid m > 1\}$ D $\{m \mid m > \frac{1}{9}\}$ 3. _____

4. $\frac{2n}{7} \leq 4$

- F $\{n \mid n \leq 14\}$ G $\{n \mid n \geq 14\}$ H $\{n \mid n \leq \frac{8}{7}\}$ J $\{n \mid n \geq \frac{8}{7}\}$ 4. _____

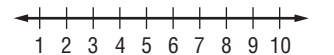
5. $3t - 2(t - 1) \geq 5t - 4(2 + t)$

- A $\{t \mid t \leq -\frac{5}{7}\}$ C $\{t \mid \text{all real numbers}\}$
 B $\{t \mid t \leq \frac{3}{4}\}$ D \emptyset 5. _____

Part II

6. Solve the inequality $4.2 > -11 + t$. Check your solution. 6. _____

7. Solve the inequality $2x - 1 > 7$. Then graph the solution set. 7. _____



Define a variable, write an inequality, and solve each problem.

8. For a package to qualify for a certain postage rate, the sum of its length and girth cannot exceed 85 inches. If the girth is 63 inches, how long can the package be? 8. _____

9. The minimum daily requirement of vitamin C for 14-year-olds is at least 50 milligrams per day. An average-sized apple contains 6 milligrams of vitamin C. How many apples would a person have to eat each day to satisfy this requirement? 9. _____

5 Chapter 5 Vocabulary Test

SCORE _____

boundary	compound inequality	intersection	system of inequalities
closed half-plane	half-plane	set-builder notation	union

Choose a term from the vocabulary list above to complete the sentence.

- An equation defines the _____ or edge for each half-plane. 1. _____
- A _____ containing *and* is true if both of the inequalities it contains are true. 2. _____
- The solution set for an inequality that contains two variables consists of many ordered pairs which fill a region on the coordinate plane called a _____. 3. _____
- The graph of a compound inequality containing *and* is the _____ of the graphs of the two inequalities. 4. _____
- The graph of a compound inequality containing *or* is the _____ of the graphs of the two inequalities. 5. _____

Define each term in your own words.

- open half-plane 6. _____
- set-builder notation 7. _____

5 Chapter 5 Test, Form 1

Write the letter for the correct answer in the blank at the right of each question.

For Questions 1–7, solve each inequality.

1. $x - 7 > 3$
A $\{x \mid x > 10\}$ **B** $\{x \mid x > -4\}$ **C** $\{x \mid x < 10\}$ **D** $\{x \mid x < -4\}$ 1. _____

2. $3 \geq t + 1$
F $\{t \mid t \leq 4\}$ **G** $\{t \mid t \geq 2\}$ **H** $\{t \mid t \leq 2\}$ **J** $\{t \mid t \geq 4\}$ 2. _____

3. $1 \geq \frac{-y}{4}$
A $\left\{y \mid y \geq -\frac{1}{4}\right\}$ **B** $\{y \mid y \geq -4\}$ **C** $\{y \mid y \leq 4\}$ **D** $\{y \mid y \leq 3\}$ 3. _____

4. $5m < -25$
F $\{m \mid m < 125\}$ **G** $\{m \mid m < -125\}$ **H** $\{m \mid m > -5\}$ **J** $\{m \mid m < -5\}$ 4. _____

5. $-36 \leq 3t$
A $\{t \mid t \geq -12\}$ **B** $\{t \mid t \leq 12\}$ **C** $\{t \mid t \geq 12\}$ **D** $\{t \mid t \leq -12\}$ 5. _____

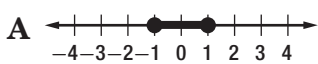
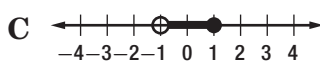
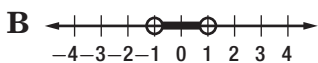
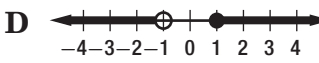
6. $6y - 8 > 4y + 26$
F $\{y \mid y > -9\}$ **G** $\{y \mid y > -17\}$ **H** $\{y \mid y > 9\}$ **J** $\{y \mid y > 17\}$ 6. _____


7. $3(2d - 1) \geq 4(2d - 3) - 3$
A $\{d \mid d \geq -9\}$ **B** $\{d \mid d \leq -6\}$ **C** $\{d \mid d \geq 3\}$ **D** $\{d \mid d \leq 6\}$ 7. _____

8. Six is at least four more than a number. Which inequality represents this sentence?
F $6 \leq n + 4$ **G** $6 \geq n + 4$ **H** $4 \leq n + 6$ **J** $4 \geq n + 6$ 8. _____

9. More than eighteen students in an algebra class pass the first test. This is about three-fifths of the class. How many students are in the class?
A less than 30 **B** less than 25 **C** more than 30 **D** 25 9. _____

10. Phillip has between two hundred and three hundred baseball cards. Which inequality represents this situation?
F $200 < p < 300$ **H** $p < 300$ or $p < 200$
G $200 > p > 300$ **J** $p < 200$ and $p > 300$ 10. _____

11. Which of the following is the graph of the solution set of $m > -1$ and $m \leq 1$?
A  **C** 
B  **D**  11. _____

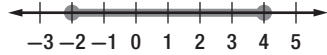
12. Which compound inequality has the solution set shown in the graph?

F $x < -1$ or $x > 3$ **H** $x > -1$ or $x \geq 3$
G $x > -1$ or $x < 3$ **J** $x \leq -1$ or $x \geq 3$ 12. _____

5 Chapter 5 Test, Form 1 *(continued)*

13. Which of the following is the solution set of $2a + 1 > 9$ or $a < -1$?

- A** $\{a \mid a < -1 \text{ or } a > 4\}$ **C** $\{a \mid -1 \leq a \leq 4\}$
B $\{a \mid a \leq -1 \text{ or } a \geq 4\}$ **D** $\{a \mid a < -1 \text{ or } a > 5\}$ 13. _____

14. Which inequality corresponds to the graph shown?



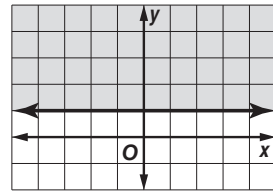
- F** $|x - 3| \leq 1$ **H** $|x - 3| \geq 1$
G $|x - 1| \leq 3$ **J** $|x - 1| \geq 3$ 14. _____

15. Solve $|x - 3| < 2$.

- A** $\{x \mid 1 < x < 5\}$ **C** $\{x \mid -1 < x < 1\}$
B $\{x \mid -5 < x < -1\}$ **D** $\{x \mid -1 < x < 5\}$ 15. _____

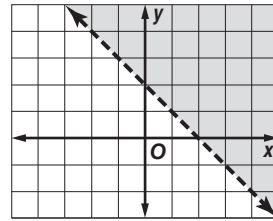
16. Which inequality has the solution set shown in the graph?

- F** $y < 1$ **H** $y > 1$
G $y \leq 1$ **J** $y \geq 1$



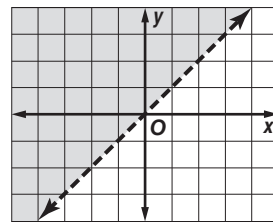
17. Which inequality has the solution set shown in the graph?

- A** $y < -x + 2$ **C** $y < -x + 1$
B $y > -x + 2$ **D** $y > -x + 1$



18. Determine which of the ordered pairs are a part of the solution set for the inequality graphed at the right.

- F** (2, 1) **H** (-3, -3)
G (1, 3) **J** (-2, -3)



19. Which inequality has a solution set of $\{x \mid x > 3 \text{ or } x < -3\}$?

- A** $|2x| > 6$ **C** $|2x| \geq 6$
B $|2x| < 6$ **D** $|2x| \leq 6$ 19. _____

20. Juan's income y consists of at least \$37,500 salary plus 5% commission on all of his sales x . Which inequality represents Juan's income in one year?

- F** $y \leq 37,500 + 5x$ **H** $y \geq 37,500 + 0.05x$
G $y \geq x + 0.05(37,500)$ **J** $y \geq 37,500 + 5$ 20. _____

Bonus If $x < 0$, which integer does not satisfy the inequality $x + 2 < 1$?

B: _____

5 Chapter 5 Test, Form 2A

Write the letter for the correct answer in the blank at the right of each question.

For Questions 1–6, solve each inequality.

1. $-51 \leq x + 38$
A $\{x \mid x \leq -13\}$ **B** $\{x \mid x \leq 89\}$ **C** $\{x \mid x \geq -89\}$ **D** $\{x \mid x \geq -13\}$ 1. _____

2. $m - \frac{3}{8} > \frac{1}{2}$
F $\left\{m \mid m > \frac{7}{8}\right\}$ **G** $\left\{m \mid m < \frac{7}{8}\right\}$ **H** $\left\{m \mid m < \frac{1}{8}\right\}$ **J** $\left\{m \mid m > \frac{1}{8}\right\}$ 2. _____

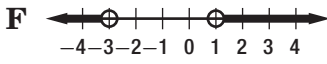
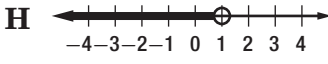
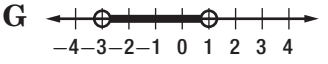
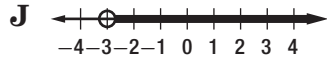
3. $\frac{t}{-2} > 4$
A $\{t \mid t < -8\}$ **B** $\{t \mid t < -2\}$ **C** $\{t \mid t > 2\}$ **D** $\{t \mid t > -8\}$ 3. _____


4. $-3.5z < 42$
F $\{z \mid z > 12\}$ **G** $\{z \mid z < 12\}$ **H** $\{z \mid z < -12\}$ **J** $\{z \mid z > -12\}$ 4. _____

5. $4w - 6 > 6w - 20$
A $\{w \mid w < 7\}$ **B** $\{w \mid w < 2\}$ **C** $\{w \mid w < -7\}$ **D** $\{w \mid w < -2\}$ 5. _____

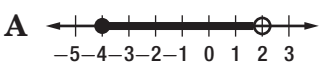
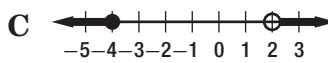
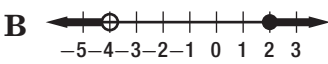
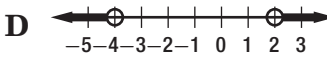
6. $8r - (5r + 4) \geq -31$
F $\{r \mid r \leq -9\}$ **G** $\{r \mid r \geq -9\}$ **H** $\{r \mid r \geq 9\}$ **J** $\{r \mid r \leq 9\}$ 6. _____

7. The sum of two consecutive integers is at most 3. What is the greatest possible value for the greater integer?
A 5 **B** 1 **C** 3 **D** 2 7. _____

8. Which of the following is the graph of the solution set of $y < -3$ or $y < 1$?
F  **H** 
G  **J**  8. _____

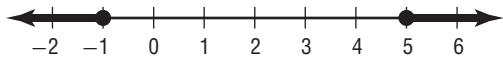
9. Which compound inequality has the solution set shown in the graph?

A $-1 < n < 2$ **C** $n \geq -1$ or $n < 2$
B $-1 \leq n < 2$ **D** $-1 < n \leq 2$ 9. _____

10. Which of the following is the solution set of $-4 < 3t + 5 \leq 20$?
F $\{t \mid -3 < t \leq 5\}$ **H** $\{t \mid t < -3\}$
G $\{t \mid t < -3$ and $t \leq 5\}$ **J** $\{t \mid t < -3$ or $t \geq 5\}$ 10. _____

11. Which of the following is the graph of the solution set of $t - 4 \geq 4t + 8$ or $3t > 14 - 4t$?
A  **C** 
B  **D**  11. _____

5 Chapter 5 Test, Form 2A *(continued)*

12. Which inequality corresponds to the graph shown?



- F** $|x - 2| < 3$
G $|x - 2| > 3$

- H** $|x - 2| \geq 3$
J $|x - 2| \leq 3$

12. _____

13. Which of the following is the solution set of $|2x - 3| > 4$?

- A** $\{x \mid x < -0.5 \text{ or } x > 3.5\}$
B $\{x \mid x < -1 \text{ or } x > 7\}$

- C** $\{x \mid -0.5 < x < 3.5\}$
D $\{x \mid x < 0.5 \text{ or } x > 3.5\}$

13. _____

14. Pete's grade on a test was within 5 points of his class average of 94. What is his range of grades on the test?

- F** $g \leq 89 \text{ or } g \geq 99$
G $89 \leq g \leq 99$

- H** $g \geq 89 \text{ or } g \geq 99$
J $g < 99 \text{ or } g < 89$

14. _____

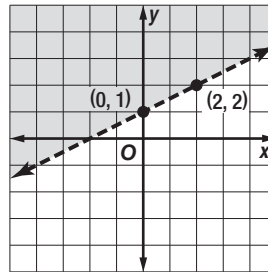
15. Which ordered pair is part of the solution set of the inequality $12 + y \leq -3x$?

- A** $(-16, 3)$ **B** $(1, 4)$ **C** $(4, -1)$ **D** $(3, -16)$

15. _____

16. Which inequality is graphed at the right?

- F** $y < 2x + 1$ **H** $y < \frac{1}{2}x + 1$
G $y > 2x + 1$ **J** $y > \frac{1}{2}x + 1$



16. _____

17. Taka bought a new coat and new shoes. He spent \$122. Which inequality represents this situation if x represents the cost of a coat and y represents the cost of the shoes he buys?

- A** $122 \leq y + x$ **B** $y \leq 122 + x$ **C** $y - x \geq 122$ **D** $y \leq 122 - x$

17. _____

18. Determine which of the ordered pairs are a part of the solution of $y + 1 > \frac{1}{2}x + 3$.

- F** $(2, 3)$ **G** $(-4, 0)$ **H** $(1, 2)$ **J** $(-3, 1)$

18. _____

19. Which inequality has a solution set of $\{x \mid x > -3 \text{ or } x < -4\}$?

- A** $|2x + 7| < 1$ **C** $|2x + 7| > -1$
B $|2x + 7| > 1$ **D** $|2x + 7| > -1$

19. _____

20. Laurie and Maya sold at most \$50 worth of get-well and friendship cards. The friendship cards, x , were sold for \$2 each and the get-well cards, y , were sold for \$1.50 each. Which point represents a reasonable number of cards sold?

- F** $(20, 10)$ **G** $(15, 10)$ **H** $(18, 20)$ **J** $(10, 30)$

20. _____

Bonus Solve $6(|n| - 3) - 4|n| + 5 \leq 11$.

B: _____

5 Chapter 5 Test, Form 2B

Write the letter for the correct answer in the blank at the right of each question.

For Questions 1–6, solve each inequality.

1. $-13 > w + 12$
A $\{w \mid w < -25\}$ **B** $\{w \mid w > -25\}$ **C** $\{w \mid w > -1\}$ **D** $\{w \mid w < -1\}$ 1. _____

2. $x - \frac{1}{4} \leq -\frac{1}{2}$
F $\left\{x \mid x \leq -\frac{1}{4}\right\}$ **G** $\left\{x \mid x \leq -\frac{3}{4}\right\}$ **H** $\left\{x \mid x \geq -\frac{1}{4}\right\}$ **J** $\left\{x \mid x \geq -\frac{3}{4}\right\}$ 2. _____

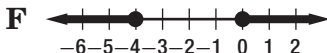
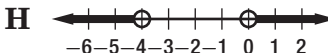
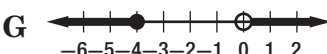
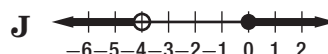
3. $\frac{m}{-5} < -3$
A $\{m \mid m > -15\}$ **B** $\{m \mid m < -15\}$ **C** $\{m \mid m < 15\}$ **D** $\{m \mid m > 15\}$ 3. _____


4. $-1.1t \leq 4.62$
F $\{t \mid t \leq 5.72\}$ **G** $\{t \mid t \geq 5.72\}$ **H** $\{t \mid t \leq -4.2\}$ **J** $\{t \mid t \geq -4.2\}$ 4. _____

5. $5z - 4 > 2z + 8$
A $\{z \mid z > 4\}$ **B** $\{z \mid z < 1\}$ **C** $\{z \mid z < 4\}$ **D** $\{z \mid z > 1\}$ 5. _____

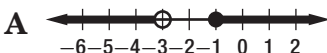
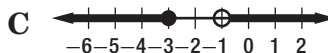
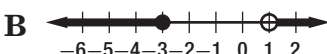
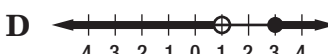
6. $7 - 9r - (r + 12) \leq 25$
F $\{r \mid r \leq -3\}$ **G** $\{r \mid r \leq -0.6\}$ **H** $\{r \mid r \geq -3\}$ **J** $\{r \mid r \geq -0.6\}$ 6. _____

7. The sum of two consecutive integers is at most 7. What is the largest possible value for the lesser integer?
A 1 **B** 3 **C** 2 **D** 5 7. _____

8. Which of the following is the graph of the solution set of $x > 0$ or $x < -4$?
F  **H** 
G  **J**  8. _____

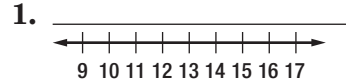
9. Which compound inequality has the solution set shown in the graph?

