Glencoe McGraw-Hill

California Mathematics

Grade 6

Study Guide and Intervention Workbook

Glencoe

New York, New York Columbus, Ohio Chicago, Illinois Woodland Hills, California

TO THE STUDENT This *Study Guide and Intervention Workbook* gives you additional examples and problems for the concept exercises in each lesson. The exercises are designed to aid your study of mathematics by reinforcing important mathematical skills needed to succeed in the everyday world. The materials are organized by chapter and lesson, with one *Study Guide and Intervention* worksheet for every lesson in *Glencoe California Mathematics, Grade 6.*

Always keep your workbook handy. Along with your textbook, daily homework, and class notes, the completed *Study Guide and Intervention Workbook* can help you review for quizzes and tests.

TO THE TEACHER These worksheets are the same as those found in the Chapter Resource Masters for *Glencoe California Mathematics, Grade 6.* The answers to these worksheets are available at the end of each Chapter Resource Masters booklet as well as in your Teacher Wraparound Edition interleaf pages.

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

ISBN: 978-0-07-878871-0
MHID: 0-07-878871-4

Study Guide and Intervention, Grade 6

Printed in the United States of America

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6MR1.1, 5NS2.1

A Plan for Problem Solving

Four-Step Problem-Solving Plan

When solving problems, it is helpful to have an organized plan to solve the problem. The following four steps can be used to solve any math problem.

1. **Explore** – Get a general understanding of the problem. What information is given?
2. **Plan** – Select a strategy to solve the problem and estimate the answer.
3. **Solve** – Carry out your plan to solve the problem.
4. **Check** – Determine the reasonableness of your answer compared to your estimate.

Example 1 **Use the four-step plan to solve the problem.**

RECREATION A canoe rental store along the Illinois River in Oklahoma has 30 canoes that it rents on a daily basis during the summer season. If canoes rent for $15 per day, how much money can the store collect for canoe rentals during the month of July?

Explore You know that they rent 30 canoes per day for $15 each. You need to determine the total amount of money that can be collected during the month of July.

Plan First, find the total amount of money that can be collected each day by finding the product of 30 and 15. Next, multiply the previous result by 31, the number of days in July. You can estimate this result by 30. $30 \times 15 \times 30 = 13{,}500$

Solve Since $30 \times \$15 = \$450$, the canoe rental store can collect $450 in rental fees each day. This means the total amount of money that could be collected during the month of July is $\$450 \times 31$ or $13,950.

Check Is your answer reasonable? The answer is close to the estimate of $13,500.

Exercises

Use the four-step plan to solve each problem.

1. **MONEY** Colin works for his dad during summer vacation. His dad pays him $5.20 per hour and he works 20 hours per week. How much will Colin earn during his 8-week summer vacation?

2. **BOOKS** A student assistant in the school library is asked to shelve 33 books. If he puts away 9 books the first hour and then 6 books each hour after that, how long will it take him to shelve all 33 books?

3. **SHOPPING** Alicia bought a $48 sweater on sale for $25 and a $36 purse on sale for $22. How much did Alicia save?

4. **MAIL** It cost Ramon $3.73 to mail a package to his grandmother. The post office charged $2.38 for the first pound and 45 cents for each additional pound. How much did the package weigh?

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1-2 Study Guide and Intervention

5NS1.3

Powers and Exponents

Exponent

$$3^4 = \underbrace{3 \cdot 3 \cdot 3 \cdot 3}_{\text{common factors}} = 81$$

Base

The **exponent** tells you how many times the **base** is used as a factor.

Example 1 **Write 6^3 as a product of the same factor.**

The base is 6. The exponent 3 means that 6 is used as a factor 3 times.
$6^3 = 6 \cdot 6 \cdot 6$

Example 2 **Evaluate 5^4.**

$5^4 = 5 \cdot 5 \cdot 5 \cdot 5$
$= 625$

Example 3 **Write $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$ in exponential form.**

The base is 4. It is used as a factor 5 times, so the exponent is 5.
$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 4^5$

Exercises

Write each power as a product of the same factor.

1. 7^3 **2.** 2^7 **3.** 9^2 **4.** 15^4

Evaluate each expression.

5. 3^5 **6.** 7^3 **7.** 8^4 **8.** 5^3

Write each product in exponential form.

9. $2 \cdot 2 \cdot 2 \cdot 2$

10. $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$

11. $10 \cdot 10 \cdot 10$

12. $9 \cdot 9 \cdot 9 \cdot 9 \cdot 9$

13. $12 \cdot 12 \cdot 12$

14. $5 \cdot 5 \cdot 5 \cdot 5$

15. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

16. $1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1$

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7NS2.4

Squares and Square Roots

The product of a number and itself is the **square** of the number. Numbers like 4, 25, and 2.25 are called **perfect squares** because they are squares of rational numbers. The factors multiplied to form perfect squares are called **square roots**. Both $5 \cdot 5$ and $(-5)(-5)$ equal 25. So, 25 has two square roots, 5 and −5. A **radical sign**, $\sqrt{\ }$, is the symbol used to indicate the *positive* square root of a number. So, $\sqrt{25} = 5$.

Examples

1 Find the square of 5.

$5 \cdot 5 = 25$

2 Find the square of 16.

16 [x^2] [ENTER] **256**

3 Find $\sqrt{49}$.

$7 \cdot 7 = 49$, so $\sqrt{49} = 7$.

4 Find $\sqrt{169}$.

[2nd] [$\sqrt{\ }$] 169 [ENTER] **13**

So, $\sqrt{169} = 13$.

Example 5

A square tile has an area of 144 square inches. What are the dimensions of the tile?

