

**GLENCOE
MATHEMATICS**

Algebra 2

Chapter 1 Resource Masters



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Consumable Workbooks

Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks.

<i>Study Guide and Intervention Workbook</i>	0-07-828029-X
<i>Skills Practice Workbook</i>	0-07-828023-0
<i>Practice Workbook</i>	0-07-828024-9

ANSWERS FOR WORKBOOKS The answers for Chapter 1 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

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Algebra 2
Chapter 1 Resource Masters

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Teacher's Guide to Using the Chapter 1 Resource Masters

The **Fast File** Chapter Resource system allows you to conveniently file the resources you use most often. The *Chapter 1 Resource Masters* includes the core materials needed for Chapter 1. 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 and printing in the *Algebra 2 TeacherWorks* CD-ROM.

Vocabulary Builder Pages vii–viii include 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.

WHEN TO USE Give these pages to students before beginning Lesson 1-1. Encourage them to add these pages to their Algebra 2 Study Notebook. Remind them to add definitions and examples as they complete each lesson.

Study Guide and Intervention

Each lesson in *Algebra 2* addresses two objectives. There is one Study Guide and Intervention master for each objective.

WHEN TO USE Use these masters as reteaching activities for students who need additional reinforcement. These pages can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Skills Practice There is one master for each lesson. These provide computational practice at a basic level.

WHEN TO USE These masters can be used with students who have weaker mathematics backgrounds or need additional reinforcement.

Practice There is one master for each lesson. These problems more closely follow the structure of the Practice and Apply section of the Student Edition exercises. These exercises are of average difficulty.

WHEN TO USE These provide additional practice options or may be used as homework for second day teaching of the lesson.

Reading to Learn Mathematics

One master is included for each lesson. The first section of each master asks questions about the opening paragraph of the lesson in the Student Edition. Additional questions ask students to interpret the context of and relationships among terms in the lesson. Finally, students are asked to summarize what they have learned using various representation techniques.

WHEN TO USE This master can be used as a study tool when presenting the lesson or as an informal reading assessment after presenting the lesson. It is also a helpful tool for ELL (English Language Learner) students.

Enrichment There is one extension master for each lesson. These activities may extend the concepts in the lesson, offer an historical or multicultural look at the concepts, or widen students' perspectives on the mathematics they are learning. These are not written exclusively for honors students, but are accessible for use with all levels of students.

WHEN TO USE These may be used as extra credit, short-term projects, or as activities for days when class periods are shortened.

Assessment Options

The assessment masters in the *Chapter 1 Resource Masters* offer a wide range of assessment tools for intermediate and final assessment. The following lists describe each assessment master and its intended use.

Chapter Assessment

CHAPTER TESTS

- *Form 1* contains multiple-choice questions and is intended for use with basic level students.
- *Forms 2A and 2B* contain multiple-choice questions aimed at the average level student. These tests are similar in format to offer comparable testing situations.
- *Forms 2C and 2D* are composed of free-response questions aimed at the average level student. These tests are similar in format to offer comparable testing situations. Grids with axes are provided for questions assessing graphing skills.
- *Form 3* is an advanced level test with free-response questions. Grids without axes are provided for questions assessing graphing skills.

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

- The **Open-Ended Assessment** includes performance assessment tasks that are suitable for all students. A scoring rubric is included for evaluation guidelines. Sample answers are provided for assessment.
- A **Vocabulary Test**, suitable for all students, includes a list of the vocabulary words in the chapter and ten questions assessing students' knowledge of those terms. This can also be used in conjunction with one of the chapter tests or as a review worksheet.

Intermediate Assessment

- Four free-response **quizzes** are included to offer assessment at appropriate intervals in the chapter.
- A **Mid-Chapter Test** provides an option to assess the first half of the chapter. It is composed of both multiple-choice and free-response questions.

Continuing Assessment

- The **Cumulative Review** provides students an opportunity to reinforce and retain skills as they proceed through their study of Algebra 2. It can also be used as a test. This master includes free-response questions.
- The **Standardized Test Practice** offers continuing review of algebra concepts in various formats, which may appear on the standardized tests that they may encounter. This practice includes multiple-choice, grid-in, and quantitative-comparison questions. Bubble-in and grid-in answer sections are provided on the master.

Answers

- Page A1 is an answer sheet for the Standardized Test Practice questions that appear in the Student Edition on pages 52–53. This improves students' familiarity with the answer formats they may encounter in test taking.
- The answers for the lesson-by-lesson masters are provided as reduced pages with answers appearing in red.
- Full-size answer keys are provided for the assessment masters in this booklet.

1

Reading to Learn Mathematics***Vocabulary Builder***

This is an alphabetical list of the key vocabulary terms you will learn in Chapter 1. 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
absolute value		
algebraic expression		
<u>Associative Property</u> uh-SOH-shee-uh-tihv		
<u>Commutative Property</u> kuh-MYOO-tuh-tihv		
compound inequality		
<u>Distributive Property</u> dih-STRIH-byuh-tihv		
empty set		
Identity Property		
intersection		
Inverse Property		

(continued on the next page)

1

Reading to Learn Mathematics**Vocabulary Builder** *(continued)*

Vocabulary Term	Found on Page	Definition/Description/Example
irrational numbers		
open sentence		
rational numbers		
Reflexive Property		
set-builder notation		
Substitution Property		
Symmetric Property suh·MEH·trihk		
Transitive Property		
Trichotomy Property try·KAH·tuh·mee		
union		

1-1

Study Guide and Intervention

Expressions and Formulas

Order of Operations

Order of Operations

1. Simplify the expressions inside grouping symbols.
2. Evaluate all powers.
3. Do all multiplications and divisions from left to right.
4. Do all additions and subtractions from left to right.

Example 1

Evaluate $[18 - (6 + 4)] \div 2$.

$$\begin{aligned} [18 - (6 + 4)] \div 2 &= [18 - 10] \div 2 \\ &= 8 \div 2 \\ &= 4 \end{aligned}$$

Example 2

Evaluate $3x^2 + x(y - 5)$ if $x = 3$ and $y = 0.5$.

Replace each variable with the given value.

$$\begin{aligned} 3x^2 + x(y - 5) &= 3 \cdot (3)^2 + 3(0.5 - 5) \\ &= 3 \cdot (9) + 3(-4.5) \\ &= 27 - 13.5 \\ &= 13.5 \end{aligned}$$

Exercises

Find the value of each expression.

1. $14 + (6 \div 2)$

2. $11 - (3 + 2)^2$

3. $2 + (4 - 2)^3 - 6$

4. $9(3^2 + 6)$

5. $(5 + 2^3)^2 - 5^2$

6. $5^2 + \frac{1}{4} + 18 \div 2$

7. $\frac{16 + 2^3 \div 4}{1 - 2^2}$

8. $(7 - 3^2)^2 + 6^2$

9. $20 \div 2^2 + 6$

10. $12 + 6 \div 3 - 2(4)$

11. $14 \div (8 - 20 \div 2)$

12. $6(7) + 4 \div 4 - 5$

13. $8(4^2 \div 8 - 32)$

14. $\frac{6 + 4 \div 2}{4 \div 6 - 1}$

15. $\frac{6 + 9 \div 3 + 15}{8 - 2}$

Evaluate each expression if $a = 8.2$, $b = -3$, $c = 4$, and $d = -\frac{1}{2}$.

16. $\frac{ab}{d}$

17. $5(6c - 8b + 10d)$

18. $\frac{c^2 - 1}{b - d}$

19. $ac - bd$

20. $(b - c)^2 + 4a$

21. $\frac{a}{d} + 6b - 5c$

22. $3\left(\frac{c}{d}\right) - b$

23. $cd + \frac{b}{d}$

24. $d(a + c)$

25. $a + b \div c$

26. $b - c + 4 \div d$

27. $\frac{a}{b + c} - d$

1-1

Study Guide and Intervention *(continued)***Expressions and Formulas**

Formulas A **formula** is a mathematical sentence that uses variables to express the relationship between certain quantities. If you know the value of every variable except one in a formula, you can use substitution and the order of operations to find the value of the unknown variable.

Example

To calculate the number of reams of paper needed to print n copies of a booklet that is p pages long, you can use the formula $r = \frac{np}{500}$, where r is the number of reams needed. How many reams of paper must you buy to print 172 copies of a 25-page booklet?

Substitute $n = 172$ and $p = 25$ into the formula $r = \frac{np}{500}$.

$$\begin{aligned} r &= \frac{(172)(25)}{500} \\ &= \frac{43,000}{500} \\ &= 8.6 \end{aligned}$$

You cannot buy 8.6 reams of paper. You will need to buy 9 reams to print 172 copies.

Exercises

For Exercises 1-3, use the following information.

For a science experiment, Sarah counts the number of breaths needed for her to blow up a beach ball. She will then find the volume of the beach ball in cubic centimeters and divide by the number of breaths to find the average volume of air per breath.

- Her beach ball has a radius of 9 inches. First she converts the radius to centimeters using the formula $C = 2.54I$, where C is a length in centimeters and I is the same length in inches. How many centimeters are there in 9 inches?
- The volume of a sphere is given by the formula $V = \frac{4}{3}\pi r^3$, where V is the volume of the sphere and r is its radius. What is the volume of the beach ball in cubic centimeters? (Use 3.14 for π .)
- Sarah takes 40 breaths to blow up the beach ball. What is the average volume of air per breath?
- A person's basal metabolic rate (or BMR) is the number of calories needed to support his or her bodily functions for one day. The BMR of an 80-year-old man is given by the formula $\text{BMR} = 12w - (0.02)(6)12w$, where w is the man's weight in pounds. What is the BMR of an 80-year-old man who weighs 170 pounds?

1-1

Skills Practice

Expressions and Formulas

Find the value of each expression.

1. $18 \div 2 \times 3$

2. $9 + 6 \div 2 + 1$

3. $(3 - 8)^2(4) - 3$

4. $5 + 3(2 - 12 \div 2)$

5. $-\frac{1}{3}[-9 + 10(3)]$

6. $\frac{6(7 - 5)}{4}$

7. $(168 \div 7)3^2 - 4^3$

8. $[3(5) - 128 \div 2^2]5$

Evaluate each expression if $r = -1$, $s = 3$, $t = 12$, $v = 0$, and $w = -\frac{1}{2}$.

9. $6r + 2s$

10. $2st - 4rs$

11. $w(s - r)$

12. $s + 2r - 16v$

13. $(4s)^2$

14. $s^2r - wt$

15. $2(3r + w)$

16. $\frac{3v + t}{5s - t}$

17. $-w[t + (t - r)]$

18. $\frac{rv^3}{s^2}$

19. $9r^2 + (s^2 - 1)t$

20. $7s - 2v + \frac{2w}{r}$

21. TEMPERATURE The formula $K = C + 273$ gives the temperature in kelvins (K) for a given temperature in degrees Celsius. What is the temperature in kelvins when the temperature is 55 degrees Celsius?

22. TEMPERATURE The formula $C = \frac{5}{9}(F - 32)$ gives the temperature in degrees Celsius for a given temperature in degrees Fahrenheit. What is the temperature in degrees Celsius when the temperature is 68 degrees Fahrenheit?

1-1

Practice

Expressions and Formulas

Find the value of each expression.

1. $3(4 - 7) - 11$

2. $4(12 - 4^2)$

3. $1 + 2 - 3(4) \div 2$

4. $12 - [20 - 2(6^2 \div 3 \times 2^2)]$

5. $20 \div (5 - 3) + 5^2(3)$

6. $(-2)^3 - (3)(8) + (5)(10)$

7. $18 - \{5 - [34 - (17 - 11)]\}$

8. $[4(5 - 3) - 2(4 - 8)] \div 16$

9. $\frac{1}{2}[6 - 4^2]$

10. $\frac{1}{4}[-5 + 5(-3)]$

11. $\frac{-8(13 - 37)}{6}$

12. $\frac{(-8)^2}{5 - 9} - (-1)^2 + 4(-9)$

Evaluate each expression if $a = \frac{3}{4}$, $b = -8$, $c = -2$, $d = 3$, and $e = \frac{1}{3}$.

13. $ab^2 - d$

14. $(c + d)b$

15. $\frac{ab}{c} + d^2$

16. $\frac{d(b - c)}{ac}$

17. $(b - de)e^2$

18. $ac^3 - b^2de$

19. $-b[a + (c - d)^2]$

20. $\frac{ac^4}{d} - \frac{c}{e^2}$

21. $9bc - \frac{1}{e}$

22. $2ab^2 - (d^3 - c)$

23. TEMPERATURE The formula $F = \frac{9}{5}C + 32$ gives the temperature in degreesFahrenheit for a given temperature in degrees Celsius. What is the temperature in degrees Fahrenheit when the temperature is -40 degrees Celsius?**24. PHYSICS** The formula $h = 120t - 16t^2$ gives the height h in feet of an object t seconds after it is shot upward from Earth's surface with an initial velocity of 120 feet per second. What will the height of the object be after 6 seconds?**25. AGRICULTURE** Faith owns an organic apple orchard. From her experience the last few seasons, she has developed the formula $P = 20x - 0.01x^2 - 240$ to predict her profit P in dollars this season if her trees produce x bushels of apples. What is Faith's predicted profit this season if her orchard produces 300 bushels of apples?

1-1

Reading to Learn Mathematics***Expressions and Formulas*****Pre-Activity** How are formulas used by nurses?

Read the introduction to Lesson 1-1 at the top of page 6 in your textbook.

- Nurses use the formula $F = \frac{V \times d}{t}$ to control the flow rate for IVs. Name the quantity that each of the variables in this formula represents and the units in which each is measured.

F represents the _____ and is measured in _____ per minute.

V represents the _____ of solution and is measured in _____.

d represents the _____ and is measured in _____ per milliliter.

t represents _____ and is measured in _____.

- Write the expression that a nurse would use to calculate the flow rate of an IV if a doctor orders 1350 milliliters of IV saline to be given over 8 hours, with a drop factor of 20 drops per milliliter. Do not find the value of this expression.

Reading the Lesson

- There is a customary order for grouping symbols. Brackets are used outside of parentheses. Braces are used outside of brackets. Identify the innermost expression(s) in each of the following expressions.
 - $[(3 - 2^2) + 8] \div 4$
 - $9 - [5(8 - 6) + 2(10 + 7)]$
 - $\{14 - [8 + (3 - 12)^2]\} \div (6^3 - 100)$
- Read the following instructions. Then use grouping symbols to show how the instructions can be put in the form of a mathematical expression.
Multiply the difference of 13 and 5 by the sum of 9 and 21. Add the result to 10. Then divide what you get by 2.
- Why is it important for everyone to use the same order of operations for evaluating expressions?

Helping You Remember

- Think of a phrase or sentence to help you remember the order of operations.

1-1

Enrichment

Significant Digits

All measurements are approximations. The **significant digits** of an approximate number are those which indicate the results of a measurement. For example, the mass of an object, measured to the nearest gram, is 210 grams. The measurement 210 g has 3 significant digits. The mass of the same object, measured to the nearest 100 g, is 200 g. The measurement 200 g has one significant digit.

1. Nonzero digits and zeros between significant digits are significant. For example, the measurement 9.071 m has 4 significant digits, 9, 0, 7, and 1.
2. Zeros at the end of a decimal fraction are significant. The measurement 0.050 mm has 2 significant digits, 5 and 0.
3. Underlined zeros in whole numbers are significant. The measurement $104,000$ km has 5 significant digits, 1, 0, 4, 0, and 0.

In general, a computation involving multiplication or division of measurements *cannot* be more accurate than the least accurate measurement in the computation. Thus, the result of computation involving multiplication or division of measurements should be rounded to the number of significant digits in the least accurate measurement.

Example

The mass of 37 quarters is 210 g. Find the mass of one quarter.

$$\begin{aligned} \text{mass of 1 quarter} &= 210 \text{ g} \div 37 \\ &= 5.68 \text{ g} \end{aligned}$$

210 has 3 significant digits.
37 does not represent a measurement.
Round the result to 3 significant digits.
Why?

Write the number of significant digits for each measurement.

- | | | | |
|-----------------|-----------------|------------------------|----------------------------|
| 1. 8314.20 m | 2. 30.70 cm | 3. 0.01 mm | 4. 0.0605 mg |
| 5. $370,000$ km | 6. $370,000$ km | 7. 9.7×10^4 g | 8. 3.20×10^{-2} g |

Solve. Round each result to the correct number of significant digits.

- | | | |
|---|---|---|
| 9. $23 \text{ m} \times 1.54 \text{ m}$ | 10. $12,000 \text{ ft} \div 520 \text{ ft}$ | 11. $2.5 \text{ cm} \times 25$ |
| 12. $11.01 \text{ mm} \times 11$ | 13. $908 \text{ yd} \div 0.5$ | 14. $38.6 \text{ m} \times 4.0 \text{ m}$ |

1-2

Study Guide and Intervention

Properties of Real Numbers

Real Numbers All real numbers can be classified as either rational or irrational. The set of rational numbers includes several subsets: natural numbers, whole numbers, and integers.

R	real numbers	{all rationals and irrationals}
Q	rational numbers	{all numbers that can be represented in the form $\frac{m}{n}$, where m and n are integers and n is not equal to 0}
I	irrational numbers	{all nonterminating, nonrepeating decimals}
N	natural numbers	{1, 2, 3, 4, 5, 6, 7, 8, 9, ...}
W	whole numbers	{0, 1, 2, 3, 4, 5, 6, 7, 8, ...}
Z	integers	{..., -3, -2, -1, 0, 1, 2, 3, ...}

Example

Name the sets of numbers to which each number belongs.

a. $-\frac{11}{3}$ rationals (Q), reals (R)

b. $\sqrt{25}$

$\sqrt{25} = 5$ naturals (N), wholes (W), integers (Z), rationals (Q), reals (R)

Exercises

Name the sets of numbers to which each number belongs.

1. $\frac{6}{7}$

2. $-\sqrt{81}$

3. 0

4. 192.0005

5. 73

6. $34\frac{1}{2}$

7. $\frac{\sqrt{36}}{9}$

8. 26.1

9. π

10. $\frac{15}{3}$

11. $-4.\overline{17}$

12. $\frac{\sqrt{25}}{5}$

13. -1

14. $\sqrt{42}$

15. -11.2

16. $-\frac{8}{13}$

17. $\frac{\sqrt{5}}{2}$

18. $33.\overline{3}$

19. 894,000

20. -0.02

1-2

Study Guide and Intervention *(continued)***Properties of Real Numbers****Properties of Real Numbers**

Real Number Properties		
For any real numbers a , b , and c		
Property	Addition	Multiplication
Commutative	$a + b = b + a$	$a \cdot b = b \cdot a$
Associative	$(a + b) + c = a + (b + c)$	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
Identity	$a + 0 = a = 0 + a$	$a \cdot 1 = a = 1 \cdot a$
Inverse	$a + (-a) = 0 = (-a) + a$	If a is not zero, then $a \cdot \frac{1}{a} = 1 = \frac{1}{a} \cdot a$.
Distributive	$a(b + c) = ab + ac$ and $(b + c)a = ba + ca$	

Example**Simplify $9x + 3y + 12y - 0.9x$.**

$$\begin{aligned}
 9x + 3y + 12y - 0.9x &= 9x + (-0.9x) + 3y + 12y && \text{Commutative Property (+)} \\
 &= (9 + (-0.9))x + (3 + 12)y && \text{Distributive Property} \\
 &= 8.1x + 15y && \text{Simplify.}
 \end{aligned}$$

Exercises**Simplify each expression.**

- $8(3a - b) + 4(2b - a)$
- $40s + 18t - 5t + 11s$
- $\frac{1}{5}(4j + 2k - 6j + 3k)$
- $10(6g + 3h) + 4(5g - h)$
- $12\left(\frac{a}{3} - \frac{b}{4}\right)$
- $8(2.4r - 3.1s) - 6(1.5r + 2.4s)$
- $4(20 - 4p) - \frac{3}{4}(4 - 16p)$
- $5.5j + 8.9k - 4.7k - 10.9j$
- $1.2(7x - 5) - (10 - 4.3x)$
- $9(7e - 4f) - 0.6(e + 5f)$
- $2.5m(12 - 8.5)$
- $\frac{3}{4}p - \frac{1}{5}r - \frac{3}{5}r - \frac{1}{2}p$
- $4(10g + 80h) - 20(10h - 5g)$
- $2(15 + 45c) + \frac{5}{6}(12 + 18c)$
- $(7 - 2.1x)3 + 2(3.5x - 6)$
- $\frac{2}{3}(18 - 6n + 12 + 3n)$
- $14(j - 2) - 3j(4 - 7)$
- $50(3a - b) - 20(b - 2a)$

1-2

Skills Practice***Properties of Real Numbers*****Name the sets of numbers to which each number belongs.**

1. 34

2. -525

3. 0.875

4. $\frac{12}{3}$

5. $-\sqrt{9}$

6. $\sqrt{30}$

Name the property illustrated by each equation.

7. $3 \cdot x = x \cdot 3$

8. $3a + 0 = 3a$

9. $2(r + w) = 2r + 2w$

10. $2r + (3r + 4r) = (2r + 3r) + 4r$

11. $5y\left(\frac{1}{5y}\right) = 1$

12. $15x(1) = 15x$

13. $0.6[25(0.5)] = [0.6(25)]0.5$

14. $(10b + 12b) + 7b = (12b + 10b) + 7b$

Name the additive inverse and multiplicative inverse for each number.

15. 15

16. 1.25

17. $-\frac{4}{5}$

18. $3\frac{3}{4}$

Simplify each expression.

19. $3x + 5 + 2x - 3$

20. $x - y - z + y - x + z$

21. $-(3g + 3h) + 5g - 10h$

22. $a^2 - a + 4a - 3a^2 + 1$

23. $3(m - z) + 5(2m - z)$

24. $2x - 3y - (5x - 3y - 2z)$

25. $6(2 + v) - 4(2v + 1)$

26. $\frac{1}{3}(15d + 3) - \frac{1}{2}(8 - 10d)$

1-2

Practice

Properties of Real Numbers

Name the sets of numbers to which each number belongs.

1. 6425

2. $\sqrt{7}$

3. 2π

4. 0

5. $\sqrt{\frac{25}{36}}$

6. $-\sqrt{16}$

7. -35

8. -31.8

Name the property illustrated by each equation.

9. $5x \cdot (4y + 3x) = 5x \cdot (3x + 4y)$

10. $7x + (9x + 8) = (7x + 9x) + 8$

11. $5(3x + y) = 5(3x + 1y)$

12. $7n + 2n = (7 + 2)n$

13. $3(2x)y = (3 \cdot 2)(xy)$

14. $3x \cdot 2y = 3 \cdot 2 \cdot x \cdot y$

15. $(6 + -6)y = 0y$

16. $\frac{1}{4} \cdot 4y = 1y$

17. $5(x + y) = 5x + 5y$

18. $4n + 0 = 4n$

Name the additive inverse and multiplicative inverse for each number.

19. 0.4

20. -1.6

21. $-\frac{11}{16}$

22. $5\frac{5}{6}$

Simplify each expression.

23. $5x - 3y - 2x + 3y$

24. $-11a - 13b + 7a - 3b$

25. $8x - 7y - (3 - 6y)$

26. $4c - 2c - (4c + 2c)$

27. $3(r - 10s) - 4(7s + 2r)$

28. $\frac{1}{5}(10a - 15) + \frac{1}{2}(8 + 4a)$

29. $2(4 - 2x + y) - 4(5 + x - y)$

30. $\frac{5}{6}\left(\frac{3}{5}x + 12y\right) - \frac{1}{4}(2x - 12y)$

31. TRAVEL Olivia drives her car at 60 miles per hour for t hours. Ian drives his car at 50 miles per hour for $(t + 2)$ hours. Write a simplified expression for the sum of the distances traveled by the two cars.

32. NUMBER THEORY Use the properties of real numbers to tell whether the following statement is true or false: If $a > b$, it follows that $a\left(\frac{1}{a}\right) > b\left(\frac{1}{b}\right)$. Explain your reasoning.

1-2

Reading to Learn Mathematics

Properties of Real Numbers

Pre-Activity How is the Distributive Property useful in calculating store savings?

Read the introduction to Lesson 1-2 at the top of page 11 in your textbook.

- Why are all of the amounts listed on the register slip at the top of page 11 followed by negative signs?
- Describe two ways of calculating the amount of money you saved by using coupons if your register slip is the one shown on page 11.

Reading the Lesson

1. Refer to the Key Concepts box on page 11. The numbers $2.\overline{57}$ and $0.010010001\dots$ both involve decimals that “go on forever.” Explain why one of these numbers is rational and the other is irrational.
2. Write the Associative Property of Addition in symbols. Then illustrate this property by finding the sum $12 + 18 + 45$ in two different ways.
3. Consider the equations $(a \cdot b) \cdot c = a \cdot (b \cdot c)$ and $(a \cdot b) \cdot c = c \cdot (a \cdot b)$. One of the equations uses the Associative Property of Multiplication and one uses the Commutative Property of Multiplication. How can you tell which property is being used in each equation?