A $-2 < y < 3$ **C** $y \geq -2$ or $y < 3$
B $-2 < y \leq 3$ **D** $-2 \leq y < 3$ 9. _____

10. Which of the following is the solution set of $-3 < 2x + 7 \leq 13$?
F $\{x \mid -5 < x \leq 3\}$ **H** $\{x \mid x < -5\}$
G $\{x \mid x < 3$ or $x > -5\}$ **J** $\{x \mid -5 \leq x < 3\}$ 10. _____

11. Which of the following is the graph of the solution set of $7a + 3 \leq a - 15$ or $5a - 3 < 8a$?
A  **C** 
B  **D**  11. _____

5 Chapter 5 Test, Form 2C

1. Solve $x - 12 > 1$. Then graph your solution on a number line.



Solve each inequality.

2. $7 + z < 3$

2. _____

3. $\frac{b}{8} > -\frac{1}{5}$

3. _____

4. $\frac{t}{6} \geq 14$

4. _____

5. $-19.8 \geq 3.6y$

5. _____

6. $-4r < 22$

6. _____

7. $4x - 5 < 2x + 11$

7. _____

8. $5(p + 2) - 2(p - 1) \geq 7p + 4$

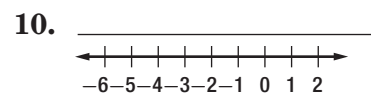
8. _____

9. $1.3(c - 4) \leq 2.6 + 0.7c$

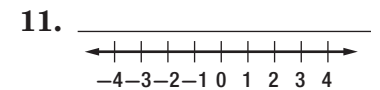
9. _____

Solve each compound inequality. Then graph the solution set.

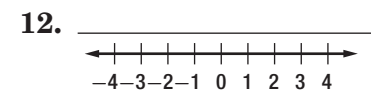
10. $3w < 6$ and $-5 < w$



11. $-4 \leq n$ or $3n + 1 < -2$

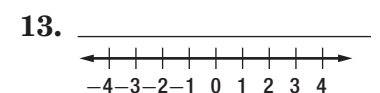


12. $-4x - 8 \geq -4$ or $7x - 5 < 16$

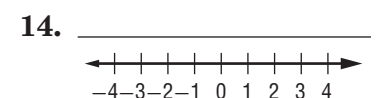


For Questions 13 and 14, solve each inequality. Then graph the solution set.

13. $|1 - x| \leq 2$



14. $|3 - 2x| \geq 1$



5 Chapter 5 Test, Form 2C *(continued)*

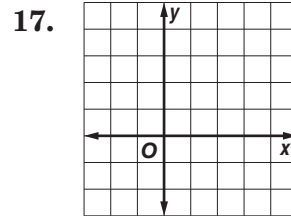
15. Solve $|8x + 2| < 14$.

15. _____

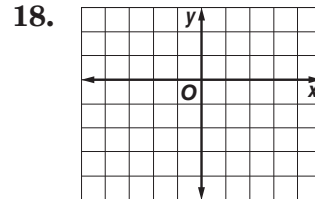
16. Ian has \$6000. He wants to buy a car within \$1500 of this amount. Define a variable, write an open sentence, and find the range of car prices.

16. _____

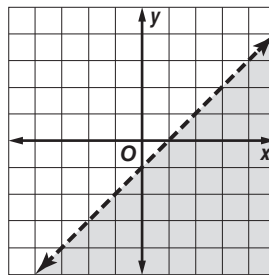
17. Graph $y > -\frac{1}{3}x + 2$.



18. Use a graph to solve $2x - 3y \leq 6$.



19. What inequality has the solution set shown in the graph?



19. _____

20. **EXPENSES** Camille has no more than \$20.00 to spend each week for lunch and bus fare. Lunch costs \$3.00 each day, and bus fare is \$0.75 each ride. Write an inequality for this situation. Can Camille buy lunch 5 times and ride the bus 8 times in one week?

20. _____

Bonus Graph the solution set of the compound inequality

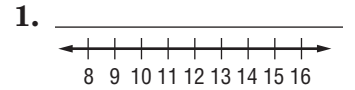
$$3 < |x - 4| < 7.$$

B:

5 Chapter 5 Test, Form 2D

SCORE _____

1. Solve $y - 7 \leq 5$. Then graph your solution on a number line.



Solve each inequality.

2. $8 + k \geq 13$

2. _____

3. $\frac{h}{3} < 9$

3. _____

4. $-\frac{2}{3} > \frac{z}{5}$

4. _____

5. $9.8 \geq 2.8k$

5. _____

6. $-3m < -18$

6. _____

7. $5t + 8 \leq 3t - 3$

7. _____

8. $3(-w - 6) < 2(2w + 8) + 1$

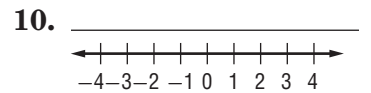
8. _____

9. $1.9 + 1.7x < 2.1(3 + x)$

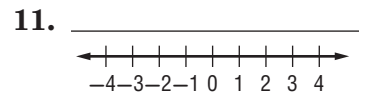
9. _____

Solve each compound inequality. Then graph the solution set.

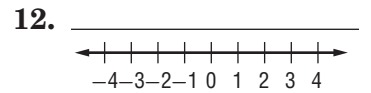
10. $7w > 14$ and $w < 3$



11. $\frac{w}{3} < 1$ or $3w + 5 > 11$

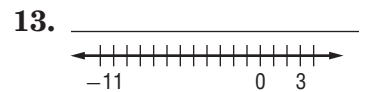


12. $2 + 3x > 8$ or $4 - 7x \leq -17$

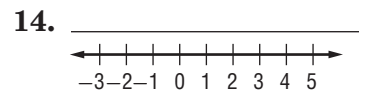


For Questions 13 and 14, solve each inequality. Then graph the solution set.

13. $|z + 4| \geq 7$



14. $|w - 1| \leq 4$



15. Solve $|2x - 5| < 3$.

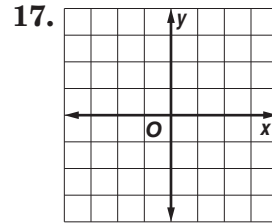
15. _____

5 Chapter 5 Test, Form 2D *(continued)*

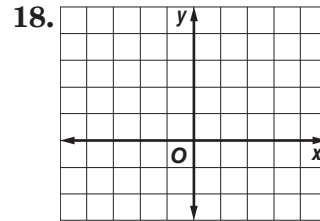
16. Abe has \$4500. He wants to buy a boat within \$1300 of this amount. Define a variable, write an open sentence, and find the range of boat prices.

16. _____

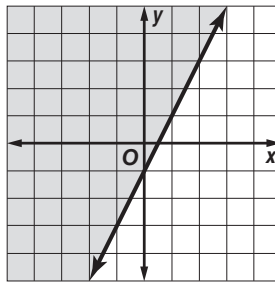
17. Graph $y \leq 3x$.



18. Use a graph to solve $2y - 4x < 8$.



19. What inequality has the solution set shown in the graph?



19. _____

20. **SHOPPING** Matthew is shopping for shoes and socks. He has \$75.00 to spend. The shoes he likes cost \$28.00, and the socks cost \$4.00. Write an inequality for this situation. Can Matthew buy 2 pairs of shoes and 5 pairs of socks?

20. _____

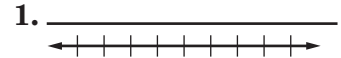
Bonus Graph the solution set of the compound inequality $|x + 1| < 4$ or $|x + 1| \geq 6$.

B: _____

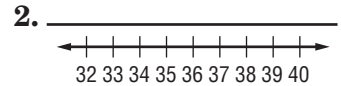
5 Chapter 5 Test, Form 3

Solve each inequality. Then graph your solution on a number line.

1. $m - (-3.4) \geq 12.7$



2. $t + (-4) < 32$



Define a variable, write an inequality, and solve each problem.

3. Negative three sevenths plus a number is at least 2.

3. _____

4. A number less 15 is greater than the sum of twice the number and 8.

4. _____

Solve each inequality.

5. $-2.6 \geq \frac{w}{4}$

5. _____

6. $-11t < -9$

6. _____

7. $2 - 3b > \frac{11 - 15b}{7}$

7. _____

8. $5x - 3(x - 6) \leq 0$

8. _____

9. $-3x + 2(6x - 7) > 4(3 - 2x) + 17x - 8$

9. _____

Define a variable, write an inequality, and solve each problem.

10. Raul plans to spend no more than \$78.00 on two shirts and a pair of jeans. He bought the two shirts for \$19.89 each. How much can he spend on the jeans?

10. _____

11. The sum of two consecutive positive even integers is at most 15. What are the possible pairs of integers?

11. _____

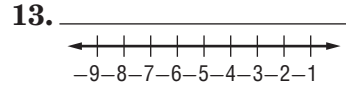
12. Susan makes 10% commission on her sales. She also receives a salary of \$25,600. How much must she sell to receive a total income between \$32,500 and \$41,900?

12. _____

5 Chapter 5 Test, Form 3 *(continued)*

Solve each compound inequality, and graph the solution set.

13. $-\frac{n}{2} < 3$ or $2n - 3 > 12$

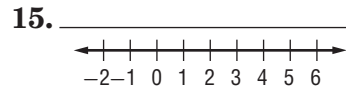


14. $2(x - 14) - x < 7(x + 2) + x \leq x + 70$

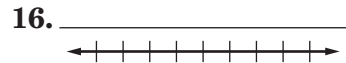


For Questions 15–17, solve each inequality. Then graph the solution set.

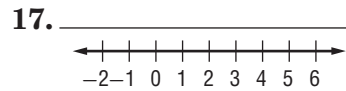
15. $|-4x + 8| < 16$



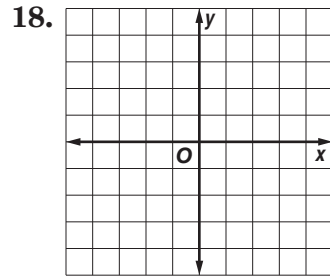
16. $|5x - 3| \geq 17$



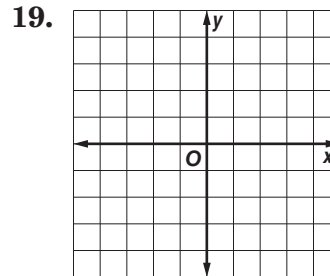
17. $\left| \frac{3 - 2x}{5} \right| \geq 1$



18. Graph $-y \leq 3x$.



19. Use a graph to solve $x + 3y > -12$.



20. DOGS Each afternoon Maria walks the dogs at a local pet shelter for up to 2 hours. Maria spends 16 minutes walking a large dog and 12 minutes walking a small dog. Write an inequality for this situation. If Maria walked 9 dogs in one afternoon, what is the greatest number of large dogs that she could have walked that afternoon?

20. _____

Bonus If $xy < 0$, determine if the compound inequality, $2x + 1 > 7$ and $4 - y < 3$, is *true* or *false*. Explain your reasoning.

B: _____

5 Chapter 5 Extended-Response Test

Demonstrate your knowledge by giving a clear, concise solution to each problem. Be sure to include all relevant drawings and justify your answers. You may show your solution in more than one way or investigate beyond the requirements of the problem.

1. Solve $10n - 7(n + 2) > 5n - 12$. Explain each step in your solution.

2. Draw a line on a coordinate plane so that you can determine at least two points on the graph.
 - a. Write an inequality to represent one of the half planes created by the line.
 - b. Determine if the solution set of the inequality written for part **a** includes the line or not. Explain your response.

3. Let $b > 2$. Describe how you would determine if $ab > 2a$.

4. Determine if the open sentence $|x - 2| > 4$ and the compound inequality $-2x < 4$ or $x > 6$ have the same solution set.

5. **ARCHITECTURE** An architect is designing a house for the Frazier family. In the design, she must consider the desires of the family and the local building codes. The rectangular lot on which the house will be built is 158 feet long, and 90 feet wide.
 - a. The building codes state that one can build no closer than 20 feet to the lot line. Write an inequality to represent the possible widths of the house along the 90-foot dimension. Solve the inequality.
 - b. The Fraziers requested that the rectangular house contain no less than 2800 square feet and no more than 3200 square feet of floor space. If the house has only one floor, use the maximum value for the width of the house from part **a**, and explain how to use an inequality to find the possible lengths.
 - c. The Fraziers have asked that the cost of the house be about \$175,000 and are willing to deviate from this price no more than \$20,000. Write an open sentence involving an absolute value and solve. Explain the meaning of the answer.

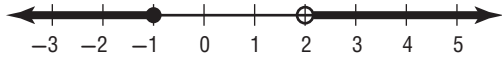
5 Standardized Test Practice

SCORE _____

(Chapters 1-5)

Part 1: Multiple Choice

Instructions: Fill in the appropriate circle for the best answer.

- Which equation is *not* equivalent to $x - 7 = 12$? (Lesson 2-2)
A $x - 9 = 14$ **B** $x - 10 = 9$ **C** $x = 19$ **D** $x - 3 = 16$ 1. A B C D
- Find the value of y so that the line through $(2, 3)$ and $(5, y)$ has a slope of -2 . (Lesson 3-3)
F -3 **G** $\frac{3}{2}$ **H** 9 **J** $\frac{9}{2}$ 2. F G H J
- Solve $-8x - 15 = -31$. (Lesson 2-3)
A 22 **B** 6 **C** 2 **D** 26 3. A B C D
- If $f(x) = 3(x - 5)$, find $f(4)$. (Lesson 1-7)
F 7 **G** 27 **H** -3 **J** 3 4. F G H J
- Which equation shows the slope-intercept form of the line passing through $(0, 1)$ and $(2, 0)$? (Lesson 4-2)
A $y = -2x + 1$ **B** $y = \frac{1}{2}x - 1$ **C** $y = 2x - 1$ **D** $y = -\frac{1}{2}x + 1$ 5. A B C D
- Write a compound inequality for the graph shown below. (Lesson 5-4)

F $-1 < x \leq 2$ **H** $-1 \leq x < 2$
G $x \leq -1$ or $x > 2$ **J** $x < -1$ or $x \geq 2$ 6. F G H J
- Solve $-\frac{1}{3}h \leq 6$. (Lesson 5-2)
A $h \leq -2$ **B** $h \leq -18$ **C** $h \geq -2$ **D** $h \geq -18$ 7. A B C D
- Solve $h + 3 \geq 2$. (Lesson 5-1)
F $h \leq 2$ **G** $h \geq -1$ **H** $h \geq 5$ **J** $h \leq -1$ 8. F G H J
- Solve $4x + 12 > 2$. (Lesson 5-3)
A $x > -2\frac{1}{2}$ **B** $x > -40$ **C** $x > 2\frac{1}{2}$ **D** $x > 3\frac{1}{2}$ 9. A B C D
- Which of the following is an arithmetic sequence? (Lesson 3-5)
F $1, 3, 6, 10, \dots$ **H** $34, 35, 38, 43, \dots$
G $5, 8, 11, 14, \dots$ **J** $1, 4, 9, 16, \dots$ 10. F G H J

5 Standardized Test Practice *(continued)*

Part 3: Short Response

Instructions: Write your answers in the space provided.

20. Solve $\frac{a}{6} - 5 = 12$. (Lesson 2-3) 20. _____

21. If $f(x) = x^2 - 4x$, find $f(-3)$. (Lesson 1-7) 21. _____

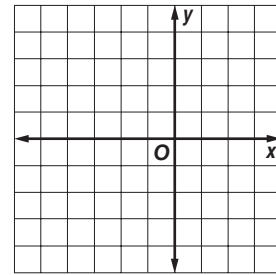
22. Solve $y = \frac{1}{4}x - 1$ if the domain is $\{-4, -2, 0, 2, 4\}$. (Lesson 1-5) 22. _____

23. Write the slope-intercept form of an equation of the line that passes through $(0, -4)$ and is parallel to the graph of $4x - y = 7$. (Lesson 4-4) 23. _____

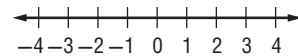
24. Solve $\frac{4}{5}a \leq -12$. (Lesson 5-2) 24. _____

25. Solve the proportion $\frac{0.6}{x} = \frac{0.3}{5}$. (Lesson 2-6) 25. _____

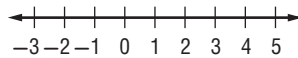
26. Graph $2x + 3y \geq -9$. (Lesson 5-6) 26.