[2nd] [$\sqrt{\ }$] 144 [ENTER] **12** Find the square root of 144.

So, the tile measures 12 inches by 12 inches.

Exercises

Find the square of each number.

1. 2 **2.** 9 **3.** 14

4. 15 **5.** 21 **6.** 45

Find each square root.

7. $\sqrt{16}$ **8.** $\sqrt{36}$ **9.** $\sqrt{256}$

10. $\sqrt{1{,}024}$ **11.** $\sqrt{361}$ **12.** $\sqrt{484}$

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1-4 Study Guide and Intervention

6AF1.3, 6AF1.4

Order of Operations

Use the **order of operations** to evaluate numerical expressions.

1. Do all operations within grouping symbols first.
2. Evaluate all powers before other operations.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

Example 1 **Evaluate $(10 - 2) - 4 \cdot 2$.**

$(10 - 2) - 4 \cdot 2 = 8 - 4 \cdot 2$ Subtract first since 10 − 2 is in parentheses.
$= 8 - 8$ Multiply 4 and 2.
$= 0$ Subtract 8 from 8.

Example 2 **Evaluate $8 + (1 + 5)^2 \div 4$.**

$8 + (1 + 5)^2 \div 4 = 8 + 6^2 \div 4$ First, add 1 and 5 inside the parentheses.
$= 8 + 36 \div 4$ Find the value of 6^2.
$= 8 + 9$ Divide 36 by 4.
$= 17$ Add 8 and 9.

Exercises

Evaluate each expression.

1. $(1 + 7) \times 3$

2. $28 - 4 \cdot 7$

3. $5 + 4 \cdot 3$

4. $(40 \div 5) - 7 + 2$

5. $35 \div 7(2)$

6. 3×10^3

7. $45 \div 5 + 36 \div 4$

8. $42 \div 6 \times 2 - 9$

9. $2 \times 8 - 3^2 + 2$

10. $5 \times 2^2 + 32 \div 8$

11. $3 \times 6 - (9 - 8)^3$

12. 3.5×10^2

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6MR1.1, 5NS2.1

Problem Solving Investigation: Guess and Check

When solving problems, one strategy that is helpful to use is guess and check. Based on the information in the problem, you can make a guess of the solution. Then use computations to check if your guess is correct. You can repeat this process until you find the correct solution

You can use guess and check, along with the following four-step problem solving plan to solve a problem.

Explore • Read and get a general understanding of the problem.

Plan • Make a plan to solve the problem and estimate the solution.

Solve • Use your plan to solve the problem.

Check • Check the reasonableness of your solution.

Example

VETERINARY SCIENCE **Dr. Miller saw 40 birds and cats in one day. All together the pets he saw had 110 legs. How many of each type of animal did Dr. Miller see in one day?**

Explore You know that Dr. Miller saw 40 birds and cats total. You also know that there were 110 legs in all. You need to find out how many of each type of animal he saw in one day.

Plan Make a guess and check it. Adjust the guess until you get the correct answer.

Solve

Number of birds	Number of cats	Total number of feet
20	20	2(20) + 4(20) = 120
30	10	2(30) + 4(10) = 100
25	15	2(25) + 4(15) = 110

Check 25 birds have 50 feet. 15 cats have 60 feet. Since 50 + 60 is 110, the answer is correct.

Exercise

GEOMETRY In a math class of 26 students, each girl drew a triangle and each boy drew a square. If there were 89 sides in all, how many girls and how many boys were in the class?

1-6 Study Guide and Intervention

6AF1.2, 6AF1.4

Algebra: Variables and Expressions

To evaluate an algebraic expression you replace each variable with its numerical value, then use the order of operations to simplify.

Example 1 **Evaluate $6x - 7$ if $x = 8$.**

$6x - 7 = 6(8) - 7$	Replace *x* with 8.
$= 48 - 7$	Use the order of operations.
$= 41$	Subtract 7 from 48.

Example 2 **Evaluate $5m - 3n$ if $m = 6$ and $n = 5$.**

$5m - 3n = 5(6) - 3(5)$	Replace *m* with 6 and *n* with 5.
$= 30 - 15$	Use the order of operations.
$= 15$	Subtract 15 from 30.

Example 3 **Evaluate $\frac{ab}{3}$ if $a = 7$ and $b = 6$.**

$\frac{ab}{3} = \frac{(7)(6)}{3}$	Replace *a* with 7 and *b* with 6.
$= \frac{42}{3}$	The fraction bar is like a grouping symbol.
$= 14$	Divide.

Example 4 **Evaluate $x^3 + 4$ if $x = 3$.**

$x^3 + 4 = 3^3 + 4$	Replace *x* with 3.
$= 27 + 4$	Use the order of operations.
$= 31$	Add 27 and 4.

Exercises

Evaluate each expression if $a = 4$, $b = 2$, and $c = 7$.

1. $3ac$

2. $5b^3$

3. abc

4. $5 + 6c$

5. $\frac{ab}{8}$

6. $2a - 3b$

7. $\frac{b^4}{4}$

8. $c - a$

9. $20 - bc$

10. $2bc$

11. $ac - 3b$

12. $6a^2$

13. $7c$

14. $6a - b$

15. $ab - c$

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1-7 Study Guide and Intervention

6AF1.1

Algebra: Equations

- An **equation** is a sentence in mathematics that contains an equals sign, =.
- The **solution** of an equation is the value that when substituted for the variable makes the equation true.

Example 1 **Solve $23 + y = 29$ mentally.**

$23 + y = 29$	Write the equation.
$23 + 6 = 29$	You know that 23 + 6 is 29.
$29 = 29$	Simplify.

The solution is 6.