Helping You Remember

4. How can the meanings of the words *commuter* and *association* help you to remember the difference between the commutative and associative properties?

1-2 Enrichment

Properties of a Group

A set of numbers forms a group with respect to an operation if for that operation the set has (1) the Closure Property, (2) the Associative Property, (3) a member which is an identity, and (4) an inverse for each member of the set.

Example 1 Does the set $\{0, 1, 2, 3, \dots\}$ form a group with respect to addition?

Closure Property: For all numbers in the set, is $a + b$ in the set? $0 + 1 = 1$, and 1 is in the set; $0 + 2 = 2$, and 2 is in the set; and so on. The set has closure for addition.

Associative Property: For all numbers in the set, does $a + (b + c) = (a + b) + c$? $0 + (1 + 2) = (0 + 1) + 2$; $1 + (2 + 3) = (1 + 2) + 3$; and so on. The set is associative for addition.

Identity: Is there some number, i , in the set such that $i + a = a = a + i$ for all a ? $0 + 1 = 1 = 1 + 0$; $0 + 2 = 2 = 2 + 0$; and so on. The identity for addition is 0.

Inverse: Does each number, a , have an inverse, a' , such that $a' + a = a + a' = i$? The integer inverse of 3 is -3 since $-3 + 3 = 0$, and 0 is the identity for addition. But the set does not contain -3 . Therefore, there is no inverse for 3.

The set is not a group with respect to addition because only three of the four properties hold.

Example 2 Is the set $\{-1, 1\}$ a group with respect to multiplication?

Closure Property: $(-1)(-1) = 1$; $(-1)(1) = -1$; $(1)(-1) = -1$; $(1)(1) = 1$
The set has closure for multiplication.

Associative Property: $(-1)[(-1)(-1)] = (-1)(1) = -1$; and so on
The set is associative for multiplication.

Identity: $1(-1) = -1$; $1(1) = 1$
The identity for multiplication is 1.

Inverse: -1 is the inverse of -1 since $(-1)(-1) = 1$, and 1 is the identity.
 1 is the inverse of 1 since $(1)(1) = 1$, and 1 is the identity.
Each member has an inverse.

The set $\{-1, 1\}$ is a group with respect to multiplication because all four properties hold.

Tell whether the set forms a group with respect to the given operation.

- | | |
|--|---|
| 1. {integers}, addition | 2. {integers}, multiplication |
| 3. $\{\frac{1}{2}, \frac{2}{2}, \frac{3}{2}, \dots\}$, addition | 4. {multiples of 5}, multiplication |
| 5. $\{x, x^2, x^3, x^4, \dots\}$ addition | 6. $\{\sqrt{1}, \sqrt{2}, \sqrt{3}, \dots\}$, multiplication |
| 7. {irrational numbers}, addition | 8. {rational numbers}, addition |

1-3

Study Guide and Intervention**Solving Equations**

Verbal Expressions to Algebraic Expressions The chart suggests some ways to help you translate word expressions into algebraic expressions. Any letter can be used to represent a number that is not known.

Word Expression	Operation
and, plus, sum, increased by, more than	addition
minus, difference, decreased by, less than	subtraction
times, product, of (as in $\frac{1}{2}$ of a number)	multiplication
divided by, quotient	division

Example 1 Write an algebraic expression to represent 18 less than the quotient of a number and 3.

$$\frac{n}{3} - 18$$

Example 2 Write a verbal sentence to represent $6(n - 2) = 14$.

Six times the difference of a number and two is equal to 14.

Exercises

Write an algebraic expression to represent each verbal expression.

- the sum of six times a number and 25
- four times the sum of a number and 3
- 7 less than fifteen times a number
- the difference of nine times a number and the quotient of 6 and the same number
- the sum of 100 and four times a number
- the product of 3 and the sum of 11 and a number
- four times the square of a number increased by five times the same number
- 23 more than the product of 7 and a number

Write a verbal sentence to represent each equation.

9. $3n - 35 = 79$

10. $2(n^3 + 3n^2) = 4n$

11. $\frac{5n}{n + 3} = n - 8$

1-3 Study Guide and Intervention *(continued)***Solving Equations**

Properties of Equality You can solve equations by using addition, subtraction, multiplication, or division.

Addition and Subtraction Properties of Equality	For any real numbers a , b , and c , if $a = b$, then $a + c = b + c$ and $a - c = b - c$.
Multiplication and Division Properties of Equality	For any real numbers a , b , and c , if $a = b$, then $a \cdot c = b \cdot c$ and, if c is not zero, $\frac{a}{c} = \frac{b}{c}$.

Example 1 Solve $100 - 8x = 140$.

$$\begin{aligned} 100 - 8x &= 140 \\ 100 - 8x - 100 &= 140 - 100 \\ -8x &= 40 \\ x &= -5 \end{aligned}$$

Example 2 Solve $4x + 5y = 100$ for y .

$$\begin{aligned} 4x + 5y &= 100 \\ 4x + 5y - 4x &= 100 - 4x \\ 5y &= 100 - 4x \\ y &= \frac{1}{5}(100 - 4x) \\ y &= 20 - \frac{4}{5}x \end{aligned}$$

Exercises

Solve each equation. Check your solution.

1. $3s = 45$

2. $17 = 9 - a$

3. $5t - 1 = 6t - 5$

4. $\frac{2}{3}m = \frac{1}{2}$

5. $7 - \frac{1}{2}x = 3$

6. $-8 = -2(z + 7)$

7. $0.2b = 10$

8. $3x + 17 = 5x - 13$

9. $5(4 - k) = -10k$

10. $120 - \frac{3}{4}y = 60$

11. $\frac{5}{2}n = 98 - n$

12. $4.5 + 2p = 8.7$

13. $4n + 20 = 53 - 2n$

14. $100 = 20 - 5r$

15. $2x + 75 = 102 - x$

Solve each equation or formula for the specified variable.

16. $a = 3b - c$, for b

17. $\frac{s}{2t} = 10$, for t

18. $h = 12g - 1$, for g

19. $\frac{3pq}{r} = 12$, for p

20. $2xy = x + 7$, for x

21. $\frac{d}{2} + \frac{f}{4} = 6$, for f

22. $3(2j - k) = 108$, for j

23. $3.5s - 42 = 14t$, for s

24. $\frac{m}{n} + 5m = 20$, for m

25. $4x - 3y = 10$, for y

1-3 Skills Practice

Solving Equations

Write an algebraic expression to represent each verbal expression.

1. 4 times a number, increased by 7
2. 8 less than 5 times a number
3. 6 times the sum of a number and 5
4. the product of 3 and a number, divided by 9
5. 3 times the difference of 4 and a number
6. the product of -11 and the square of a number

Write a verbal expression to represent each equation.

7. $n - 8 = 16$
8. $8 + 3x = 5$
9. $b^2 + 3 = b$
10. $\frac{y}{3} = 2 - 2y$

Name the property illustrated by each statement.

11. If $a = 0.5b$, and $0.5b = 10$, then $a = 10$.
12. If $d + 1 = f$, then $d = f - 1$.
13. If $-7x = 14$, then $14 = -7x$.
14. If $(8 + 7)r = 30$, then $15r = 30$.

Solve each equation. Check your solution.

15. $4m + 2 = 18$
16. $x + 4 = 5x + 2$
17. $3t = 2t + 5$
18. $-3b + 7 = -15 + 2b$
19. $-5x = 3x - 24$
20. $4v + 20 - 6 = 34$
21. $a - \frac{2a}{5} = 3$
22. $2.2n + 0.8n + 5 = 4n$

Solve each equation or formula for the specified variable.

23. $I = prt$, for p
24. $y = \frac{1}{4}x - 12$, for x
25. $A = \frac{x + y}{2}$, for y
26. $A = 2\pi r^2 + 2\pi rh$, for h

1-3 Practice

Solving Equations

Write an algebraic expression to represent each verbal expression.

- 2 more than the quotient of a number and 5
- the sum of two consecutive integers
- 5 times the sum of a number and 1
- 1 less than twice the square of a number

Write a verbal expression to represent each equation.

- $5 - 2x = 4$
- $3y = 4y^3$
- $3c = 2(c - 1)$
- $\frac{m}{5} = 3(2m + 1)$

Name the property illustrated by each statement.

- If $t - 13 = 52$, then $52 = t - 13$.
- If $8(2q + 1) = 4$, then $2(2q + 1) = 1$.
- If $h + 12 = 22$, then $h = 10$.
- If $4m = -15$, then $-12m = 45$.

Solve each equation. Check your solution.

- $14 = 8 - 6r$
- $9 + 4n = -59$
- $\frac{3}{4} - \frac{1}{2}n = \frac{5}{8}$
- $\frac{5}{6}s + \frac{3}{4} = \frac{11}{12}$
- $-1.6r + 5 = -7.8$
- $6x - 5 = 7 - 9x$
- $5(6 - 4v) = v + 21$
- $6y - 5 = -3(2y + 1)$

Solve each equation or formula for the specified variable.

- $E = mc^2$, for m
- $c = \frac{2d + 1}{3}$, for d
- $h = vt - gt^2$, for v
- $E = \frac{1}{2}Iw^2 + U$, for I

Define a variable, write an equation, and solve the problem.

- GEOMETRY** The length of a rectangle is twice the width. Find the width if the perimeter is 60 centimeters.
- GOLF** Luis and three friends went golfing. Two of the friends rented clubs for \$6 each. The total cost of the rented clubs and the green fees for each person was \$76. What was the cost of the green fees for each person?

1-3

Reading to Learn Mathematics***Solving Equations***

Pre-Activity How can you find the most effective level of intensity for your workout?

Read the introduction to Lesson 1-3 at the top of page 20 in your textbook.

- To find your target heart rate, what two pieces of information must you supply?
- Write an equation that shows how to calculate your target heart rate.

Reading the Lesson

- a. How are algebraic expressions and equations alike?
- b. How are algebraic expressions and equations different?
- c. How are algebraic expressions and equations related?

Read the following problem and then write an equation that you could use to solve it. Do not actually solve the equation. In your equation, let m be the number of miles driven.

2. When Louisa rented a moving truck, she agreed to pay \$28 per day plus \$0.42 per mile. If she kept the truck for 3 days and the rental charges (without tax) were \$153.72, how many miles did Louisa drive the truck?

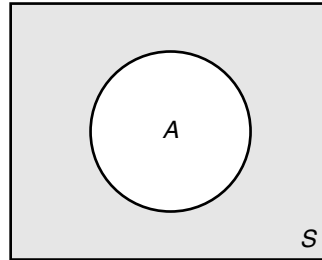
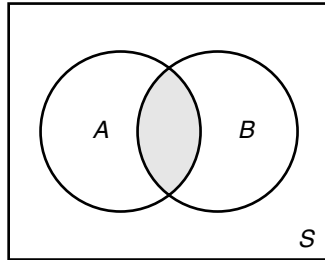
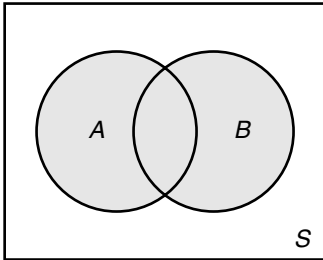
Helping You Remember

3. How can the words *reflection* and *symmetry* help you remember and distinguish between the reflexive and symmetric properties of equality? Think about how these words are used in everyday life or in geometry.

1-3 Enrichment

Venn Diagrams

Relationships among sets can be shown using Venn diagrams. Study the diagrams below. The circles represent sets A and B , which are subsets of set S .



The union of A and B consists of all elements in *either* A or B .

The intersection of A and B consists of all elements in *both* A and B .

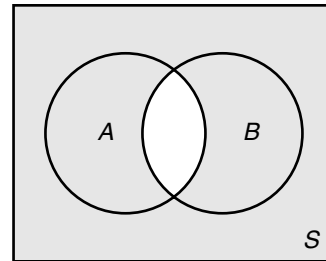
The complement of A consists of all elements *not* in A .

You can combine the operations of union, intersection, and finding the complement.

Example

Shade the region $(A \cap B)'$.

$(A \cap B)'$ means the complement of the intersection of A and B . First find the intersection of A and B . Then find its complement.



Draw a Venn diagram and shade the region indicated.

1. $A' \cap B$

2. $A' \cup B$

3. $A' \cap B'$

4. $A' \cup B'$

5. $(A \cup B)'$

6. $A \cap B'$

Draw a Venn diagram and three overlapping circles. Then shade the region indicated.

7. $(A \cup B) \cup C'$

8. $(A \cup B)' \cap C'$

9. $A \cup (B \cup C)$

10. $(A \cup B) \cup C$

11. Is the union operation associative?

12. Is the intersection operation associative?

1-4

Study Guide and Intervention

Solving Absolute Value Equations

Absolute Value Expressions The **absolute value** of a number is the number of units it is from 0 on a number line. The symbol $|x|$ is used to represent the absolute value of a number x .

Absolute Value	<ul style="list-style-type: none"> • Words For any real number a, if a is positive or zero, the absolute value of a is a. If a is negative, the absolute value of a is the opposite of a. • Symbols For any real number a, $a = a$, if $a \geq 0$, and $a = -a$, if $a < 0$.
-----------------------	---

Example 1 Evaluate $|-4| - |-2x|$
if $x = 6$.

$$\begin{aligned} |-4| - |-2x| &= |-4| - |-2 \cdot 6| \\ &= |-4| - |-12| \\ &= 4 - 12 \\ &= -8 \end{aligned}$$

Example 2 Evaluate $|2x - 3y|$
if $x = -4$ and $y = 3$.

$$\begin{aligned} |2x - 3y| &= |2(-4) - 3(3)| \\ &= |-8 - 9| \\ &= |-17| \\ &= 17 \end{aligned}$$

Exercises

Evaluate each expression if $w = -4$, $x = 2$, $y = \frac{1}{2}$, and $z = -6$.

1. $|2x - 8|$

2. $|6 + z| - |-7|$

3. $5 + |w + z|$

4. $|x + 5| - |2w|$

5. $|x| - |y| - |z|$

6. $|7 - x| + |3x|$

7. $|w - 4x|$

8. $|wz| - |xy|$

9. $|z| - 3|5yz|$

10. $5|w| + 2|z - 2y|$

11. $|z| - 4|2z + y|$

12. $10 - |xw|$

13. $|6y + z| + |yz|$

14. $3|wx| + \frac{1}{4}|4x + 8y|$

15. $7|yz| - 30$

16. $14 - 2|w - xy|$

17. $|2x - y| + 5y$

18. $|xyz| + |wxz|$

19. $z|z| + x|x|$

20. $12 - |10x - 10y|$

21. $\frac{1}{2}|5z + 8w|$

22. $|yz - 4w| - w$

23. $\frac{3}{4}|wz| + \frac{1}{2}|8y|$

24. $xz - |xz|$

1-4 Study Guide and Intervention *(continued)***Solving Absolute Value Equations**

Absolute Value Equations Use the definition of absolute value to solve equations containing absolute value expressions.

For any real numbers a and b , where $b \geq 0$, if $|a| = b$ then $a = b$ or $a = -b$.

Always check your answers by substituting them into the original equation. Sometimes computed solutions are not actual solutions.

Example Solve $|2x - 3| = 17$. Check your solutions.

Case 1

$$\begin{aligned} a &= b \\ 2x - 3 &= 17 \\ 2x - 3 + 3 &= 17 + 3 \\ 2x &= 20 \\ x &= 10 \end{aligned}$$

CHECK

$$\begin{aligned} |2x - 3| &= 17 \\ |2(10) - 3| &= 17 \\ |20 - 3| &= 17 \\ |17| &= 17 \\ 17 &= 17 \checkmark \end{aligned}$$

Case 2

$$\begin{aligned} a &= -b \\ 2x - 3 &= -17 \\ 2x - 3 + 3 &= -17 + 3 \\ 2x &= -14 \\ x &= -7 \end{aligned}$$

CHECK

$$\begin{aligned} |2(-7) - 3| &= 17 \\ |-14 - 3| &= 17 \\ |-17| &= 17 \\ 17 &= 17 \checkmark \end{aligned}$$

There are two solutions, 10 and -7 .

Exercises

Solve each equation. Check your solutions.

1. $|x + 15| = 37$

2. $|t - 4| - 5 = 0$

3. $|x - 5| = 45$

4. $|m + 3| = 12 - 2m$

5. $|5b + 9| + 16 = 2$

6. $|15 - 2k| = 45$

7. $5n + 24 = |8 - 3n|$

8. $|8 + 5a| = 14 - a$

9. $\frac{1}{3}|4p - 11| = p + 4$

10. $|3x - 1| = 2x + 11$

11. $\left| \frac{1}{3}x + 3 \right| = -1$

12. $40 - 4x = 2|3x - 10|$

13. $5f - |3f + 4| = 20$

14. $|4b + 3| = 15 - 2b$

15. $\frac{1}{2}|6 - 2x| = 3x + 1$

16. $|16 - 3x| = 4x - 12$

1-4

Skills Practice

Solving Absolute Value Equations

Evaluate each expression if $w = 0.4$, $x = 2$, $y = -3$, and $z = -10$.

1. $|5w|$

2. $|-9y|$

3. $|9y - z|$

4. $-|17z|$

5. $-|10z - 31|$

6. $-|8x - 3y| + |2y + 5x|$

7. $25 - |5z + 1|$

8. $44 + |-2x - y|$

9. $2|4w|$

10. $3 - |1 - 6w|$

11. $|-3x - 2y| - 4$

12. $6.4 + |w - 1|$

Solve each equation. Check your solutions.

13. $|y + 3| = 2$

14. $|5a| = 10$

15. $|3k - 6| = 2$

16. $|2g + 6| = 0$

17. $10 = |1 - c|$

18. $|2x + x| = 9$

19. $|p - 7| = -14$

20. $2|3w| = 12$

21. $|7x - 3x| + 2 = 18$

22. $4|7 - y| - 1 = 11$

23. $|3n - 2| = \frac{1}{2}$

24. $|8d - 4d| + 5 = 13$

25. $-5|6a + 2| = -15$

26. $|k| + 10 = 9$

1-4 Practice**Solving Absolute Value Equations**

Evaluate each expression if $a = -1$, $b = -8$, $c = 5$, and $d = -1.4$.

1. $|6a|$

2. $|2b + 4|$

3. $-|10d + a|$

4. $|17c| + |3b - 5|$

5. $-6|10a - 12|$

6. $|2b - 1| - |-8b + 5|$

7. $|5a - 7| + |3c - 4|$

8. $|1 - 7c| - |a|$

9. $-3|0.5c + 2| - |-0.5b|$

10. $|4d| + |5 - 2a|$

11. $|a - b| + |b - a|$

12. $|2 - 2d| - 3|b|$

Solve each equation. Check your solutions.

13. $|n - 4| = 13$

14. $|x - 13| = 2$

15. $|2y - 3| = 29$

16. $7|x + 3| = 42$

17. $|3u - 6| = 42$

18. $|5x - 4| = -6$

19. $-3|4x - 9| = 24$

20. $-6|5 - 2y| = -9$

21. $|8 + p| = 2p - 3$

22. $|4w - 1| = 5w + 37$

23. $4|2y - 7| + 5 = 9$

24. $-2|7 - 3y| - 6 = -14$

25. $2|4 - s| = -3s$

26. $5 - 3|2 + 2w| = -7$

27. $5|2r + 3| - 5 = 0$

28. $3 - 5|2d - 3| = 4$

29. WEATHER A thermometer comes with a guarantee that the stated temperature differs from the actual temperature by no more than 1.5 degrees Fahrenheit. Write and solve an equation to find the minimum and maximum actual temperatures when the thermometer states that the temperature is 87.4 degrees Fahrenheit.

30. OPINION POLLS Public opinion polls reported in newspapers are usually given with a margin of error. For example, a poll with a margin of error of $\pm 5\%$ is considered accurate to within plus or minus 5% of the actual value. A poll with a stated margin of error of $\pm 3\%$ predicts that candidate Tonwe will receive 51% of an upcoming vote. Write and solve an equation describing the minimum and maximum percent of the vote that candidate Tonwe is expected to receive.

1-4

Reading to Learn Mathematics***Solving Absolute Value Equations***

Pre-Activity How can an absolute value equation describe the magnitude of an earthquake?

Read the introduction to Lesson 1-4 at the top of page 28 in your textbook.

- What is a seismologist and what does magnitude of an earthquake mean?
- Why is an absolute value equation rather than an equation without absolute value used to find the extremes in the actual magnitude of an earthquake in relation to its measured value on the Richter scale?
- If the magnitude of an earthquake is estimated to be 6.9 on the Richter scale, it might actually have a magnitude as low as _____ or as high as _____.

Reading the Lesson

1. Explain how $-a$ could represent a positive number. Give an example.
2. Explain why the absolute value of a number can never be negative.
3. What does the sentence $b \geq 0$ mean?
4. What does the symbol \emptyset mean as a solution set?

Helping You Remember

5. How can the number line model for absolute value that is shown on page 28 of your textbook help you remember that many absolute value equations have two solutions?

1-4 Enrichment

Considering All Cases in Absolute Value Equations

You have learned that absolute value equations with one set of absolute value symbols have two cases that must be considered. For example, $|x + 3| = 5$ must be broken into $x + 3 = 5$ or $-(x + 3) = 5$. For an equation with two sets of absolute value symbols, four cases must be considered.

Consider the problem $|x + 2| + 3 = |x + 6|$. First we must write the equations for the case where $x + 6 \geq 0$ and where $x + 6 < 0$. Here are the equations for these two cases:

$$|x + 2| + 3 = x + 6$$

$$|x + 2| + 3 = -(x + 6)$$

Each of these equations also has two cases. By writing the equations for both cases of each equation above, you end up with the following four equations:

$$x + 2 + 3 = x + 6$$

$$x + 2 + 3 = -(x + 6)$$

$$-(x + 2) + 3 = x + 6$$

$$-x - 2 + 3 = -(x + 6)$$

Solve each of these equations and check your solutions in the original equation,

$$|x + 2| + 3 = |x + 6|. \text{ The only solution to this equation is } -\frac{5}{2}.$$

Solve each absolute value equation. Check your solution.

1. $|x - 4| = |x + 7|$

2. $|2x + 9| = |x - 3|$

3. $|-3x - 6| = |5x + 10|$

4. $|x + 4| - 6 = |x - 3|$

5. How many cases would there be for an absolute value equation containing three sets of absolute value symbols?

6. List each case and solve $|x + 2| + |2x - 4| = |x - 3|$. Check your solution.

1-5 Study Guide and Intervention

Solving Inequalities

Solve Inequalities The following properties can be used to solve inequalities.

Addition and Subtraction Properties for Inequalities	Multiplication and Division Properties for Inequalities
For any real numbers a , b , and c : 1. If $a < b$, then $a + c < b + c$ and $a - c < b - c$. 2. If $a > b$, then $a + c > b + c$ and $a - c > b - c$.	For any real numbers a , b , and c , with $c \neq 0$: 1. If c is positive and $a < b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$. 2. If c is positive and $a > b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. 3. If c is negative and $a < b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. 4. If c is negative and $a > b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$.

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

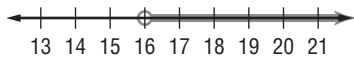
Example 1 Solve $2x + 4 > 36$. Then graph the solution set on a number line.

$$2x + 4 - 4 > 36 - 4$$

$$2x > 32$$

$$x > 16$$

The solution set is $\{x \mid x > 16\}$.



Example 2 Solve $17 - 3w \geq 35$. Then graph the solution set on a number line.

$$17 - 3w \geq 35$$

$$17 - 3w - 17 \geq 35 - 17$$

$$-3w \geq 18$$

$$w \leq -6$$

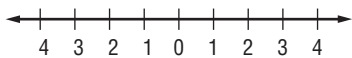
The solution set is $(-\infty, -6]$.



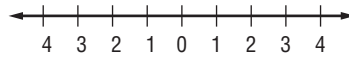
Exercises

Solve each inequality. Describe the solution set using set-builder or interval notation. Then graph the solution set on a number line.

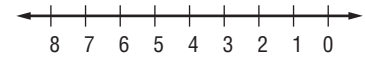
1. $7(7a - 9) \leq 84$



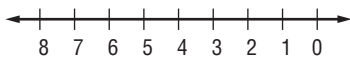
2. $3(9z + 4) > 35z - 4$



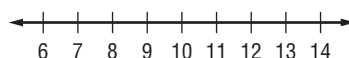
3. $5(12 - 3n) < 165$



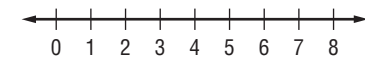
4. $18 - 4k < 2(k + 21)$



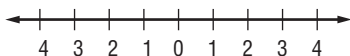
5. $4(b - 7) + 6 < 22$



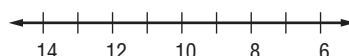
6. $2 + 3(m + 5) \geq 4(m + 3)$



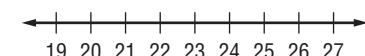
7. $4x - 2 > -7(4x - 2)$



8. $\frac{1}{3}(2y - 3) > y + 2$



9. $2.5d + 15 \leq 75$



1-5 Study Guide and Intervention *(continued)***Solving Inequalities**

Real-World Problems with Inequalities Many real-world problems involve inequalities. The chart below shows some common phrases that indicate inequalities.