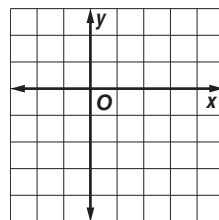
27. Solve $|3f + 2| \leq 7$. Then graph the solution set. (Lesson 5-5) 27. _____



28. Solve $-5 \leq 2a - 1 < 9$. Then graph the solution set. (Lesson 5-4) 28. _____



29. Graph the equation $y = x - 4$. (Lesson 3-1) 29.



30. Mark is shopping during a computer store's 20% sale. He is considering buying computers that range in cost from \$500 to \$1000.

a. How much are the computers after the 20% discount? (Lesson 5-4) 30a. _____

b. If sales tax is 7%, how much should Mark expect to pay? (Lesson 5-4) 30b. _____

NAME _____ DATE _____ PERIOD _____

5 Anticipation Guide

Linear Inequalities

Step 1 Before you begin Chapter 5

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

STEP 1 A, D, or NS	Statement	STEP 2 A or D
	1. According to the Addition Property of Inequalities, adding any number to each side of a true inequality will result in a true inequality.	A
	2. The inequality $m + 23 \geq 35$ can be solved by adding 23 to each side.	D
	3. 16 is no greater than the difference of a number and 12 can be written as $16 \leq n - 12$.	A
	4. If both sides of $\frac{r}{12} < 4$ are multiplied by 12, the result is $r < 48$.	A
	5. The result of dividing both sides of the inequality $-2y \geq 10$ by -2 is $y \geq -5$.	D
	6. To solve an inequality involving multiplication, such as $9t > 27$, division is used.	A
	7. To solve the inequality $8x - 2 < 70$, first divide by 8 and then add 2.	D
	8. A compound inequality is an inequality containing more than one variable.	D
	9. On a number line, a closed dot is used for an inequality containing the symbol \geq or \leq .	A
	10. If $ t < 8$, then t equals all numbers between 0 and 8.	D
	11. On the graph of $y > 2x - 3$, the solution set will be all numbers above the graph of the line $y = 2x - 3$.	A

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Step 2 After you complete Chapter 5

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.

Chapter 5

Glencoe Algebra 1

3

NAME _____ DATE _____ PERIOD _____

5-1 Study Guide and Intervention

Solving Inequalities by Addition and Subtraction

Solve Inequalities by Addition Addition can be used to solve inequalities. If any number is added to each side of a true inequality, the resulting inequality is also true.

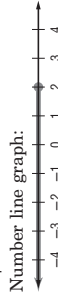
Addition Property of Inequalities For all numbers a , b , and c , if $a > b$, then $a + c > b + c$, and if $a < b$, then $a + c < b + c$.

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example 1 Solve $x - 8 \leq -6$. Then graph the solution.

$$\begin{aligned} x - 8 &\leq -6 && \text{Original inequality} \\ x - 8 + 8 &\leq -6 + 8 && \text{Add 8 to each side.} \\ x &\leq 2 && \text{Simplify.} \end{aligned}$$

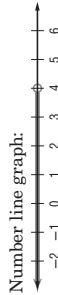
The solution in set-builder notation is $\{x | x \leq 2\}$.



Example 2 Solve $4 - 2a > -a$. Then graph the solution.

$$\begin{aligned} 4 - 2a &> -a && \text{Original inequality} \\ 4 - 2a + 2a &> -a + 2a && \text{Add 2a to each side.} \\ 4 &> a && \text{Simplify.} \\ a &< 4 && 4 > a \text{ is the same as } a < 4. \end{aligned}$$

The solution in set-builder notation is $\{a | a < 4\}$.



Lesson 5-1

Exercises

Solve each inequality. Check your solution, and then graph it on a number line.

- $t - 12 \geq 16$ $\{t | t \geq 28\}$
- $n - 12 < 6$ $\{n | n < 18\}$
- $6 \leq g - 3$ $\{g | g \geq 9\}$
- $n - 8 < -13$ $\{n | n < -5\}$
- $-12 > -12 + y$ $\{y | y < 0\}$
- $-6 > m - 8$ $\{m | m < 2\}$

Solve each inequality. Check your solution.

- $-3x \leq 8 - 4x$
- $0.6n \geq 12 - 0.4n$
- $-8k - 12 < -9k$
- $x | x \leq 8$
- $\{n | n \geq 12\}$
- $\{k | k < 12\}$
- $-y - 10 > 15 - 2y$
- $z | z \leq \frac{4}{3}$
- $11z - \frac{1}{3} \leq \frac{4}{3}$
- $-2b > -4 - 3b$
- $y | y > 25$
- $\{b | b > -4\}$

Define a variable, write an inequality, and solve each problem. Check your solution. 13–15. Sample answer: Let $n =$ the number.

- A number decreased by 4 is less than 14. $n - 4 < 14$; $\{n | n < 18\}$
- The difference of two numbers is more than 12, and one of the numbers is 3. $n - 3 > 12$; $\{n | n > 15\}$ or $3 - n > 12$; $\{n | n < -9\}$
- Forty is no greater than the difference of a number and 2. $40 \leq n - 2$; $\{n | n \geq 42\}$

Chapter 5

Glencoe Algebra 1

5

NAME _____

DATE _____

PERIOD _____

5-1 Study Guide and Intervention

(continued)

Solving Inequalities by Addition and Subtraction

Solve Inequalities by Subtraction Subtraction can be used to solve inequalities. If any number is subtracted from each side of a true inequality, the resulting inequality is also true.

Subtraction Property of Inequalities

For all numbers a , b , and c , if $a > b$, then $a - c > b - c$, and if $a < b$, then $a - c < b - c$.

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example Solve $3a + 5 > 4 + 2a$. Then graph it on a number line.

- $3a + 5 > 4 + 2a$ Original inequality
- $3a + 5 - 2a > 4 + 2a - 2a$ Subtract $2a$ from each side.
- $a + 5 > 4$ Simplify.
- $a + 5 - 5 > 4 - 5$ Subtract 5 from each side.
- $a > -1$ Simplify.

The solution is $\{a | a > -1\}$.

Number line graph:



Exercises

Solve each inequality. Check your solution, and then graph it on a number line.

1. $t + 12 \geq 8$
 $\{t | t \geq -4\}$
2. $n + 12 > -12$
 $\{n | n > -24\}$
3. $16 \leq h + 9$
 $\{h | h \geq 7\}$
4. $y + 4 > -2$
 $\{y | y > -6\}$
5. $3r + 6 > 4r$
 $\{r | r < 6\}$
6. $\frac{3}{2}q - 5 \geq \frac{1}{2}q$
 $\{q | q \geq 5\}$
7. $4p \geq 3p + 0.7$
 $\{p | p \geq 0.7\}$
8. $r + \frac{1}{4} > \frac{3}{8}$
 $\{r | r > \frac{1}{8}\}$
9. $9k + 12 > 8k$
 $\{k | k > -12\}$
10. $-1.2 > 2.4 + y$
 $\{y | y < -3.6\}$
11. $4y < 5y + 14$
 $\{y | y > -14\}$
12. $3n + 17 < 4n$
 $\{n | n > 17\}$

Define a variable, write an inequality, and solve each problem. Check your solution. 13–15. Sample answer: Let $n =$ the number.

13. The sum of a number and 8 is less than 12. $n + 8 < 12$; $\{n | n < 4\}$
14. The sum of two numbers is at most 6, and one of the numbers is -2 . $n + (-2) \leq 6$; $\{n | n \leq 8\}$
15. The sum of a number and 6 is greater than or equal to -4 . $n + 6 \geq -4$; $\{n | n \geq -10\}$

Chapter 5

Glencoe Algebra 1

6

NAME _____

DATE _____

PERIOD _____

5-1 Skills Practice

Solving Inequalities by Addition and Subtraction

Match each inequality to the graph of its solution.

1. $x + 11 > 16$ **c**
2. $x - 6 < 1$ **e**
3. $x + 2 \leq -3$ **a**
4. $x + 3 \geq 1$ **b**
5. $x - 1 < -7$ **d**

Solve each inequality. Check your solution, and then graph it on a number line.

6. $d - 5 \leq 1$ $\{d | d \leq 6\}$
7. $t + 9 < 8$ $\{t | t < -1\}$
8. $a - 7 > -13$ $\{a | a > -6\}$
9. $w - 1 < 4$ $\{w | w < 5\}$
10. $4 \geq k + 3$ $\{k | k \leq 1\}$
11. $-9 \leq b - 4$ $\{b | b \geq -5\}$
12. $-2 \geq x + 4$ $\{x | x \leq -6\}$
13. $2y < y + 2$ $\{y | y < 2\}$

Define a variable, write an inequality, and solve each problem. Check your solution. 14–18. Sample answer: Let $n =$ the number.

14. A number decreased by 10 is greater than -5 . $n - 10 > -5$; $\{n | n > 5\}$
15. A number increased by 1 is less than 9. $n + 1 < 9$; $\{n | n < 8\}$
16. Seven more than a number is less than or equal to -18 . $n + 7 \leq -18$; $\{n | n \leq -25\}$
17. Twenty less than a number is at least 15. $n - 20 \geq 15$; $\{n | n \geq 35\}$
18. A number plus 2 is at most 1. $n + 2 \leq 1$; $\{n | n \leq -1\}$

Chapter 5

Glencoe Algebra 1

7

NAME _____ DATE _____ PERIOD _____

5-1 Practice

Solving Inequalities by Addition and Subtraction

Match each inequality with its corresponding graph.

1. $-8 \geq x - 15$ **b**

2. $4x + 3 < 5x$ **d**

3. $8x > 7x - 4$ **a**

4. $12 + x \leq 9$ **c**

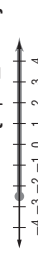


Solve each inequality. Check your solution, and then graph it on a number line.

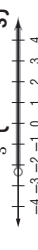
5. $r - (-5) > -2$ $\{r \mid r > -7\}$



7. $n - 2.5 \geq -5$ $\{n \mid n \geq -2.5\}$



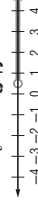
9. $z + 3 > \frac{3}{2}$ $\{z \mid z > -\frac{3}{2}\}$



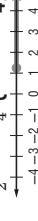
6. $3x + 8 \geq 4x$ $\{x \mid x \leq 8\}$



8. $1.5 < y + 1$ $\{y \mid y > 0.5\}$



10. $\frac{1}{2} \leq c - \frac{3}{4}$ $\{c \mid c \geq \frac{1}{4}\}$



Define a variable, write an inequality, and solve each problem. Check your solution. 11–14. Sample answer: Let n = the number.

11. The sum of a number and 17 is no less than 26.
 $n + 17 \geq 26$; $\{n \mid n \geq 9\}$

12. Twice a number minus 4 is less than three times the number.
 $2n - 4 < 3n$; $\{n \mid n > -4\}$

13. Twelve is at most a number decreased by 7.
 $12 \leq n - 7$; $\{n \mid n \geq 19\}$

14. Eight plus four times a number is greater than five times the number.
 $8 + 4n > 5n$; $\{n \mid n < 8\}$

15. **ATMOSPHERIC SCIENCE** The troposphere extends from the Earth's surface to a height of 6–12 miles, depending on the location and the season. If a plane is flying at an altitude of 5.8 miles, and the troposphere is 8.6 miles deep in that area, how much higher can the plane go without leaving the troposphere? **no more than 2.8 mi**

16. **EARTH SCIENCE** Mature soil is composed of three layers, the uppermost being topsoil. Jamal is planting a bush that needs a hole 18 centimeters deep for the roots. The instructions suggest an additional 8 centimeters depth for a cushion. If Jamal wants to add even more cushion, and the topsoil in his yard is 30 centimeters deep, how much more cushion can he add and still remain in the topsoil layer? **no more than 4 cm**

NAME _____ DATE _____ PERIOD _____

5-1 Word Problem Practice

Solving Inequalities by Addition and Subtraction

1. **SOUND** The loudest insect on Earth is the African cicada. It produces sounds as loud as 105 decibels at 20 inches away. The blue whale is the loudest mammal on Earth. The call of the blue whale can reach levels up to 83 decibels louder than the African cicada. How loud are the calls of the blue whale?
less than 188 decibels

2. **GARBAGE** The amount of garbage that the average American adds to a landfill daily is 4.6 pounds. If at least 2.5 pounds of a person's daily garbage could be recycled, how much will still go into a landfill?
no more than 2.1 pounds per day.

3. **SHOPPING** Tyler has \$75 to spend at the mall. He purchases a music video for \$14.99 and a pair of jeans for \$18.99. He also spent \$4.75 for lunch. Tyler still wants to purchase a video game. How much money can he spend on a video game? **Tyler can spend no more than \$36.27 on a video game.**

4. **SUPREME COURT** The first Chief Justice of the U.S. Supreme Court, John Jay, served 2079 days as Chief Justice. He served 10,463 days fewer than John Marshall, who served as Supreme Court Chief Justice for the longest period of time. How many days must the current Supreme Court Chief Justice John Roberts serve to surpass John Marshall's record of service?
 $x > 12,542$; more than 12,542 days

5. **WEATHER** Theodore Fujita of the University of Chicago developed a classification of tornadoes according to wind speed and damage. The table shows the classification system.

Level	Name	Wind Speed Range (mph)
F0	Gale	40–72
F1	Moderate	73–112
F2	Significant	113–157
F3	Severe	158–206
F4	Devastating	207–260
F5	Incredible	261–318
F6	Inconceivable	319–379

Source: National Weather Service

a. Suppose an F3 tornado has winds that are 162 miles per hour. Write and solve an inequality to determine how much the winds would have to increase before the F3 tornado becomes an F4 tornado.
 $162 + x \geq 207$; $x \geq 45$; at least 45 mph

b. A tornado has wind speeds that are at least 158 miles per hour. Write and solve an inequality that describes how much greater these wind speeds are than the slowest tornado.
 $40 + y \geq 158$; $y \geq 118$; at least 118 mph

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5-1 Enrichment

Triangle Inequalities

Recall that a line segment can be named by the letters of its endpoints. Line segment \overline{AB} (written as \overline{AB}) has points A and B for endpoints. The *length* of \overline{AB} is written without the bar as AB .

$$AB > BC \quad m\angle A < m\angle B$$

The statement on the left above shows that \overline{AB} is shorter than \overline{BC} . The statement on the right above shows that the measure of angle A is less than that of angle B .

These three inequalities are true for any triangle ABC , no matter how long the sides.

- $AB + BC > AC$
- If $AB > AC$, then $m\angle C > m\angle B$.
- If $m\angle C > m\angle B$, then $AB > AC$.

Use the three triangle inequalities for these problems.

- List the sides of triangle DEF in order of increasing length.



- In the figure at the right, which line segment is the shortest?



- Explain why the lengths 5 centimeters, 10 centimeters, and 20 centimeters could not be used to make a triangle. **5 + 10 is not greater than 20.**

- Two sides of a triangle measure 3 inches and 7 inches. Between which two values must the third side be? **4 in. and 10 in.**

- In triangle XYZ , $XY = 15$, $YZ = 12$, and $XZ = 9$. Which angle has the greatest measure? Which has the least? **$\angle Z$; $\angle Y$**

- List the angles $\angle A$, $\angle C$, $\angle ABC$, and $\angle ABD$, in order of increasing size.



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5-2 Study Guide and Intervention

Solving Inequalities by Multiplication and Division

Solve Inequalities by Multiplication If each side of an inequality is multiplied by the same positive number, the resulting inequality is also true. However, if each side of an inequality is multiplied by the same negative number, the direction of the inequality must be reversed for the resulting inequality to be true.

Multiplication Property of Inequalities

- For all numbers a , b , and c , with $c \neq 0$,
- if c is positive and $a > b$, then $ac > bc$;
if c is positive and $a < b$, then $ac < bc$;
 - if c is negative and $a > b$, then $ac < bc$;
if c is negative and $a < b$, then $ac > bc$.

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example 1 Solve $-\frac{y}{8} \leq 12$.

$$-\frac{y}{8} \geq 12 \quad \text{Original inequality}$$

$$(-8)\left(-\frac{y}{8}\right) \leq (-8)12 \quad \text{Multiply each side by } -8; \text{ change } \geq \text{ to } \leq.$$

$$y \leq -96 \quad \text{Simplify.}$$

The solution is $\{y | y \leq -96\}$.

Example 2 Solve $\frac{3}{4}k < 15$.

$$\frac{3}{4}k < 15 \quad \text{Original inequality}$$

$$\left(\frac{4}{3}\right)\left(\frac{3}{4}k\right) < \left(\frac{4}{3}\right)15 \quad \text{Multiply each side by } \frac{4}{3}$$

$$k < 20 \quad \text{Simplify.}$$

The solution is $\{k | k < 20\}$.

Exercises

Solve each inequality. Check your solution.