Example 2

TRAVEL On their annual family vacation, the Whites travel 790 miles in two days. If on the first day they travel 490 miles, how many miles must they drive on the second day to reach their destination?

The total distance to travel in two days is 790 miles.

Let m represent the distance to travel on day two.

$m + 490 = 790$

$m + 490 = 790$	Write the equation.
$300 + 490 = 790$	Replace m with 300 to make the equation true.
$790 = 790$	Simplify.

The number 300 is the solution. The distance the Whites must travel on day two is 300 miles.

Exercises

Solve each equation mentally.

1. $k + 7 = 15$

2. $g - 8 = 20$

3. $6y = 24$

4. $\frac{a}{3} = 9$

5. $\frac{x}{6} = 9$

6. $8 + r = 24$

7. $12 \cdot 8 = h$

8. $n \div 11 = 8$

9. $48 \div 12 = x$

10. $h - 12 = 24$

11. $19 + y = 28$

12. $9f = 90$

Define a variable. Then write and solve an equation.

13. **MONEY** Aaron wants to buy a video game. The game costs $15.50. He has $10.00 saved from his weekly allowance. How much money does he need to borrow from his mother in order to buy the video game?

1-8 Study Guide and Intervention

6AF1.3

Algebra: Properties

Property	Arithmetic	Algebra
Distributive Property	$5(3 + 4) = 5(3) + 5(4)$	$a(b + c) = a(b) + a(c)$
Commutative Property of Addition	$5 + 3 = 3 + 5$	$a + b = b + a$
Commutative Property of Multiplication	$5 \times 3 = 3 \times 5$	$a \times b = b \times a$
Associative Property of Addition	$(2 + 3) + 4 = 2 + (3 + 4)$	$(a + b) + c = a + (b + c)$
Associative Property of Multiplication	$(4 \times 5) \times 6 = 4 \times (5 \times 6)$	$(a \times b) \times c = a \times (b \times c)$
Identity Property of Addition	$5 + 0 = 5$	$a + 0 = a$
Identity Property of Multiplication	$5 \times 1 = 5$	$a \times 1 = a$

Example 1 **Use the Distributive Property to write 6(4 + 3) as an equivalent expression. Then evaluate the expression.**

$6(4 + 3) = 6 \cdot 4 + 6 \cdot 3$ Apply the Distributive Property.
$= 24 + 18$ Multiply.
$= 42$ Add.

Example 2 **Name the property shown by each statement.**

$5 \times 4 = 4 \times 5$ Commutative Property of Multiplication

$12 + 0 = 12$ Identity Property of Addition

$7 + (6 + 3) = (7 + 6) + 3$ Associative Property of Addition

Exercises

Use the Distributive Property to write each expression as an equivalent expression. Then evaluate the expression.

1. $5(7 + 2)$ **2.** $4(9 + 1)$ **3.** $2(6 + 7)$

Name the property shown by each statement.

4. $9 \times 1 = 9$

5. $7 \times 3 = 3 \times 7$

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

7. $6(3 + 2) = 6(3) + 6(2)$

8. $15 + 12 = 12 + 15$

9. $1 \times 20 = 20$

10. $(9 \times 5) \times 2 = 9 \times (5 \times 2)$

11. $3 = 0 + 3$

1-9 Study Guide and Intervention

6AF1.2

Algebra: Arithmetic Sequences

An **arithmetic sequence** is a list in which each term is found by adding the same number to the previous term. 1, 3, 5, 7, 9, …
+2 +2 +2 +2

Example 1 **Describe the relationship between terms in the arithmetic sequence 17, 23, 29, 35, … Then write the next three terms in the sequence.**

17, 23, 29, 35, ….
+6 +6 +6

Each term is found by adding 6 to the previous term.

$35 + 6 = 41$ $41 + 6 = 47$ $47 + 6 = 53$

The next three terms are 41, 47, and 53.

Example 2

MONEY Brian's parents have decided to start giving him a monthly allowance for one year. Each month they will increase his allowance by $10. Suppose this pattern continues. What algebraic expression can be used to find Brian's allowance after any given number of months? How much money will Brian receive for allowance for the 10th month?

Make a table to display the sequence.

Position	Operation	Value of Term
1	$1 \cdot 10$	10
2	$2 \cdot 10$	20
3	$3 \cdot 10$	30
n	$n \cdot 10$	$10n$

Each term is 10 times its position number. So, the expression is $10n$.
How much money will Brian earn after 10 months?

$10n$ Write the expression.
$10(10) = 100$ Replace n with 10

So, for the 10th month Brian will receive $100.

Exercises

Describe the relationship between terms in the arithmetic sequences. Write the next three terms in the sequence.

1. 2, 4, 6, 8, … **2.** 4, 7, 10, 13, … **3.** 0.3, 0.6, 0.9, 1.2, …

4. 200, 212, 224, 236, … **5.** 1.5, 2.0, 2.5, 3.0, … **6.** 12, 19, 26, 33, …

7. **SALES** Mama's bakery just opened and is currently selling only two types of pastry. Each month, Mama's bakery will add two more types of pastry to their menu. Suppose this pattern continues. What algebraic expression can be used to find the number of pastries offered after any given number of months? How many pastries will be offered in one year?

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1-10 Study Guide and Intervention

6AF1.2, 6MR2.4

Algebra: Equations and Functions

The solution of an equation with two variables consists of two numbers, one for each variable that makes the equation true. When a relationship assigns exactly one output value for each input value, it is called a function. Function tables help to organize input numbers, output numbers, and function rules.

Example 1 **Complete a function table for $y = 5x$. Then state the domain and range.**

Choose four values for x. Substitute the values for x into the expression. Then evaluate to find the y value.

x	$5x$	y
0	5(0)	0
1	5(1)	5
2	5(2)	10
3	5(3)	15

The domain is {0, 1, 2, 3}. The range is {0, 5, 10, 15}.