<	>	≤	≥
is less than is fewer than	is greater than is more than	is at most is no more than is less than or equal to	is at least is no less than is greater than or equal to

Example

SPORTS The Vikings play 36 games this year. At midseason, they have won 16 games. How many of the remaining games must they win in order to win at least 80% of *all* their games this season?

Let x be the number of remaining games that the Vikings must win. The total number of games they will have won by the end of the season is $16 + x$. They want to win at least 80% of their games. Write an inequality with \geq .

$$\begin{aligned} 16 + x &\geq 0.8(36) \\ x &\geq 0.8(36) - 16 \\ x &\geq 12.8 \end{aligned}$$

Since they cannot win a fractional part of a game, the Vikings must win at least 13 of the games remaining.

Exercises

- 1. PARKING FEES** The city parking lot charges \$2.50 for the first hour and \$0.25 for each additional hour. If the most you want to pay for parking is \$6.50, solve the inequality $2.50 + 0.25(x - 1) \leq 6.50$ to determine for how many hours you can park your car.

PLANNING For Exercises 2 and 3, use the following information.

Ethan is reading a 482-page book for a book report due on Monday. He has already read 80 pages. He wants to figure out how many pages per hour he needs to read in order to finish the book in less than 6 hours.

- Write an inequality to describe this situation.
- Solve the inequality and interpret the solution.

BOWLING For Exercises 4 and 5, use the following information.

Four friends plan to spend Friday evening at the bowling alley. Three of the friends need to rent shoes for \$3.50 per person. A string (game) of bowling costs \$1.50 per person. If the friends pool their \$40, how many strings can they afford to bowl?

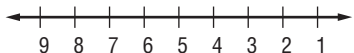
- Write an equation to describe this situation.
- Solve the inequality and interpret the solution.

1-5 Skills Practice

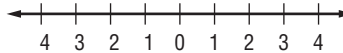
Solving Inequalities

Solve each inequality. Describe the solution set using set-builder or interval notation. Then, graph the solution set on a number line.

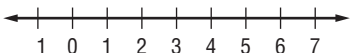
1. $\frac{z}{-4} \geq 2$



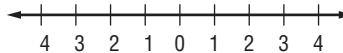
2. $3a + 7 \leq 16$



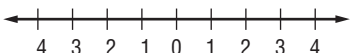
3. $16 < 3q + 4$



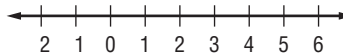
4. $20 - 3s > 7s$



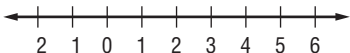
5. $3x \geq -9$



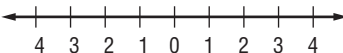
6. $4b - 9 \leq 7$



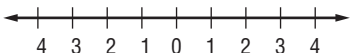
7. $2z < -9 + 5z$



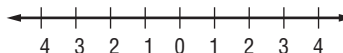
8. $7f - 9 > 3f - 1$



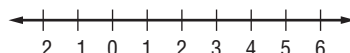
9. $-3s - 8 \leq 5s$



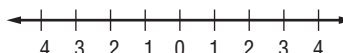
10. $7t - (t - 4) \leq 25$



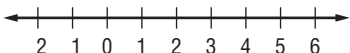
11. $0.7m + 0.3m \geq 2m - 4$



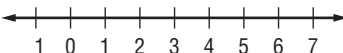
12. $4(5x + 7) \leq 13$



13. $1.7y - 0.78 > 5$



14. $4x - 9 > 2x + 1$



Define a variable and write an inequality for each problem. Then solve.

15. Nineteen more than a number is less than 42.

16. The difference of three times a number and 16 is at least 8.

17. One half of a number is more than 6 less than the same number.

18. Five less than the product of 6 and a number is no more than twice that same number.

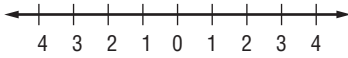
1-5

Practice

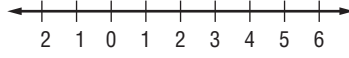
Solving Inequalities

Solve each inequality. Describe the solution set using set-builder or interval notation. Then, graph the solution set on a number line.

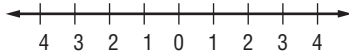
1. $8x - 6 \geq 10$



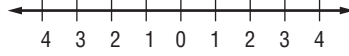
2. $23 - 4u < 11$



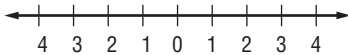
3. $-16 - 8r \geq 0$



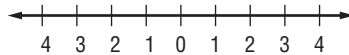
4. $14s < 9s + 5$



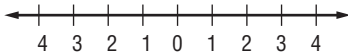
5. $9x - 11 > 6x - 9$



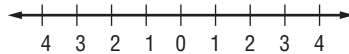
6. $-3(4w - 1) > 18$



7. $1 - 8u \leq 3u - 10$



8. $17.5 < 19 - 2.5x$



9. $9(2r - 5) - 3 < 7r - 4$



10. $1 + 5(x - 8) \leq 2 - (x + 5)$



11. $\frac{4x - 3}{2} \geq -3.5$



12. $q - 2(2 - q) \leq 0$



13. $-36 - 2(w + 77) > -4(2w + 52)$



14. $4n - 5(n - 3) > 3(n + 1) - 4$



Define a variable and write an inequality for each problem. Then solve.

15. Twenty less than a number is more than twice the same number.

16. Four times the sum of twice a number and -3 is less than 5.5 times that same number.

17. **HOTELS** The Lincoln's hotel room costs \$90 a night. An additional 10% tax is added. Hotel parking is \$12 per day. The Lincoln's expect to spend \$30 in tips during their stay. Solve the inequality $90x + 90(0.1)x + 12x + 30 \leq 600$ to find how many nights the Lincoln's can stay at the hotel without exceeding total hotel costs of \$600.

18. **BANKING** Jan's account balance is \$3800. Of this, \$750 is for rent. Jan wants to keep a balance of at least \$500. Write and solve an inequality describing how much she can withdraw and still meet these conditions.

1-5

Reading to Learn Mathematics***Solving Inequalities*****Pre-Activity** How can inequalities be used to compare phone plans?

Read the introduction to Lesson 1-5 at the top of page 33 in your textbook.

- Write an inequality comparing the number of minutes per month included in the two phone plans.
- Suppose that in one month you use 230 minutes of airtime on your wireless phone. Find your monthly cost with each plan.

Plan 1: _____ Plan 2: _____

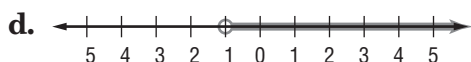
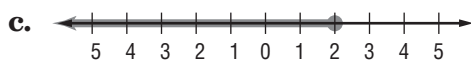
Which plan should you choose? _____

Reading the Lesson

1. There are several different ways to write or show inequalities. Write each of the following in interval notation.

a. $\{x \mid x < -3\}$

b. $\{x \mid x \geq 5\}$



2. Show how you can write an inequality symbol followed by a number to describe each of the following situations.

- There are fewer than 600 students in the senior class.
- A student may enroll in no more than six courses each semester.
- To participate in a concert, you must be willing to attend at least ten rehearsals.
- There is space for at most 165 students in the high school band.

Helping You Remember

3. One way to remember something is to explain it to another person. A common student error in solving inequalities is forgetting to reverse the inequality symbol when multiplying or dividing both sides of an inequality by a negative number. Suppose that your classmate is having trouble remembering this rule. How could you explain this rule to your classmate?

1-5 Enrichment***Equivalence Relations***

A relation R on a set A is an *equivalence relation* if it has the following properties.

- Reflexive Property** For any element a of set A , $a R a$.
- Symmetric Property** For all elements a and b of set A , if $a R b$, then $b R a$.
- Transitive Property** For all elements a , b , and c of set A , if $a R b$ and $b R c$, then $a R c$.

Equality on the set of all real numbers is reflexive, symmetric, and transitive. Therefore, it is an equivalence relation.

In each of the following, a relation and a set are given. Write *yes* if the relation is an equivalence relation on the given set. If it is not, tell which of the properties it fails to exhibit.


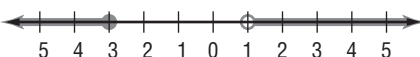
1. $<$, {all numbers}
2. \cong , {all triangles in a plane}
3. is the sister of, {all women in Tennessee}
4. \geq , {all numbers}
5. is a factor of, {all nonzero integers}
6. \sim , {all polygons in a plane}
7. is the spouse of, {all people in Roanoke, Virginia}
8. \perp , {all lines in a plane}
9. is a multiple of, {all integers}
10. is the square of, {all numbers}
11. \parallel , {all lines in a plane}
12. has the same color eyes as, {all members of the Cleveland Symphony Orchestra}
13. is the greatest integer not greater than, {all numbers}
14. is the greatest integer not greater than, {all integers}

1-6


Study Guide and Intervention

Solving Compound and Absolute Value Inequalities

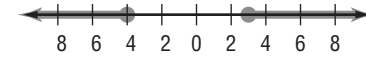
Compound Inequalities A compound inequality consists of two inequalities joined by the word *and* or the word *or*. To solve a compound inequality, you must solve each part separately.

<p>And Compound Inequalities</p>	<p>Example: $x > -4$ and $x < 3$</p> 	<p>The graph is the intersection of solution sets of two inequalities.</p>
<p>Or Compound Inequalities</p>	<p>Example: $x \leq -3$ or $x > 1$</p> 	<p>The graph is the union of solution sets of two inequalities.</p>

Example 1 Solve $-3 \leq 2x + 5 \leq 19$.
Graph the solution set on a number line.

$$\begin{aligned} -3 &\leq 2x + 5 & \text{and} & & 2x + 5 &\leq 19 \\ -8 &\leq 2x & & & 2x &\leq 14 \\ -4 &\leq x & & & x &\leq 7 \\ -4 &\leq x &\leq 7 & & & \end{aligned}$$


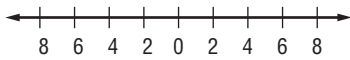
Example 2 Solve $3y - 2 \geq 7$ or $2y - 1 \leq -9$. Graph the solution set on a number line.

$$\begin{aligned} 3y - 2 &\geq 7 & \text{or} & & 2y - 1 &\leq -9 \\ 3y &\geq 9 & \text{or} & & 2y &\leq -8 \\ y &\geq 3 & \text{or} & & y &\leq -4 \end{aligned}$$


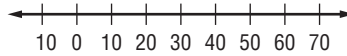
Exercises

Solve each inequality. Graph the solution set on a number line.

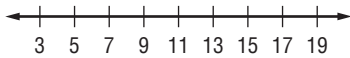
1. $-10 < 3x + 2 \leq 14$



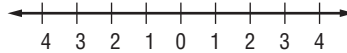
2. $3a + 8 < 23$ or $\frac{1}{4}a - 6 > 7$



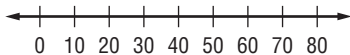
3. $18 < 4x - 10 < 50$



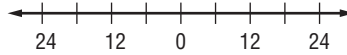
4. $5k + 2 < -13$ or $8k - 1 > 19$



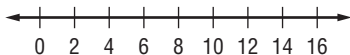
5. $100 \leq 5y - 45 \leq 225$



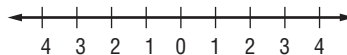
6. $\frac{2}{3}b - 2 > 10$ or $\frac{3}{4}b + 5 < -4$



7. $22 < 6w - 2 < 82$



8. $4d - 1 > -9$ or $2d + 5 < 11$



1-6 Study Guide and Intervention *(continued)*

Solving Compound and Absolute Value Inequalities

Absolute Value Inequalities Use the definition of absolute value to rewrite an absolute value inequality as a compound inequality.

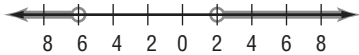
For all real numbers a and b , $b > 0$, the following statements are true.

1. If $|a| < b$, then $-b < a < b$.
2. If $|a| > b$, then $a > b$ or $a < -b$.

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

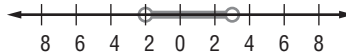
Example 1 Solve $|x + 2| > 4$. Graph the solution set on a number line.

By statement 2 above, if $|x + 2| > 4$, then $x + 2 > 4$ or $x + 2 < -4$. Subtracting 2 from both sides of each inequality gives $x > 2$ or $x < -6$.



Example 2 Solve $|2x - 1| < 5$. Graph the solution set on a number line.

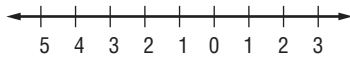
By statement 1 above, if $|2x - 1| < 5$, then $-5 < 2x - 1 < 5$. Adding 1 to all three parts of the inequality gives $-4 < 2x < 6$. Dividing by 2 gives $-2 < x < 3$.



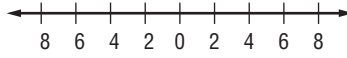
Exercises

Solve each inequality. Graph the solution set on a number line.

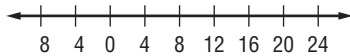
1. $|3x + 4| < 8$



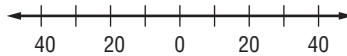
2. $|4s| + 1 > 27$



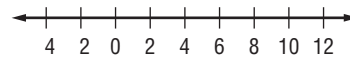
3. $\left| \frac{c}{2} - 3 \right| \leq 5$



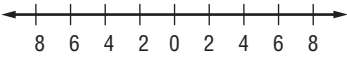
4. $|a + 9| \geq 30$



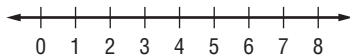
5. $|2f - 11| > 9$



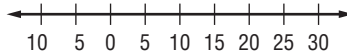
6. $|5w + 2| < 28$



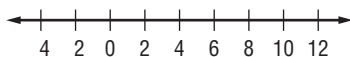
7. $|10 - 2k| < 2$



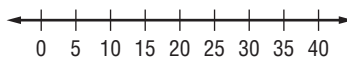
8. $\left| \frac{x}{2} - 5 \right| + 2 > 10$



9. $|4b - 11| < 17$



10. $|100 - 3m| > 20$

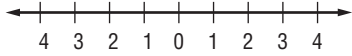


1-6 Skills Practice

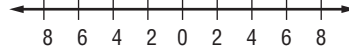
Solving Compound and Absolute Value Inequalities

Write an absolute value inequality for each of the following. Then graph the solution set on a number line.

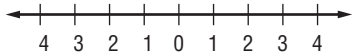
1. all numbers greater than or equal to 2 or less than or equal to -2



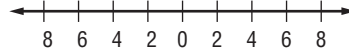
2. all numbers less than 5 and greater than -5



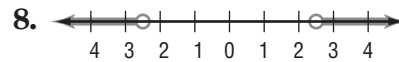
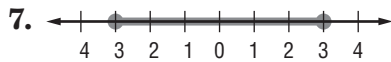
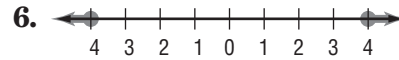
3. all numbers less than -1 or greater than 1



4. all numbers between -6 and 6

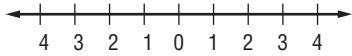


Write an absolute value inequality for each graph.

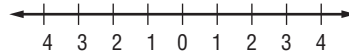


Solve each inequality. Graph the solution set on a number line.

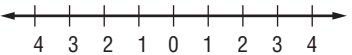
9. $2c + 1 > 5$ or $c < 0$



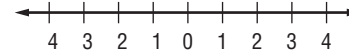
10. $-11 \leq 4y - 3 \leq 1$



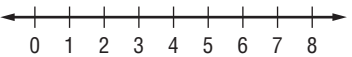
11. $10 > -5x > 5$



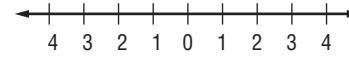
12. $4a \geq -8$ or $a < -3$



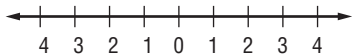
13. $8 < 3x + 2 \leq 23$



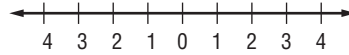
14. $w - 4 \leq 10$ or $-2w \leq 6$



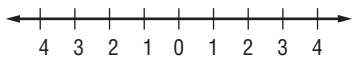
15. $|t| \geq 3$



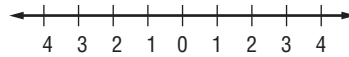
16. $|6x| < 12$



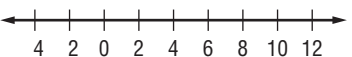
17. $|-7r| > 14$



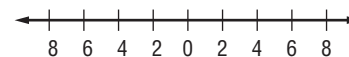
18. $|p + 2| \leq -2$



19. $|n - 5| < 7$



20. $|h + 1| \geq 5$



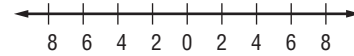
1-6

Practice

Solving Compound and Absolute Value Inequalities

Write an absolute value inequality for each of the following. Then graph the solution set on a number line.

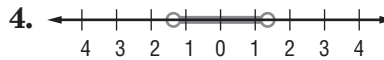
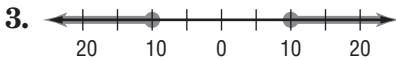
1. all numbers greater than 4 or less than -4



2. all numbers between -1.5 and 1.5, including -1.5 and 1.5

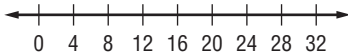


Write an absolute value inequality for each graph.

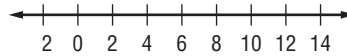


Solve each inequality. Graph the solution set on a number line.

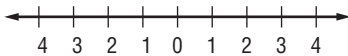
5. $-8 \leq 3y - 20 < 52$



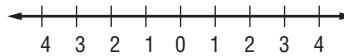
6. $3(5x - 2) < 24$ or $6x - 4 > 4 + 5x$



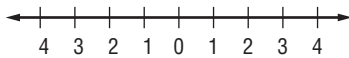
7. $2x - 3 > 15$ or $3 - 7x < 17$



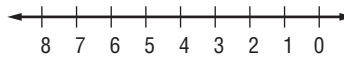
8. $15 - 5x \leq 0$ and $5x + 6 \geq -14$



9. $|2w| \geq 5$



10. $|y + 5| < 2$



11. $|x - 8| \geq 3$



12. $|2z - 2| \leq 3$



13. $|2x + 2| - 7 \leq -5$



14. $|x| > x - 1$



15. $|3b + 5| \leq -2$



16. $|3n - 2| - 2 < 1$



17. **RAINFALL** In 90% of the last 30 years, the rainfall at Shell Beach has varied no more than 6.5 inches from its mean value of 24 inches. Write and solve an absolute value inequality to describe the rainfall in the other 10% of the last 30 years.

18. **MANUFACTURING** A company's guidelines call for each can of soup produced not to vary from its stated volume of 14.5 fluid ounces by more than 0.08 ounces. Write and solve an absolute value inequality to describe acceptable can volumes.

1-6

Reading to Learn Mathematics

Solving Compound and Absolute Value Inequalities

Pre-Activity How are compound inequalities used in medicine?

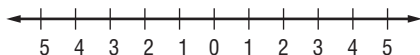
Read the introduction to Lesson 1-6 at the top of page 40 in your textbook.

- Five patients arrive at a medical laboratory at 11:30 A.M. for a glucose tolerance test. Each of them is asked when they last had something to eat or drink. Some of the patients are given the test and others are told that they must come back another day. Each of the patients is listed below with the times when they started to fast. (The P.M. times refer to the night before.) Which of the patients were accepted for the test?

Ora	5:00 A.M.	Juanita	11:30 P.M.
Jason	1:30 A.M.	Samir	5:00 P.M.

Reading the Lesson

- Write a compound inequality that says, “ x is greater than -3 and x is less than or equal to 4 .”
 - Graph the inequality that you wrote in part a on a number line.



- Use a compound inequality and set-builder notation to describe the following graph.



- Write a statement equivalent to $|4x - 5| > 2$ that does not use the absolute value symbol.
- Write a statement equivalent to $|3x + 7| < 8$ that does not use the absolute value symbol.

Helping You Remember

- Many students have trouble knowing whether an absolute value inequality should be translated into an *and* or an *or* compound inequality. Describe a way to remember which of these applies to an absolute value inequality. Also describe how to recognize the difference from a number line graph.

1-6 Enrichment

Conjunctions and Disjunctions

An absolute value inequality may be solved as a compound sentence.

Example 1 Solve $|2x| < 10$.

$|2x| < 10$ means $2x < 10$ and $2x > -10$.

Solve each inequality. $x < 5$ and $x > -5$.

Every solution for $|2x| < 10$ is a replacement for x that makes both $x < 5$ and $x > -5$ true.

A compound sentence that combines two statements by the word *and* is a *conjunction*.

Example 2 Solve $|3x - 7| \geq 11$.

$|3x - 7| \geq 11$ means $3x - 7 \geq 11$ or $3x - 7 \leq -11$.

Solve each inequality. $3x \geq 18$ or $3x \leq -4$

$$x \geq 6 \text{ or } x \leq -\frac{4}{3}$$

Every solution for the inequality is a replacement for x that makes either $x \geq 6$ or $x \leq -\frac{4}{3}$ true.

A compound sentence that combines two statements by the word *or* is a *disjunction*.

Solve each inequality. Then write whether the solution is a conjunction or disjunction.

1. $|4x| > 24$

2. $|x - 7| \leq 8$

3. $|2x + 5| < 1$

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

5. $|3x - 1| \leq x$

6. $7 - |2x| > 5$

7. $\left|\frac{x}{2} + 1\right| \geq 7$

8. $\left|\frac{x - 4}{3}\right| < 4$

9. $|8 - x| > 2$

10. $|5 - 2x| \leq 3$

Chapter 1 Test, Form 1

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

1. Find the value of $4 + 5[14 - (8 + 3)]$.
 A. 27 B. 19 C. 49 D. -46 1. _____
2. Evaluate $(a + y)^2 + 2y$ if $a = 5$ and $y = -3$.
 A. 58 B. -2 C. 70 D. 10 2. _____
3. Evaluate $|-2b|$ if $b = 8$.
 A. -16 B. 6 C. 10 D. 16 3. _____
4. The formula $S = \frac{n(n+1)}{2}$ can be used to find the sum of the first n natural numbers. Find the sum of the first 20 natural numbers.
 A. 210 B. 20 C. 21 D. 190 4. _____
5. Name the sets of numbers to which $\frac{3}{5}$ belongs.
 A. rationals B. naturals, reals
 C. rationals, reals D. integers, rationals, reals 5. _____
6. Simplify $2(x + 3) + 5(2x - 1)$.
 A. $12x + 1$ B. $12x + 11$ C. $12x + 2$ D. $9x + 1$ 6. _____
7. Select the algebraic expression that represents the verbal expression:
the product of nine and a number
 A. $\frac{9}{n}$ B. $9n$ C. $9 - n$ D. $9 + n$ 7. _____

For Questions 8–11, solve each equation.

8. $\frac{1}{2}y = 8$
 A. 16 B. 4 C. $\frac{1}{4}$ D. 10 8. _____
9. $4(2x - 9) = 3x + 4$
 A. -32 B. $\frac{-32}{5}$ C. $\frac{40}{3}$ D. 8 9. _____
10. $|x - 5| = 4$
 A. {9} B. {1} C. {9, 1} D. \emptyset 10. _____
11. $4|x + 3| = 20$
 A. {2} B. {-8} C. {2, -8} D. \emptyset 11. _____

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

12. Which equation could be used to solve the following problem?
The sum of 4 times a number and 7 is 31. Find the number.
- A. $4(n + 7) = 31$ B. $4n = 7 + 31$
 C. $4n - 7 = 31$ D. $4n + 7 = 31$ 12. _____

13. Amar is five years older than his sister. The sum of their ages is 39. Find Amar's age.
- A. 17 B. 22 C. 34 D. 29 13. _____

For Questions 14–18, solve each inequality.