1. $\frac{y}{6} \leq 2$

$\{y | y \leq 12\}$

5. $\frac{1}{4}n \geq 10$

$\{n | n \geq 40\}$

9. $\frac{g}{5} \geq -2$

$\{g | g \geq -10\}$

2. $-\frac{n}{50} > 22$

$\{n | n < -1100\}$

6. $-\frac{2}{3}b < \frac{1}{3}$

$\{b | b > -\frac{1}{2}\}$

10. $-\frac{3}{4} > -\frac{9p}{5}$

$\{p | p > \frac{5}{12}\}$

3. $\frac{3}{5}h \geq -3$

$\{h | h \geq -5\}$

7. $\frac{3m}{5} < -\frac{3}{20}$

$\{m | m < -\frac{1}{4}\}$

11. $\frac{n}{10} \geq 5.4$

$\{n | n \geq 54\}$

4. $-\frac{p}{6} < -6$

$\{p | p > 36\}$

8. $-2.5l \leq -\frac{2l}{4}$

$\{l | l \leq 5.02\}$

12. $\frac{2a}{7} \geq -6$

$\{a | a \geq -21\}$

Define a variable, write an inequality, and solve each problem. Check your solution. **13–15. Sample answer: Let n = the number.**

- Half of a number is at least 14. $\frac{1}{2}n \geq 14$; $\{n | n \geq 28\}$

- The opposite of one-third a number is greater than 9. $-\frac{1}{3}n > 9$; $\{n | n < -27\}$

- One fifth of a number is at most 30. $\frac{1}{5}n \leq 30$; $\{n | n \leq 150\}$

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5-2 Study Guide and Intervention (continued)

Solving Inequalities by Multiplication and Division

Solve Inequalities by Division If each side of a true inequality is divided by the same positive number, the resulting inequality is also true. However, if each side of an inequality is divided by the same negative number, the direction of the inequality symbol must be reversed for the resulting inequality to be true.

- Division Property of Inequalities**
 For all numbers a , b , and c with $c \neq 0$,
 1. if c is positive and $a > b$, then $\frac{a}{c} > \frac{b}{c}$; if c is positive and $a < b$, then $\frac{a}{c} < \frac{b}{c}$.
 2. if c is negative and $a > b$, then $\frac{a}{c} < \frac{b}{c}$; if c is negative and $a < b$, then $\frac{a}{c} > \frac{b}{c}$.

The property is also true when $>$ and $<$ are replaced with \geq and \leq .

Example Solve $-12y \geq 48$.

$$\begin{aligned} -12y &\geq 48 && \text{Original inequality} \\ -12y &\leq -48 && \text{Divide each side by } -12 \text{ and change } \geq \text{ to } \leq. \\ -12 &&& \end{aligned}$$

Simplify.
 The solution is $\{y \mid y \leq -4\}$.

Exercises

Solve each inequality. Check your solution.

- $25g \geq -100$
 - $-2x \geq 9$
 - $-5c > 2$
 - $-8m < -64$
 - $-6k < \frac{1}{5}$
 - $18 < -3b$
 - $30 < -3n$
 - $-0.24 < 0.6w$
 - $k > -\frac{1}{30}$
 - $-30 > -5p$
 - $-2n \geq 6.2$
 - $35 < 0.05h$
 - $-40 > 10h$
 - $-\frac{2}{3n} \geq 6$
 - $-3 < \frac{r}{4}$
 - $4 > \frac{-x}{2}$
- $\{g \mid g \geq -4\}$ $\{x \mid x \leq -4\frac{1}{2}\}$ $\{c \mid c < -\frac{2}{5}\}$ $\{m \mid m > 8\}$
 $\{k \mid k > -\frac{1}{30}\}$ $\{b \mid b < -6\}$ $\{n \mid n < -10\}$ $\{w \mid w > -0.4\}$
 $\{m \mid m \geq -12\frac{1}{2}\}$ $\{p \mid p > 6\}$ $\{n \mid n \leq -3.1\}$ $\{h \mid h > 700\}$
 $\{h \mid h < -4\}$ $\{n \mid n \leq -9\}$ $\{p \mid p > -12\}$ $\{x \mid x > -8\}$

Define a variable, write an inequality, and solve each problem. Then check your solution. **17–19. Sample answer: Let n = the number.**

- Four times a number is no more than 108. $4n \leq 108$; $\{n \mid n \leq 27\}$
- The opposite of three times a number is greater than 12. $-3n > 12$; $\{n \mid n < -4\}$
- Negative five times a number is at most 100. $-5n \leq 100$; $\{n \mid n \geq -20\}$

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Lesson 5-2

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5-2 Skills Practice

Solving Inequalities by Multiplication and Division

Match each inequality with its corresponding statement.

- $3n < 9$ a. Three times a number is at most nine.
- $\frac{1}{3}n \geq 9$ b. One third of a number is no more than nine.
- $3n \leq 9$ c. Negative three times a number is more than nine.
- $-3n > 9$ d. Three times a number is less than nine.
- $\frac{1}{3}n \leq 9$ e. Negative three times a number is at least nine.
- $-3n \geq 9$ f. One third of a number is greater than or equal to nine.

Solve each inequality. Check your solution.

- $14g > 56$ 8. $11w \leq 77$ 9. $20b \geq -120$ 10. $-8r < 16$
 $\{g \mid g > 4\}$ $\{w \mid w \leq 7\}$ $\{b \mid b \geq -6\}$ $\{r \mid r > -2\}$
- $-15p \leq -90$ 12. $\frac{x}{4} < 9$ 13. $\frac{a}{9} \geq -15$ 14. $-\frac{p}{7} > -9$
 $\{p \mid p \geq 6\}$ $\{x \mid x < 36\}$ $\{a \mid a \geq -135\}$ $\{p \mid p < 63\}$
- $-\frac{t}{12} \geq 6$ 16. $5z < -90$ 17. $-13m > -26$ 18. $\frac{k}{5} \leq -17$
 $\{t \mid t \leq -72\}$ $\{z \mid z < -18\}$ $\{m \mid m < 2\}$ $\{k \mid k \leq -85\}$
- $-y < 36$ 20. $-16c \geq -224$ 21. $-\frac{h}{10} \leq 2$ 22. $12 > \frac{d}{12}$
 $\{y \mid y > -36\}$ $\{c \mid c \leq 14\}$ $\{h \mid h \geq -20\}$ $\{d \mid d < 144\}$

Define a variable, write an inequality, and solve each problem. Check your solution. **23–27. Sample answer: Let n = the number.**

- Four times a number is greater than -48 . $4n > -48$; $\{n \mid n > -12\}$
- One eighth of a number is less than or equal to 3 . $\frac{1}{8}n \leq 3$; $\{n \mid n \leq 24\}$
- Negative twelve times a number is no more than 84 . $-12n \leq 84$; $\{n \mid n \geq -7\}$
- Negative one sixth of a number is less than -9 . $-\frac{1}{6}n < -9$; $\{n \mid n > 54\}$
- Eight times a number is at least 16 . $8n \geq 16$; $\{n \mid n \geq 2\}$

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5-2 Practice

Solving Inequalities by Multiplication and Division

Match each inequality with its corresponding statement.

- 1. $-4n \geq 5$ **d**
- 2. $\frac{4}{5}n > 5$ **f**
- 3. $4n \leq 5$ **e**
- 4. $\frac{4}{5}n \leq 5$ **b**
- 5. $4n < 5$ **c**
- 6. $-4n < 5$ **a**

Solve each inequality. Check your solution.

- 7. $-\frac{a}{5} < -14$ 8. $-13h \leq 52$ 9. $\frac{b}{16} \geq -6$ 10. $39 > 13p$
 - 11. $\frac{2}{3}n > -12$ 12. $-\frac{5}{9}t < 25$ 13. $-\frac{3}{5}m \leq -6$ 14. $\frac{10}{3}k \geq -10$
 - 15. $-3b \leq 0.75$ 16. $-0.9c > -9$ 17. $0.1x \geq -4$ 18. $-2.3 < \frac{j}{4}$
 - 19. $-15y < 3$ 20. $2.6v \geq -20.8$ 21. $0 > -0.5u$ 22. $\frac{7}{8}f \leq -1$
- {a | a > 70}** **{h | h ≥ -4}** **{b | b ≥ -96}** **{p | p < 3}**
{n | n > -18} **{t | t > -45}** **{m | m ≥ 10}** **{k | k ≥ -3}**
{b | b ≥ -0.25} **{c | c < 10}** **{x | x ≥ -40}** **{j | j > -9.2}**
{y | y > -1/5} **{v | v ≥ -8}** **{u | u > 0}** **{f | f ≤ -8/7}**

Define a variable, write an inequality, and solve each problem. Check your solution. **23–25. Sample answer: Let n = the number.**

- 23. Negative three times a number is at least 57. $-3n \geq 57$; $\{n | n \leq -19\}$
- 24. Two thirds of a number is no more than -10 . $\frac{2}{3}n \leq -10$; $\{n | n \leq -15\}$
- 25. Negative three fifths of a number is less than -6 . $-\frac{3}{5}n < -6$; $\{n | n > 10\}$
- 26. **FLOODING** A river is rising at a rate of 3 inches per hour. If the river rises more than 2 feet, it will exceed flood stage. How long can the river rise at this rate without exceeding flood stage? **no more than 8 h**
- 27. **SALES** Pet Supplies makes a profit of \$5.50 per bag on its line of natural dog food. If the store wants to make a profit of no less than \$5225 on natural dog food, how many bags of dog food does it need to sell? **at least 950 bags**

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5-2 Word Problem Practice

Solving Inequalities by Multiplication and Division

1. PIZZA Tara and friends order a pizza. Tara eats 3 of the 10 slices and pays \$4.20 for her share. Assuming that Tara has paid at least her fair share, write an inequality for how much the pizza could have cost. **$x \leq \$14$**

4. EVENT PLANNING The Downtown Community Center does not charge a rental fee as long as a rentee orders a minimum of \$5000 worth of food from the center. Antonio is planning a banquet for the Quarterback Club. If he is expecting 225 people to attend, what is the minimum he will have to spend on food per person to avoid paying a rental fee? **\$22.23**

5. PHYSICS The density of a substance determines whether it will float or sink in a liquid. The density of water is 1 gram per milliliter. Any object with a greater density will sink and any object with a lesser density will float. Density is given by the formula $d = \frac{m}{v}$, where m is mass and v is volume. Here is a table of common chemical solutions and their densities.

Solution	Density (g/mL)
concentrated calcium chloride	1.40
70% isopropyl alcohol	0.92

Source: American Chemistry Council

2. AIRLINES On average, at least 25,000 pieces of luggage are lost or misdirected each day by United States airlines. Of these, 98% are located by the airlines within 5 days. From a given day's lost luggage, at least how many pieces of luggage are still lost after 5 days? **at least 500 pieces**

3. SCHOOL Gil earned these scores on the first three tests in biology this term: 86, 88, and 78. What is the lowest score that Gil can earn on the fourth and final test of the term if he wants to have an average of at least 83? **80**

a. Plastics vary in density when they are manufactured; therefore, their volumes are variable for a given mass. A tablet of polystyrene (a manufactured plastic) sinks in water and in alcohol solution and floats in calcium chloride solution. The tablet has a mass of 0.4 gram. What is the most its volume can be? **0.435 g**

b. What is the least its volume can be? **0.286 g**

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5-2 Enrichment

Quadratic Inequalities

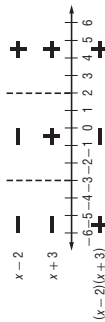
Like linear inequalities, inequalities with higher degrees can also be solved. Quadratic inequalities have a degree of 2. The following example shows how to solve quadratic inequalities.

Example Solve $(x + 3)(x - 2) > 0$.

Step 1 Determine what values of x will make the left side 0. In other words, what values of x will make either $x + 3 = 0$ or $x - 2 = 0$?

$$x = -3 \text{ or } 2$$

Step 2 Plot these points on a number line. Above the number line, place a $+$ if $x + 3$ is positive for that region or a $-$ if $x + 3$ is negative for that region. Next, above the signs you have just entered, do the same for $x - 2$.



The final positive regions correspond to values for which the quadratic expression is greater than 0. So, the answer is

$$x < -3 \text{ or } x > 2.$$

Exercises

Solve each inequality.

- $(x - 1)(x + 2) > 0$
 $x < -2 \text{ or } x > 1$
- $(x + 5)(x + 2) > 0$
 $x < -5 \text{ or } x > -2$
- $(x - 1)(x - 5) < 0$
 $1 < x < 5$
- $(x + 3)(x - 4) \leq 0$
 $-3 \leq x \leq 4$

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5-3 Study Guide and Intervention

Solving Multi-Step Inequalities

Solve Multi-Step Inequalities To solve linear inequalities involving more than one operation, undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example 1 Solve $6x - 4 \leq 2x + 12$.

$6x - 4 \leq 2x + 12$ Original inequality
 $6x - 4 - 2x \leq 2x + 12 - 2x$ Subtract $2x$ from each side.
 $4x - 4 \leq 12$ Simplify.
 $4x - 4 + 4 \leq 12 + 4$ Add 4 to each side.
 $4x \leq 16$ Simplify.
 $\frac{4x}{4} \leq \frac{16}{4}$ Divide each side by 4.
 $x \leq 4$ Simplify.

The solution is $\{x \mid x \leq 4\}$.

Example 2 Solve $3a - 15 > 4 + 5a$.

$3a - 15 > 4 + 5a$ Original inequality
 $3a - 15 - 5a > 4 + 5a - 5a$ Subtract $5a$ from each side.
 $-2a - 15 > 4$ Simplify.
 $-2a - 15 + 15 > 4 + 15$ Add 15 to each side.
 $-2a > 19$ Simplify.
 $\frac{-2a}{-2} < \frac{19}{-2}$ Divide each side by -2 and change $>$ to $<$.
 $a < -9\frac{1}{2}$ Simplify.

The solution is $\{a \mid a < -9\frac{1}{2}\}$.

Exercises

Solve each inequality. Check your solution.

- $11y + 13 \geq -1$
- $8n - 10 < 6 - 2n$
- $\frac{9}{7} + 1 > -5$
- $\{y \mid y \geq -1\frac{3}{11}\}$
- $\{n \mid n < 1\frac{3}{5}\}$
- $\{q \mid q > -42\}$
- $4.6n + 12 < 8 + 8n$
- $5. -12 - d > -12 + 4d$
- $6.5r - 6 > 8r - 18$
- $\{n \mid n > 2\}$
- $\{d \mid d < 0\}$
- $\{r \mid r < 4\}$
- $\frac{-3x + 6}{2} \leq 12$
- $7.3y - 14.4 > 4.9y$
- $8. -8m - 3 < 18 - m$
- $\{x \mid x \geq -6\}$
- $\{y \mid y > 6\}$
- $\{m \mid m > -3\}$
- $-4y - 10 > 19 - 2y$
- $11.9n - 24n + 45 > 0$
- $12. \frac{4x - 2}{5} \geq -4$
- $\{y \mid y < -14\frac{1}{2}\}$
- $\{n \mid n < 3\}$
- $\{x \mid x \geq -4\frac{1}{2}\}$

Define a variable, write an inequality, and solve each problem. Check your solution. **13–15. Sample answer: Let n = the number.**

- Negative three times a number plus four is no more than the number minus eight.
 $-3n + 4 \leq n - 8; \{n \mid n \geq 3\}$
- One fourth of a number decreased by three is at least two.
 $\frac{1}{4}n - 3 \geq 2; \{n \mid n \geq 20\}$
- The sum of twelve and a number is no greater than the sum of twice the number and -8 .
 $12 + n \leq 2n + (-8); \{n \mid n \geq 20\}$

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5-3 Study Guide and Intervention (continued)

Solving Multi-Step Inequalities

Solve Inequalities Involving the Distributive Property When solving inequalities that contain grouping symbols, first use the Distributive Property to remove the grouping symbols. Then undo the operations in reverse of the order of operations, just as you would solve an equation with more than one operation.

Example Solve $3a - 2(6a - 4) > 4 - (4a + 6)$.

- $3a - 2(6a - 4) > 4 - (4a + 6)$ Original inequality
- $3a - 12a + 8 > 4 - 4a - 6$ Distributive Property
- $-9a + 8 > -2 - 4a$ Combine like terms.
- $-9a + 8 + 4a > -2 - 4a + 4a$ Add $4a$ to each side.
- $-5a + 8 > -2$ Combine like terms.
- $-5a + 8 - 8 > -2 - 8$ Subtract 8 from each side.
- $-5a > -10$ Simplify.
- $a < 2$ Divide each side by -5 and change $>$ to $<$.

The solution in set-builder notation is $\{a \mid a < 2\}$.

Exercises

Solve each inequality. Check your solution.

1. $2(t + 3) \geq 16$ 2. $3(d - 2) - 2d > 16$ 3. $4h - 8 < 2(h - 1)$
- $\{t \mid t \geq 5\}$ $\{d \mid d > 22\}$ $\{h \mid h < 3\}$
4. $6y + 10 > 8 - (y + 14)$ 5. $4.6(x - 3.4) > 5.1x$ 6. $-5x - (2x + 3) \geq 1$
- $\{y \mid y > -2\frac{2}{7}\}$ $\{x \mid x < -31.28\}$ $\{x \mid x \leq -\frac{4}{7}\}$
7. $3(2y - 4) - 2(y + 1) > 10$ 8. $8 - 2(b + 1) < 12 - 3b$ 9. $-2(k - 1) > 8(1 + k)$
- $\{y \mid y > 6\}$ $\{b \mid b < 6\}$ $\{k \mid k < -\frac{3}{5}\}$
10. $0.3(y - 2) > 0.4(1 + y)$ 11. $m + 17 \leq -(4m - 13)$
- $\{y \mid y < -10\}$ $\{m \mid m \leq -\frac{4}{5}\}$
12. $3n + 8 \leq 2(n - 4) - 2(1 - n)$ 13. $2(y - 2) > -4 + 2y$
- $\{n \mid n \geq 18\}$ \emptyset
14. $k - 17 \leq -(17 - k)$ 15. $n - 4 \leq -3(2 + n)$
- $\{k \mid k \text{ is a real number}\}$ $\{n \mid n \leq -\frac{1}{2}\}$

Define a variable, write an inequality, and solve each problem. Check your solution.