Exercises

Complete the following function tables. Then state the domain and range.

1. $y = x + 4$

x	$x + 4$	y
0		
1		
2		
3		

2. $y = 10x$

x	$10x$	y
1		
2		
3		
4		

3. $y = x - 1$

x	$x - 1$	y
2		
3		
4		
5		

4. $y = 3x$

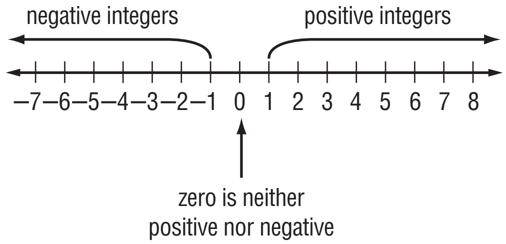
x	$3x$	y
10		
11		
12		
13		

2-1 Study Guide and Intervention

6NS1.1

Integers and Absolute Value

Integers less than zero are **negative integers**. Integers greater than zero are **positive integers**.



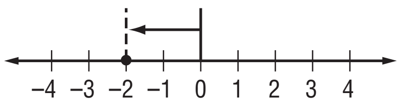
The absolute value of an integer is the distance the number is from zero on a number line. Two vertical bars are used to represent absolute value. The symbol for absolute value of 3 is $|3|$.

Example 1 **Write an integer that represents 160 feet below sea level.**

Because it represents *below* sea level, the integer is -160.

Example 2 **Evaluate $|-2|$.**

On the number line, the graph of -2 is 2 units away from 0. So, $|-2| = 2$.



Exercises

Write an integer for each situation.

1. 12°C above 0

2. a loss of $24

3. a gain of 20 pounds

4. falling 6 feet

Evaluate each expression.

5. $|12|$

6. $|-150|$

7. $|-8|$

8. $|75|$

9. $|-19|$

10. $|84|$

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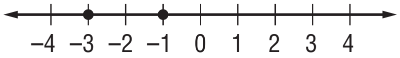
2-2 Study Guide and Intervention

6NS1.1

Comparing and Ordering Integers

When two numbers are graphed on a number line, the number to the left is always less than (<) the number to the right. The number to the right is always greater than (>) the number to the left.

Model



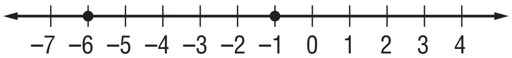
Words -3 is less than -1. -1 is greater than -1.

Symbols $-3 < -1$ $-1 > -3$

The symbol points to the lesser number.

Example 1 **Replace the ● with < or > to make –1 ● –6 a true sentence.**

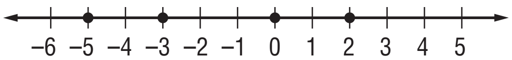
Graph each integer on a number line.



Since -1 is to the right of -6, $-1 > -6$.

Example 2 **Order the integers 2, –3, 0, –5 from least to greatest.**

To order the integers, graph them on a number line.



Order the integers by reading from left to right: $-5, -3, 0, 2$.

Exercises

1. Replace the ● with < or > to make -5 ● -10 a true sentence.

2. Order $-1, 5, -3$, and 2 from least to greatest.

3. Order $0, -4, -2$, and 7 from greatest to least.

4. Order $-3, |-2|, 4, 0$, and -5 from greatest to least.

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2-3 Study Guide and Intervention

5AF1., 6MR2.4

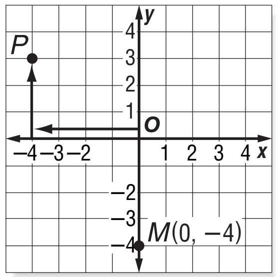
The Coordinate Plane

The **coordinate plane** is used to locate points. The horizontal number line is the ***x*-axis**. The vertical number line is the ***y*-axis**. Their intersection is the **origin**.

Points are located using **ordered pairs**. The first number in an ordered pair is the ***x*-coordinate**; the second number is the ***y*-coordinate**.

The coordinate plane is separated into four sections called **quadrants**.

Example 1 **Name the ordered pair for point P. Then identify the quadrant in which P lies.**



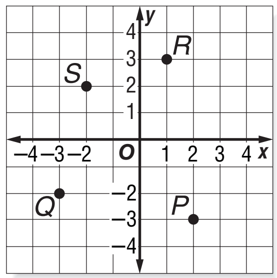
- Start at the origin.
- Move 4 units left along the x-axis.
- Move 3 units up on the y-axis.
  The ordered pair for point P is $(-4, 3)$.
  P is in the upper left quadrant or quadrant II.

Example 2 **Graph and label the point $M(0, -4)$.**

- Start at the origin.
- Move 0 units along the x-axis.
- Move 4 units down on the y-axis.
- Draw a dot and label it $M(0, -4)$.

Exercises

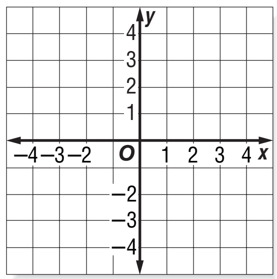
Name the ordered pair for each point graphed at the right. Then identify the quadrant in which each point lies.



1. P **2.** Q

3. R **4.** S

Graph and label each point on the coordinate plane.