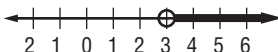
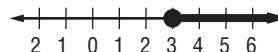
14. $-8w + 4 \geq 12$
- A. $\{w \mid w \leq -1\}$ B. $\{w \mid w \geq -1\}$
 C. $\{w \mid w \leq -2\}$ D. $\{w \mid w \geq -2\}$ 14. _____

15. $2x - 1 \leq 5$ or $7 - x < 1$
- A. $\{x \mid 3 \leq x < 6\}$ B. $\{x \mid x \leq 3$ or $x > 6\}$
 C. $\{x \mid x < 6\}$ D. \emptyset 15. _____

16. $-3 \leq 2y + 1 \leq 9$
- A. $\left\{y \mid -\frac{3}{2} \leq y \leq 4\right\}$ B. all real numbers
 C. $\left\{y \mid -2 \leq y \leq \frac{9}{2}\right\}$ D. $\{y \mid -2 \leq y \leq 4\}$ 16. _____

17. $|m + 8| > 3$
- A. $\{m \mid -11 < m < -5\}$ B. $\{m \mid m < -5$ or $m > 5\}$
 C. $\{m \mid m < -11$ or $m > -5\}$ D. \emptyset 17. _____

18. $|2x - 5| \leq 9$
- A. $\{x \mid -4 \leq x \leq 14\}$ B. $\{x \mid -2 \leq x \leq 7\}$
 C. $\{x \mid x \leq -2$ or $x \geq 7\}$ D. all real numbers 18. _____

19. Identify the graph of the solution set of $9 > 3 + 2x$.
- A.  B. 
 C.  D.  19. _____

20. A parking garage charges \$2 for the first hour and \$1 for each additional hour. Fran has \$7.50 to spend for parking. What is the greatest number of hours Fran can park?
- A. 3 B. 5 C. 6 D. 7 20. _____

Bonus Solve $11 \leq 7 - x < -5$. **B:** _____

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

- Find the value of $5 + 4 \cdot 3 \div 6 - 1$.
 A. $\frac{7}{2}$ B. $\frac{27}{5}$ C. 6 D. $\frac{17}{5}$ 1. _____
- Evaluate $2b(4a - c^2)$ if $a = 5$, $b = \frac{3}{2}$, and $c = 11$.
 A. -303 B. 423 C. -6 D. $-\frac{303}{2}$ 2. _____
- Evaluate $-|3c - d|$ if $c = -1$ and $d = 5$.
 A. 8 B. 2 C. -7 D. -8 3. _____
- The formula for the surface area of a sphere is $A = 4\pi r^2$, where r is the length of the radius. Find the surface area of a sphere with a radius of 14 feet. Use $\frac{22}{7}$ for π .
 A. 7248 ft^2 B. 7744 ft^2 C. 2464 ft^2 D. 704 ft^2 4. _____
- Name the sets of numbers to which $-\frac{1}{3}$ belongs.
 A. naturals, rationals B. rational, reals
 C. integers, rationals D. integers, rationals, reals 5. _____
- Simplify $\frac{1}{3}(15x - 9) + \frac{1}{5}(25x + 5)$.
 A. $10x - 2$ B. $\frac{64}{3}x - \frac{32}{15}$ C. $5x - 2$ D. $\frac{1}{5}(40x - 4)$ 6. _____
- Name the property illustrated by $5(x + y) = 5(y + x)$.
 A. Commutative Property of Multiplication
 B. Distributive Property
 C. Commutative Property of Addition
 D. Associative Property of Addition 7. _____

For Questions 8–11, solve each equation.

- $23 = 5 - \frac{2}{3}m$
 A. -42 B. -12 C. -27 D. 42 8. _____
- $18 = 3|4x - 10|$
 A. {1, -1} B. {1, 4} C. {4, -4} D. {4} 9. _____
- $5(2x - 6) = 7x - 3$
 A. -9 B. 9 C. 11 D. \emptyset 10. _____
- $|x - 3| + 10 = 2$
 A. {-5} B. {-5, 11} C. {11} D. \emptyset 11. _____

1 Chapter 1 Test, Form 2A *(continued)*

12. Jamie is 4 years younger than her brother. Five years from now, the sum of their ages will be 32. Find Jamie's present age.
 A. 9 B. 10 C. 13 D. 14 12. _____

13. One side of a triangle is four centimeters longer than the shortest side. The third side of the triangle is twice as long as the shortest side. Find the length of the longest side of the triangle if its perimeter is 40 centimeters.
 A. 9 cm B. 13 cm C. 24 cm D. 18 cm 13. _____

For Questions 14–18, solve each inequality.

14. $0.38 > \frac{2x - 7}{5}$
 A. $\{x \mid x < 4.45\}$ B. $\{x \mid x < 98.5\}$ C. $\{x \mid x < 13\}$ D. $\{x \mid x < 3.69\}$ 14. _____

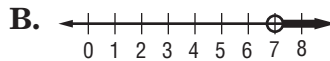
15. $9 \leq 7 - x \leq -1$
 A. $\{x \mid -2 \leq x \leq 8\}$ B. \emptyset
 C. $\{x \mid x \leq -2 \text{ or } x \geq 8\}$ D. $\{x \mid x \leq -2\}$ 15. _____

16. $5x - 4 \geq 26 \text{ or } 29 - 3x > 2$
 A. $\{x \mid 6 \leq x < 9\}$ B. $\{x \mid x \leq 6 \text{ or } x > 9\}$
 C. all real numbers D. $\{x \mid x \neq 9\}$ 16. _____

17. $|2x - 3| \leq 7$
 A. $\{x \mid x \leq 5\}$ B. $\{x \mid -5 \leq x \leq 5\}$
 C. $\{x \mid -2 \leq x \leq 5\}$ D. all real numbers 17. _____

18. $2|m + 7| > 8$
 A. $\{m \mid -11 < m < -3\}$ B. all real numbers
 C. $\{m \mid m < -13 \text{ or } m > -1\}$ D. $\{m \mid m < -11 \text{ or } m > -3\}$ 18. _____

19. Identify the graph of the solution set of $-2.3 < 4 + 0.9y$.



19. _____

20. One number is four times a second number. If you take one-half of the second number and increase it by the first number, the result is at least 45. Find the least possible value for the second number.
 A. 10 B. 9 C. 11 D. 12 20. _____

Bonus Carlos expects the grade on his next Algebra test to be between 75 and 85. Using g to represent Carlos' test grade, write an absolute value inequality to describe this situation.

B: _____

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

- Find the value of $5 + 8 \cdot 2 \div 4 - 11$.
 A. $-\frac{23}{4}$ B. $-\frac{11}{2}$ C. -3 D. -2 1. _____
- Evaluate $(a - y)^2 + 2y^3$ if $a = 2$ and $y = -3$.
 A. -29 B. 43 C. 79 D. -53 2. _____
- Evaluate $-|a - 3b|$ if $a = -2$ and $b = 6$.
 A. 20 B. -16 C. -20 D. -36 3. _____
- The formula $A = \frac{180(n-2)}{n}$ relates the measure A of an interior angle of a regular polygon to the number of sides n . If an interior angle measures 120° , find the number of sides.
 A. 5 B. 6 C. 8 D. 10 4. _____
- Name the sets of numbers to which -28 belongs.
 A. integers B. naturals, integers, reals
 C. integers, rationals D. integers, rationals, reals 5. _____
- Simplify $\frac{1}{3}(6x + 3) - 4(3x - 2)$.
 A. $-10x + 9$ B. $-9x + 9$ C. $-10x - 1$ D. $-10x - 7$ 6. _____
- Name the property illustrated by $7 \cdot (9 + 1) = (9 + 1) \cdot 7$.
 A. Distributive Property
 B. Commutative Property of Multiplication
 C. Associative Property of Multiplication
 D. Commutative Property of Addition 7. _____

For Questions 8–11, solve each equation.

- $\frac{2}{5y} = \frac{3}{14}$
 A. $\frac{28}{15}$ B. $\frac{35}{3}$ C. $\frac{3}{35}$ D. $\frac{15}{28}$ 8. _____
- $3|x - 5| = 12$
 A. $\{9\}$ B. $\{1\}$ C. $\{1, 9\}$ D. \emptyset 9. _____
- $3(5x - 1) = 3x + 3$
 A. $\frac{1}{2}$ B. 2 C. -2 D. $-\frac{1}{2}$ 10. _____
- $|y - 8| + 6 = 15$
 A. $\{17\}$ B. $\{-1\}$ C. $\{17, -1\}$ D. \emptyset 11. _____

1 Chapter 1 Test, Form 2B *(continued)*

12. Yoshi is 12 years older than his sister. Six years from now, the sum of their ages will be 32. Find Yoshi's present age.
 A. 10 B. 18 C. 4 D. 16 12. _____

13. Two sides of a triangle are equal in length. The length of the third side is three meters less than the sum of the lengths of the other two sides. Find the length of the longest side of the triangle if its perimeter is 29 meters.
 A. 8 m B. 13 m C. $\frac{55}{3}$ m D. 10 m 13. _____

For Questions 14–18, solve each inequality.

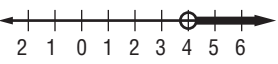
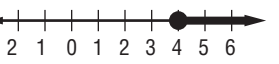
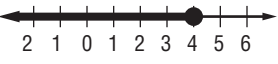

14. $-3(r - 11) + 15 \geq 9$
 A. $\{r \mid r \leq 13\}$ B. $\{r \mid r \geq 13\}$ C. $\{r \mid r \leq -13\}$ D. $\{r \mid r \geq -13\}$ 14. _____

15. $-2 < 4z + 10 \leq 12$
 A. $\{z \mid -3 < z \leq 2\}$ B. $\{z \mid -3 < z \leq 3\}$
 C. $\{z \mid -3 < z \leq \frac{1}{2}\}$ D. $\{z \mid -\frac{1}{2} < z \leq \frac{1}{2}\}$ 15. _____

16. $2x - 5 \leq 10$ or $33 - 4x < 5$
 A. $\{x \mid x \leq \frac{15}{2}$ or $x < 7\}$ B. $\{x \mid 7 < x \leq \frac{15}{2}\}$
 C. all real numbers D. \emptyset 16. _____

17. $3|m - 4| > 6$
 A. $\{m \mid 2 < m < 6\}$ B. $\{m \mid m < 2$ or $m > 6\}$
 C. $\{m \mid m < 1$ or $m > 7\}$ D. all real numbers 17. _____

18. $|3w - 7| \leq 2$
 A. $\{w \mid \frac{5}{3} \leq w \leq 3\}$ B. $\{w \mid -3 \leq w \leq 3\}$
 C. $\{w \mid w \leq 3\}$ D. all real numbers 18. _____

19. Identify the graph of the solution set of $8.5 > 6.1 + 0.6y$.
 A.  B. 
 C.  D.  19. _____

20. One number is two less than a second number. If you take one-half of the first number and increase it by the second number, the result is at least 41. Find the least possible value for the second number.
 A. 30 B. 28 C. $\frac{82}{3}$ D. 15 20. _____

Bonus Solve $|x| + x > 0$. **B:** _____

Chapter 1 Test, Form 2C

1. Find the value of $6 + 8^2 \div 4 - 2$. 1. _____

2. Evaluate $\frac{3a^2 + 2b}{c^2}$ if $a = 1$, $b = 2$, and $c = 3$. 2. _____

For Questions 3 and 4, evaluate each expression if $a = 2.5$ and $b = -8$.

3. $-|b - 2a|$ 3. _____

4. $3|b + 6| - |a|$ 4. _____

5. Use $I = prt$, the formula for simple interest over t years, to find I when $p = \$2500$, $r = 8.5\%$, and $t = 30$ months. 5. _____

Name the sets of numbers to which each number belongs.

6. 1.82 6. _____

7. $\sqrt{25}$ 7. _____

8. $\frac{5}{6}$ 8. _____

For Questions 9 and 10, name each property illustrated by each equation.

9. $\left(\frac{5}{11}\right)\left(2\frac{1}{5}\right) = 1$ 9. _____

10. $-ab + 0 = -ab$ 10. _____

11. Simplify $\frac{1}{4}(12v - 8) + 2(6v + 1)$. 11. _____

12. Write an algebraic expression to represent the verbal expression *ten less than the cube of a number*. 12. _____

Solve each equation.

13. $4x = 18$ 13. _____

14. $5x + 2 = 3x + 24$ 14. _____

15. $|2x + 3| = 7$ 15. _____

16. $4|x - 2| = 24$ 16. _____

1 Chapter 1 Test, Form 2C *(continued)*

Define a variable, write an equation, and solve the problem.

17. The sum of twice a number and 6 is 28. What is the number? **17.** _____

18. Lana ordered concert tickets that cost \$7.50 for children and \$12.00 for adults. She ordered 8 more children's tickets than adults' tickets. Her total bill was \$138. How many of each type of ticket did she order? **18.** _____

For Questions 19–24, solve each inequality. Describe the solution set using set builder or interval notation. Then, graph the solution set on a number line.

19. $3t - 5 > 31$ **19.** _____


20. $2(x + 3) \leq 54$ **20.** _____


21. $-5 < 6n - 17 \leq 13$ **21.** _____


22. $7v + 6 \leq -22$ or $11 - v < 19$ **22.** _____


23. $|x - 2| > 4$ **23.** _____


24. $|2x + 3| \leq 5$ **24.** _____


25. Define a variable and write an inequality. Then solve the resulting inequality. The Braves play 162 games in a season. So far, they have won 56 and lost 40. To win at least 60% of *all* games, how many more games must they win? **25.** _____

Bonus Find the value of k so that the equation below has the solution set $\{-5\}$. **B:** _____
 $4(x + 3) = x(3 - k)$

Chapter 1 Test, Form 2D

1. Find the value of $4 + 6^2 \div 9 - 3$. 1. _____

2. Evaluate $\frac{5a - b^2}{3c}$ if $a = 4$, $b = 3$, and $c = 2$. 2. _____

For Questions 3 and 4, evaluate each expression if $a = 3.5$ and $b = -10$.

3. $-|b + 2a|$ 3. _____

4. $|-3 - a| - \left|\frac{b}{2}\right|$ 4. _____

5. Use $I = prt$, the formula for simple interest over t years, to find I when $p = \$2000$, $r = 6\%$, and $t = 18$ months. 5. _____

Name the sets of numbers to which each number belongs.

6. $\sqrt{16}$ 6. _____

7. -2.5 7. _____

8. $\frac{7}{9}$ 8. _____

For Questions 9 and 10, name the property illustrated by each equation.

9. $3ab + (-3ab) = 0$ 9. _____

10. $1xyz = xyz$ 10. _____

11. Simplify $\frac{1}{5}(10x - 15) + 4(2x - 5)$. 11. _____

12. Write an algebraic expression to represent the verbal expression *five times the sum of seven and a number*. 12. _____

Solve each equation.

13. $5n - 3 = 12$ 13. _____

14. $7x - 10 = 4x + 11$ 14. _____

15. $|6w + 3| = 9$ 15. _____

16. $|x - 4| - 5 = -2$ 16. _____

1 Chapter 1 Test, Form 2D *(continued)*

Define a variable, write an equation, and solve the problem.

17. The sum of 3 times a number and 1 is 25. Find the number. **17.** _____

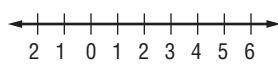
18. The length of a rectangular garden is 7 feet longer than its width. The perimeter of the garden is 38 feet. Find the width and length of the garden. **18.** _____

For Questions 19–24, solve each inequality. Describe the solution set using set builder or interval notation. Then, graph the solution set on a number line.

19. $10t - 14 < 6$ **19.** _____


20. $3(4x - 2) \geq 7x + 19$ **20.** _____


21. $-7 < 9x + 2 < 11$ **21.** _____


22. $5n + 7 < 2$ or $17 - 2n \leq 11$ **22.** _____


23. $|x - 5| > 3$ **23.** _____


24. $|2x + 1| \leq 9$ **24.** _____


25. Define a variable and write an inequality. Then solve the resulting inequality. The 25 coins in Danielle’s piggy bank have a value of at least \$1.44. The bank contains only nickels and dimes. What is the fewest number of dimes that could be in the bank? **25.** _____

Bonus Find the value of k so that the equation below has the solution set $\{-3\}$. **B:** _____
 $3(2x - 1) = x(2 - k)$

Chapter 1 Test, Form 3

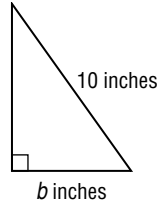
1. Find the value of $8 + 2 \cdot 3^2 \div 6 - 14$. 1. _____
2. Evaluate $(n - v)^2 + 3v^3$ if $n = 5$ and $v = -2$. 2. _____
3. Determine whether the statement is *sometimes*, *always*, or *never* true. Explain your reasoning.
If a and b are real numbers, then $-|a + 2b|$ is negative. 3. _____
4. The formula for the volume of a cylinder is $V = \pi r^2 h$, where r is the radius of the base and h is the height of the cylinder. Find the volume of a cylinder with a radius of 1.2 inches and a height of 3 inches. Use 3.14 for π . 4. _____
5. Name the sets of numbers to which each number belongs. 5. a. _____
a. -4 b. $\sqrt{15}$ c. 0 d. $\frac{3}{4}$ e. 2 b. _____
c. _____
d. _____
e. _____
6. Simplify $\frac{3}{8}(16x - 8) + \frac{2}{3}(15y + 12)$. 6. _____
7. Write a verbal expression to represent the algebraic expression $4(n^3 + 2n)$. 7. _____

For Questions 8–11, solve each equation.

8. $-6(n - 8) = 4(12 - 5n) + 14n$ 8. _____
9. $2|3x - 5| = 14$ 9. _____
10. $A = \frac{1}{2}h(a + b)$, for a 10. _____
11. $|y - 8| + 7 = 3$ 11. _____
12. Define a variable, write an equation, and solve the problem. The width of a rectangle is 3 meters more than one-fourth its length. The perimeter is 10 meters more than twice its length. Find the length and width. 12. _____

1 Chapter 1 Test, Form 3 *(continued)*

13. The formula for the area of a triangle is $A = \frac{1}{2}bh$, where b represents the base length, and h represents the height. The perimeter of the triangle shown is 28 inches. Write an equation for the area A of this triangle in terms of its base length b .




13. _____

For Questions 14–19, solve each inequality. Describe the solution set using set builder or interval notation. Then, graph the solution set on a number line.


14. $2.8 < \frac{4x - 3}{5}$

14. _____


15. $-3(5y - 4) \geq 17$

15. _____



16. $5x + 2 \leq -18$ or $2x + 1 > 21$

16. _____



17. $\frac{33}{4} \leq 3w + 9 < 12$

17. _____


18. $|x - 3| > 5$

18. _____


19. $|3w - 7| \leq 2$

19. _____


20. Define a variable and write an inequality. Then solve the resulting inequality. Mr. Brooks plans to invest part of \$5000 in a stock that pays 8% interest annually. The rest will be invested in a savings account that pays 6% interest annually. Mr. Brooks wants to make at least \$350 on the investment for the first year. What is the least amount that should be invested in the stock?

20. _____

Bonus A jet is flying from Hawaii to San Francisco, a distance of 2400 miles. In still air, the jet flies at 600 mph, but there is now a 40-mph tailwind. In case of emergency, how many hours after takeoff will it be faster for the jet to go on to San Francisco rather than to return to Hawaii?

B: _____

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. a. State the property of real numbers or the property of equality that justifies each step in the solution of the equation given.

$$3x + 5 = 8x$$

Given

$$3x + 5 + (-3x) = 8x + (-3x)$$

$$3x + [(-3x) + 5] = 8x + (-3x)$$

$$[3x + (-3x)] + 5 = 8x + (-3x)$$

$$0 + 5 = 8x + (-3x)$$

$$5 = 8x + (-3x)$$

$$5 = [8 + (-3)]x$$

$$5 = 5 \cdot x$$

Substitution

$$\frac{1}{5} \cdot 5 = \frac{1}{5}(5x)$$

$$\frac{1}{5} \cdot 5 = \left(\frac{1}{5} \cdot 5\right)x$$

$$1 = 1 \cdot x$$

$$1 = x$$

$$x = 1$$

- b. Write your own solution of the equation $6(7 - x) + 3 = 9x$ as you would write it on a test. Compare your solution to the solution above. Did you use all of the same properties as you listed above to solve your equation? Explain.
2. Given the inequality $|x - 3| \leq k$, find a value of k , if possible, that satisfies each condition. In each case, explain your choice.
- Find a value of k for which the inequality has no solution.
 - Find a value of k for which the inequality has exactly one solution.
 - Find a value of k for which a solution exists but for which the solution set does not include 5.
3. a. Write a word problem for the inequality $2 + \frac{1}{4}x \leq 10$.
- b. Solve your problem and explain the meaning of your answer.
- c. Graph the solution of the inequality $2 + \frac{1}{4}x \leq 10$. Does the graph have meaning for your word problem? Why or why not?

absolute value	Division Property	irrational numbers	solution
Addition Property	empty set	Multiplication Property	Substitution Property
algebraic expression	equation	open sentence	Subtraction Property
Associative Property	formula	order of operations	Symmetric Property
Commutative Property	Identity Property	rational numbers	Transitive Property
compound inequality	intersection	real numbers	Trichotomy Property
counterexample	interval notation	Reflexive Property	union
Distributive Property	Inverse Property	set-builder notation	variable

Choose from the terms above to complete each sentence.

- The _____ of addition says that adding 0 to any number does not change its value.
- The _____ are the numbers that can be written as ratios of two integers, with the integer in the denominator not being 0.
- The property that allows you to switch the two sides of an equation is the _____.
- $3x = 3x$ is an example of the _____.
- The graph of a compound inequality containing the word *and* is the _____ of the graphs of the two separate inequalities.
- $\{x \mid x \leq 6.3\}$ describes a set by using _____.
- The _____ of Multiplication says that you can reverse the order of two factors without changing the value of their product.
- If $2y - 6 = 3$ and $3 = 4y + 21$, then $2y - 6 = 4y + 21$. This is an example of the _____.
- Two inequalities combined by the word *and* or the word *or* form a _____.
- The _____ of a number is the number of units between that number and 0 on a number line.

In your own words—
Define each term.

- irrational number
- Trichotomy Property

1

Chapter 1 Quiz*(Lessons 1-1 and 1-2)*

SCORE _____

1. Find the value of $40 - 6^2 \div 4 \cdot 3$. 1. _____
2. Evaluate $3n^2 - 2an$ if $a = -3$ and $n = 4$. 2. _____
3. The formula for the perimeter P of a rectangle is $P = 2(\ell + w)$, where ℓ represents the length, and w represents the width of the rectangle. Find the perimeter of a rectangle with a length of 19.2 meters and a width of 4.7 meters. 3. _____
4. Name the sets of numbers to which $\sqrt{5}$ belongs. 4. _____
5. Simplify $\frac{1}{3}(6v - 1) + \frac{3}{4}(8v + 2)$. 5. _____

1

Chapter 1 Quiz*(Lesson 1-3)*

SCORE _____

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

1. **Standardized Test Practice** If $7n + 3 = \frac{4}{3}$, what is the value of $7n + 5$?
 A. $-\frac{5}{3}$ B. $\frac{10}{3}$ C. $\frac{13}{3}$ D. $-\frac{5}{21}$ 1. _____

For Questions 2 and 3, solve each equation. Check your solution.

2. $\frac{3}{4} - \frac{2x}{3} = \frac{5x}{6} + \frac{1}{2}$ 2. _____
3. $8 - 7w = 3w + 9$ 3. _____
4. Solve $y = mx + b$ for x . 4. _____
5. Define a variable, write an equation, and solve the problem. Carla began a running program to prepare for track team try-outs. On her first day she ran 3 miles, and on her second day she ran 5 miles. Since then, Carla has run 7 miles each day. If her log book shows that Carla has run a total of 99 miles, for how many days has Carla been running 7 miles? 5. _____

1 Chapter 1 Quiz

SCORE _____

(Lessons 1-4 and 1-5)

1. Evaluate $|a - 8b|$ if $a = -3$ and $b = \frac{1}{4}$.

1. _____

For Questions 2 and 3, solve each equation.

2. $-4|3x - 1| = -20$

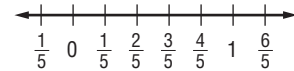
2. _____

3. $|5 + 2x| = x - 5$

3. _____

4. Solve $7 - 3x \leq 2x + 6$, and graph its solution set on a number line.

4. _____



5. Define a variable and write an inequality. Then solve. The Boston Celtics play an 82-game schedule. If they have won 41 of their first 50 games, how many more games must they win to win at least 70% of all 82 games?

5. _____

1 Chapter 1 Quiz

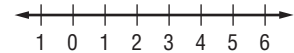
SCORE _____

(Lesson 1-6)

Solve each inequality. Describe the solution set using set builder or interval notation. Then, graph the solution set on a number line.

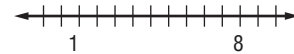
1. $3x - 5 > 4$ or $9 - 2x > 5$

1. _____



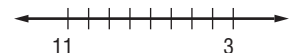
2. $-6 < 5m - 1 < 39$

2. _____



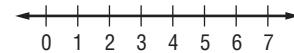
3. $|x + 7| > 4$

3. _____



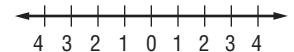
4. $|2x - 7| \leq 5$

4. _____



5. $|4x + 9| \geq -2$

5. _____



Chapter 1 Mid-Chapter Test*(Lessons 1–1 through 1–5)***Part I** For Questions 1–5, write the letter for the correct answer in the blank at the right of each question.