- 16-18. **Sample answer: Let n = the number.**
16. Twice the sum of a number and 4 is less than 12. $2(n + 4) < 12$; $\{n \mid n < 2\}$
17. Three times the sum of a number and six is greater than four times the number decreased by two. $3(n + 6) > 4n - 2$; $\{n \mid n < 20\}$
18. Twice the difference of a number and four is less than the sum of the number and five. $2(n - 4) < n + 5$; $\{n \mid n < 13\}$

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5-3 Skills Practice

Solving Multi-Step Inequalities

Justify each indicated step.

1. $\frac{3}{4}t - 3 \geq -15$ 2. $5(k + 8) - 7 \leq 23$
- $\frac{3}{4}t - 3 + 3 \geq -15 + 3$ a. $\frac{3}{4}t \geq -12$ $5k + 40 - 7 \leq 23$
- $\frac{3}{4}(\frac{4}{3}t) \geq \frac{4}{3}(-12)$ b. $\frac{3}{4}t \geq -10$ $5k + 33 \leq 23$
- $t \geq -16$ c. $\frac{3}{4}t \geq -10$ $5k + 33 - 33 \leq 23 - 33$
- $\frac{3}{4}t \geq -12$ $\frac{5k \leq -10}{5} \leq \frac{-10}{5}$
- $\frac{3}{4}(\frac{4}{3}t) \geq \frac{4}{3}(-12)$ $\frac{5k \leq -10}{5} \leq \frac{-10}{5}$
- $t \geq -16$ $k \leq -2$

- a. Add 3 to each side.
- b. Multiply each side by $\frac{4}{3}$.
- c. Divide each side by 5.

Solve each inequality. Check your solution.

3. $-2b + 4 > -6$ 4. $3x + 15 \leq 21$ 5. $\frac{d}{2} - 1 \geq 3$
- $\{b \mid b < 5\}$ $\{x \mid x \leq 2\}$ $\{d \mid d \geq 8\}$
6. $\frac{2}{5}a - 4 < 2$ 7. $-\frac{t}{5} + 7 > -4$ 8. $\frac{3}{4}j - 10 \geq 5$
- $\{a \mid a < 15\}$ $\{t \mid t < 55\}$ $\{j \mid j \geq 20\}$
9. $-\frac{2}{3}t + 3 < -9$ 10. $2p + 5 \geq 3p - 10$ 11. $4k + 15 > -2k + 3$
- $\{t \mid t > 18\}$ $\{p \mid p \leq 15\}$ $\{k \mid k > -2\}$
12. $2(-3m - 5) \geq -28$ 13. $-6(w + 1) < 2(w + 5)$ 14. $2(q - 3) + 6 \leq -10$
- $\{m \mid m \leq 3\}$ $\{w \mid w > -2\}$ $\{q \mid q \leq -5\}$

Define a variable, write an inequality, and solve each problem.

- 15-20. **Sample answer: Let n = the number.**
15. Four more than the quotient of a number and three is at least nine. $\frac{n}{3} + 4 \geq 9$; $\{n \mid n \geq 15\}$
16. The sum of a number and fourteen is less than or equal to three times the number. $n + 14 \leq 3n$; $\{n \mid n \geq 7\}$
17. Negative three times a number increased by seven is less than negative eleven. $-3n + 7 < -11$; $\{n \mid n > 6\}$
18. Five times a number decreased by eight is at most ten more than twice the number. $5n - 8 \leq 2n + 10$; $\{n \mid n \leq 6\}$
19. Seven more than five sixths of a number is more than negative three. $\frac{5}{6}n + 7 > -3$; $\{n \mid n > -12\}$
20. Four times the sum of a number and two increased by three is at least twenty-seven. $4(n + 2) + 3 \geq 27$; $\{n \mid n \geq 4\}$

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5-3 Practice

Solving Multi-Step Inequalities

Justify each indicated step.

- $x > \frac{5x - 12}{8}$
 $8x > (8) \frac{5x - 12}{8}$
 $8x > 5x - 12$
 $8x - 5x > 5x - 12 - 5x$
 $3x > -12$
 $\frac{3x}{3} > \frac{-12}{3}$
 $x > -4$
- $2(2h + 2) < 2(3h + 5) - 12$
 $4h + 4 < 6h + 10 - 12$
 $4h + 4 < 6h - 2$
 $4h + 4 - 6h < 6h - 2 - 6h$
 $-2h + 4 < -2$
 $-2h + 4 - 4 < -2 - 4$
 $-2h < -6$
 $\frac{-2h}{-2} > \frac{-6}{-2}$
 $h > 3$

- Distributive Property**
- Subtract 6h from each side.**
- Subtract 4 from each side.**
- Divide each side by -2 and change < to >.**

Solve each inequality. Check your solution.

- $-5 - \frac{t}{6} \geq -9$
 $\{t \mid t \leq 24\}$
- $4u - 6 \geq 6u - 20$
 $\{u \mid u \leq 7\}$
- $\frac{3f - 10}{5} > 7$
 $\{f \mid f > 15\}$
- $h \leq \frac{6h + 3}{5}$
 $\{h \mid h \geq -3\}$
- $3(z + 1) + 11 < -2(z + 13)$
 $\{z \mid z < -8\}$
- $3r + 2(4r + 2) \leq 2(6r + 1)$
 $\{r \mid r \geq 2\}$
- $5n - 3(n - 6) \geq 0$
 $\{n \mid n \geq -9\}$

Define a variable, write an inequality, and solve each problem. Check your solution. **12–13. Sample answer: Let $n =$ the number.**

- A number is less than one fourth the sum of three times the number and four.
 $n < \frac{3n + 4}{4}; \{n \mid n < 4\}$
- Two times the sum of a number and four is no more than three times the sum of the number and seven decreased by four.
 $2(n + 4) \leq 3(n + 7) - 4; \{n \mid n \geq -9\}$
- GEOMETRY** The area of a triangular garden can be no more than 120 square feet. The base of the triangle is 16 feet. What is the height of the triangle? **no more than 15 ft**
- MUSIC PRACTICE** Nabuko practices the violin at least 12 hours per week. She practices for three fourths of an hour each session. If Nabuko has already practiced 3 hours in one week, how many sessions remain to meet or exceed her weekly practice goal? **at least 12 sessions**

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5-3 Word Problem Practice

Solving Multi-Step Inequalities

- BEACHCOMBING** Jay has lost his mother's favorite necklace, so he will rent a metal detector to try to find it. A rental company charges a one-time rental fee of \$15 plus \$2 per hour to rent a metal detector. Jay has only \$35 to spend. What is the maximum amount of time he can rent the metal detector?
10 hours
- AGES** Bobby, Billy, and Barry Smith are each one year apart in age. The sum of their ages is greater than the age of their father, who is 60. How old can the oldest brother can be?
no younger than 22
- TAXI FARE** Jamal works in a city and sometimes takes a taxi to work. The taxicabs charge \$1.50 for the first $\frac{1}{5}$ mile and \$0.25 for each additional $\frac{1}{5}$ mile. Jamal has only \$3.75 in his pocket. What is the maximum distance he can travel by taxi if he does not tip the driver?
2 mi
- PLAYGROUND** The perimeter of a rectangular playground must be no greater than 120 meters, because that is the total length of the materials available for the border. The width of the playground cannot exceed 22 meters. What are the possible lengths of the playground?
less than or equal to 38 meters
- MEDICINE** Clark's Rule is a formula used to determine pediatric dosages of over-the-counter medicines.
 $\frac{\text{weight of child (lb)}}{150} \times \text{adult dose} = \text{child dose}$

- If an adult dose of acetaminophen is 1000 milligrams and a child weighs no more than 90 pounds, what is the recommended child's dose?
 $x \leq 600$; **no more than 600 mg**

This label appears on a child's cold medicine. What is the adult minimum dosage in milliliters?

Weight (lb)	Age (yr)	Dose
under 48	under 6	call a doctor
48-95	6-11	2 tsp or 10 mL

15.79 mL

- What is the maximum adult dosage in milliliters?
31.25 mL

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5-3 Enrichment

Carlos Montezuma

During his lifetime, Carlos Montezuma (1866–1923) was one of the most influential Native Americans in the United States. He was recognized as a prominent physician and was also a passionate advocate of the rights of Native American peoples. The exercises that follow will help you learn some interesting facts about Dr. Montezuma's life.

Solve each inequality. The word or phrase next to the equivalent inequality will complete the statement correctly.

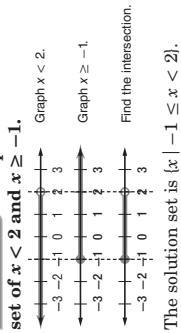
- $-2k > 10$
 Montezuma was born in the state of _____.
 a. $k < -5$ Arizona
 b. $k > -5$ Montana
 c. $k > 12$ Utah
- $2.5 \geq r - 9$
 He was a Native American of the Yavapais, who are a ____ people.
 a. $r \leq -4$ Navajo
 b. $r \geq -4$ Mohawk
 c. $r \leq 14$ Mohave-Apache
- $-y \leq -9$
 Montezuma received a medical degree from ____ in 1889.
 a. $y \geq 9$ Chicago Medical College
 b. $y \geq -9$ Harvard Medical School
 c. $y \leq 9$ Johns Hopkins University
- $-3 + q > 12$
 As a physician, Montezuma's field of specialization was _____.
 a. $q > -4$ heart surgery
 b. $q > 15$ internal medicine
 c. $q < -15$ respiratory diseases
- $5 + 4x - 14 \leq x$
 For much of his career, he maintained a medical practice in _____.
 a. $x \leq 9$ New York City
 b. $x \leq 3$ Chicago
 c. $x \geq -9$ Boston
- $7 - t < 7 + t$
 In addition to maintaining his medical practice, he was also at(n) _____.
 a. $t > 7$ director of a blood bank
 b. $t > 0$ instructor at a medical college
 c. $t < -7$ legal counsel to physicians
- $3a + 8 \geq 4a - 10$
 Montezuma founded, wrote, and edited _____, a monthly newsletter that addressed Native American concerns.
 a. $a \leq -2$ Yavapai
 b. $a \geq 18$ Apache
 c. $a \leq 18$ Wassaja
- $6n > 8n - 12$
 Montezuma testified before a committee of the United States Congress concerning his work in treating _____.
 a. $n < 6$ appendicitis
 b. $n > -6$ asthma
 c. $n > -10$ heart attacks

5-4 Study Guide and Intervention

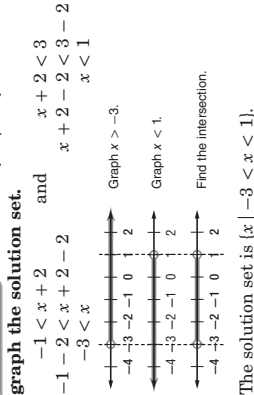
Solving Compound Inequalities

Inequalities Containing and A compound inequality containing *and* is true only if both inequalities are true. The graph of a compound inequality containing *and* is the intersection of the graphs of the two inequalities. Every solution of the compound inequality must be a solution of both inequalities.

Example 1 Graph the solution set of $x < 2$ and $x \geq -1$.



Example 2 Solve $-1 < x + 2 < 3$. Then graph the solution set.



Exercises

Graph the solution set of each compound inequality.

- $b > -1$ and $b \leq 3$
- $2 \geq q \geq -5$
- $x > -3$ and $x \leq 4$
- $-2 \leq p < 4$
- $-3 < d$ and $d < 2$
- $-1 \leq p \leq 3$

Solve each compound inequality. Then graph the solution set.

- $4 < w + 3 \leq 5$
 $\{w \mid 1 < w \leq 2\}$
- $4 < w + 3 \leq 5$
 $\{w \mid 1 < w \leq 2\}$
- $-4 < x + 2 \leq -2$
 $\{x \mid -6 < x \leq -4\}$
- $-3 \leq p - 5 < 2$
 $\{p \mid 2 \leq p < 7\}$
- $y - 1 < 2$ and $y + 2 \geq 1$
 $\{y \mid -1 \leq y < 3\}$
- $n - 2 > -3$ and $n + 4 < 6$
 $\{n \mid -1 < n < 2\}$

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5-4 Study Guide and Intervention *(continued)*

Solving Compound Inequalities

Inequalities Containing or A compound inequality containing *or* is true if one or both of the inequalities are true. The graph of a compound inequality containing *or* is the **union** of the graphs of the two inequalities. The union can be found by graphing both inequalities on the same number line. A solution of the compound inequality is a solution of either inequality, not necessarily both.

Example Solve $2a + 1 < 11$ or $a > 3a + 2$. Then graph the solution set.

$$2a + 1 < 11 \quad \text{or} \quad a > 3a + 2$$

$$2a + 1 - 1 < 11 - 1 \quad a - 3a > 3a - 3a + 2$$

$$2a < 10 \quad -2a > 2$$

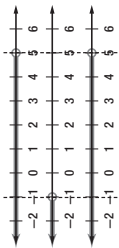
$$\frac{2a}{2} < \frac{10}{2} \quad \frac{-2a}{-2} < \frac{2}{-2}$$

$$a < 5 \quad a < -1$$

Graph $a < 5$.

Graph $a < -1$.

Find the union.



The solution set is $\{a \mid a < -1\}$.

Exercises

Graph the solution set of each compound inequality.

- $b > 2$ or $b \leq -3$
- $3 \geq q$ or $q \leq 1$
- $y \leq -4$ or $y > 0$
- $4 \leq p$ or $p < 8$
- $-3 < d$ or $d < 2$
- $-2 \leq x$ or $3 \leq x$

Solve each compound inequality. Then graph the solution set.

- $3 < 3w$ or $3w \geq 9$
- $-3p + 1 \leq -11$ or $p < 2$
- $2y + 2 < 12$ or $y - 3 \geq 2y$
- $\frac{1}{2}n > -2$ or $2n - 2 < 6 + n$

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5-4 Skills Practice

Solving Compound Inequalities

Graph the solution set of each compound inequality.

- $b > 3$ or $b \leq 0$
- $z \leq 3$ and $z \geq -2$
- $k > 1$ and $k > 5$
- $y < -1$ or $y \geq 1$

Write a compound inequality for each graph.

- Graph: Number line from -4 to 6 with open circles at -2 and 1, and the region between them is shaded.
- Graph: Number line from -4 to 6 with closed circles at -2 and 1, and the region between them is shaded.
- Graph: Number line from -4 to 6 with open circles at -2 and 1, and the region between them is shaded.
- Graph: Number line from -4 to 6 with open circles at -2 and 1, and the region between them is shaded.

Solve each compound inequality. Then graph the solution set.

- $m + 3 \geq 5$ and $m + 3 < 7$
- $4 < f + 6$ and $f + 6 < 5$
- $-6 < b - 4 < 2$
- $3 \geq q$ or $q \leq 1$
- $-3 < d$ or $d < 2$
- $2y + 2 < 12$ or $y - 3 \geq 2y$
- $3 < 3w$ or $3w \geq 9$
- $-3p + 1 \leq -11$ or $p < 2$
- $2x + 4 \leq 6$ or $x \geq 2x - 4$
- $\frac{1}{2}n > -2$ or $2n - 2 < 6 + n$

Define a variable, write an inequality, and solve each problem. Check your solution. 15–17. Sample answer: Let $n =$ the number.

- A number plus one is greater than negative five and less than three.
 $-5 < n + 1 < 3$; $\{n \mid -6 < n < 2\}$
- A number decreased by two is at most four or at least nine.
 $n - 2 \leq 4$ or $n - 2 \geq 9$; $\{n \mid n \leq 6$ or $n \geq 11\}$
- The sum of a number and three is no more than eight or is more than twelve.
 $n + 3 \leq 8$ or $n + 3 > 12$; $\{n \mid n \leq 5$ or $n > 9\}$

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5-4 Word Problem Practice

Solving Compound Inequalities

1. **WEATHER** Ken saw this graph in the newspaper weather forecast. It shows the predicted temperature range for the following day. Write an inequality to represent the number line graph.



$54 \leq x \leq 68$

2. **POOLS** The pH of a person's eyes is 7.2. Therefore, the ideal pH for the water in a swimming pool is between 7.0 and 7.6. Write a compound inequality to represent pH levels that could cause physical discomfort to a person's eyes.

$x \leq 7.0$ or $x \geq 7.6$

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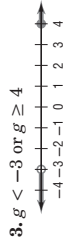
5-4 Practice

Solving Compound Inequalities

Graph the solution set of each compound inequality.



2. $x > 0$ or $x < 3$



Write a compound inequality for each graph.



5. $x \leq -3$ or $x \geq 3$



7. $-2 \leq x < 5$

8. $-6 \leq -4 < -2 < -1 < 0 < 1 < 2$

Solve each compound inequality. Then graph the solution set.