5. $A(-1, 1)$ **6.** $B(0, -3)$

7. $C(3, 2)$ **8.** $D(-3, -1)$

9. $E(1, -2)$ **10.** $F(1, 3)$

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2-4 Study Guide and Intervention

6NS2.3

Adding Integers

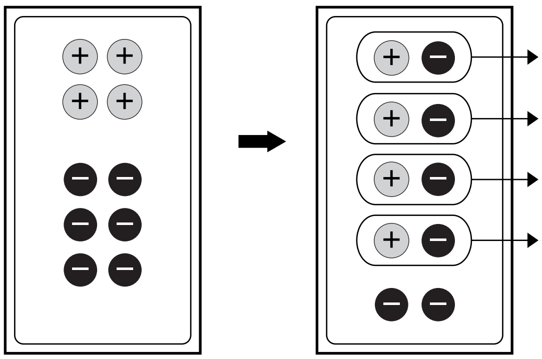
For integers with the same sign:
- the sum of two positive integers is positive.
- the sum of two negative integers is negative.

For integers with different signs, subtract their absolute values. The sum is:
- positive if the positive integer has the greater absolute value.
- negative if the negative integer has the greater absolute value.

To add integers, it is helpful to use counters or a number line.

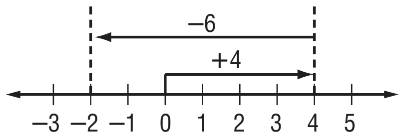
Example **Find 4 + (−6).**

Method 1 Use counters.
Combine a set of 4 positive counters and a set of 6 negative counters on a mat.



4 + (−6) 4 + (−6) = −2

Method 2 Use a number line.
- Start at 0.
- Move 4 units right.
- Then move 6 units left.



4 + (−6) = −2

Exercises

Add.

1. $-5 + (-2)$ **2.** $8 + 1$ **3.** $-7 + 10$

4. $16 + (-11)$ **5.** $-22 + (-7)$ **6.** $-50 + 50$

7. $-10 + (-10)$ **8.** $100 + (-25)$ **9.** $-35 + -20$

Evaluate each expression if $a = 8$, $b = -8$, and $c = 4$.

10. $a + 15$ **11.** $b + (-9)$ **12.** $a + b$

13. $b + c$ **14.** $-10 + c$ **15.** $12 + b$

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2-5 Study Guide and Intervention

6NS2.3

Subtracting Integers

To subtract an integer, add its opposite.

Example 1 **Find 6 − 9.**

$6 - 9 = 6 + (-9)$ To subtract 9, add −9.

$= -3$ Simplify.

Example 2 **Find −10 − (−12).**

$-10 - (-12) = -10 + 12$ To subtract −12, add 12.

$= 2$ Simplify.

Example 3 **Evaluate $a - b$ if $a = -3$ and $b = 7$.**

$a - b = -3 - 7$ Replace *a* with −3 and *b* with 7.

$= -3 + (-7)$ To subtract 7, add −7.

$= -10$ Simplify.

Exercises

Subtract.

1. $7 - 9$

2. $20 - (-6)$

3. $-10 - 4$

4. $0 - 12$

5. $-7 - 8$

6. $13 - 18$

7. $-20 - (-5)$

8. $-8 - (-6)$

9. $25 - (-14)$

10. $-75 - 50$

11. $15 - 65$

12. $19 - (-10)$

Evaluate each expression if $m = -2$, $n = 10$, and $p = 5$.

13. $m - 6$

14. $9 - n$

15. $p - (-8)$

16. $p - m$

17. $m - n$

18. $-25 - p$

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2-6 Study Guide and Intervention

6NS2.3

Multiplying Integers

The product of two integers with **different** signs is **negative**.

The product of two integers with the **same** sign is **positive**.

Example 1 **Multiply 5(−2).**

$5(-2) = -10$ The integers have different signs. The product is negative.

Example 2 **Multiply −3(7).**

$-3(7) = -21$ The integers have different signs. The product is negative.

Example 3 **Multiply −6(−9).**

$-6(-9) = 54$ The integers have the same sign. The product is positive.

Example 4 **Multiply $(-7)^2$.**

$(-7)^2 = (-7)(-7)$ There are 2 factors of −7.
$= 49$ The product is positive.

Example 5 **Simplify −2(6*c*).**

$-2(6c) = (-2 \cdot 6)c$ Associative Property of Multiplication.
$= -12c$ Simplify.

Example 6 **Simplify 2(5*x*).**

$2(5x) = (2 \cdot 5)x$ Associative Propery of Multiplication.
$= 10x$ Simplify.

Exercises

Multiply.

1. $-5(8)$ **2.** $-3(-7)$ **3.** $10(-8)$

4. $-8(3)$ **5.** $-12(-12)$ **6.** $(-8)^2$

ALGEBRA **Simplify each expression.**

7. $-5(7a)$ **8.** $3(-2x)$ **9.** $4(6f)$

10. $7(6b)$ **11.** $-6(-3y)$ **12.** $7(-8g)$

ALGEBRA **Evaluate each expression if $a = -3$, $b = -4$, and $c = 5$.**

13. $-2a$ **14.** $9b$ **15.** ab

16. $-3ac$ **17.** $-2c^2$ **18.** abc

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2-7 Study Guide and Intervention

6MR1.1, 6NS2.3

Problem-Solving Investigation: Look for a Pattern

Looking for a pattern is one strategy that can help you when solving problems. You can use the four-step problem-solving plan along with looking for a pattern to solve problems.

Explore	• Determine what information is given in the problem and what you need to find.
Plan	• Select a strategy including a possible estimate.
Solve	• Solve the problem by carrying out your plan.
Check	• Examine your answer to see if it seems reasonable.

Example **MEMBERSHIP** The local tennis club started the year with 675 members. In one month they had 690 members. After two months they had 705 members. After three months they had 720 members. When the tennis club reaches 750 members they will close their enrollment. How many months will it take the club to reach their maximum enrollment if they continue adding new members at the same rate?