1. Find the value of $(9 + 2)8 - 6 \div 2$.
 A. 11 B. 41 C. 22 D. 85 1. _____
2. Name the sets of numbers to which -7 belongs.
 A. integers, rationals
 B. integers, rationals, reals
 C. whole numbers, integers, reals
 D. integers, reals 2. _____
3. Name the property illustrated by $-ab + ab = 0$.
 A. Additive Inverse B. Additive Identity
 C. Multiplicative Inverse D. Multiplicative Identity 3. _____
4. Solve $6(x - 5) = x + 5$.
 A. 2 B. 0 C. 7 D. 5 4. _____
5. Simplify $\frac{1}{2}(8y - 10) - 3(y + 1)$.
 A. $y - 8$ B. $7y - 2$ C. $y - 9$ D. $y - 13$ 5. _____

Part II

6. Write an algebraic expression to represent the verbal expression *the difference of three times a number x and 7*. 6. _____
7. Given the formula $C = \frac{5(F - 32)}{9}$, find the value of C if F is 68. 7. _____
8. Define a variable, write an equation, and solve the problem. Adults' tickets to a play cost \$5 and students' tickets cost \$2. If 295 tickets were sold and a total of \$950 was collected, how many students' tickets were sold? 8. _____
9. Evaluate $m + np^2$ if $m = 0.5$, $n = -3$, and $p = -2$. 9. _____
10. Solve $h = \frac{-b}{2a}$ for b . 10. _____
11. Find the value of $17 + [6 - (2^3 + 1)]$. 11. _____

1

Chapter 1 Cumulative Review

(Chapter 1)

1. Simplify $\left(-7\frac{1}{5}\right) \div \frac{1}{5}$

(Prerequisite Skill)

2. Evaluate $(-0.7)^2$.

(Prerequisite Skill)

1. _____

2. _____

For Questions 3 and 4, find the value of each expression.

3. $4 \cdot 6 \div 3 + 12$

(Lesson 1-1)

4. $19 - [(6 + 24) - 7 \cdot 2^2]$

(Lesson 1-1)

3. _____

4. _____

5. Use the formula $F = \frac{9}{5}C + 32$ to find the value of F if $C = 25$.

(Lesson 1-1)

5. _____

6. Name the sets of numbers to which the number 13 belongs.

(Lesson 1-2)

6. _____

7. Simplify $\frac{1}{4}(16x - 12) + \frac{1}{3}(9x + 3)$. (Lesson 1-2)

7. _____

8. Write an algebraic expression to represent the verbal expression *the square of a number increased by the cube of the same number*. (Lesson 1-3)

8. _____

Solve each equation.

9. $12x - 51 = 3(x + 7)$

(Lesson 1-3)

10. $|2y - 1| + 4 = 13$

(Lesson 1-4)

9. _____

10. _____

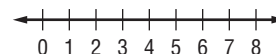
11. $-5(m - 5) = 3(10 - 2m) + m$ (Lesson 1-3)

11. _____

Solve each inequality. Graph the solution set.

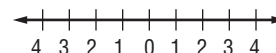
12. $4(t - 5) \geq 5 - t$ (Lesson 1-5)

12. _____



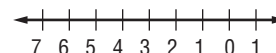
13. $3x + 5 \leq -10$ or $12 - x < 20$ (Lesson 1-6)

13. _____



14. $|x + 3| \geq 4$ (Lesson 1-6)

14. _____



Define a variable, write an equation, and solve the problem.

16. Forty-eight decreased by three times a number is thirty-six. Find the number. (Lesson 1-3)

16. _____

Define a variable and write an inequality. Then solve.

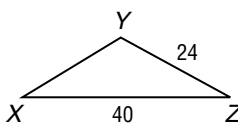
17. The Cincinnati Reds play 162 games in a season. So far they have won 57 games. How many more games must they win in order to win at least 65% of all games for the season?

(Lesson 1-5)

17. _____

1

Standardized Test Practice*(Chapter 1)***Part 1: Multiple Choice****Instructions:** Fill in the appropriate oval for the best answer.

- If $2x - 6$ is an even integer, what is the next consecutive even integer?
 A. $2x - 5$ B. $2x - 7$ C. $2x - 4$ D. $2x - 8$ 1. (A) (B) (C) (D)
- 9 is 18% of what number?
 E. 200 F. 50 G. 1.62 H. 50% 2. (E) (F) (G) (H)
- Which number is least?
 A. $\frac{3}{5}$ B. $\frac{5}{16}$ C. $\frac{19}{49}$ D. $\frac{5}{9}$ 3. (A) (B) (C) (D)
- The radius of a circle is tripled. What happens to the area of the circle?
 E. area is tripled F. area is multiplied by 6
 G. area is multiplied by 9 H. area is multiplied by $\frac{1}{3}$ 4. (E) (F) (G) (H)
- Which number is not a solution of $2x - 3 \geq 5$?
 A. 7 B. 2 C. 4 D. 6 5. (A) (B) (C) (D)
- Which represents a rational number?
 E. $\sqrt{17}$ F. $\sqrt{36}$ G. $\sqrt{50}$ H. $\sqrt{101}$ 6. (E) (F) (G) (H)
- In the figure shown, the length of \overline{XY} is $\frac{1}{3}$ of the perimeter of $\triangle ABC$. What is the length of \overline{XY} ?

 A. 16 B. 24 C. 96 D. 32 7. (A) (B) (C) (D)
- Which number is not prime?
 E. 73 F. 79 G. 91 H. 97 8. (E) (F) (G) (H)
- If $x < 0$, which of the following is negative?
 A. $-x$ B. x^2 C. x^3 D. $\frac{1}{-x}$ 9. (A) (B) (C) (D)
- If $a \blacktriangle b$ is defined as b^a , what is the value of $2 \blacktriangle 3$?
 E. 9 F. 8 G. 6 H. 3 10. (E) (F) (G) (H)
- If 6 more than the product of a number and -2 is greater than 10, which of the following could be that number?
 A. -3 B. -2 C. 0 D. 3 11. (A) (B) (C) (D)

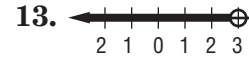
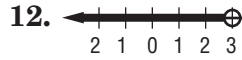
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Standardized Test Practice *(continued)*

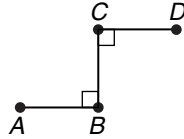
Part 2: Grid In

Instructions: Enter your answer by writing each digit of the answer in a column box and then shading in the appropriate oval that corresponds to that entry.

12. The average of 8, 6, 9, 12, and $4x$ is x .
What is the value of x ?

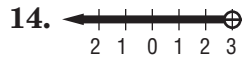


13. $\overline{BC} \perp \overline{CD}$
 $\overline{BC} \perp \overline{AB}$
 $AB = 3$
 $BC = 6$
 $CD = 5$



What is the length of the shortest path from A to D ?

14. If $\frac{3}{10} = \frac{x}{0.3}$, what is the value of x ?



15. Simplify $\frac{19 \cdot 19}{19 + 19 + 19}$.

Part 3: Quantitative Comparison

Instructions: Compare the quantities in columns A and B. Shade in
 (A) if the quantity in column A is greater;
 (B) if the quantity in column B is greater;
 (C) if the quantities are equal; or
 (D) if the relationship cannot be determined from the information given.

Column A

Column B

16.

$(0.05)^2$

$\sqrt{0.0025}$

16. (A) (B) (C) (D)

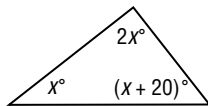
17.

$\frac{4b - 6}{2}$

$2b - 3$

17. (A) (B) (C) (D)

18.



$x + 20$

$2x$

18. (A) (B) (C) (D)

19.

$3g$

g

19. (A) (B) (C) (D)

1

Standardized Test Practice

Student Record Sheet (Use with pages 52–53 of the Student Edition.)

Part 1 Multiple Choice

Select the best answer from the choices given and fill in the corresponding oval.

1 (A) (B) (C) (D)

4 (A) (B) (C) (D)

7 (A) (B) (C) (D)

9 (A) (B) (C) (D)

2 (A) (B) (C) (D)

5 (A) (B) (C) (D)

8 (A) (B) (C) (D)

10 (A) (B) (C) (D)

3 (A) (B) (C) (D)

6 (A) (B) (C) (D)

Part 2 Short Response/Grid In

Solve the problem and write your answer in the blank.

For Questions 13–18, also enter your answer by writing each number or symbol in a box. Then fill in the corresponding oval for that number or symbol.

11 _____

13 _____

15 _____

17 _____

12 _____

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

14 _____

16 _____

18 _____

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	/	/	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Part 3 Quantitative Comparison

Select the best answer from the choices given and fill in the corresponding oval.

19 (A) (B) (C) (D)

21 (A) (B) (C) (D)

23 (A) (B) (C) (D)

20 (A) (B) (C) (D)

22 (A) (B) (C) (D)

Answers

NAME _____ DATE _____ PERIOD _____

1-1 Study Guide and Intervention *(continued)*

Expressions and Formulas

Formulas A formula is a mathematical sentence that uses variables to express the relationship between certain quantities. If you know the value of every variable except one in a formula, you can use substitution and the order of operations to find the value of the unknown variable.

Example To calculate the number of reams of paper needed to print n copies of a booklet that is p pages long, you can use the formula $r = \frac{np}{500}$, where r is the number of reams needed. How many reams of paper must you buy to print 172 copies of a 25-page booklet?

$$\begin{aligned} \text{Substitute } n = 172 \text{ and } p = 25 \text{ into the formula } r = \frac{np}{500}. \\ r &= \frac{(172)(25)}{500} \\ &= \frac{43,000}{500} \\ &= 8.6 \end{aligned}$$

You cannot buy 8.6 reams of paper. You will need to buy 9 reams to print 172 copies.

Exercises

For Exercises 1–3, use the following information.

For a science experiment, Sarah counts the number of breaths needed for her to blow up a beach ball. She will then find the volume of the beach ball in cubic centimeters and divide by the number of breaths to find the average volume of air per breath.

- Her beach ball has a radius of 9 inches. First she converts the radius to centimeters using the formula $C = 2.54I$, where C is a length in centimeters and I is the same length in inches. How many centimeters are there in 9 inches? **22.86 cm**
- The volume of a sphere is given by the formula $V = \frac{4}{3}\pi r^3$, where V is the volume of the sphere and r is its radius. What is the volume of the beach ball in cubic centimeters? (Use 3.14 for π .) **50,015 cm³**
- Sarah takes 40 breaths to blow up the beach ball. What is the average volume of air per breath? **about 1250 cm³**
- A person's basal metabolic rate (or BMR) is the number of calories needed to support his or her bodily functions for one day. The BMR of an 80-year-old man is given by the formula $BMR = 12w - (0.02)(6)12w$, where w is the man's weight in pounds. What is the BMR of an 80-year-old man who weighs 170 pounds? **1795 calories**

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Glencoe Algebra 2

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1-1 Study Guide and Intervention

Expressions and Formulas

Order of Operations

- Simplify the expressions inside grouping symbols.
- Evaluate all powers.
- Do all multiplications and divisions from left to right.
- Do all additions and subtractions from left to right.

Example 1 Evaluate $[18 - (6 + 4)] \div 2$.

$$\begin{aligned} [18 - (6 + 4)] \div 2 &= [18 - 10] \div 2 \\ &= 8 \div 2 \\ &= 4 \end{aligned}$$

Example 2 Evaluate $3x^2 + x(y - 5)$ if $x = 3$ and $y = 0.5$.

Replace each variable with the given value.

$$\begin{aligned} 3x^2 + x(y - 5) &= 3 \cdot (3)^2 + 3(0.5 - 5) \\ &= 3 \cdot (9) + 3(-4.5) \\ &= 27 - 13.5 \\ &= 13.5 \end{aligned}$$

Exercises

Find the value of each expression.

- $1. 14 + (6 \div 2)$ **17**
- $2. 11 - (3 + 2)^2$ **-14**
- $3. 2 + (4 - 2)^3 - 6$ **4**
- $4. 9(3^2 + 6)$ **135**
- $5. (5 + 2^3)^2 - 5^2$ **144**
- $6. 5^2 + \frac{1}{4} + 18 \div 2$ **34.25**
- $7. \frac{16 + 9^3 \div 4}{1 - 2^2}$ **-6**
- $8. (7 - 3^2)^2 + 6^2$ **40**
- $9. 20 \div 2^2 + 6$ **11**
- $10. 12 + 6 \div 3 - 2(4)$ **6**
- $11. 14 + (8 - 20 \div 2) - 7$ **-7**
- $12. 6(7) + 4 + 4 - 5$ **38**
- $13. 8(4^2 \div 8 - 32) - 240$ **-240**
- $14. \frac{6 + 4 \div 2}{4 \div 6 - 1}$ **-24**
- $15. \frac{6 + 9 \div 3 + 15}{8 - 2}$ **4**

Evaluate each expression if $a = 8$, $b = -3$, $c = 4$, and $d = -\frac{1}{2}$.

- $\frac{ab}{d}$ **49.2**
- $5(6c - 8b + 10d)$ **215**
- $\frac{c^2 - 1}{b - d}$ **-6**
- $ac - bd$ **31.3**
- $(b - c)^2 + 4a$ **81.8**
- $\frac{a}{d} + 6b - 5c$ **-54.4**
- $3\left(\frac{c}{d}\right) - b$ **-21**
- $cd + \frac{b}{d}$ **4**
- $24.d(a + c)$ **-6.1**
- $a + b \div c$ **7.45**
- $b - c + 4 \div d$ **-15**
- $\frac{a}{b} - d$ **8.7**

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Glencoe Algebra 2

Lesson 1-1

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1-1 Skills Practice

Expressions and Formulas

Find the value of each expression.

1. $18 \div 2 \times 3$ **27**
 2. $2 \cdot 9 + 6 \div 2 + 1$ **13**
 3. $(3 - 8)^2(4) - 3$ **97**
 4. $5 + 3(2 - 12 \div 2) - 7$
 5. $-\frac{1}{3}[-9 + 10(3)] - 7$
 6. $\frac{6(7 - 5)}{4}$ **3**
 7. $(168 \div 7)^3 - 4^3$ **152**
 8. $[3(5) - 128 \div 2^2]5 - 85$
- Evaluate each expression if $r = -1$, $s = 3$, $t = 12$, $v = 0$, and $w = -\frac{1}{2}$.

9. $6r + 2s$ **0**
10. $2st - 4rs$ **84**
11. $w(s - r) - 2$
12. $s + 2r - 16v$ **1**
13. $(4s)^2$ **144**
14. $s^2r - wt - 3$
15. $2(3r + w) - 7$
16. $\frac{3v + t}{5s - t}$ **4**
17. $-w[t + (t - r)]$ **$\frac{25}{2}$**
18. $\frac{rv^3}{s^2}$ **0**
19. $9r^2 + (s^2 - 1)t$ **105**
20. $7s - 2v + \frac{2w}{r}$ **22**

21. TEMPERATURE The formula $K = C + 273$ gives the temperature in kelvins (K) for a given temperature in degrees Celsius. What is the temperature in kelvins when the temperature is 55 degrees Celsius? **328 K**

22. TEMPERATURE The formula $C = \frac{5}{9}(F - 32)$ gives the temperature in degrees Celsius for a given temperature in degrees Fahrenheit. What is the temperature in degrees Celsius when the temperature is 68 degrees Fahrenheit? **20°C**

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1-1 Practice (Average)

Expressions and Formulas

Find the value of each expression.

1. $3(4 - 7) - 11$ **-20**
2. $4(12 - 4^2)$ **-16**
3. $1 + 2 - 3(4) \div 2 - 3$
4. $12 - [20 - 2(6^2 \div 3 \times 2^2)]$ **88**
5. $20 \div (5 - 3) + 5^2(3)$ **85**
6. $(-2)^3 - (3)(8) + (5)(10)$ **18**
7. $18 - \{5 - [34 - (17 - 11)]\}$ **41**
8. $[4(5 - 3) - 2(4 - 8)] \div 16$ **1**
9. $\frac{1}{2}[6 - 4^2]$ **-5**
10. $\frac{1}{4}[-5 + 5(-3)]$ **-5**
11. $\frac{-8(13 - 37)}{6}$ **32**
12. $\frac{(-8)^2}{5 - 9} - (-1)^2 + 4(-9) - 53$

Evaluate each expression if $a = \frac{3}{4}$, $b = -8$, $c = -2$, $d = 3$, and $e = \frac{1}{3}$.

13. $ab^2 - d$ **45**
14. $(c + d)b - 8$
15. $\frac{ab}{c} + d^2$ **12**
16. $\frac{d(b - c)}{ac}$ **12**
17. $(b - de)e^2 - 1$
18. $ac^3 - b^2de - 70$
19. $-b[a + (c - d)^2]$ **206**
20. $\frac{ac^4}{d} - \frac{c}{e^2}$ **22**
21. $9bc - \frac{1}{e}$ **141**
22. $2ab^2 - (d^3 - c)$ **67**

23. TEMPERATURE The formula $F = \frac{9}{5}C + 32$ gives the temperature in degrees Fahrenheit for a given temperature in degrees Celsius. What is the temperature in degrees Fahrenheit when the temperature is -40 degrees Celsius? **-40°F**

24. PHYSICS The formula $h = 120t - 16t^2$ gives the height h in feet of an object t seconds after it is shot upward from Earth's surface with an initial velocity of 120 feet per second. What will the height of the object be after 6 seconds? **144 ft**

25. AGRICULTURE Faith owns an organic apple orchard. From her experience the last few seasons, she has developed the formula $P = 20x - 0.01x^2 - 240$ to predict her profit P in dollars this season if her trees produce x bushels of apples. What is Faith's predicted profit this season if her orchard produces 300 bushels of apples? **\$4860**

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1-1

Reading to Learn Mathematics
Expressions and Formulas

Pre-Activity How are formulas used by nurses?

Read the introduction to Lesson 1-1 at the top of page 6 in your textbook.

- Nurses use the formula $F = \frac{V \times d}{t}$ to control the flow rate for IVs. Name the quantity that each of the variables in this formula represents and the units in which each is measured.

- F represents the flow rate and is measured in drops per minute.
- V represents the volume of solution and is measured in milliliters.
- d represents the drop factor and is measured in drops per milliliter.
- t represents time and is measured in minutes.

- Write the expression that a nurse would use to calculate the flow rate of an IV if a doctor orders 1350 milliliters of IV saline to be given over 8 hours, with a drop factor of 20 drops per milliliter. Do not find the value of this expression. 1350×20
 8×60

Reading the Lesson

- There is a customary order for grouping symbols. Brackets are used outside of parentheses. Braces are used outside of brackets. Identify the innermost expression(s) in each of the following expressions.
 - $[(3 - 2^2) + 8] \div 4$ **(3 - 2²)**
 - $9 - [5(8 - 6) + 2(10 + 7)]$ **(8 - 6) and (10 + 7)**
 - $[14 - (8 + (3 - 12)^2)] \div (6^3 - 100)$ **(3 - 12)**
- Read the following instructions. Then use grouping symbols to show how the instructions can be put in the form of a mathematical expression.
Multiply the difference of 13 and 5 by the sum of 9 and 21. Add the result to 10. Then divide what you get by 2. **$[(13 - 5)(9 + 21) + 10] \div 2$**
- Why is it important for everyone to use the same order of operations for evaluating expressions? **Sample answer: If everyone did not use the same order of operations, different people might get different answers.**

Helping You Remember

- Think of a phrase or sentence to help you remember the order of operations.
Sample answer: Please excuse my dear Aunt Sally. (parentheses; exponents; multiplication and division; addition and subtraction)

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Glencoe Algebra 2

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1-1

Enrichment

Significant Digits

All measurements are approximations. The **significant digits** of an approximate number are those which indicate the results of a measurement. For example, the mass of an object, measured to the nearest gram, is 210 grams. The measurement 210 g has 3 significant digits. The mass of the same object, measured to the nearest 100 g, is 200 g. The measurement 200 g has one significant digit.

- Nonzero digits and zeros between significant digits are significant. For example, the measurement 9.071 m has 4 significant digits, 9, 0, 7, and 1.
- Zeros at the end of a decimal fraction are significant. The measurement 0.050 mm has 2 significant digits, 5 and 0.
- Underlined zeros in whole numbers are significant. The measurement 104,000 km has 5 significant digits, 1, 0, 4, 0, and 0.

In general, a computation involving multiplication or division of measurements *cannot* be more accurate than the least accurate measurement in the computation. Thus, the result of computation involving multiplication or division of measurements should be rounded to the number of significant digits in the least accurate measurement.

Example

The mass of 37 quarters is 210 g. Find the mass of one quarter.

mass of 1 quarter = $210 \text{ g} \div 37$ 210 has 3 significant digits.
 $= 5.68 \text{ g}$ 37 does not represent a measurement.
 Round the result to 3 significant digits.
 Why? 5.68

Write the number of significant digits for each measurement.

- | | | | |
|---------------|---------------|--------------------------------|------------------------------------|
| 1. 8314.20 m | 2. 30.70 cm | 3. 0.01 mm | 4. 0.0605 mg |
| 6 | 4 | 1 | 3 |
| 5. 370,000 km | 6. 370,000 km | 7. $9.7 \times 10^4 \text{ g}$ | 8. $3.20 \times 10^{-2} \text{ g}$ |
| 3 | 5 | 2 | 3 |

Solve. Round each result to the correct number of significant digits.

- | | | |
|---|---|---|
| 9. $23 \text{ m} \times 1.54 \text{ m}$ | 10. $12,000 \text{ ft} \div 520 \text{ ft}$ | 11. $2.5 \text{ cm} \times 25$ |
| 35 m² | 23 | 63 cm |
| 12. $11.01 \text{ mm} \times 11$ | 13. $908 \text{ yd} \div 0.5$ | 14. $38.6 \text{ m} \times 4.0 \text{ m}$ |
| 121.1 mm | 1820 yd | 150 m² |

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Glencoe Algebra 2

Lesson 1-1

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1-2 Study Guide and Intervention

Properties of Real Numbers

Real Numbers All real numbers can be classified as either rational or irrational. The set of rational numbers includes several subsets: natural numbers, whole numbers, and integers.

R	real numbers	{all rationals and irrationals}
Q	rational numbers	{all numbers that can be represented in the form $\frac{m}{n}$, where m and n are integers and n is not equal to 0}
I	irrational numbers	{all nonterminating, nonrepeating decimals}
N	natural numbers	{1, 2, 3, 4, 5, 6, 7, 8, 9, ...}
W	whole numbers	{0, 1, 2, 3, 4, 5, 6, 7, 8, ...}
Z	integers	{..., -3, -2, -1, 0, 1, 2, 3, ...}

Example Name the sets of numbers to which each number belongs.

- a. $-\frac{11}{3}$ rationals (Q), reals (R)
 b. $\sqrt{25}$ $\sqrt{25} = 5$ naturals (N), wholes (W), integers (Z), rationals (Q), reals (R)

Exercises

Name the sets of numbers to which each number belongs.

1. $\frac{6}{7}$ Q, R 2. $-\sqrt{81}$ Z, Q, R 3. 0 W, Z, Q, R 4. 192.0005 Q, R
 5. 73 N, W, Z, Q, R 6. $34\frac{1}{2}$ Q, R 7. $\sqrt[36]{9}$ Q, R 8. 26.1 Q, R
 9. π I, R 10. $\frac{15}{3}$ N, W, Z, Q, R 11. $-4.1\overline{7}$ Q, R
 12. $\sqrt[25]{5}$ N, W, Z, Q, R 13. -1 Z, Q, R 14. $\sqrt{42}$ I, R
 15. -11.2 Q, R 16. $-\frac{8}{13}$ Q, R 17. $\frac{\sqrt{5}}{2}$ I, R
 18. $33.\overline{3}$ Q, R 19. 894,000 N, W, Z, Q, R 20. -0.02 Q, R

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1-2 Study Guide and Intervention

Properties of Real Numbers

Properties of Real Numbers

Real Number Properties		
For any real numbers a , b , and c		
Property	Addition	Multiplication
Commutative	$a + b = b + a$	$a \cdot b = b \cdot a$
Associative	$(a + b) + c = a + (b + c)$	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
Identity	$a + 0 = a = 0 + a$	$a \cdot 1 = a = 1 \cdot a$
Inverse	$a + (-a) = 0 = (-a) + a$	If a is not zero, then $a \cdot \frac{1}{a} = 1 = \frac{1}{a} \cdot a$.
Distributive	$a(b + c) = ab + ac$ and $(b + c)a = ba + ca$	

Example

Simplify $9x + 3y + 12y - 0.9x$.

$$9x + 3y + 12y - 0.9x = 9x + (-0.9x) + 3y + 12y$$

$$= (9 + (-0.9))x + (3 + 12)y$$

$$= 8.1x + 15y$$

Commutative Property (+)
 Distributive Property
 Simplify.

Exercises

Simplify each expression.