9. $k - 3 < -7$ or $k + 5 \geq 8$ $\{k \mid k < -4$ or $k \geq 3\}$

10. $-n < 2$ or $2n - 3 > 5$ $\{n \mid n > -2\}$

11. $5 < 3h + 2 \leq 11$ $\{h \mid 1 < h \leq 3\}$

12. $2c - 4 > -6$ and $3c + 1 < 13$ $\{c \mid -1 < c < 4\}$

Define a variable, write an inequality, and solve each problem. Check your solution. 13–14. Sample answer: Let n = the number.

13. Two times a number plus one is greater than five and less than seven. $5 < 2n + 1 < 7$; $\{n \mid 2 < n < 3\}$

14. A number minus one is at most nine, or two times the number is at least twenty-four. $n - 1 \leq 9$ or $2n \geq 24$; $\{n \mid n \leq 10$ or $n \geq 12\}$

15. **METEOROLOGY** Strong winds called the prevailing westerlies blow from west to east in a belt from 40° to 60° latitude in both the Northern and Southern Hemispheres.

a. Write an inequality to represent the latitude of the prevailing westerlies. $\{w \mid 40 \leq w \leq 60\}$

b. Write an inequality to represent the latitudes where the prevailing westerlies are not located. $\{w \mid w < 40$ or $w > 60\}$

16. **NUTRITION** A cookie contains 9 grams of fat. If you eat no fewer than 4 and no more than 7 cookies, how many grams of fat will you consume? **between 36 g and 63 g inclusive**

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4. **HEALTH** The human heart circulates from 770,000 to 1,600,000 gallons of blood through a person's body every year. How many gallons of blood does the heart circulate through the body in one day? **between 2110 and 4384 gal**

5. **HEALTH** Body mass index (BMI) is a measure of weight status. The BMI of a person over 20 years old is calculated using the following formula.
 $BMI = 703 \times \frac{\text{weight in pounds}}{(\text{height in inches})^2}$
The table below shows the meaning of different BMI measures.

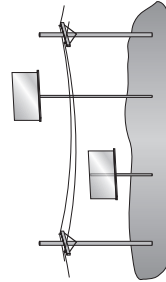
BMI	Weight Status
less than 18.5	underweight
18.5 – 24.9	normal
25 – 29.9	overweight
more than 30	obese

Source: Centers for Disease Control

a. Write a compound inequality to represent the normal BMI range. $18.5 \leq x < 25$

b. Write a compound inequality to represent an adult weight that is within the healthy BMI range for a person 6 feet tall. $136.4 \leq w \leq 183.6$

3. **STORE SIGNS** In Randy's town, street-side signs themselves must be exactly 8 feet high. When mounted on poles, the signs must be shorter than 20 feet or taller than 35 feet so that they do not interfere with the power and phone lines. Write a compound inequality to represent the possible height of the poles.



$x < 12$ or $x > 27$

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5-4 Enrichment

Some Properties of Inequalities

The two expressions on either side of an inequality symbol are sometimes called the *first* and *second* members of the inequality.

If the inequality symbols of two inequalities point in the same direction, the inequalities have the same sense. For example, $a < b$ and $c < d$ have the same sense; $a < b$ and $c > d$ have opposite senses.

In the problems on this page, you will explore some properties of inequalities.

Three of the four statements below are true for all numbers a and b (or a, b, c , and d). Write each statement in algebraic form. If the statement is true for all numbers, prove it. If it is not true, give an example to show that it is false.

1. Given an inequality, a new and equivalent inequality can be created by interchanging the members and reversing the sense.

If $a > b$, then $b < a$.

$a > b, a - b > 0, -b > -a, (-1)(-b) < (-1)(-a), b < a$

2. Given an inequality, a new and equivalent inequality can be created by changing the signs of both terms and reversing the sense.

If $a > b$, then $-a < -b$.

$a > b, a - b > 0, -b > -a, -a < -b$

3. Given two inequalities with the same sense, the sum of the corresponding members are members of an equivalent inequality with the same sense.

If $a > b$ and $c > d$, then $a + c > b + d$.

$a > b$ and $c > d$, so $(a - b)$ and $(c - d)$ are positive numbers, so the sum $(a - b) + (c - d)$ is also positive.

$(a - b) + (c - d) > 0$, so $a + c > b + d$.

4. Given two inequalities with the same sense, the difference of the corresponding members are members of an equivalent inequality with the same sense.

If $a > b$ and $c > d$, then $a - c > b - d$. The statement is false. $5 > 4$ and $3 > 2$, but $5 - 3 \not> 4 - 2$.

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5-5 Study Guide and Intervention

Inequalities Involving Absolute Value

Inequalities Involving Absolute Value ($<$) When solving inequalities that involve absolute value, there are two cases to consider for inequalities involving $<$ (or \leq).

$$\text{If } |x| < n, \text{ then } x > -n \text{ and } x < n.$$

Remember that inequalities with *and* are related to intersections.

Example Solve $|3a + 4| < 10$. Then graph the solution set.

Write $|3a + 4| < 10$ as $3a + 4 < 10$ and $3a + 4 > -10$.

$$3a + 4 < 10 \quad \text{and} \quad 3a + 4 > -10$$

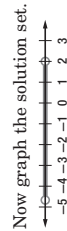
$$3a + 4 - 4 < 10 - 4 \quad 3a + 4 - 4 > -10 - 4$$

$$3a < 6 \quad 3a > -14$$

$$\frac{3a}{3} < \frac{6}{3} \quad \frac{3a}{3} > \frac{-14}{3}$$

$$a < 2 \quad a > -4\frac{2}{3}$$

The solution set is $\left\{a \mid -4\frac{2}{3} < a < 2\right\}$.



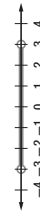
Now graph the solution set.

Exercises

Solve each inequality. Then graph the solution set.

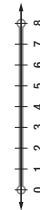
1. $|y| < 3$

$$\{y \mid -3 < y < 3\}$$



2. $|x - 4| < 4$

$$\{x \mid 0 < x < 8\}$$



3. $|y + 3| \leq 2$

$$\{y \mid -5 \leq y \leq -1\}$$



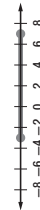
4. $|b + 2| \leq 3$

$$\{b \mid -5 \leq b \leq 1\}$$



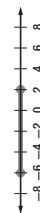
5. $|w - 2| \leq 5$

$$\{w \mid -3 \leq w \leq 7\}$$



6. $|t + 2| \leq 4$

$$\{t \mid -6 \leq t \leq 2\}$$



7. $|2x| \leq 8$

$$\{x \mid -4 \leq x \leq 4\}$$



8. $|5y - 2| \leq 7$

$$\{y \mid -1 \leq y \leq 1\frac{4}{5}\}$$



9. $|p - 0.2| < 0.5$

$$\{p \mid -0.3 < p < 0.7\}$$



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5-5 Study Guide and Intervention (continued)

Inequalities Involving Absolute Value

Solve Absolute Value Inequalities (>) When solving inequalities that involve absolute value, there are two cases to consider for inequalities involving $>$ (or \geq). Remember that inequalities with or are related to unions.

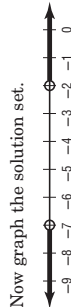
Example Solve $|2b + 9| > 5$. Then graph the solution set.

Write $|2b + 9| > 5$ as $|2b + 9| > 5$ or $|2b + 9| < -5$.

$2b + 9 > 5$ or $2b + 9 < -5$
 $2b + 9 - 9 > 5 - 9$ or $2b + 9 - 9 < -5 - 9$

$2b > -4$ or $2b < -14$
 $\frac{2b}{2} > \frac{-4}{2}$ or $\frac{2b}{2} < \frac{-14}{2}$
 $b > -2$ or $b < -7$

The solution set is $\{b \mid b > -2 \text{ or } b < -7\}$.



Now graph the solution set.

Exercises

Solve each inequality. Then graph the solution set.

- $|c - 2| > 6$ $\{c \mid c < -4 \text{ or } c > 8\}$
- $|x - 3| > 0$ $\{x \mid x > 3 \text{ or } x < 3\}$
- $|3f + 10| \geq 4$ $\{f \mid f \leq -4\frac{2}{3} \text{ or } f \geq -2\}$
- $|x| \geq 2$ $\{x \mid x \leq -2 \text{ or } x \geq 2\}$
- $|x| \geq 3$ $\{x \mid x \leq -3 \text{ or } x \geq 3\}$
- $|2x + 1| \geq -2$ $\{x \mid x \text{ is a real number}\}$
- $|2d - 1| \geq 4$ $\{d \mid d \leq -1\frac{1}{2} \text{ or } d \geq 2\frac{1}{2}\}$
- $|3 - (x - 1)| \geq 8$ $\{x \mid x \leq -4 \text{ or } x \geq 12\}$
- $|3r + 2| > -5$ $\{r \mid r \text{ is a real number}\}$

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5-5 Skills Practice

Inequalities Involving Absolute Value

Match each open sentence with the graph of its solution set.

- $|x| > 2$ **b**
- $|x - 2| \leq 3$ **c**
- $|x + 1| < 4$ **a**

Express each statement using an inequality involving absolute value.

- The weatherman predicted that the temperature would be within 3° of 52°F .
 $|x - 52| \leq 3$
- Serena will make the B team if she scores within 8 points of the team average of 92.
 $|x - 92| \leq 8$

- The dance committee expects attendance to number within 25 of last year's 87 students.
 $|x - 87| \leq 25$

Solve each inequality. Then graph the solution set.

- $|x + 1| < 0$ **no solution**
- $|x - 3| < 1$ $\{c \mid 2 < c < 4\}$
- $|n + 2| \geq 1$ $\{n \mid n \geq -1 \text{ or } n \leq -3\}$
- $|w - 2| < 2$ $\{w \mid 0 < w < 4\}$
- $|t + 6| > 4$ $\{t \mid t < -10 \text{ or } t > -2\}$
- $|k - 5| \leq 4$ $\{k \mid 1 \leq k \leq 9\}$

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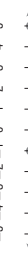
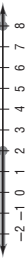
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NAME _____ DATE _____ PERIOD _____

5-5 Practice

Inequalities Involving Absolute Value

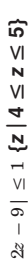

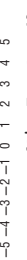

Match each open sentence with the graph of its solution set.

1. $|x - 3| \geq 1$ **a.** 
2. $|2x + 1| < 5$ **c.** 
3. $|5 - x| \geq 3$ **b.** 



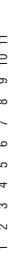
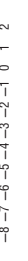
Express each statement using an inequality involving absolute value.

4. The height of the plant must be within 2 inches of the standard 13-inch show size.
 $|h - 13| \leq 2$
5. The majority of grades in Sean's English class are within 4 points of 85.
 $|g - 85| \leq 4$

Solve each inequality. Then graph the solution set.

6. $|2z - 9| \leq 1$ $\{z \mid 4 \leq z \leq 5\}$ 
7. $|3 - 2r| > 7$ $\{r \mid r < -2 \text{ or } r > 5\}$ 
8. $|3x + 6| < 9$ $\{t \mid -5 < t < 1\}$ 
9. $|2g - 5| \geq 9$ $\{g \mid g \leq -2 \text{ or } g \geq 7\}$ 

Write an open sentence involving absolute value for each graph.

10.  $|x - 6| < 5$
11.  $|x + 4| > 2$
12.  $|x + 3| \geq 4$
13.  $|x - 2| \leq 4$

14. **RESTAURANTS** The menu at Jeanné's favorite restaurant states that the roasted chicken with vegetables entree typically contains 480 Calories. Based on the size of the chicken, the actual number of Calories in the entree can vary by as many as 40 Calories from this amount.

- a. Write an absolute value inequality to represent the situation. $|x - 480| \leq 40$
- b. What is the range of the number of Calories in the chicken entree? $440 \leq x \leq 520$

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5-5 Word Problem Practice

Inequalities Involving Absolute Value

1. **SPEEDOMETERS** The government requires speedometers on cars sold in the United States to be accurate within $\pm 2.5\%$ of the actual speed of the car. If your speedometer reads 60 miles per hour while you are driving on a highway, what is the range of possible actual speeds at which your car could be traveling?

$\{x \mid 58.5 \leq x \leq 61.5\}$

2. **BAKING** Pete is making muffins for a bake sale. Before he starts baking, he goes online to research different muffin recipes. The recipes that he finds all specify baking temperatures between 350°F and 400°F , inclusive. Write an absolute value inequality to represent the possible temperatures t called for in the muffin recipes Pete is researching.

$|t - 375| \leq 25$

3. **ARCHERY** In an Olympic archery event, the center of the target is set exactly 130 centimeters off the ground. To get the highest score of ten points, an archer must shoot an arrow no further than 3.05 centimeters from the exact center of the target.

a. Write an absolute value inequality to represent the possible distances d from the ground an archer can hit the target and still score ten points.

$|d - 130| \leq 3.05$

b. Graph the solution set of the inequality you wrote in part a.



4. **CATS** During a recent visit to the veterinarian's office, Mrs. Van Allen was informed that a healthy weight for her cat is approximately 10 pounds, plus or minus one pound. Write an absolute value inequality that represents unhealthy weights w for her cat.

$|w - 10| \geq 1$

5. **STATISTICS** The most familiar statistical measure is the arithmetic mean, or average. A second important statistical measure is the standard deviation, which is a measure of how far the individual scores deviate from the mean. For example, in a recent year the mean score on the mathematics section of the SAT test was 515 and the standard deviation was 114. This means that people within one deviation of the mean have SAT math scores that are no more than 114 points higher or 114 points lower than the mean.

a. Write an absolute value inequality to find the range of SAT mathematics test scores within one standard deviation of the mean.

$|x - 515| \leq 114$

b. What is the range of SAT mathematics test scores ± 2 standard deviation from the mean?

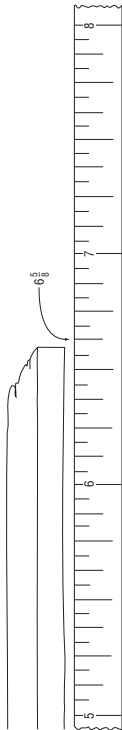
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5-5 Enrichment

Precision of Measurement

The precision of a measurement depends both on your accuracy in measuring and the number of divisions on the ruler you use. Suppose you measured a length of wood to the nearest one-eighth of an inch and got a length of $6\frac{5}{8}$ inches.



The drawing shows that the actual measurement lies somewhere between $6\frac{9}{16}$ and $6\frac{11}{16}$ inches. This measurement can be written using the symbol \pm , which is read *plus or minus*. It can also be written as a compound inequality.

$$6\frac{5}{8} \pm \frac{1}{16} \text{ in.} \quad 6\frac{9}{16} \text{ in.} \leq m \leq 6\frac{11}{16} \text{ in.}$$

In this example, $\frac{1}{16}$ inch is the absolute error. The absolute error is one-half the smallest unit used in a measurement.

Write each measurement as a compound inequality. Use the variable m .

- $5\frac{1}{2} \pm \frac{1}{4}$ in.
- 3.78 ± 0.005 kg
- 7.11 ± 0.005 g
- $15\frac{1}{2}$ yd $\leq m \leq 16\frac{1}{2}$ yd
- 22.5 ± 0.5 cm
- $\frac{9}{16} \pm \frac{1}{32}$ in.
- 3.775 kg $\leq m \leq 3.785$ kg
- 17 in. $\leq m \leq \frac{19}{32}$ in.
- 21.5 cm $\leq m \leq 22.5$ cm
- 9.5 in. $\leq m \leq 10.5$ in.
- 7.135 mm $\leq m \leq 7.145$ mm
- 1 cm, $\frac{1}{2}$ cm
- 0.01 mm, 0.005 mm

For each measurement, give the smallest unit used and the absolute error.

- 9.5 in. $\leq m \leq 10.5$ in.
- 1 in., 0.5 in.
- 8.4 in. $\leq m \leq 4\frac{3}{4}$ in.
- $\frac{1}{2}$ in., $\frac{1}{4}$ in.

- $23\frac{1}{2}$ cm $\leq m \leq 24\frac{1}{2}$ cm
- 1 cm, $\frac{1}{2}$ cm
- 7.135 mm $\leq m \leq 7.145$ mm
- 0.01 mm, 0.005 mm

5-5 Graphing Calculator Activity

Absolute Value Inequalities

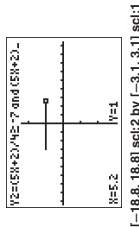
The **TEST** menu can be used to solve and graph absolute value inequalities by using the equivalent compound inequalities related to absolute value.

Example Graph and solve each inequality.

a. $|x + 4| \geq 8$

Enter the inequality into **Y1**. Then enter the equivalent compound inequality into **Y2** and graph to view the results. Be sure to choose appropriate settings for the view window.

Keystrokes: **MATH** \blacktriangleright **ENTER** **X,T,θ,n** \pm **4** **]** **2nd** **[TEST]** **4** **8** **]** **2nd** **[TEST]** **6** **[** **8** **]** **2nd** **[TEST]** **2** **]** **X,T,θ,n** \pm **4** **]** **2nd** **[TEST]** **4** **8** **]** **ENTER** **GRAPH**.