Explore The club began with 675 members and is adding new members every month. It needs to find out when it reaches its maximum enrollment of 750 members.

Plan Look for a pattern or rule that increases the membership each month. Then use the rule to extend the pattern to find the solution.

Solve After the initial 675 members, 15 new members joined each month. Extend the pattern to find the solution.

675, 690, 705, 720, 735, 750
+15 +15 +15 +15 +15

They will have reached their maximum enrollment in 5 months.

Check They increased by $5 \cdot 15$ or 75 members in 5 months which when added to the original 675 members is $675 + 75 = 750$. So, 5 months is a reasonable answer.

Exercises

1. **PRODUCE** A farmer has 42 apples sitting on his front porch. The next day there are only 36 apples left on the porch. After 2 days there are only 30 apples left on the porch and in 3 days 24 apples remain on the porch. After how many days will there be no more apples on the porch if the same amount continue to disappear each day?

2. **TELEPHONE** A local phone company charges a standard rate of $3 per call. After one minute the charge is $4.50. In two minutes the charge is $6.00. If Susan only has $10.00, how long can her phone conversation be if the charges per minute stay constant?

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2-8 Study Guide and Intervention

6NS2.3

Dividing Integers

The quotient of two integers with different signs is negative.

The quotient of two integers with the same sign is positive.

Example 1 **Divide 30 ÷ (−5).**

$30 \div (-5)$	The integers have different signs.
$30 \div (-5) = -6$	The quotient is negative.

Example 2 **Divide −100 ÷ (−5).**

$-100 \div (-5)$	The integers have the same sign.
$-100 \div (-5) = 20$	The quotient is positive.

Exercises

Divide.

1. $-12 \div 4$

2. $-14 \div (-7)$

3. $\frac{18}{-2}$

4. $-6 \div (-3)$

5. $-10 \div 10$

6. $\frac{-80}{-20}$

7. $350 \div (-25)$

8. $-420 \div (-3)$

9. $\frac{540}{45}$

10. $\frac{-256}{16}$

ALGEBRA **Evaluate each expression if $d = -24$, $e = -4$, and $f = 8$.**

11. $12 \div e$

12. $40 \div f$

13. $d \div 6$

14. $d \div e$

15. $f \div e$

16. $e^2 \div f$

17. $\frac{-d}{e}$

18. $ef \div 2$

19. $\frac{f^2}{e^2}$

20. $\frac{de}{f}$

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6AF1.2

3-1 Study Guide and Intervention

Writing Expressions and Equations

The table below shows phrases written as mathematical expressions.

Phrases	Expression	Phrases	Expression
9 more than a number the sum of 9 and a number a number plus 9 a number increased by 9 the total of x and 9	$x + 9$	4 subtracted from a number a number minus 4 4 less than a number a number decreased by 4 the difference of h and 4	$h - 4$
Phrases	**Expression**	**Phrases**	**Expression**
6 multiplied by g 6 times a number the product of g and 6	$6g$	a number divided by 5 the quotient of t and 5 divide a number by 5	$\frac{t}{5}$

The table below shows sentences written as an equation.

Sentences	Equation
Sixty less than three times the amount is $59. Three times the amount less 60 is equal to 59. 59 is equal to 60 subtracted from three times a number. A number times three minus 60 equals 59.	$3n - 60 = 59$

Exercises

Write each phrase as an algebraic expression.

1. 7 less than m

2. the quotient of 3 and y

3. the total of 5 and c

4. the difference of 6 and r

5. n divided by 2

6. the product of k and 9

Write each sentence as an algebraic equation.

7. A number increased by 7 is 11.

8. The price decreased by $4 is $29.

9. Twice as many points as Bob would be 18 points.

10. After dividing the money 5 ways, each person got $67.

11. Three more than 8 times as many trees is 75 trees.

12. Seven less than a number is 15.

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6AF1.1, 6MR2.4

3-2 Study Guide and Intervention

Solving Addition and Subtraction Equations

Remember, equations must always remain balanced. If you subtract the same number from each side of an equation, the two sides remain equal. Also, if you add the same number to each side of an equation, the two sides remain equal.

Example 1 **Solve $x + 5 = 11$. Check your solution.**

$x + 5 = 11$	Write the equation.
$\quad - 5 = -5$	Subtract 5 from each side.
$x = 6$	Simplify.

Check

$x + 5 = 11$	Write the equation.
$6 + 5 \stackrel{?}{=} 11$	Replace *x* with 6.
$11 = 11$ ✓	This sentence is true.

The solution is 6.

Example 2 **Solve $15 = t - 12$. Check your solution.**

$15 = t - 12$	Write the equation.
$+12 = \quad +12$	Add 12 to each side.
$27 = t$	Simplify.

Check

$15 = t - 12$	Write the equation.
$15 \stackrel{?}{=} 27 - 12$	Replace *t* with 27.
$15 = 15$ ✓	This sentence is true.

The solution is 27.

Exercises

Solve each equation. Check your solution.

1. $h + 3 = 14$

2. $m + 8 = 22$

3. $p + 5 = 15$

4. $17 = y + 8$

5. $w + 4 = -1$

6. $k + 5 = -3$

7. $25 = 14 + r$

8. $57 + z = 97$

9. $b - 3 = 6$

10. $7 = c - 5$

11. $j - 12 = 18$

12. $v - 4 = 18$

13. $-9 = w - 12$

14. $y - 8 = -12$

15. $14 = f - 2$

16. $23 = n - 12$

3-3 Study Guide and Intervention

6AF1.1, 6AF2.3

Solving Multiplication Equations

If each side of an equation is divided by the same non-zero number, the resulting equation is equivalent to the given one. You can use this property to solve equations involving multiplication and division.