1. $8(3a - b) + 4(2b - a)$ 2. $40s + 18t - 5t + 11s$ 3. $\frac{1}{5}(4j + 2k - 6j + 3k)$
 20a 51s + 13t $k - \frac{2}{5}j$
 4. $10(6g + 3h) + 4(5g - h)$ 5. $12\left(\frac{a}{3} - \frac{b}{4}\right)$ 6. $8(2.4r - 3.1s) - 6(1.5r + 2.4s)$
 80g + 26h 4a - 3b 10.2r - 39.2s
 7. $4(20 - 4p) - \frac{3}{4}(4 - 16p)$ 8. $5.5j + 8.9k - 4.7k - 10.9j$ 9. $1.2(7x - 5) - (10 - 4.3x)$
 77 - 4p 4.2k - 5.4j 12.7x - 16
 10. $9(7e - 4f) - 0.6(e + 5f)$ 11. $2.5m(12 - 8.5)$ 12. $\frac{3}{4}p - \frac{1}{5}r - \frac{3}{5}r - \frac{1}{2}p$
 62.4e - 39f 8.75m $\frac{1}{4}p - \frac{4}{5}r$
 13. $4(10g + 80k) - 20(10h - 5g)$ 14. $2(15 + 45c) + \frac{5}{6}(12 + 18c)$
 140g + 120h 40 + 105c
 15. $(7 - 2.1x)3 + 2(3.5x - 6)$ 16. $\frac{2}{3}(18 - 6n + 12 + 3n)$
 0.7x + 9 20 - 2n
 17. $14(j - 2) - 3j(4 - 7)$ 18. $50(3a - b) - 20(b - 2a)$
 2j - 7 190a - 70b

Lesson 1-2



1-2 Skills Practice

Properties of Real Numbers

Name the sets of numbers to which each number belongs.

1. 34 **N, W, Z, Q, R** 2. -525 **Z, Q, R**

3. 0.875 **Q, R** 4. $\frac{12}{3}$ **N, W, Z, Q, R**

5. $-\sqrt{9}$ **Z, Q, R** 6. $\sqrt{30}$ **I, R**

7. $3 \cdot x = x \cdot 3$ **Comm. (+)**

8. $3a + 0 = 3a$ **Add. Iden.**

9. $2(r + w) = 2r + 2w$ **Distributive**

10. $2r + (3r + 4r) = (2r + 3r) + 4r$ **Assoc. (+)**

11. $5y\left(\frac{1}{5y}\right) = 1$ **Mult. Inv.**

12. $15x(1) = 15x$ **Mult. Iden.**

13. $0.6[25(0.5)] = [0.6(25)]0.5$ **Assoc. (×)**

14. $(10b + 12b) + 7b = (12b + 10b) + 7b$ **Comm. (+)**

15. $15 - 15, 15$

16. $1.25 - 1.25, 0.8$

17. $-\frac{4}{5}, \frac{4}{5}, -\frac{4}{4}$

18. $3\frac{3}{4} - 3\frac{3}{4}, \frac{4}{15}$

19. $3x + 5 + 2x - 3$ **5x + 2**

20. $x - y - z + y - x + z$ **0**

21. $-(3g + 3h) + 5g - 10h$ **2g - 13h**

22. $a^2 - a + 4a - 3a^2 + 1$ **-2a^2 + 3a + 1**

23. $3(m - z) + 5(2m - z)$ **13m - 8z**

24. $2x - 3y + 5x - 3y - 2z$ **-3x + 2z**

25. $6(2 + v) - 4(2v + 1)$ **8 - 2v**

26. $\frac{1}{3}(15d + 3) - \frac{1}{2}(8 - 10d)$ **10d - 3**

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Lesson 1-2

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1-2 Practice (Average)

Properties of Real Numbers

Name the sets of numbers to which each number belongs.

1. 6425 2. $\sqrt{7}$ 3. 2π 4. 0

N, W, Z, Q, R **I, R** **I, R** **W, Z, Q, R**

5. $\sqrt[25]{36}$ **Q, R** 6. $-\sqrt{16}$ **Z, Q, R** 7. -35 **Z, Q, R** 8. -31.8 **Q, R**

9. $5x \cdot (4y + 3x) = 5x \cdot (3x + 4y)$ **Comm. (+)**

10. $7x + (9x + 8) = (7x + 9x) + 8$ **Assoc. (+)**

11. $5(3x + y) = 5(3x + 1y)$ **Mult. Iden.**

12. $7n + 2n = (7 + 2)n$ **Distributive**

13. $3(2x)y = (3 \cdot 2)(xy)$ **Assoc. (×)**

14. $3x \cdot 2y = 3 \cdot 2 \cdot x \cdot y$ **15. (6 + -6)y = 0y** **Add. Inv.**

16. $\frac{1}{4} \cdot 4y = 1y$ **Mult. Inv.**

17. $5(x + y) = 5x + 5y$ **18. 4n + 0 = 4n** **Add. Iden.**

19. 0.4 **-0.4, 2.5**

20. -1.6 **1.6, -0.625**

21. $-\frac{11}{16}, \frac{11}{16}$

22. $5\frac{5}{6}, -5\frac{5}{6}, \frac{6}{35}$

23. $5x - 3y - 2x + 3y$ **3x**

24. $-11a - 13b + 7a - 3b$ **-4a - 16b**

25. $8x - 7y - (3 - 6y)$ **8x - y - 3**

26. $4c - 2c - (4c + 2c)$ **-4c**

27. $3(r - 10s) - 4(7s + 2r)$ **-5r - 58s**

28. $\frac{1}{5}(10a - 15) + \frac{1}{2}(8 + 4a)$ **4a + 1**

29. $2(4 - 2x + y) - 4(5 + x - y)$ **13y**

30. $\frac{5}{6}\left(\frac{3}{5}x + 12y\right) - \frac{1}{4}(2x - 12y)$ **-12 - 8x + 6y**

31. **TRAVEL** Olivia drives her car at 60 miles per hour for t hours. Ian drives his car at 50 miles per hour for $(t + 2)$ hours. Write a simplified expression for the sum of the distances traveled by the two cars. **(110t + 100) mi**

32. **NUMBER THEORY** Use the properties of real numbers to tell whether the following statement is true or false: If $a > b$, it follows that $a\left(\frac{1}{a}\right) > b\left(\frac{1}{b}\right)$. Explain your reasoning. **false; counterexample: $5\left(\frac{1}{5}\right) \nlessgtr 4\left(\frac{1}{4}\right)$**

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1-2

Reading to Learn Mathematics

Properties of Real Numbers

Pre-Activity How is the Distributive Property useful in calculating store savings?

Read the introduction to Lesson 1-2 at the top of page 11 in your textbook.

- Why are all of the amounts listed on the register slip at the top of page 11 followed by negative signs? **Sample answer:** The amount of each coupon is subtracted from the total amount of purchases so that you save money by using coupons.

- Describe two ways of calculating the amount of money you saved by using coupons if your register slip is the one shown on page 11.

Sample answer: Add all the individual coupon amounts or add the amounts for the scanned coupons and multiply the sum by 2.

Reading the Lesson

- Refer to the Key Concepts box on page 11. The numbers $2.\overline{57}$ and $0.010010001\dots$ both involve decimals that “go on forever.” Explain why one of these numbers is rational and the other is irrational. **Sample answer:** $2.\overline{57} = 2.5757\dots$ is a repeating decimal because there is a block of digits, 57, that repeats forever, so this number is rational. The number $0.010010001\dots$ is a non-repeating decimal because, although the digits follow a pattern, there is no block of digits that repeats. So this number is an irrational number.

- Write the Associative Property of Addition in symbols. Then illustrate this property by finding the sum $12 + 18 + 45$ in two different ways. **(a + b) + c = a + (b + c);**
Sample answer: $(12 + 18) + 45 = 30 + 45 = 75;$
 $12 + (18 + 45) = 12 + 63 = 75$

- Consider the equations $(a \cdot b) \cdot c = a \cdot (b \cdot c)$ and $(a \cdot b) \cdot c = c \cdot (a \cdot b)$. One of the equations uses the Associative Property of Multiplication and one uses the Commutative Property of Multiplication. How can you tell which property is being used in each equation? **The first equation uses the Associative Property of Multiplication.** The quantities a , b , and c are used in the same order, but they are grouped differently on the two sides of the equation. The second equation uses the quantities in different orders on the two sides of the equation. So the second equation uses the Commutative Property of Multiplication.

Helping You Remember

- How can the meanings of the words *commuter* and *association* help you to remember the difference between the commutative and associative properties? **Sample answer:** A commuter is someone who travels back and forth to work or another place, and the commutative property says you can switch the order when two numbers that are being added or multiplied. An association is a group of people who are connected or united, and the associative property says that you can switch the grouping when three numbers are added or multiplied.

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1-2

Enrichment

Properties of a Group

A set of numbers forms a group with respect to an operation if for that operation the set has (1) the Closure Property, (2) the Associative Property, (3) a member which is an identity, and (4) an inverse for each member of the set.

Example 1 Does the set $\{0, 1, 2, 3, \dots\}$ form a group with respect to addition?

Closure Property: For all numbers in the set, is $a + b$ in the set? $0 + 1 = 1$, and 1 is in the set; $0 + 2 = 2$, and 2 is in the set; and so on. The set has closure for addition.

Associative Property: For all numbers in the set, does $a + (b + c) = (a + b) + c$? $0 + (1 + 2) = (0 + 1) + 2$; $1 + (2 + 3) = (1 + 2) + 3$; and so on. The set is associative for addition.

Identity: Is there some number, i , in the set such that $i + a = a = a + i$ for all a ? $0 + 1 = 1 = 1 + 0$; $0 + 2 = 2 = 2 + 0$; and so on. The identity for addition is 0.

Inverse: Does each number, a , have an inverse, a' , such that $a' + a = a + a' = i$? The integer inverse of 3 is -3 since $-3 + 3 = 0$, and 0 is the identity for addition. But the set does not contain -3 . Therefore, there is no inverse for 3.

The set is not a group with respect to addition because only three of the four properties hold.

Example 2 Is the set $\{-1, 1\}$ a group with respect to multiplication?

Closure Property: $(-1)(-1) = 1$; $(-1)(1) = -1$; $(1)(-1) = -1$; $(1)(1) = 1$. The set has closure for multiplication.

Associative Property: $(-1)[(-1)(-1)] = (-1)(1) = -1$; and so on. The set is associative for multiplication.

Identity: $1(-1) = -1$; $1(1) = 1$. The identity for multiplication is 1.

Inverse: -1 is the inverse of -1 since $(-1)(-1) = 1$, and 1 is the identity. 1 is the inverse of 1 since $(1)(1) = 1$, and 1 is the identity. Each member has an inverse.

The set $\{-1, 1\}$ is a group with respect to multiplication because all four properties hold.

Tell whether the set forms a group with respect to the given operation.

- {integers}, addition **yes**
- {integers}, multiplication **no**
- $\{\frac{1}{2}, \frac{3}{2}, \dots\}$, addition **no**
- {multiples of 5}, multiplication **no**
- $\{x, x^2, x^3, x^4, \dots\}$ addition **no**
- $\{\sqrt{1}, \sqrt{2}, \sqrt{3}, \dots\}$, multiplication **no**
- {rational numbers}, addition **no**
- {rational numbers}, addition **yes**

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1-3 Study Guide and Intervention (continued)

Solving Equations

Properties of Equality You can solve equations by using addition, subtraction, multiplication, or division.

Addition and Subtraction Properties of Equality	For any real numbers a , b , and c , if $a = b$, then $a + c = b + c$ and $a - c = b - c$.
Multiplication and Division Properties of Equality	For any real numbers a , b , and c , if $a = b$, then $a \cdot c = b \cdot c$ and, if c is not zero, $\frac{a}{c} = \frac{b}{c}$.

Example 1 Solve $100 - 8x = 140$.

$$\begin{aligned} 100 - 8x &= 140 \\ 100 - 8x - 100 &= 140 - 100 \\ -8x &= 40 \\ x &= -5 \end{aligned}$$

Example 2 Solve $4x + 5y = 100$ for y .

$$\begin{aligned} 4x + 5y &= 100 \\ 4x + 5y - 4x &= 100 - 4x \\ 5y &= 100 - 4x \\ y &= \frac{1}{5}(100 - 4x) \\ y &= 20 - \frac{4}{5}x \end{aligned}$$

Exercises

Solve each equation. Check your solution.

- $3s = 45$ **15**
- $17 = 9 - a$ **-8**
- $5t - 1 = 6t - 5$ **4**
- $\frac{2}{3}m = \frac{1}{2}$ **$\frac{3}{4}$**
- $7 - \frac{1}{2}x = 3$ **8**
- $-8 = -2(z + 7)$ **-3**
- $0.2b = 10$ **50**
- $3x + 17 = 5x - 13$ **15**
- $5(4 - k) = -10k - 4$
- $120 - \frac{3}{4}y = 60$ **80**
- $\frac{5}{2}n = 98 - n$ **28**
- $4.5 + 2p = 8.7$ **2.1**
- $4n + 20 = 53 - 2n$ **$5\frac{1}{2}$**
- $100 = 20 - 5r$ **-16**
- $2x + 75 = 102 - x$ **9**

Solve each equation or formula for the specified variable.

- $a = 3b - c$, for b **$b = \frac{a+c}{3}$**
- $\frac{s}{2t} = 10$, for t **$t = \frac{s}{20}$**
- $12g - 1$, for g **$g = \frac{h+1}{12}$**
- $19. \frac{3pq}{r} = 12$, for p **$p = \frac{4r}{q}$**
- $2xy = x + 7$, for x **$x = \frac{7}{2y-1}$**
- $\frac{d}{2} + \frac{f}{4} = 6$, for $f = 24 - 2d$
- $3(2j - k) = 108$, for $j = 18 + \frac{k}{2}$
- $3.5s - 42 = 14t$, for $s = 4t + 12$
- $\frac{m}{n} + 5m = 20$, for m **$m = \frac{20n}{5n+1}$**
- $4x - 3y = 10$, for $y = \frac{4}{3}x - \frac{10}{3}$

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1-3 Study Guide and Intervention

Solving Equations

Verbal Expressions to Algebraic Expressions The chart suggests some ways to help you translate word expressions into algebraic expressions. Any letter can be used to represent a number that is not known.

Word Expression	Operation
and, plus, sum, increased by, more than	addition
minus, difference, decreased by, less than	subtraction
times, product, of (as in $\frac{1}{2}$ of a number)	multiplication
divided by, quotient	division

Example 1 Write an algebraic expression to represent 18 less than the quotient of a number and 3.
 $\frac{n}{3} - 18$

Example 2 Write a verbal sentence to represent $6(n - 2) = 14$.
Six times the difference of a number and two is equal to 14.

Exercises

Write an algebraic expression to represent each verbal expression.

- the sum of six times a number and 25 **$6n + 25$**
- four times the sum of a number and 3 **$4(n + 3)$**
- 7 less than fifteen times a number **$15n - 7$**
- the difference of nine times a number and the quotient of 6 and the same number **$9n - \frac{6}{n}$**
- the sum of 100 and four times a number **$100 + 4n$**
- the product of 3 and the sum of 11 and a number **$3(11 + n)$**
- four times the square of a number increased by five times the same number **$4n^2 + 5n$**
- 23 more than the product of 7 and a number **$7n + 23$**

Write a verbal sentence to represent each equation. Sample answers are given.

- $3n - 35 = 79$ **The difference of three times a number and 35 is equal to 79.**
- $2(n^3 + 3n^2) = 4n$ **Twice the sum of the cube of a number and three times the square of the number is equal to four times the number.**
- $\frac{5n}{n+3} = n - 8$ **The quotient of five times a number and the sum of the number and 3 is equal to the difference of the number and 8.**

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Lesson 1-3

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1-3 Skills Practice

Solving Equations

Write an algebraic expression to represent each verbal expression.

- 4 times a number, increased by 7
 $4n + 7$
- 8 less than 5 times a number
 $5n - 8$
- 6 times the sum of a number and 5
 $6(n + 5)$
- 3 times the difference of 4 and a number $3(4 - n)$
- the product of -11 and the square of a number $-11n^2$

Write a verbal expression to represent each equation. 7-10. Sample answers are given.

- $n - 8 = 16$
The difference of a number and 8 is 16.
- $b^2 + 3 = b$
Three added to the square of a number is the number.
- If $a = 0.5b$, and $0.5b = 10$, then $a = 10$.
Transitive (=)
- If $(8 + 7)r = 30$, then $15r = 30$.
Substitution (=)

Name the property illustrated by each statement.

- If $d + 1 = f$, then $d = f - 1$.
Subtraction (=)
- If $(8 + 7)r = 30$, then $15r = 30$.
Substitution (=)

Solve each equation. Check your solution.

- $4m + 2 = 18$ 4
- $x + 4 = 5x + 2$ $\frac{1}{2}$
- $3t + 5 = 2t + 5$ 5
- $-5x = 3x - 24$ 3
- $a - \frac{2a}{5} = 3$ 5
- $x + 4 = 5x + 2$ $\frac{1}{2}$
- $-3b + 7 = -15 + 2b$ $\frac{22}{5}$
- $4v + 20 - 6 = 34$ 5
- $2.2n + 0.8n + 5 = 4n$ 5

Solve each equation or formula for the specified variable.

- $I = prt$, for p $p = \frac{I}{rt}$
- $A = \frac{x + y}{2}$, for y $y = 2A - x$
- $y = \frac{1}{4}x - 12$, for x $x = 4y + 48$
- $2\pi A = 2\pi r^2 + 2\pi rh$, for h $h = \frac{A - 2\pi r^2}{2\pi r}$

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1-3 Practice (Average)

Solving Equations

Write an algebraic expression to represent each verbal expression.

- 2 more than the quotient of a number and 5
 $\frac{y}{5} + 2$
- the sum of two consecutive integers
 $n + (n + 1)$
- 5 times the sum of a number and 1
 $5(m + 1)$
- 1 less than twice the square of a number
 $2y^2 - 1$

Write a verbal expression to represent each equation. 5-8. Sample answers are given.

- $5 - 2x = 4$
The difference of 5 and twice a number is 4.
- $3y = 4y^3$
Three times a number is 4 times the cube of the number.
- $\frac{m}{5} = 3(2m + 1)$
The quotient of a number and 5 is 3 times the sum of twice the number and 1.

Name the property illustrated by each statement.

- If $t - 13 = 52$, then $52 = t - 13$.
Symmetric (=)
- If $h + 12 = 22$, then $h = 10$.
Subtraction (=)
- If $8(2q + 1) = 4$, then $2(2q + 1) = 1$.
Division (=)
- If $4m = -15$, then $-12m = 45$.
Multiplication (=)

Solve each equation. Check your solution.

- $14 = 8 - 6r - 1$
- $\frac{3}{4} - \frac{1}{2}n = \frac{5}{8} - \frac{1}{4}$
- $-1.6r + 5 = -7.8$ 8
- $5(6 - 4c) = v + 21$ $\frac{3}{7}$
- $9 + 4n = -59 - 17$
- $\frac{5}{6}s + \frac{3}{4} = \frac{11}{12} - \frac{1}{5}$
- $6x - 5 = 7 - 9x$ $\frac{4}{5}$
- $6y - 5 = -3(2y + 1)$ $\frac{1}{6}$

Solve each equation or formula for the specified variable.

- $E = mc^2$, for m $m = \frac{E}{c^2}$
- $h = vt - gt^2$, for v $v = \frac{h + gt^2}{t}$
- $c = \frac{2d + 1}{3}$, for d $d = \frac{3c - 1}{2}$
- $E = \frac{1}{2}Iw^2 + U$, for I $I = \frac{2(E - U)}{w^2}$

Define a variable, write an equation, and solve the problem.

- GEOMETRY** The length of a rectangle is twice the width. Find the width if the perimeter is 60 centimeters. $w = \text{width}; 2(2w) + 2w = 60; 10 \text{ cm}$
- GOLF** Luis and three friends went golfing. Two of the friends rented clubs for \$6 each. The total cost of the rented clubs and the green fees for each person was \$76. What was the cost of the green fees for each person? $g = \text{green fees per person}; 6(2) + 4g = 76; \16

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1-3

Reading to Learn Mathematics
Solving Equations

Pre-Activity How can you find the most effective level of intensity for your workout?

- Read the introduction to Lesson 1-3 at the top of page 20 in your textbook.
- To find your target heart rate, what two pieces of information must you supply? **age (A) and desired intensity level (I)**
- Write an equation that shows how to calculate your target heart rate.

$$P = \frac{(220 - A) \cdot I}{6} \text{ or } P = (220 - A) \cdot I \div 6$$

Reading the Lesson

- How are algebraic expressions and equations alike?
Sample answer: Both contain variables, constants, and operation signs.
- How are algebraic expressions and equations different?
Sample answer: Equations contain equal signs; expressions do not.
- How are algebraic expressions and equations related?
Sample answer: An equation is a statement that says that two algebraic expressions are equal.

Read the following problem and then write an equation that you could use to solve it. Do not actually solve the equation. In your equation, let m be the number of miles driven.

- When Louisa rented a moving truck, she agreed to pay \$28 per day plus \$0.42 per mile. If she kept the truck for 3 days and the rental charges (without tax) were \$153.72, how many miles did Louisa drive the truck? **$3(28) + 0.42m = 153.72$**

Helping You Remember

- How can the words *reflection* and *symmetry* help you remember and distinguish between the reflexive and symmetric properties of equality? Think about how these words are used in everyday life or in geometry.

Sample answer: When you look at your reflection, you are looking at yourself. The reflexive property says that every number is equal to itself. In geometry, symmetry with respect to a line means that the parts of a figure on the two sides of a line are identical. The symmetric property of equality allows you to interchange the two sides of an equation. The equal sign is like the line of symmetry.

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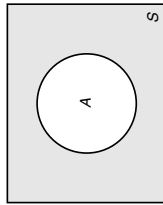
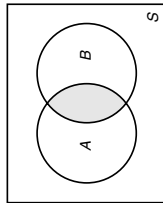
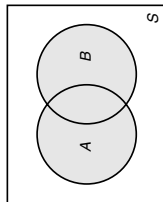
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1-3 Enrichment

Venn Diagrams

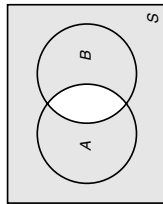
Relationships among sets can be shown using Venn diagrams. Study the diagrams below. The circles represent sets A and B , which are subsets of set S .



The union of A and B consists of all elements in *either* A or B . The intersection of A and B consists of all elements in *both* A and B . The complement of A consists of all elements *not* in A . You can combine the operations of union, intersection, and finding the complement.

Example Shade the region $(A \cap B)'$.

$(A \cap B)'$ means the complement of the intersection of A and B . First find the intersection of A and B . Then find its complement.



Draw a Venn diagram and shade the region indicated. See students' diagrams.

- $A' \cap B$
- $A' \cup B$
- $A \cap B'$
- $A' \cup B'$
- $(A \cup B)'$
- $A \cap B'$

Draw a Venn diagram and three overlapping circles. Then shade the region indicated. See students' diagrams.

- $(A \cup B) \cup C'$
- $(A \cup B)' \cap C'$
- $A \cup (B \cup C)$
- $(A \cup B) \cup C$

11. Is the union operation associative? **yes**

12. Is the intersection operation associative? **yes**

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1-4 Study Guide and Intervention

Solving Absolute Value Equations

Absolute Value Expressions The absolute value of a number is the number of units it is from 0 on a number line. The symbol $|x|$ is used to represent the absolute value of a number x .

Words For any real number a , if a is positive or zero, the absolute value of a is a .
If a is negative, the absolute value of a is the opposite of a .

Symbols For any real number a , $|a| = a$, if $a \geq 0$, and $|a| = -a$, if $a < 0$.

Example 1 Evaluate $|-4| - |-2x|$ if $x = 6$.

$$\begin{aligned} |-4| - |-2x| &= |-4| - |-2 \cdot 6| \\ &= |-4| - |-12| \\ &= 4 - 12 \\ &= -8 \end{aligned}$$

Example 2 Evaluate $|2x - 3y|$ if $x = -4$ and $y = 3$.

$$\begin{aligned} |2x - 3y| &= |2(-4) - 3(3)| \\ &= |-8 - 9| \\ &= |-17| \\ &= 17 \end{aligned}$$

Example Solve $|2x - 3| = 17$. Check your solutions.

Case 1	Case 2	
$a = b$	$a = -b$	
$2x - 3 = 17$	$2x - 3 = -17$	
$2x - 3 + 3 = 17 + 3$	$2x - 3 + 3 = -17 + 3$	
$2x = 20$	$2x = -14$	
$x = 10$	$x = -7$	

CHECK $|2x - 3| = 17$ **CHECK** $|2(-7) - 3| = 17$

$$\begin{aligned} |2(10) - 3| &= 17 & |-14 - 3| &= 17 \\ |20 - 3| &= 17 & |-17| &= 17 \\ |17| &= 17 & 17 &= 17 \checkmark \end{aligned}$$

There are two solutions, 10 and -7.

Exercises

Solve each equation. Check your solutions.