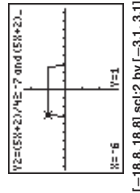


Use **TRACE** to confirm the solution. When $y = 1$ the statement is true, and when $y = 0$ the statement is false. Thus, the solution is $x < -12$ or $x \geq 4$.

b. $\left| \frac{5x + 2}{4} \right| \leq 7$

Enter the inequality into **Y1** and the equivalent compound inequalities into **Y2**. Then graph the solution set.

Keystrokes: **MATH** \blacktriangleright **ENTER** **[** **5** **X,T,θ,n** **+** **2** **]** **[** **±** **]** **4** **]** **2nd** **[TEST]** **6** **7** **]** **2nd** **[TEST]** **4** **8** **]** **2nd** **[TEST]** **2** **]** **X,T,θ,n** \pm **4** **]** **2nd** **[TEST]** **6** **7** **]** **2nd** **[TEST]** **4** **8** **]** **ENTER** **GRAPH**.

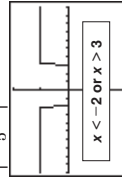
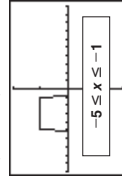
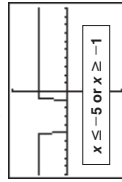


The statement is true between -6 and 5.2 . Thus the solution is $-6 \leq x \leq 5.2$.

Exercises

Graph and solve each inequality.

- $|x + 3| \geq 2$
- $|2x + 6| \leq 4$
- $\frac{2 - 4x}{5} > 2$
- $|x + 8| < -3$



no solution

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5-6 Study Guide and Intervention

Graphing Inequalities in Two Variables

Graph Linear Inequalities The solution set of an inequality that involves two variables is graphed by graphing a related linear equation that forms a boundary of a **half-plane**. The graph of the ordered pairs that make up the solution set of the inequality fill a region of the coordinate plane on one side of the half-plane.

Example Graph $y \leq -3x - 2$.

Graph $y = -3x - 2$.

Since $y \leq -3x - 2$ is the same as $y < -3x - 2$ and $y = -3x - 2$, the boundary is included in the solution set and the graph should be drawn as a solid line.

Select a point in each half plane and test it. Choose $(0, 0)$ and $(-2, -2)$.

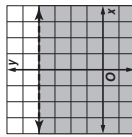
$$\begin{aligned} y &\leq -3x - 2 & y &\leq -3(0) - 2 \\ 0 &\leq -3(0) - 2 & 0 &\leq -3(-2) - 2 \\ 0 &\leq -2 \text{ is false.} & 0 &\leq 6 - 2 \\ & & -2 &\leq 4 \text{ is true.} \end{aligned}$$

The half-plane that contains $(-2, -2)$ contains the solution. Shade that half-plane.

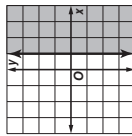
Exercises

Graph each inequality.

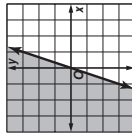
1. $y < 4$



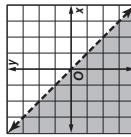
2. $x \geq 1$



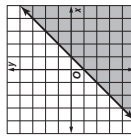
3. $3x \leq y$



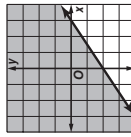
4. $-x > y$



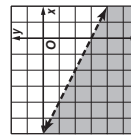
5. $x - y \geq 1$



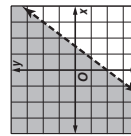
6. $2x - 3y \leq 6$



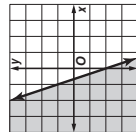
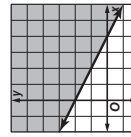
7. $y < -\frac{1}{2}x - 3$



8. $4x - 3y < 6$



9. $3x + 6y \geq 12$



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5-6 Study Guide and Intervention

Graphing Inequalities in Two Variables

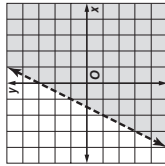
Solve Linear Inequalities We can use a coordinate plane to solve inequalities with one variable.

Example Use a graph to solve $2x + 2 > -1$.

Step 1 First graph the boundary, which is the related function. Replace the inequality sign with an equals sign, and get 0 on a side by itself.

$$\begin{aligned} 2x + 2 &> -1 && \text{Original inequality} \\ 2x + 2 &= -1 && \text{Change } < \text{ to } =. \\ 2x + 2 + 1 &= -1 + 1 && \text{Add 1 to each side.} \\ 2x + 3 &= 0 && \text{Simplify.} \end{aligned}$$

Graph $2x + 3 = y$ as a dashed line.



Step 2 Choose $(0, 0)$ as a test point, substituting these values into the original inequality give us $3 > -5$.

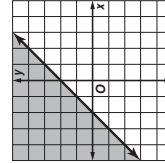
Step 3 Because this statement is true, shade the half plane containing the point $(0, 0)$.

Notice that the x -intercept of the graph is at $-1\frac{1}{2}$. Because the half-plane to the right of the x -intercept is shaded, the solution is $x > -1\frac{1}{2}$.

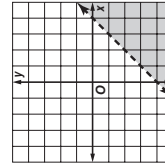
Exercises

Use a graph to solve each inequality.

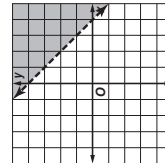
1. $x + 7 \leq 5$



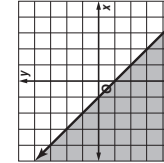
2. $x - 2 > 2$



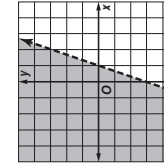
3. $-x + 1 < -3$



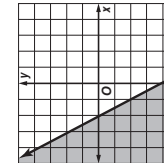
4. $-x - 7 \geq -6$



5. $3x - 20 < -17$



6. $-2x + 11 \geq 15$



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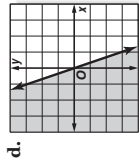
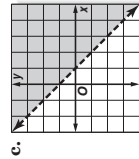
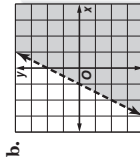
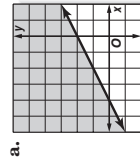
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5-6 Skills Practice

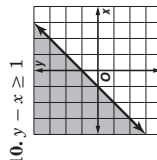
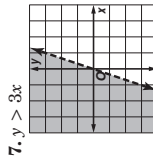
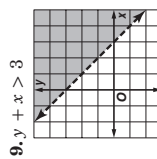
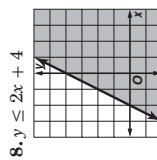
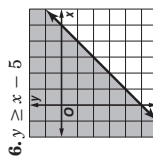
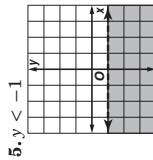
Graphing Inequalities in Two Variables

Match each inequality to the graph of its solution.

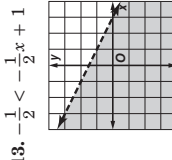
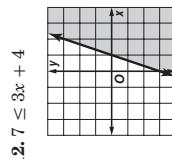
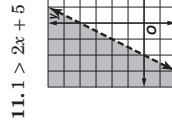
1. $y - 2x < 2$ **b**
2. $y \leq -3x$ **d**
3. $2y - x \geq 4$ **a**
4. $x + y > 1$ **c**



Graph each inequality.



Use a graph to solve each inequality.



$x < -2$

$x \geq 1$

$x > 3$

Chapter 5

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Glencoe Algebra 1

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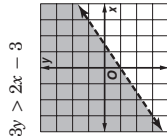
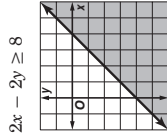
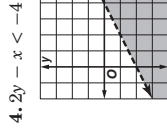
5-6 Practice

Graphing Inequalities in Two Variables

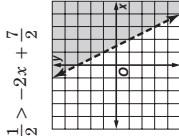
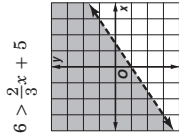
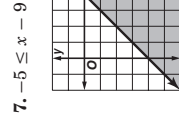
Determine which ordered pairs are part of the solution set for each inequality.

1. $3x + y \geq 6$, $\{(4, 3), (-2, 4), (-5, -3), (3, -3)\}$ **$\{(4, 3), (3, -3)\}$**
2. $y \geq x + 3$, $\{(6, 3), (-3, 2), (3, -2), (4, 3)\}$ **$\{(-3, 2)\}$**
3. $3x - 2y < 5$, $\{(4, -4), (3, 5), (5, 2), (-3, 4)\}$ **$\{(3, 5), (-3, 4)\}$**

Graph each inequality.



Use a graph to solve each inequality.



$x \geq 4$

$x < \frac{1}{2}$

$x > 1\frac{1}{2}$

10. MOVING A moving van has an interior height of 7 feet (84 inches). You have boxes in 12 inch and 15 inch heights, and want to stack them as high as possible to fit. Write an inequality that represents this situation. **$12x + 15y \leq 84$**

11. BUDGETING Satchi found a used bookstore that sells pre-owned DVDs and CDs. DVDs cost \$9 each, and CDs cost \$7 each. Satchi can spend no more than \$35.

- a. Write an inequality that represents this situation. **$9x + 7y \leq 35$**
- b. Does Satchi have enough money to buy 2 DVDs and 3 CDs?
No, the purchases will be \$39, which is greater than \$35.

Chapter 5

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Glencoe Algebra 1

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5-6 Word Problem Practice

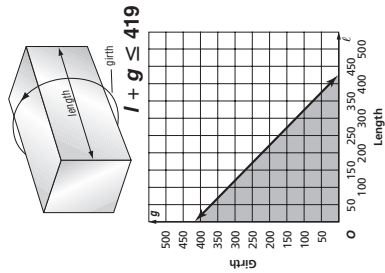
Graphing Inequalities in Two Variables

1. **FAMILY** Tyrone said that the ages of his siblings are all part of the solution set of $y > 2x$, where x is the age of a sibling and y is Tyrone's age. Which of the following ages is possible for Tyrone and a sibling?

- Tyrone is 23; Maxine is 14. **no**
 Tyrone is 18; Camille is 8. **yes**
 Tyrone is 12; Francis is 4. **yes**
 Tyrone is 11; Martin is 6. **no**
 Tyrone is 19; Paul is 9. **yes**

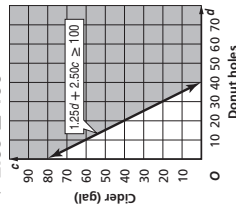
2. **FARMING** The average value of U.S. farm cropland has steadily increased in recent years. In 2000, the average value was \$1,490 per acre. Since then, the value has increased at least an average of \$77 per acre per year. Write an inequality to show land values above the average for farmland. $y > 77x + 1490$

3. **SHIPPING** An international shipping company has established size limits for packages with all their services. The total of the length of the longest side and the girth (distance completely around the package at its widest point perpendicular to the length) must be less than or equal to 419 centimeters. Write and graph an inequality that represents this situation.



Chapter 5

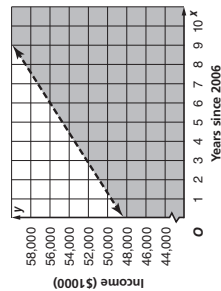
4. **FUNDRAISING** Troop 200 sold cider and donuts to raise money for charity. They sold small boxes of donut holes for \$1.25 and cider for \$2.50 a gallon. In order to cover their expenses, they needed to raise at least \$100. Write and graph an inequality that represents this situation. $1.25d + 2.5c \geq 100$



5. **INCOME** In 2006 the median yearly family income was about \$48,200 per year. Suppose the average annual rate of change since then is \$1240 per year.

a. Write and graph an inequality for the annual family incomes y that are less than the median for x years after 2006.

$$y < 1240x + 48,200$$



b. Determine whether each of the following points is part of the solution set.

(2, 51,000) **no** (8, 69,200) **no**
 (5, 50,000) **yes** (10, 61,000) **no**

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Glencoe Algebra 1

NAME _____ DATE _____ PERIOD _____

5-6 Enrichment

Linear Programming

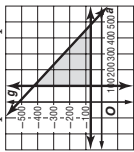
Linear programming can be used to maximize or minimize costs. It involves graphing a set of linear inequalities and using the region of intersection. You will use linear programming to solve the following problem.

Example Layne's Gift Shoppe sells at most 500 items per week. To meet her customers' demands, she sells at least 100 stuffed animals and 75 greeting cards. If the profit for each stuffed animal is \$2.50 and the profit for each greeting card is \$1.00, the equation $P(a, g) = 2.50a + 1.00g$ can be used to represent the profit. How many of each should she sell to maximize her profit?

Write the inequalities:

- $a + g \leq 500$
 $a \geq 100$
 $g \geq 75$

Graph the inequalities:



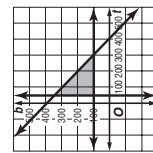
Find the vertices of the triangle formed: (100, 75), (100, 400), and (425, 75) Substitute the values of the vertices into the equation found above:

- $2.50(100) + 1(75) = 325$
 $2.50(100) + 1(400) = 650$
 $2.50(425) + 1(75) = 1137.50$
- The maximum profit is \$1137.50.

Exercises

The Spirit Club is selling shirts and banners. They sell at most 400 of the two items. To meet the demands of the students, they must sell at least 50 T-shirts and 100 banners. The profit on each shirt is \$4.00 and the profit on each banner is \$1.50, the equation $P(t, b) = 4.00t + 1.50b$ can be used to represent the profit. How many should they sell of each to maximize the profit?

- Write the inequalities to represent this situation.
 $t + b \leq 400$; $t \geq 50$; $b \geq 100$
- Graph the inequalities from Exercise 1.
See graph at right.
- Find the vertices of the figure formed.
(50, 100), (50, 350), (300, 100)
- What is the maximum profit the Spirit Club can make? **\$1350**



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NAME _____ DATE _____ PERIOD _____

5-6 Spreadsheet Activity

Inequalities in Two Variables

You can use a spreadsheet to determine whether ordered pairs satisfy an inequality.

Example Use a spreadsheet to determine which ordered pairs from the set $\{(2, 3), (4, 1), (-1, 2), (0, 7), (-8, -10)\}$ are part of the solution set for $5x - 2y > 12$.

Step 1 Use columns A and B of the spreadsheet for the replacement set.

Enter the x-coordinates in column A and the y-coordinates in column B.

	A	B	C
1	x	y	$5x - 2y > 12$
2	2	3	$=5*A2-Z*B2>12$
3	4	1	$=5*A3-Z*B3>12$
4	-1	2	$=5*A4-Z*B4>12$
5	0	7	$=5*A5-Z*B5>12$
6	-8	-10	$=5*A6-Z*B6>12$
7			

Step 2 Column C contains the formula for the inequality.

Use the names of the cells containing the x- and y-coordinates of each ordered pair to determine whether that ordered pair is part of the solution set. The formula will return **TRUE** or **FALSE**.

The solution set contains the ordered pairs for which the inequality is true. The ordered pair $(4, 1)$ is part of the solution set of $5x - 2y > 12$.

The spreadsheet can also evaluate inequalities involving absolute value. Enter an absolute value expression like $|x|$ using the function **ABS(x)**.

	A	B	C
1	x	y	$5x - 2y > 12$
2	2	3	FALSE
3	4	1	TRUE
4	-1	2	FALSE
5	0	7	FALSE
6	-8	-10	FALSE
7			

Exercises

Use a spreadsheet to determine which ordered pairs are part of the solution set for each inequality.