Example 1 **Solve $45 = 5x$. Check your solution.**

$45 = 5x$	Write the equation.
$\frac{45}{5} = \frac{5x}{5}$	Divide each side of the equation by 5.
$9 = x$	45 ÷ 5 = 9

Check $45 = 5x$ — Write the original equation.
$45 \stackrel{?}{=} 5(9)$ — Replace *x* with 9. Is this sentence true?
$45 = 45$ ✓

The solution is 9.

Example 2 **Solve $-21 = -3y$. Check your solution.**

$-21 = -3y$	Write the equation.
$\frac{-21}{-3} = \frac{-3y}{-3}$	Divide each side by −3.
$7 = y$	−21 ÷ (−3) = 7

Check $-21 = -3y$ — Write the original equation.
$-21 \stackrel{?}{=} -3(7)$ — Replace *y* with 7. Is this sentence true?
$-21 = -21$ ✓

The solution is 7.

Exercises

Solve each equation. Then check your solution.

1. $8q = 56$ **2.** $4p = 32$ **3.** $42 = 6m$ **4.** $104 = 13h$

5. $-6n = 30$ **6.** $-18x = 36$ **7.** $48 = -8y$ **8.** $72 = -3b$

9. $-9a = -45$ **10.** $-12m = -120$ **11.** $-66 = -11t$ **12.** $-144 = -9r$

13. $3a = 4.5$ **14.** $2h = 3.8$ **15.** $4.9 = 0.7k$ **16.** $9.75 = 2.5z$

3-4 Study Guide and Intervention

6MR2.7, 6NS2.3

Problem-Solving Investigation: Work Backward

By working backward from where you end to where you began, you can solve problems. Use the four-step problem solving model to stay organized when working backward.

Example 1 **Jonah put half of his birthday money into his savings account. Then he paid back the $10 that he owed his brother for dance tickets. Lastly, he spent $3 on lunch at school. At the end of the day he was left with $12. How much money did Jonah receive for his birthday?**

Explore	You know that he had $12 left and the amounts he spent throughout the day. You need to find out how much money he received for his birthday.	
Plan	Start with the amount of money he was left with and work backward.	
Solve	He had $12 left.	12
	Undo the $3 he spent on lunch.	+ 3
		15
	Undo the $10 he gave back to his brother	+10
		25
	Undo the half put into his savings account	× 2
	So, Jonah received $50 for his birthday.	50
Check	Assume that Jonah receive $50 for his birthday. After putting half into his savings account he had $50 ÷ 2 or $25. Then he gave $10 to his brother for dance tickets, so he had $25 − $10 or $15. Lastly, he spent $3 on lunch at school, so he had $15 − $3, or $12. So, our answer of $50 is correct.	

Exercises

Solve each problem by using the work backward strategy.

1. On Monday everyone was present in Mr. Miller's class. At 12:00 5 students left early for doctors' appointments. At 1:15, half of the remaining students went to an assembly. Finally, at 2:00, 6 more students left for a student council meeting. At the end of they day, there were only 5 students in the room. Assuming that no students returned after having left, how many students are in Mr. Miller's class?

2. Jordan was trading baseball cards with some friends. He gave 15 cards to Tommy and got 3 back. He gave two thirds of his remaining cards to Elaine and kept the rest for himself. When he got home he counted that he had 25 cards. How many baseball cards did Jordan start with?

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3-5 Study Guide and Intervention

7AF4.1

Solving Two-Step Equations

To solve two-step equations, you need to add or subtract first. Then divide to solve the equation.

Example 1 **Solve $7v - 3 = 25$. Check your solution.**

$7v - 3 = 25$ Write the equation.

$+3 = +3$ Add 3 to each side.

$7v = 28$ Simplify.

$\frac{7v}{7} = \frac{28}{7}$ Divide each side by 7.

$v = 4$ Simplify.

Check $7v - 3 = 25$ Write the original equation.

$7(4) - 3 \stackrel{?}{=} 25$ Replace *v* with 4.

$28 - 3 \stackrel{?}{=} 25$ Multiply.

$25 = 25$ ✓ The solution checks.

The solution is 4.

Example 2 **Solve $-10 = 8 + 3x$. Check your solution.**

$-10 = 8 + 3x$ Write the equation.

$-8 = -8$ Subtract 8 from each side.

$-18 = 3x$ Simplify.

$\frac{-18}{3} = \frac{3x}{3}$ Divide each side by 3.

$-6 = x$ Simplify.

Check $-10 = 8 + 3x$ Write the original equation.

$-10 \stackrel{?}{=} 8 + 3(-6)$ Replace *x* with −6.

$-10 \stackrel{?}{=} 8 + (-18)$ Multiply.

$-10 = -10$ ✓ The solution checks.

The solution is −6.

Exercises

Solve each equation. Check your solution.

1. $4y + 1 = 13$ **2.** $6x + 2 = 26$ **3.** $-3 = 5k + 7$ **4.** $6n + 4 = -26$

5. $7 = -3c - 2$ **6.** $-8p + 3 = -29$ **7.** $-5 = -5t - 5$ **8.** $-9r + 12 = -24$

9. $11 + 7n = 4$ **10.** $35 = 7 + 4b$ **11.** $15 + 2p = 9$ **12.** $49 = 16 + 3y$

13. $2 = 4t - 14$ **14.** $-9x - 10 = 62$ **15.** $30 = 12z - 18$ **16.** $7 + 4g = 7$

17. $24 + 9x = -3$ **18.** $50 = 16q + 2$ **19.** $3c - 2.5 = 4.1$ **20.** $9y + 4.8 = 17.4$

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3-6 Study Guide and Intervention

6AF3.1, 6AF3.2

Measurement: Perimeter and Area

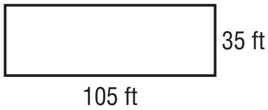
The distance around a geometric figure is called the **perimeter**.