- $|x + 15| = 37$ **{-52, 22}**
- $|t - 4| - 5 = 0$ **{-1, 9}**
- $|x - 5| = 45$ **{-40, 50}**
- $|m + 3| = 12 - 2m$ **{3}**
- $|5b + 9| + 16 = 2$ **\emptyset**
- $|15 - 2k| = 45$ **{-15, 30}**
- $|8 + 5a| = 14 - a$ **$\left\{-\frac{11}{2}, 1\right\}$**
- $\frac{1}{3}|4p - 11| = p + 4$ **$\left\{23, -\frac{1}{7}\right\}$**
- $\frac{1}{3}|x + 3| = -1$ **\emptyset**
- $3f - |3f + 4| = 20$ **{12}**
- $40 - 4x = 2|3x - 10|$ **{6, -10}**
- $4b + 3| = 15 - 2b$ **{2, -9}**
- $\frac{1}{2}|6 - 2x| = 3x + 1$ **$\left\{\frac{1}{2}\right\}$**

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1-4 Study Guide and Intervention

Solving Absolute Value Equations

Absolute Value Expressions The absolute value of a number is the number of units it is from 0 on a number line. The symbol $|x|$ is used to represent the absolute value of a number x .

Words For any real number a , if a is positive or zero, the absolute value of a is a .
If a is negative, the absolute value of a is the opposite of a .

Symbols For any real number a , $|a| = a$, if $a \geq 0$, and $|a| = -a$, if $a < 0$.

Example 1 Evaluate $|-4| - |-2x|$ if $x = 6$.

$$\begin{aligned} |-4| - |-2x| &= |-4| - |-2 \cdot 6| \\ &= |-4| - |-12| \\ &= 4 - 12 \\ &= -8 \end{aligned}$$

Example 2 Evaluate $|2x - 3y|$ if $x = -4$ and $y = 3$.

$$\begin{aligned} |2x - 3y| &= |2(-4) - 3(3)| \\ &= |-8 - 9| \\ &= |-17| \\ &= 17 \end{aligned}$$

Exercises

Evaluate each expression if $w = -4$, $x = 2$, $y = \frac{1}{2}$, and $z = -6$.

- $2x - 8$ **4**
- $|6 + z| - |-7|$ **-7**
- $3.5 + |w + z|$ **15**
- $|x + 5| - |2w|$ **-1**
- $|x| - |y| - |z|$ **$-4\frac{1}{2}$**
- $|7 - x| + |3x|$ **11**
- $|w - 4x|$ **12**
- $|wz| - |xy|$ **23**
- $|z| - 3|5yz|$ **-39**
- $5|w| + 2|z - 2y|$ **34**
- $|z| - 4|2z + y|$ **-40**
- $10 - |xw|$ **2**
- $6y + z + |yz|$ **6**
- $3|wx| + \frac{1}{4}|4x + 8y|$ **27**
- $7|yz| - 30$ **-9**
- $14 - 2|w - xy|$ **4**
- $|2x - y| + 5y$ **6**
- $|xyz| + |wxz|$ **54**
- $z|z| + x|x|$ **-32**
- $12 - |10x - 10y|$ **-3**
- $\frac{1}{2}|5z + 8w|$ **31**
- $|yz - 4w| - w$ **17**
- $\frac{3}{4}|wz| + \frac{1}{2}|8y|$ **20**
- $24.xz - |xz|$ **-24**

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<div style="text-align: center;"> <h2>1-4 Skills Practice</h2> <h3>Solving Absolute Value Equations</h3> <p>Evaluate each expression if $w = 0.4$, $x = 2$, $y = -3$, and $z = -10$.</p> </div> <ol style="list-style-type: none"> 1. $5w$ 2 2. $-9y$ 27 3. $9y - z$ 17 4. $- 17z$ -170 5. $- 10z - 31$ -131 6. $- 8x - 3y + 2y + 5x$ -21 7. $25 - 5z + 1$ -24 8. $44 + -2x - y$ 45 9. $2 4w$ 3.2 10. $3 - 1 - 6w$ 1.6 11. $-3x - 2y - 4 - 4$ 7 <p>Solve each equation. Check your solutions.</p> <ol style="list-style-type: none"> 13. $y + 3 = 2$ $\{-5, -1\}$ 14. $5a = 10$ $\{-2, 2\}$ 15. $3k - 6 = 2$ $\{\frac{4}{3}, \frac{8}{3}\}$ 16. $2g + 6 = 0$ $\{-3\}$ 17. $10 = 1 - c$ $\{-9, 11\}$ 18. $2x + x = 9$ $\{-3, 3\}$ 19. $p - 7 = -14$ \emptyset 20. $2 3w = 12$ $\{-2, 2\}$ 21. $7x - 3x + 2 = 18$ $\{-4, 4\}$ 23. $3n - 2 = \frac{1}{2}$ $\{\frac{1}{2}, \frac{5}{2}\}$ 24. $8d - 4d + 5 = 13$ $\{-2, 2\}$ 25. $-5 6a + 2 = -15$ $\{-\frac{5}{6}, \frac{1}{6}\}$ 	<div style="text-align: center;"> <h2>1-4 Practice (Average)</h2> <h3>Solving Absolute Value Equations</h3> <p>Evaluate each expression if $a = -1$, $b = -8$, $c = 5$, and $d = -1.4$.</p> </div> <ol style="list-style-type: none"> 1. $6a$ 6 2. $2b + 4$ 12 3. $- 10d + a$ -15 4. $17c + 3b - 5$ 114 5. $-6 10a - 12$ -132 6. $2b - 1 - -8b + 5$ -52 7. $5a - 7 + 3c - 4$ 23 8. $1 - 7c - a$ 33 9. $-3 0.5c + 2 - -0.5b$ -17.5 10. $4d + 5 - 2a$ 12.6 11. $a - b + b - a$ 14 12. $2 - 2d - 3 b$ -19.2 <p>Solve each equation. Check your solutions.</p> <ol style="list-style-type: none"> 13. $n - 4 = 13$ $\{-9, 17\}$ 14. $x - 13 = 2$ $\{11, 15\}$ 15. $2y - 3 = 29$ $\{-13, 16\}$ 16. $7 x + 3 = 42$ $\{-9, 3\}$ 17. $3u - 6 = 42$ $\{-12, 16\}$ 18. $5x - 4 = -6$ \emptyset 19. $-3 4x - 9 = 24$ \emptyset 20. $-6 5 - 2y = -9$ $\{1.75, 3.25\}$ 21. $8 + p = 2p - 3$ $\{11\}$ 22. $4w - 1 = 5w + 37$ $\{-38\}$ 23. $4 2y - 7 + 5 = 9$ $\{3, 4\}$ 24. $-2 7 - 3y - 6 = -14$ $\{1, 3\frac{2}{3}\}$ 25. $2 4 - s = -3s$ $\{-8\}$ 26. $5 - 3 2 + 2w = -7$ $\{-3, 1\}$ 27. $5 2r + 3 - 5 = 0$ $\{-2, -1\}$ 28. $3 - 5 2d - 3 = 4$ \emptyset <p>29. WEATHER A thermometer comes with a guarantee that the stated temperature differs from the actual temperature by no more than 1.5 degrees Fahrenheit. Write and solve an equation to find the minimum and maximum actual temperatures when the thermometer states that the temperature is 87.4 degrees Fahrenheit. $x - 87.4 \leq 1.5$; or $85.9 \leq x \leq 88.9$</p> <p>30. OPINION POLLS Public opinion polls reported in newspapers are usually given with a margin of error. For example, a poll with a margin of error of $\pm 5\%$ is considered accurate to within plus or minus 5% of the actual value. A poll with a stated margin of error of $\pm 3\%$ predicts that candidate Tonwe will receive 51% of an upcoming vote. Write and solve an equation describing the minimum and maximum percent of the vote that candidate Tonwe is expected to receive. $x - 51 \leq 3$ or $48 \leq x \leq 54$</p>
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1-4 Reading to Learn Mathematics

Solving Absolute Value Equations

Pre-Activity How can an absolute value equation describe the magnitude of an earthquake?

Read the introduction to Lesson 1-4 at the top of page 28 in your textbook.

- What is a seismologist and what does magnitude of an earthquake mean?
a scientist who studies earthquakes; a number from 1 to 10 that tells how strong an earthquake is
- Why is an absolute value equation rather than an equation without absolute value used to find the extremes in the actual magnitude of an earthquake in relation to its measured value on the Richter scale?
Sample answer: The actual magnitude can vary from the measured magnitude by up to 0.3 unit in either direction, so an absolute value equation is needed.
- If the magnitude of an earthquake is estimated to be 6.9 on the Richter scale, it might actually have a magnitude as low as 6.6 or as high as 7.2.

Reading the Lesson

- Explain how $-a$ could represent a positive number. Give an example. **Sample answer: if a is negative, then $-a$ is positive. Example: if $a = -25$, then $-a = -(-25) = 25$.**
- Explain why the absolute value of a number can never be negative. **Sample answer: The absolute value is the number of units it is from 0 on the number line. The number of units is never negative.**
- What does the sentence $b \geq 0$ mean? **Sample answer: The number b is 0 or greater than 0.**
- What does the symbol \emptyset mean as a solution set? **Sample answer: if a solution set is \emptyset , then there are no solutions.**

Helping You Remember

- How can the number line model for absolute value that is shown on page 28 of your textbook help you remember that many absolute value equations have two solutions?
Sample answer: The number line shows that for every positive number, there are two numbers that have that number as their absolute value.

Lesson 1-4

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1-4 Enrichment

Considering All Cases in Absolute Value Equations

You have learned that absolute value equations with one set of absolute value symbols have two cases that must be considered. For example, $|x + 3| = 5$ must be broken into $x + 3 = 5$ or $-(x + 3) = 5$. For an equation with two sets of absolute value symbols, four cases must be considered.

Consider the problem $|x + 2| + 3 = |x + 6|$. First, we must write the equations for the case where $x + 6 \geq 0$ and where $x + 6 < 0$. Here are the equations for these two cases:

$$|x + 2| + 3 = x + 6 \qquad x + 2 + 3 = -(x + 6)$$

$$|x + 2| + 3 = -(x + 6) \qquad -x - 2 + 3 = -(x + 6)$$

Each of these equations also has two cases. By writing the equations for both cases of each equation above, you end up with the following four equations:

$$x + 2 + 3 = x + 6 \qquad x + 2 + 3 = -(x + 6)$$

$$-(x + 2) + 3 = x + 6 \qquad -x - 2 + 3 = -(x + 6)$$

Solve each of these equations and check your solutions in the original equation, $|x + 2| + 3 = |x + 6|$. The only solution to this equation is $-\frac{5}{2}$.

Solve each absolute value equation. Check your solution.

- $|x - 4| = |x + 7|$ $x = -1.5$
- $|2x + 9| = |x - 3|$ $x = -12, -2$
- $|-3x - 6| = |5x + 10|$ $x = -2$
- $|x + 4| - 6 = |x - 3|$ $x = 2.5$

5. How many cases would there be for an absolute value equation containing three sets of absolute value symbols? **8**

6. List each case and solve $|x + 2| + |2x - 4| = |x - 3|$. Check your solution.

$$x + 2 + 2x - 4 = x - 3 \qquad -(x + 2) + 2x - 4 = x - 3$$

$$x + 2 + 2x - 4 = -(x - 3) \qquad -(x + 2) + 2x - 4 = -(x - 3)$$

$$-(x + 2) + (-2x - 4) = x - 3 \qquad x + 2 + (-2x - 4) = x - 3$$

$$-(x + 2) + (-2x - 4) = -(x - 3) \qquad x + 2 + (-2x - 4) = -(x - 3)$$

No solution

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Answers

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1-5 Study Guide and Intervention

Solving Inequalities

Solve Inequalities The following properties can be used to solve inequalities.

Addition and Subtraction Properties for Inequalities	Multiplication and Division Properties for Inequalities
For any real numbers a , b , and c : 1. If $a < b$, then $a + c < b + c$ and $a - c < b - c$. 2. If $a > b$, then $a + c > b + c$ and $a - c > b - c$.	For any real numbers a , b , and c , with $c \neq 0$: 1. If c is positive and $a < b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$. 2. If c is positive and $a > b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. 3. If c is negative and $a < b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. 4. If c is negative and $a > b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$.

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

Example 1 Solve $2x + 4 > 36$.
Then graph the solution set on a number line.

$$2x + 4 - 4 > 36 - 4$$

$$2x > 32$$

$$x > 16$$

The solution set is $\{x \mid x > 16\}$.



Exercises

Solve each inequality. Describe the solution set using set-builder or interval notation. Then graph the solution set on a number line.

1. $7(7a - 9) \leq 84$



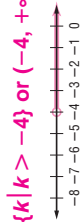
2. $3(9z + 4) > 35z - 4$



3. $5(12 - 3n) < 165$



4. $18 - 4k \leq 2(k + 21)$



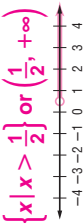
5. $4(b - 7) + 6 < 22$



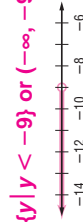
6. $2 + 3(m + 5) \geq 4(m + 3)$



7. $4x - 2 > -7(4x - 2)$



8. $\frac{1}{3}(2y - 3) > y + 2$



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1-5 Study Guide and Intervention

Solving Inequalities

Real-World Problems with Inequalities Many real-world problems involve inequalities. The chart below shows some common phrases that indicate inequalities.

$<$	$>$	\leq	\geq
is less than is fewer than	is greater than is more than	is at most is no more than is less than or equal to	is at least is no less than is greater than or equal to

Example **SPORTS** The Vikings play 36 games this year. At midseason, they have won 16 games. How many of the remaining games must they win in order to win at least 80% of all their games this season?

Let x be the number of remaining games that the Vikings must win. The total number of games they will have won by the end of the season is $16 + x$. They want to win at least 80% of their games. Write an inequality with \geq .

$$16 + x \geq 0.8(36)$$

$$x \geq 0.8(36) - 16$$

$$x \geq 12.8$$

Since they cannot win a fractional part of a game, the Vikings must win at least 13 of the games remaining.

Exercises

1. **PARKING FEES** The city parking lot charges \$2.50 for the first hour and \$0.25 for each additional hour. If the most you want to pay for parking is \$6.50, solve the inequality $2.50 + 0.25(x - 1) \leq 6.50$ to determine for how many hours you can park your car.
At most 17 hours

PLANNING For Exercises 2 and 3, use the following information.

Ethan is reading a 482-page book for a book report due on Monday. He has already read 80 pages. He wants to figure out how many pages per hour he needs to read in order to finish the book in less than 6 hours.

2. Write an inequality to describe this situation. $\frac{482 - 80}{n} \leq 6$ or $6n \geq 482 - 80$

3. Solve the inequality and interpret the solution. **Ethan must read at least 67 pages per hour in order to finish the book in less than 6 hours.**

BOWLING For Exercises 4 and 5, use the following information.

Four friends plan to spend Friday evening at the bowling alley. Three of the friends need to rent shoes for \$3.50 per person. A string (game) of bowling costs \$1.50 per person. If the friends pool their \$40, how many strings can they afford to bowl?

4. Write an equation to describe this situation. $3(3.50) + 4(1.50)n \leq 40$

5. Solve the inequality and interpret the solution. **The friends can bowl at most 4 strings.**

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1-5 Practice (Average) Solving Inequalities

Solve each inequality. Describe the solution set using set-builder or interval notation. Then, graph the solution set on a number line.

1. $\frac{z}{-4} \geq 2$ $\{z | z \leq -8\}$ or $(-\infty, -8]$

2. $3a + 7 \leq 16$ $\{a | a \leq 3\}$ or $(-\infty, 3]$

3. $16 < 3q + 4$ $\{q | q > 4\}$ or $(4, \infty)$

4. $20 - 3s > 7s$ $\{s | s < 2\}$ or $(-\infty, 2)$

5. $3x \geq -9$ $\{x | x \geq -3\}$ or $[-3, \infty)$

6. $4b - 9 \leq 7$ $\{b | b \leq 4\}$ or $(-\infty, 4]$

7. $2z < -9 + 5z$ $\{z | z > 3\}$ or $(3, \infty)$

8. $7f - 9 > 3f - 1$ $\{f | f > 2\}$ or $(2, \infty)$

9. $-3s - 8 \leq 5s$ $\{s | s \geq -1\}$ or $[-1, \infty)$

10. $7t - (t - 4) \leq 25$ $\{t | t \leq \frac{7}{2}\}$ or $(-\infty, \frac{7}{2}]$

11. $0.7m + 0.3m \geq 2m - 4$ $\{m | m \leq 4\}$ or $(-\infty, 4]$

12. $4(5x + 7) \leq 13$ $\{x | x \leq -\frac{3}{4}\}$ or $(-\infty, -\frac{3}{4}]$

13. $1.7y - 0.78 > 5$ $\{y | y > 3.4\}$ or $(3.4, \infty)$

1. $8x - 6 \geq 10$ $\{x | x \geq 2\}$ or $[2, \infty)$

2. $23 - 4u < 11$ $\{u | u > 3\}$ or $(3, \infty)$

3. $-16 - 8r \geq 0$ $\{r | r \leq -2\}$ or $(-\infty, -2]$

4. $14s < 9s + 5$ $\{s | s < 1\}$ or $(-\infty, 1)$

5. $9x - 11 > 6x - 9$ $\{x | x > \frac{2}{3}\}$ or $(\frac{2}{3}, \infty)$

6. $-3(4w - 1) > 18$ $\{w | w < -\frac{5}{4}\}$ or $(-\infty, -\frac{5}{4})$

7. $1 - 8u \leq 3u - 10$ $\{u | u \geq 1\}$ or $[1, \infty)$

8. $17.5 < 19 - 2.5x$ $\{x | x < 0.6\}$ or $(-\infty, 0.6)$

9. $9(2r - 5) - 3 < 7r - 4$ $\{r | r < 4\}$ or $(-\infty, 4)$

10. $1 + 5(x - 8) \leq 2 - (x + 5)$ $\{x | x \leq 6\}$ or $(-\infty, 6]$

11. $\frac{4x - 3}{2} \geq -3.5$ $\{x | x \geq -1\}$ or $[-1, \infty)$

12. $q - 2(2 - q) \leq 0$ $\{q | q \leq \frac{4}{3}\}$ or $(-\infty, \frac{4}{3}]$

13. $-36 - 2(w + 77) > -4(2w + 52)$ $\{w | w > -3\}$ or $(-3, \infty)$

14. $4n - 5(n - 3) > 3(n + 1) - 4$ $\{n | n < 4\}$ or $(-\infty, 4)$

Define a variable and write an inequality for each problem. Then solve.

15. Twenty less than a number is more than twice the same number.
 $n - 20 > 2n; n < -20$

16. Four times the sum of twice a number and -3 is less than 5.5 times that same number.
 $4[2n + (-3)] < 5.5n; n < 4.8$

17. **HOTELS** The Lincoln's hotel room costs \$90 a night. An additional 10% tax is added. Hotel parking is \$12 per day. The Lincoln's expect to spend \$30 in tips during their stay. Solve the inequality $90x + 90(0.1x + 12x + 30) \leq 600$ to find how many nights the Lincoln's can stay at the hotel without exceeding total hotel costs of \$600. **5 nights**

18. **BANKING** Jan's account balance is \$3800. Of this, \$750 is for rent. Jan wants to keep a balance of at least \$500. Write and solve an inequality describing how much she can withdraw and still meet these conditions. **$3800 - 750 - w \geq 500; w \leq \2550**

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1-5 Skills Practice Solving Inequalities

Solve each inequality. Describe the solution set using set-builder or interval notation. Then, graph the solution set on a number line.

1. $\frac{z}{-4} \geq 2$ $\{z | z \leq -8\}$ or $(-\infty, -8]$

2. $3a + 7 \leq 16$ $\{a | a \leq 3\}$ or $(-\infty, 3]$

3. $16 < 3q + 4$ $\{q | q > 4\}$ or $(4, \infty)$

4. $20 - 3s > 7s$ $\{s | s < 2\}$ or $(-\infty, 2)$

5. $3x \geq -9$ $\{x | x \geq -3\}$ or $[-3, \infty)$

6. $4b - 9 \leq 7$ $\{b | b \leq 4\}$ or $(-\infty, 4]$

7. $2z < -9 + 5z$ $\{z | z > 3\}$ or $(3, \infty)$

8. $7f - 9 > 3f - 1$ $\{f | f > 2\}$ or $(2, \infty)$

9. $-3s - 8 \leq 5s$ $\{s | s \geq -1\}$ or $[-1, \infty)$

10. $7t - (t - 4) \leq 25$ $\{t | t \leq \frac{7}{2}\}$ or $(-\infty, \frac{7}{2}]$

11. $0.7m + 0.3m \geq 2m - 4$ $\{m | m \leq 4\}$ or $(-\infty, 4]$

12. $4(5x + 7) \leq 13$ $\{x | x \leq -\frac{3}{4}\}$ or $(-\infty, -\frac{3}{4}]$

13. $1.7y - 0.78 > 5$ $\{y | y > 3.4\}$ or $(3.4, \infty)$

1. $8x - 6 \geq 10$ $\{x | x \geq 2\}$ or $[2, \infty)$

2. $23 - 4u < 11$ $\{u | u > 3\}$ or $(3, \infty)$

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13. $-36 - 2(w + 77) > -4(2w + 52)$ $\{w | w > -3\}$ or $(-3, \infty)$

14. $4n - 5(n - 3) > 3(n + 1) - 4$ $\{n | n < 4\}$ or $(-\infty, 4)$

Define a variable and write an inequality for each problem. Then solve.

15. Nineteen more than a number is less than 42 . $n + 19 < 42; n < 23$

16. The difference of three times a number and 16 is at least 8 . $3n - 16 \geq 8; n \geq 8$

17. One half of a number is more than 6 less than the same number. $\frac{1}{2}n > n - 6; n < 12$

18. Five less than the product of 6 and a number is no more than twice that same number.
 $6n - 5 \leq 2n; n \leq 5$

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1-5

Reading to Learn Mathematics
Solving Inequalities

Pre-Activity How can inequalities be used to compare phone plans?

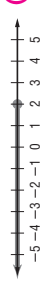

Read the introduction to Lesson 1-5 at the top of page 33 in your textbook.

- Write an inequality comparing the number of minutes per month included in the two phone plans. **$150 < 400$ or $400 > 150$**
- Suppose that in one month you use 230 minutes of airtime on your wireless phone. Find your monthly cost with each plan.

Plan 1: **\$67** Plan 2: **\$55**
Which plan should you choose? **Plan 2**

Reading the Lesson

1. There are several different ways to write or show inequalities. Write each of the following in interval notation.

- a. $\{x \mid x < -3\}$ **$(-\infty, -3)$**
 b. $\{x \mid x \geq 5\}$ **$[5, +\infty)$**
 c.  **$(-\infty, 2]$**
 d.  **$(-1, +\infty)$**

2. Show how you can write an inequality symbol followed by a number to describe each of the following situations.

- a. There are fewer than 600 students in the senior class. **< 600**
 b. A student may enroll in no more than six courses each semester. **≤ 6**
 c. To participate in a concert, you must be willing to attend at least ten rehearsals. **≥ 10**
 d. There is space for at most 165 students in the high school band. **≤ 165**

Helping You Remember

3. One way to remember something is to explain it to another person. A common student error in solving inequalities is forgetting to reverse the inequality symbol when multiplying or dividing both sides of an inequality by a negative number. Suppose that your classmate is having trouble remembering this rule. How could you explain this rule to your classmate? **Sample answer: Draw a number line. Plot two positive numbers, for example, 3 and 8. Then plot their additive inverses, -3 and -8. Write an inequality that compares the positive numbers and one that compares the negative numbers. Notice that $8 > 3$, but $-8 < -3$. The order changes when you multiply by -1.**

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1-5

Enrichment

Equivalence Relations

A relation R on a set A is an *equivalence relation* if it has the following properties.

- Reflexive Property** For any element a of set A , $a R a$.
- Symmetric Property** For all elements a and b of set A , if $a R b$, then $b R a$.
- Transitive Property** For all elements a , b , and c of set A , if $a R b$ and $b R c$, then $a R c$.

Equality on the set of all real numbers is reflexive, symmetric, and transitive. Therefore, it is an equivalence relation.

In each of the following, a relation and a set are given. Write yes if the relation is an equivalence relation on the given set. If it is not, tell which of the properties it fails to exhibit.

1. $<$, {all numbers} **no; reflexive, symmetric**
2. \cong , {all triangles in a plane} **yes**
3. is the sister of, {all women in Tennessee} **no; reflexive**
4. \geq , {all numbers} **no; symmetric**
5. is a factor of, {all nonzero integers} **no; symmetric**
6. \sim , {all polygons in a plane} **yes**
7. is the spouse of, {all people in Roanoke, Virginia} **no; reflexive, transitive**
8. \perp , {all lines in a plane} **no; reflexive, transitive**
9. is a multiple of, {all integers} **no; symmetric**
10. is the square of, {all numbers} **no; reflexive, symmetric, transitive**
11. \parallel , {all lines in a plane} **no; reflexive**
12. has the same color eyes as, {all members of the Cleveland Symphony Orchestra} **yes**
13. is the greatest integer not greater than, {all numbers} **no; reflexive, symmetric, transitive**
14. is the greatest integer not greater than, {all integers} **yes**

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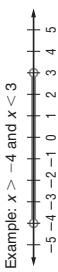
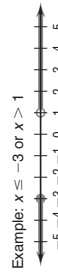
Lesson 1-5

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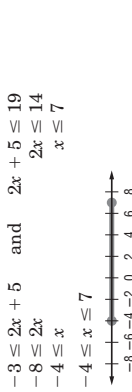
Study Guide and Intervention

Solving Compound and Absolute Value Inequalities

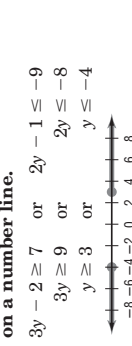
Compound Inequalities A compound inequality consists of two inequalities joined by the word *and* or the word *or*. To solve a compound inequality, you must solve each part separately.