- $2x + 3y > 1$; $\{(0, 3), (1, -3), (-2, -1), (6, 8)\}$ **$\{(0, 3), (6, 8)\}$**
- $7x - y < 8$; $\{(1, 2), (-3, -1), (0, -10), (6, 9)\}$ **$\{(1, 2), (-3, -1)\}$**
- $y \geq 3x$; $\{(3, 1), (-4, 5), (-1, 0), (7, -1), (2, 7)\}$ **$\{(-4, 5), (-1, 0), (2, 7)\}$**
- $y \leq -4x$; $\{(9, 3), (-3, 5), (0, 0), (12, 1), (3, 9)\}$ **$\{(-3, 5), (0, 0)\}$**
- $y > 12 - 2x$; $\{(-8, -3), (-1, 9), (12, 13), (-4, 11)\}$ **$\{(12, 13)\}$**
- $y > 2 + 6x$; $\{(0, -4), (-4, 8), (9, 17), (-2, 18), (-5, -5)\}$ **$\{(-4, 8), (-2, 18), (-5, -5)\}$**
- $|x + 1| \leq y$; $\{(1, -8), (0, 4), (5, 16), (-2, -8), (11, -2)\}$ **$\{(0, 4), (5, 16)\}$**
- $|y - 7| < x$; $\{(5, 8), (-1, 3), (2, 19), (-6, -6), (10, -22)\}$ **$\{(5, 8)\}$**

Chapter 5

42

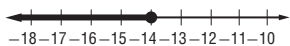
Glencoe Algebra 1

Chapter 5 Assessment Answer Key

Quiz 1 (Lessons 5-1 and 5-2)

Page 45

1. $\{w \mid w \leq -14\}$



Sample answer:
 n = the number;

2. $n - 7 \geq 15$; $\{n \mid n \geq 22\}$

3. $\{m \mid m > -78\}$

4. $\{n \mid n \geq -28\}$

5. **B**

Quiz 2 (Lessons 5-3)

Page 45

1. $\{d \mid d \leq -100\}$

2. \emptyset

3. $\{t \mid t > 6\}$

Sample answer: n = the
number; $n + 3 < 19 - n$;
 $\{n \mid n < 8\}$

5. **D**

Quiz 3 (Lessons 5-4 and 5-5)

Page 46

1. $\{x \mid 0 < x \leq 3\}$

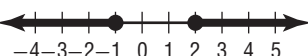


2. **B**

3. $\{x \mid -1 \leq x \leq 3\}$



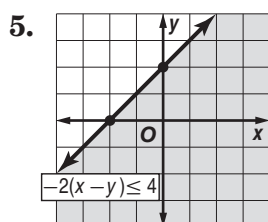
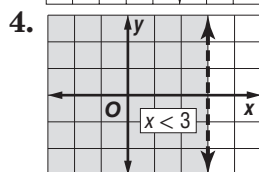
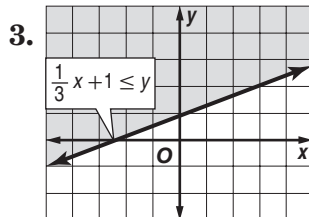
4. $\{x \mid x \geq 2 \text{ or } \leq -1\}$



5. $|x| > 1$

1. **D**

2. **yes**



Mid-Chapter Test

Page 47

1. **C**

2. **J**

3. **B**

4. **F**

5. **C**

6. $\{t \mid t < 15.2\}$

7. $\{x \mid x > 4\}$



Sample answer:
 ℓ = length; $\ell + 63 \leq 85$;
22 in. or less

Sample answer:
 a = no. of apples;
 $6a \geq 50$; at least $8\frac{1}{3}$
apples

9. _____

Chapter 5 Assessment Answer Key

Vocabulary Test
Page 48

1. boundary

2. compound inequality

3. half-plane

4. intersection

5. union

Sample answer: An open half-plane is the half of a coordinate grid that contains all solutions to an inequality, boundary included.

6. _____

Sample answer: Set-builder notation is a way of writing a solution set.

7. _____

Form 1
Page 49

1. A

2. H

3. B

4. J

5. A

6. J

7. D

8. G

9. C

10. F

11. C

12. J

Page 50

13. A

14. G

15. A

16. J

17. B

18. G

19. A

20. G

B: -1

Chapter 5 Assessment Answer Key

Form 2A
Page 51

1. C
2. F
3. A
4. J
5. A
6. G
7. D
8. H
9. D
10. F
11. C

Page 52

12. H
13. A
14. G
15. A
16. J
17. D
18. J
19. B
20. G
- B: $\{n \mid -12 \leq n \leq 12\}$

Form 2B
Page 53

1. A
2. F
3. D
4. J
5. A
6. H
7. B
8. H
9. D
10. F
11. C

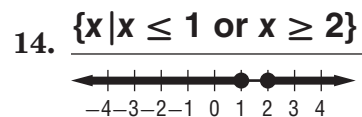
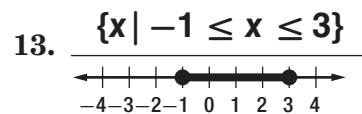
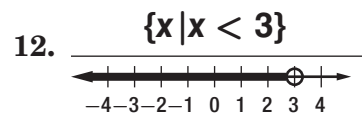
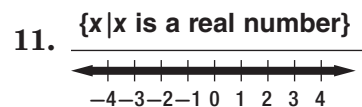
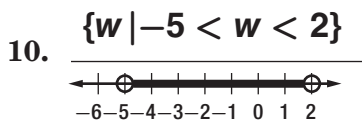
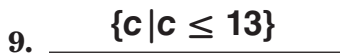
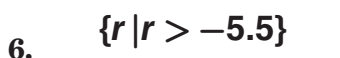
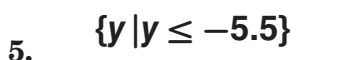
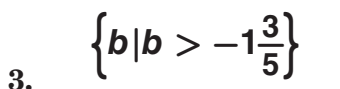
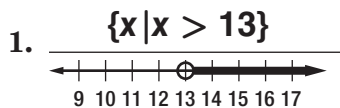
Page 54

12. H
13. C
14. J
15. B
16. H
17. A
18. J
19. A
20. F
- B: $\{x \mid -3 \leq x < 4\}$

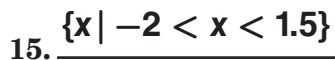
Chapter 5 Assessment Answer Key

Form 2C

Page 55



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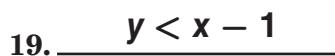
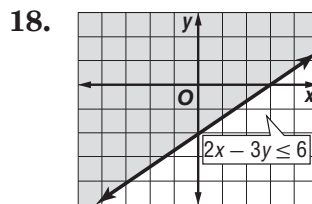
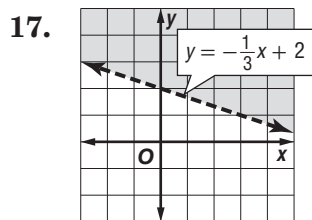


Sample answer:

$x = \text{car price};$

$|6000 - x| \leq 1500;$

$\{x | 4500 \leq x \leq 7500\}; \text{ from}$



$3x + 0.75y \leq 20;$

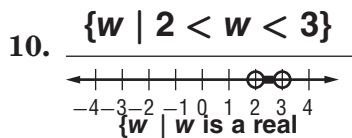
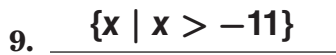
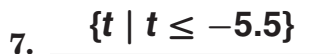
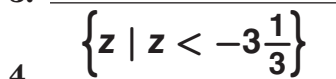
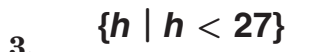
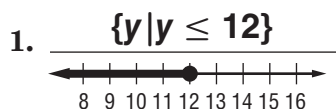
No, the cost would be more than \$20.00.



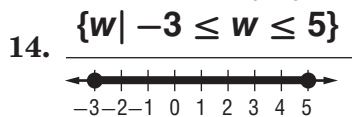
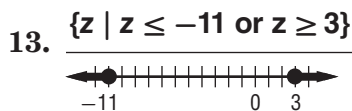
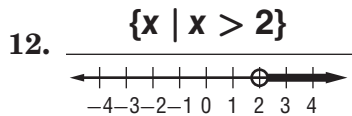
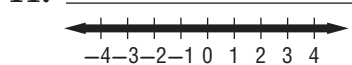
Chapter 5 Assessment Answer Key

Form 2D

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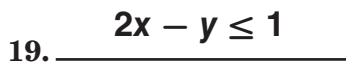
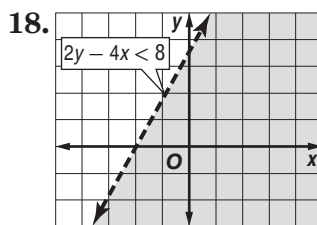
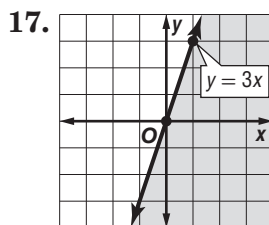


$\{w | w \text{ is a real number}\}$

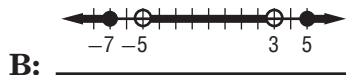


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Sample answer: $x = \text{boat price}; |4500 - x| \leq 1300; \{x | 3200 \leq x \leq 5800\}$; from \$3200 to \$5800

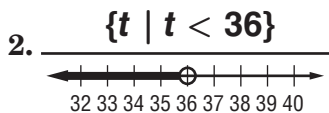
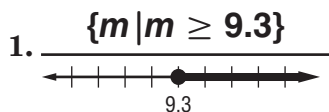


20. $28x + 4y \leq 75$; no, the cost would be more than \$75.00.



Chapter 5 Assessment Answer Key

Form 3
Page 59



Sample answer:

$n =$ the number;

3. $-\frac{3}{7} + n \geq 2; \{n \mid n \geq 2\frac{3}{7}\}$

Sample answer: $n =$ the number; $n - 15 > 2n + 8;$

4. $\{n \mid n < -23\}$

5. $\{w \mid w \leq -10.4\}$

6. $\{t \mid t > \frac{9}{11}\}$

7. $\{b \mid b < 0.5\}$

8. $\{x \mid x \leq -9\}$

9. \emptyset

Sample answer:

$j =$ cost of jeans;

$2(19.89) + j \leq 78;$

no more than \$38.22

10. _____

Sample answer:

$n =$ small positive

even integer; $n + n +$

$2 \leq 15;$

6, 8; 4, 6; 2, 4

11. _____

Sample answer:

$s =$ amount of sales;

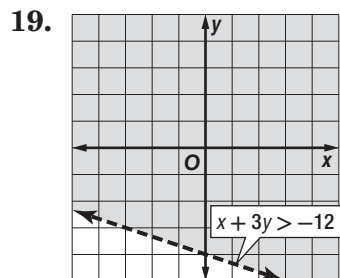
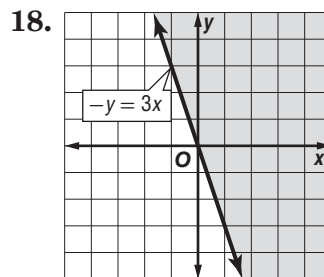
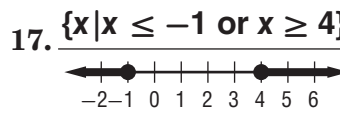
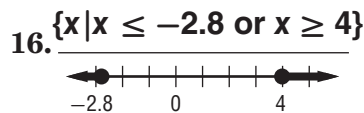
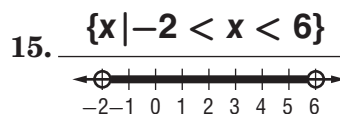
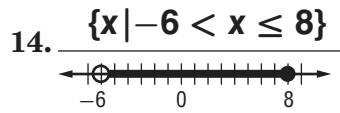
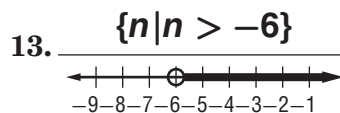
$32,500 < 0.1s + 25,600$

$< 41,900;$ between

\$69,000 and \$163,000

12. _____

Page 60



20. $16x + 12y \leq 120; 3$

False; sample answer: $x > 3$ and $y > 1.$

If $xy < 0,$ x and y cannot both be positive, so

$x > 3$ and $y > 1$ is false.

B: _____

Chapter 5 Assessment Answer Key

Page 61, Extended-Response Test Scoring Rubric

Score	General Description	Specific Criteria
4	Superior A correct solution that is supported by well-developed, accurate explanations	<ul style="list-style-type: none"> Shows thorough understanding of the concepts of <i>using the properties of inequalities, solving inequalities, solving compound inequalities, solving open sentences involving absolute value, and graphing inequalities in two variables.</i> Uses appropriate strategies to solve problems. Computations are correct. Written explanations are exemplary. Graphs are accurate and appropriate. Goes beyond requirements of some or all problems.
3	Satisfactory A generally correct solution, but may contain minor flaws in reasoning or computation	<ul style="list-style-type: none"> Shows an understanding of the concepts of <i>using the properties of inequalities, solving inequalities, solving compound inequalities, solving open sentences involving absolute value, and graphing inequalities in two variables.</i> Uses appropriate strategies to solve problems. Computations are mostly correct. Written explanations are effective. Graphs are mostly accurate and appropriate. Satisfies all requirements of problems.
2	Nearly Satisfactory A partially correct interpretation and/or solution to the problem	<ul style="list-style-type: none"> Shows an understanding of most of the concepts of <i>using the properties of inequalities, solving inequalities, solving compound inequalities, solving open sentences involving absolute value, and graphing inequalities in two variables.</i> May not use appropriate strategies to solve problems. Computations are mostly correct. Written explanations are satisfactory. Graphs are mostly accurate. Satisfies the requirements of most of the problems.
1	Nearly Unsatisfactory A correct solution with no supporting evidence or explanation	<ul style="list-style-type: none"> Final computation is correct. No written explanations or work is shown to substantiate the final computation. Graphs may be accurate but lack detail or explanation. Satisfies minimal requirements of some of the problems.
0	Unsatisfactory An incorrect solution indicating no mathematical understanding of the concept or task, or no solution is given	<ul style="list-style-type: none"> Shows little or no understanding of most of the concepts of <i>using the properties of inequalities, solving inequalities, solving compound inequalities, solving open sentences involving absolute value, and graphing inequalities in two variables.</i> Does not use appropriate strategies to solve problems. Computations are incorrect. Written explanations are unsatisfactory. Graphs are inaccurate or inappropriate. Does not satisfy requirements of problems. No answer may be given.

Chapter 5 Assessment Answer Key

Page 61, Extended-Response Test Sample Answers

In addition to the scoring rubric found on page A34, the following sample answers may be used as guidance in evaluating extended-response assessment items.

- | | |
|--------------------------------|--|
| 1. $10n - 7(n + 2) > 5n - 12$ | Original inequality |
| $10n - 7n - 14 > 5n - 12$ | Distributive Property |
| $3n - 14 > 5n - 12$ | Combine like terms. |
| $3n - 14 - 5n > 5n - 12 - 5n$ | Subtract $5n$ from each side. |
| $-2n - 14 > -12$ | Simplify. |
| $-2n - 14 + 14 > -12 + 14$ | Add 14 to each side. |
| $-2n > 2$ | Simplify. |
| $\frac{-2n}{-2} < 2 \div (-2)$ | Divide each side by -2 . Change $>$ to $<$. |
| $n < -1$ | Simplify. |

The solution set is $\{n | n < -1\}$.

- 2a.** After drawing a graph, students should write an inequality that corresponds with the line they have drawn. The inequality may or may not include equality.
- 2b.** The solution set includes the boundary (line) if the inequality written for part **a** includes equality. If the inequality written for part **a** does not include equality, then the student should state that the solution set of the inequality does not include the line.
- 3.** The inequality $ab > 2a$ can be determined to be true or false by considering the value of a . Since $b > 2$, by the Multiplication Property of Inequality $ab > 2a$ is true if a is a positive number.
- 4.** The solution set for $|x - 2| > 4$ is $\{x | x < -2 \text{ or } x > 6\}$. The solution set for $-2x < 4 \text{ or } x > 6$ is $\{x | x > -2\}$. One includes numbers greater than -2 , and the other includes numbers less than -2 or greater than 6 . These solution sets are not the same.
- 5a.** $w \leq 90 - 2(20); \{w | w \leq 50\}$
- 5b.** The formula for the area of a rectangle with 50 substituted for the width can be used to write the compound inequality $2800 \leq 50 \ell \leq 3200$. The possible lengths are found by solving this compound inequality for ℓ . The solution set is $\{\ell | 56 \leq \ell \leq 64\}$.
- 5c.** $|175,000 - x| \leq 20,000;$
 $155,000 \leq x \leq 195,000;$
The Fraziers are willing to pay from \$155,000 to \$195,000 for the house.

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1. ● (B) (C) (D)

2. ● (G) (H) (J)

3. (A) (B) ● (D)

4. (F) (G) ● (I)

5. (A) (B) (C) ●

6. (F) ● (H) (J)

7. (A) (B) (C) ●

8. (F) ● (H) (J)

9. ● (B) (C) (D)

10. (F) ● (H) (J)

11. (A) (B) (C) ●

12. ● (G) (H) (J)

13. (A) ● (C) (D)

14. (F) (G) ● (J)

15. (A) ● (C) (D)

16. ● (G) (H) (J)

17. (A) (B) (C) ●

18.

				1
	∅	∅	∅	
⊙	⊙	⊙	⊙	⊙
0	0	0	0	0
1	1	1	1	●
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

19.

				5
	∅	∅	∅	
⊙	⊙	⊙	⊙	⊙
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	●
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

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20. 102

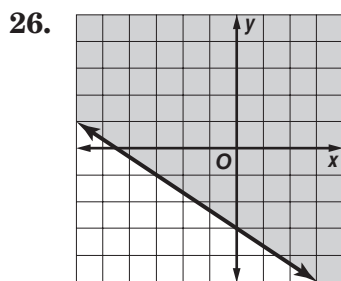
21. 21

22. $\{(-4, -2), (-2, -1.5), (0, -1), (2, -0.5), (4, 0)\}$

23. $y = 4x - 4$

24. $a \leq -15$

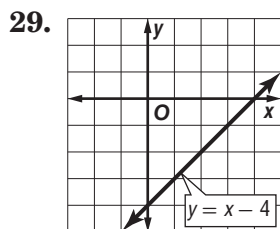
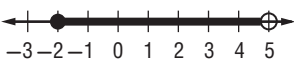
25. $x = 10$



27. $\{f \mid -3 \leq f \leq \frac{5}{3}\}$



28. $\{a \mid -2 \leq a < 5\}$



30a. $\$400 \leq x \leq \800

30b. $\$428 \leq x \leq \856