And Compound Inequalities	Example: $x > -4$ and $x < 3$ 	The graph is the intersection of solution sets of two inequalities.
Or Compound Inequalities	Example: $x \leq -3$ or $x > 1$ 	The graph is the union of solution sets of two inequalities.

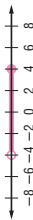
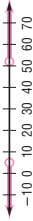
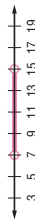
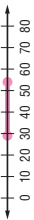

Example 1 Solve $-3 \leq 2x + 5 \leq 19$. Graph the solution set on a number line.



Example 2 Solve $3y - 2 \geq 7$ or $2y - 1 \leq -9$. Graph the solution set on a number line.



Exercises

- Solve each inequality. Graph the solution set on a number line.
- $-10 < 3x + 2 \leq 14$
 $\{x | -4 < x \leq 4\}$

 - $3a + 8 < 23$ or $\frac{1}{4}a - 6 > 7$
 $\{a | a < 5 \text{ or } a > 52\}$

 - $18 < 4x - 10 < 50$
 $\{x | 7 < x < 15\}$

 - $100 \leq 5y - 45 \leq 225$
 $\{y | 29 \leq y \leq 54\}$

 - $22 < 6w - 2 < 82$
 $\{w | 4 < w < 14\}$


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Study Guide and Intervention

Solving Compound and Absolute Value Inequalities

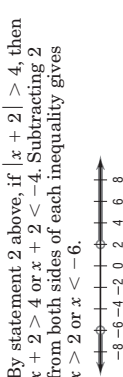
Absolute Value Inequalities Use the definition of absolute value to rewrite an absolute value inequality as a compound inequality.

For all real numbers a and b , $b > 0$, the following statements are true.

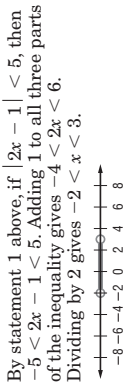
- If $|a| < b$, then $-b < a < b$.
- If $|a| > b$, then $a > b$ or $a < -b$.

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

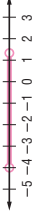

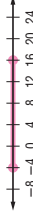
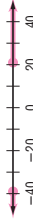
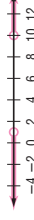
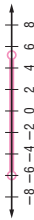

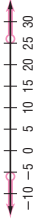
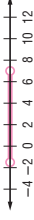
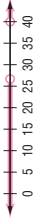
Example 1 Solve $|x + 2| > 4$. Graph the solution set on a number line.



Example 2 Solve $|2x - 1| < 5$. Graph the solution set on a number line.



Exercises

- Solve each inequality. Graph the solution set on a number line.
- $|3x + 4| < 8$
 $\{x | -4 < x < \frac{4}{3}\}$

 - $|4s| + 1 > 27$
 $\{s | s < -6.5 \text{ or } s > 6.5\}$

 - $\frac{c}{2} - 3 \leq 5$
 $\{c | -4 \leq c \leq 16\}$

 - $|a + 9| \geq 30$
 $\{a | a \leq -39 \text{ or } a \geq 21\}$

 - $|2f - 11| > 9$
 $\{f | f < 1 \text{ or } f > 10\}$

 - $|5w + 2| < 28$
 $\{w | -6 < w < 5.2\}$

 - $|10 - 2k| < 2$
 $\{k | 4 < k < 6\}$

 - $\frac{x}{2} - 5 + 2 > 10$
 $\{x | x < -6 \text{ or } x > 26\}$

 - $|4b - 11| < 17$
 $\{b | -\frac{3}{2} < b < 7\}$

 - $|100 - 3m| > 20$
 $\{m | m < 26\frac{2}{3} \text{ or } m > 40\}$


NAME _____

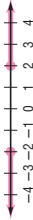

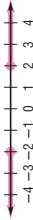

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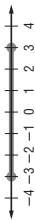

1-6 Skills Practice

Solving Compound and Absolute Value Inequalities







Write an absolute value inequality for each of the following. Then graph the solution set on a number line.

- all numbers greater than or equal to 2 or less than or equal to -2 $|n| \geq 2$

- all numbers less than or equal to 2 than -5 $|n| < 5$

- all numbers less than -1 or greater than 1 $|n| > 1$

- all numbers between -6 and 6 $|n| < 6$


Write an absolute value inequality for each graph.

-  $|n| < 1$
-  $|n| \geq 4$
-  $|n| \leq 3$
-  $|n| > 2.5$

Solve each inequality. Graph the solution set on a number line.

- $2c + 1 > 5$ or $c < 0$ $\{c | c > 2$ or $c < 0\}$

- $10 > -5x > 5$ $\{x | -2 < x < -1\}$

- $8 < 3x + 2 \leq 23$ $\{x | 2 < x \leq 7\}$

- $|t| \geq 3$ $\{t | t \leq -3$ or $t \geq 3\}$

- $|-7r| > 14$ $\{r | r < -2$ or $r > 2\}$

- $|n - 5| < 7$ $\{n | -2 < n < 12\}$


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Glencoe Algebra 2

NAME _____

DATE _____

PERIOD _____

1-6 Practice (Average)

Solving Compound and Absolute Value Inequalities

Write an absolute value inequality for each of the following. Then graph the solution set on a number line.

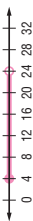

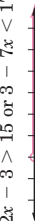
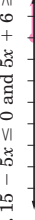

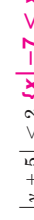
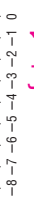





- all numbers greater than 4 or less than -4 $|n| > 4$

- all numbers between -1.5 and 1.5, including -1.5 and 1.5 $|n| \leq 1.5$


Write an absolute value inequality for each graph.

-  $|n| \geq 10$
-  $|n| < \frac{4}{3}$

Solve each inequality. Graph the solution set on a number line.

- $-8 \leq 3y - 20 < 52$ $\{y | 4 \leq y < 24\}$

- $3(5x - 2) < 24$ or $6x - 4 > 4 + 5x$
 $\{x | x < 2$ or $x > 8\}$

- $2x - 3 > 15$ or $3 - 7x < 17$ $\{x | x > -2\}$

- $15 - 5x \leq 0$ and $5x + 6 \geq -14$ $\{x | x \geq 3\}$

- $|2w| \geq 5$ $\{w | w \leq -\frac{5}{2}$ or $w \geq \frac{5}{2}\}$

- $|x - 8| \geq 3$ $\{x | x \leq 5$ or $x \geq 11\}$

- $|y + 5| < 2$ $\{y | -7 < y < -3\}$

- $2z - 2 \leq 3$ $\{z | -\frac{1}{2} \leq z \leq \frac{5}{2}\}$

- $|2x + 2| - 7 \leq -5$ $\{x | -2 \leq x \leq 0\}$

- $|x| > x - 1$ all real numbers

- $|3b + 5| \leq -2$ \emptyset

- $|r - 24| > 6.5$; $\{r | r < 17.5$ or $r > 30.5\}$


17. RAINFALL In 90% of the last 30 years, the rainfall at Shell Beach has varied no more than 6.5 inches from its mean value of 24 inches. Write and solve an absolute value inequality to describe the rainfall in the other 10% of the last 30 years.
 $|r - 24| > 6.5$; $\{r | r < 17.5$ or $r > 30.5\}$

18. MANUFACTURING A company's guidelines call for each can of soup produced not to vary from its stated volume of 14.5 fluid ounces by more than 0.08 ounces. Write and solve an absolute value inequality to describe acceptable can volumes.
 $|v - 14.5| \leq 0.08$; $\{v | 14.42 \leq v \leq 14.58\}$

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Glencoe Algebra 2

1-6 Reading to Learn Mathematics

Solving Compound and Absolute Value Inequalities

Pre-Activity How are compound inequalities used in medicine?

Read the introduction to Lesson 1-6 at the top of page 40 in your textbook.

- Five patients arrive at a medical laboratory at 11:30 A.M. for a glucose tolerance test. Each of them is asked when they last had something to eat or drink. Some of the patients are given the test and others are told that they must come back another day. Each of the patients is listed below with the times when they started to fast. (The P.M. times refer to the night before.) Which of the patients were accepted for the test?

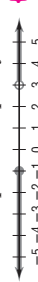
- Ora 5:00 A.M. Juanita 11:30 P.M. Jason and Juanita
 Jason 1:30 A.M. Samir 5:00 P.M.

Reading the Lesson

- a. Write a compound inequality that says, "x is greater than -3 and x is less than or equal to 4." $-3 < x \leq 4$
- b. Graph the inequality that you wrote in part a on a number line.



2. Use a compound inequality and set-builder notation to describe the following graph.



3. Write a statement equivalent to $|4x - 5| > 2$ that does not use the absolute value symbol. $4x - 5 > 2$ or $4x - 5 < -2$
4. Write a statement equivalent to $|3x + 7| < 8$ that does not use the absolute value symbol. $-8 < 3x + 7 < 8$

Helping You Remember

5. Many students have trouble knowing whether an absolute value inequality should be translated into an *and* or an *or* compound inequality. Describe a way to remember which of these applies to an absolute value inequality. Also describe how to recognize the difference from a number line graph. **Sample answer:** If the absolute value quantity is followed by a $<$ or \leq symbol, the expression inside the absolute value bars must be *between* two numbers, so this becomes an *and* inequality. The number line graph will show a single interval *between* two numbers. If the absolute value quantity is followed by a $>$ or \geq symbol, it becomes an *or* inequality, and the graph will show two disconnected intervals with arrows going in opposite directions.

1-6 Enrichment

Conjunctions and Disjunctions

An absolute value inequality may be solved as a compound sentence.

Example 1 Solve $|2x| < 10$.

$|2x| < 10$ means $2x < 10$ and $2x > -10$.

Solve each inequality. $x < 5$ and $x > -5$.

Every solution for $|2x| < 10$ is a replacement for x that makes both $x < 5$ and $x > -5$ true.

A compound sentence that combines two statements by the word *and* is a *conjunction*.

Example 2 Solve $|3x - 7| \geq 11$.

$|3x - 7| \geq 11$ means $3x - 7 \geq 11$ or $3x - 7 \leq -11$.

Solve each inequality. $3x \geq 18$ or $3x \leq -4$

$x \geq 6$ or $x \leq -\frac{4}{3}$

Every solution for the inequality is a replacement for x that makes either $x \geq 6$ or $x \leq -\frac{4}{3}$ true.

A compound sentence that combines two statements by the word *or* is a *disjunction*.

Solve each inequality. Then write whether the solution is a conjunction or disjunction.

1. $|4x| > 24$
 $x > 6$ or $x < -6$; disjunction
2. $|x - 7| \leq 8$
 $x \leq 15$ and $x \geq -1$; conjunction
3. $|2x + 5| < 1$
 $x < -2$ and $x > -3$; conjunction
4. $|x - 1| \geq 1$
 $x \geq 2$ or $x \leq 0$; disjunction
5. $|3x - 1| \leq x$
 $x \leq \frac{1}{2}$ and $x \geq \frac{1}{4}$; conjunction
6. $7 - |2x| > 5$
 $x < 1$ and $x > -1$; conjunction
7. $|\frac{x-4}{3}| < 4$
 $x \geq 12$ or $x \leq -16$; disjunction
8. $|\frac{x-4}{3}| < 4$
 $x < 16$ and $x > -8$; conjunction
9. $|8 - x| > 2$
 $x < 6$ or $x > 10$; disjunction
10. $|5 - 2x| \leq 3$
 $x \geq 1$ and $x \leq 4$; conjunction

Chapter 1 Assessment Answer Key

Form 1
Page 37

1. B
2. B
3. D
4. A
5. C
6. A
7. B
8. A
9. D
10. C
11. C

Page 38

12. D
13. B
14. A
15. B
16. D
17. C
18. B
19. A
20. C
- B: ∅

Form 2A
Page 39

1. C
2. A
3. D
4. C
5. B
6. A
7. C
8. C
9. B
10. B
11. D

(continued on the next page)

Chapter 1 Assessment Answer Key

Form 2A (continued)

Page 40

12. A

13. D

14. A

15. B

16. C

17. C

18. D

19. A

20. A

B: $|g - 80| < 5$

Form 2B

Page 41

1. D

2. A

3. C

4. B

5. D

6. A

7. B

8. A

9. C

10. A

11. C

Page 42

12. D

13. B

14. A

15. C

16. C

17. B

18. A

19. D

20. B

B: $\{x \mid x > 0\}$

Chapter 1 Assessment Answer Key

Form 2C

Page 43

1. $\frac{20}{7}$

2. $\frac{7}{9}$

3. -13

4. 3.5

5. $\$531.25$

6. Q, R

7. N, W, Z, Q, R

8. Q, R

9. Multiplicative Inverse

10. Additive Identity

11. $15v$

12. $n^3 - 10$

13. $\frac{9}{2}$

14. 11

15. $\{-5, 2\}$

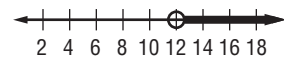
16. $\{-4, 8\}$

Page 44

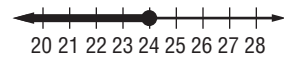
17. $n = \text{the number};$
 $2n + 6 = 28; 11$

18. $a = \text{number of}$
adult tickets;
 $12.00a + 7.50(a + 8) = 138;$
4 adults' tickets and
12 children's tickets

19. $\{t \mid t > 12\}$ or $(12, +\infty)$



20. $\{x \mid x \leq 24\}$ or $(-\infty, 24]$



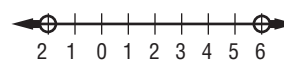
21. $\{n \mid 2 < n \leq 5\}$ or $(2, 5]$



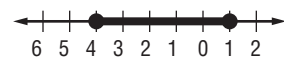
22. all real numbers or
 $(-\infty, +\infty)$



23. $\{x \mid x < -2 \text{ or } x > 6\}$ or
 $(-\infty, -2) \cup (6, +\infty)$



24. $\{x \mid -4 \leq x \leq 1\}$ or $[-4, 1]$



$g = \text{number of additional}$
games to be won;
 $\frac{g + 56}{162} \geq 0.60;$
25. at least 42 games

B: $\frac{7}{5}$

Answers

Chapter 1 Assessment Answer Key

Form 2D

Page 45

1. $\frac{5}{11}$

2. $\frac{11}{6}$

3. -3

4. 1.5

5. $\$180$

6. N, W, Z, Q, R

7. Q, R

8. Q, R

9. Additive Inverse

10. Multiplicative Identity

11. $10x - 23$

12. $5(7 + n)$

13. 3

14. 7

15. $\{-2, 1\}$

16. $\{1, 7\}$

Page 46

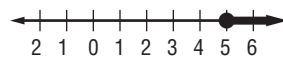
17. $n = \text{number};$
 $3n + 1 = 25; 8$

18. $w = \text{width};$
 $2[(w + 7) + w] = 38;$
width: 6 ft, length: 13 ft

19. $\{t | t < 2\}$ or $(-\infty, 2)$



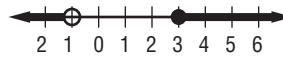
20. $\{x | x \geq 5\}$ or $[5, +\infty)$



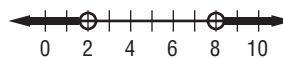
21. $\{x | -1 < x < 1\}$ or $(-1, 1)$



22. $\{n | n < -1 \text{ or } n \geq 3\}$ or
 $(-\infty, 1) \cup [3, +\infty)$



23. $\{x | x < 2 \text{ or } x > 8\}$ or
 $(-\infty, 2) \cup (8, +\infty)$



24. $\{x | -5 \leq x \leq 4\}$ or $[-5, 4]$



25. $d = \text{the number of dimes};$
 $0.10d + 0.05(25 - d) \geq 1.44;$
at least 4 dimes

B: -5

Chapter 1 Assessment Answer Key

Form 3
Page 47

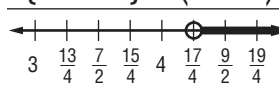
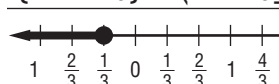
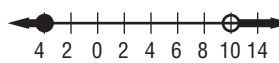
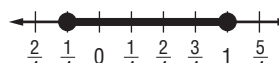
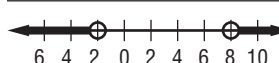
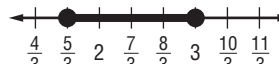
1. -3
2. 25
3. Sometimes, since when $a = -2b$, the value of the expression is zero.
4. 13.5648 in³

5. a. Z, Q, R
- b. I, R
- c. W, Z, Q, R
- d. Q, R
- e. N, W, Z, Q, R

6. $6x + 10y + 5$
four times the sum of the cube of a number and twice the same number
7. all real numbers
8. $\left\{-\frac{2}{3}, 4\right\}$
9. $a = \frac{2A}{h} - b$
10. \emptyset
 ℓ = length;
 $2\left[\ell + \left(\frac{1}{4}\ell + 3\right)\right] = 2\ell + 10$;
length: 8 meters
width: 5 meters
11. \emptyset
12. width: 5 meters

Page 48

13. $A = \frac{1}{2}b(18 - b)$

14. $\{x|x > \frac{17}{4}\}$ or $(\frac{17}{4}, +\infty)$

15. $\{y|y \leq -\frac{1}{3}\}$ or $(-\infty, -\frac{1}{3}]$

16. $\{x|x \leq -4$ or $x > 10\}$ or $(-\infty, -4] \cup (10, +\infty)$

17. $\{w|-\frac{1}{4} \leq w \leq 1\}$ or $[-\frac{1}{4}, 1]$

18. $\{x|x < -2$ or $x > 8\}$ or $(-\infty, -2) \cup (8, +\infty)$

19. $\{w|\frac{5}{3} \leq w \leq 3\}$ or $[\frac{5}{3}, 3]$

20. a = amount invested in stock;
 $0.08a + 0.06(5000 - a) \geq 3$; at least \$2500
- B: more than 1.75 h

Answers

Chapter 1 Assessment Answer Key

Page 49, Open-Ended Assessment 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>order of operations, properties of real numbers, simplifying and evaluating expressions, solving equations and inequalities including those with absolute value, and graphing inequalities.</i> Uses appropriate strategies to solve problems. Computations are correct. Written explanations are exemplary. 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>order of operations, properties of real numbers, simplifying and evaluating expressions, solving equations and inequalities including those with absolute value, and graphing inequalities.</i> Uses appropriate strategies to solve problems. Computations are mostly correct. Written explanations are effective. 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>order of operations, properties of real numbers, simplifying and evaluating expressions, solving equations and inequalities including those with absolute value, and graphing inequalities.</i> May not use appropriate strategies to solve problems. Computations are mostly correct. Written explanations are satisfactory. 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. 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>order of operations, properties of real numbers, simplifying and evaluating expressions, solving equations and inequalities including those with absolute value, and graphing inequalities.</i> Does not use appropriate strategies to solve problems. Computations are incorrect. Written explanations are unsatisfactory. Does not satisfy requirements of problems. No answer may be given.

Chapter 1 Assessment Answer Key

Page 49, Open-Ended Assessment Sample Answers

In addition to the scoring rubric found on page A26, the following sample answers may be used as guidance in evaluating open-ended assessment items.

1a. GIVEN

Addition Property of Equality
Commutative Property of Addition
Associative Property of Addition
Inverse Property of Addition
Identity Property of Addition
Distributive Property

SUBSTITUTION

Multiplication Property of Equality
Associative Property of
Multiplication
Inverse Property of Multiplication
Identity Property of Multiplication
Symmetric Property of Equality

1b. Sample student solution:

$$6(7 - x) + 3 = 9x$$

$$42 - 6x + 3 = 9x$$

$$45 - 6x + 6x = 9x + 6x$$

$$\frac{45}{15} = \frac{15x}{15}$$

$$3 = x$$

Students should note that their solutions are considerably briefer though the answers are the same. They should understand that they did, in fact, *use* all of the same properties but that they applied many of them mentally.

2a. Students may select any negative number for k . Their explanations should include the fact that an absolute value may never be less than zero.

2b. The only possible value of k is zero. Students should indicate that the only number that is zero units away from 3 on the number line is 3 itself.

2c. Students may select any value for k between 0 and 2. They should indicate that the solution of this inequality will not contain 5 if the distance from 3 on the number line is less than 2 units.

3a. Sample word problem:

Anoki is packing a box to ship to a science fair. The box must weigh no more than 10 pounds. He will put in an exhibit frame that weighs two pounds. How many rocks can he include if each rock weighs one-fourth of a pound?

3b. $\{x \mid x \leq 32\}$ and x is a whole number; For the sample problem, this would mean that no more than 32 rocks can be packed.

3c. Students should graph $\{x \mid x \leq 32\}$ and indicate that the graph includes negative numbers and numbers that are not integers. These numbers have no meaning in this context. Only 0, 1, 2, ..., 32 are possible for the number of rocks.

Chapter 1 Assessment Answer Key

Vocabulary Test/Review Page 50

- Identity Property
- rational numbers
- Symmetric Property
- Reflexive Property
- intersection
- set-builder notation
- Commutative Property
- Transitive Property
- compound inequality
- absolute value
- Sample answer: An irrational number is a real number that is not rational. This means that an irrational number cannot be written as a ratio of two integers.
- Sample answer: The Trichotomy Property says that if you compare two real numbers you will find that either the first one is smaller than the second, they are equal, or the first one is larger than the second.

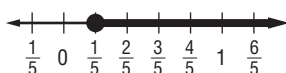
Quiz (Lessons 1-1 and 1-2) Page 51

- 13
- 72
- 47.8 m
- I, R
- $8v + \frac{7}{6}$

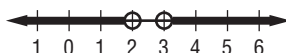

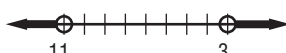
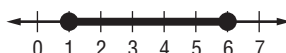

Quiz (Lesson 1-3) Page 51

- B
- $\frac{1}{6}$
- $-\frac{1}{10}$
- $x = \frac{y - b}{m}$
d = number of days running 7 miles;
 $8 + 7d = 99$; 13 days

Quiz (Lessons 1-4 and 1-5) Page 52

- 5
- $\left\{-\frac{4}{3}, 2\right\}$
- \emptyset
- $\left\{x \mid x \geq \frac{1}{5}\right\}$

- $g = \text{number of additional games to be won};$
 $\frac{41 + g}{82} \geq 0.70;$
at least 17 games

Quiz (Lesson 1-6) Page 52

- $\{x \mid x < 2 \text{ or } x > 3\}$
or $(-\infty, 2) \cup (3, +\infty)$

- $\{m \mid -1 < m < 8\}$ or $(-1, 8)$

- $\{x \mid x < -11 \text{ or } x > -3\}$
or $(-\infty, -11) \cup (-3, +\infty)$

- $\{x \mid 1 \leq x \leq 6\}$ or $[1, 6]$

- all real numbers or $(-\infty, +\infty)$


Chapter 1 Assessment Answer Key

Mid-Chapter Test

Page 53

1. D

2. B

3. A

4. C

5. A

6. $3x - 7$

7. 20

8. $t = \text{the number of students' tickets sold;}$
 $5(295 - t) + 2t = 950;$
 $175 \text{ students' tickets}$

9. -11.5

10. $b = -2ah$

11. 14

Cumulative Review

Page 54

1. -36

2. 0.49

3. 20

4. 17

5. 77

6. N, W, Z, Q, R

7. $7x - 2$

8. $n^2 + n^3$

9. 8

10. $\{-4, 5\}$

11. \emptyset

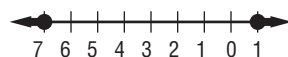
12. $\{t | t \geq 5\}$ or $[5, +\infty)$



13. all real numbers $(-\infty, +\infty)$



14. $\{x | x < -7 \text{ or } x \geq 1\}$
or $(-\infty, -7) \cup (1, +\infty)$



16. $n = \text{the number;}$
 $48 - 3n = 36; 4$

$g = \text{number of additional games to be won;}$
 $\frac{57 + g}{162} \geq 0.65; \text{ at least}$

17. 49 games

Chapter 1 Assessment Answer Key

Standardized Test Practice

Page 55

Page 56

1. A B C D

2. E F G H

3. A B C D

4. E F G H

5. A B C D

6. E F G H

7. A B C D

8. E F G H

9. A B C D

10. E F G H

11. A B C D

12.

	3	5		
	/	/		

	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.

	1	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

14.

	.	0	9	
	/	/		

	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

15.

	1	9	/	3
	/	/		

	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

16. A B C D

17. A B C D

18. A B C D

19. A B C D