To find the perimeter of any geometric figure, you can use addition or a formula.

The perimeter of a rectangle is twice the length ℓ plus twice the width w.

$$P = 2\ell + 2w$$

Example 1 **Find the perimeter of the figure at right.**



$P = 105 + 105 + 35 + 35$ or 280

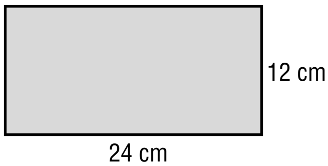
The perimeter is 280 inches.

The measure of the surface enclosed by a geometric figure is called the **area**.

The area of a rectangle is the product of the length ℓ and width w.

$$A = \ell \cdot w$$

Example 2 **Find the area of the rectangle.**



$A = \ell \cdot w$
$= 24 \cdot 12$ or 288

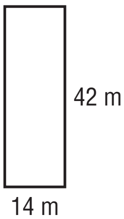
The area is 288 square centimeters.

Exercises

Find the perimeter of each figure.

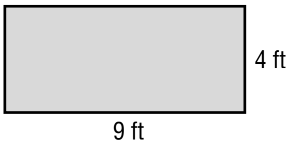
1.

2.

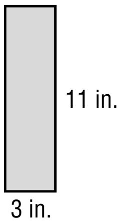


Find the perimeter and area of each rectangle.

3.



4.



5. $\ell = 8$ ft, $w = 5$ ft

6. $\ell = 3.5$ m, $w = 2$ m

7. $\ell = 8$ yd, $w = 4\frac{1}{3}$ yd

8. $\ell = 29$ cm, $w = 7.3$ cm

3-7 Study Guide and Intervention

6AF2.3, 6MR2.4

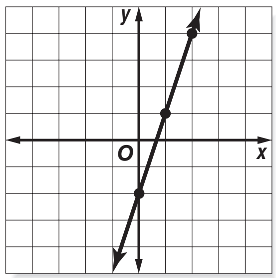
Functions and Graphs

The solution of an equation with two variables consists of two numbers, one for each variable, that make the equation true. The solution is usually written as an ordered pair (*x*, *y*), which can be graphed. If the graph for an equation is a straight line, then the equation is a linear equation.

Example 1 **Graph $y = 3x - 2$.**

Select any four values for the input x. We chose 3, 2, 0, and -1. Substitute these values for x to find the output y.

x	$3x - 2$	y	(x, y)
2	$3(2) - 2$	4	$(2, 4)$
1	$3(1) - 2$	1	$(1, 1)$
0	$3(0) - 2$	-2	$(0, -2)$
-1	$3(-1) - 2$	-5	$(-1, -5)$

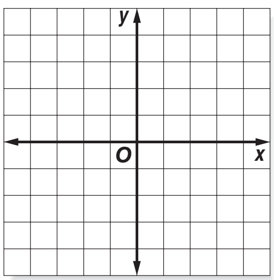


Four solutions are $(2, 4)$, $(1, 1)$, $(0, -2)$, and $(-1, -5)$. The graph is shown at the right.

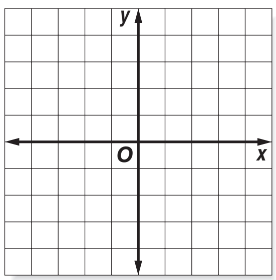
Exercises

Graph each equation.

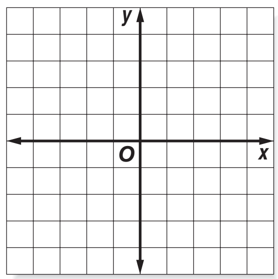
1. $y = x - 1$



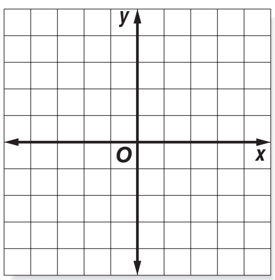
2. $y = x + 2$



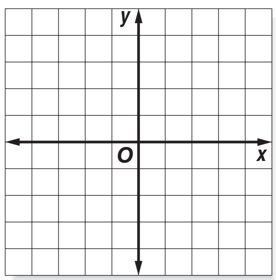
3. $y = -x$



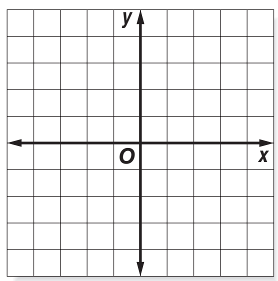
4. $y = 4x$



5. $y = 2x + 4$



6. $y = 3x - 1$



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4-1 Study Guide and Intervention

6NS2.4

Prime Factorization

A whole number is **prime** if it has exactly two factors, 1 and itself. A whole number is **composite** if it is greater than one and has more than two factors. To determine the **prime factorization** of a number, use a **factor tree**.

Example 1 **Determine whether each number is *prime* or *composite*.**

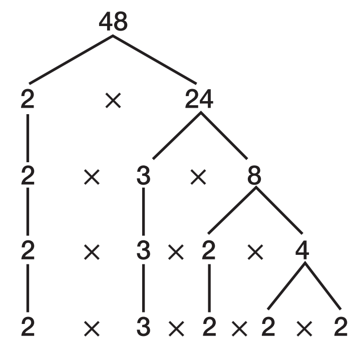
a. 11 **b. 24**

a. The number 11 has only two factors, 1 and 11, so it is prime.

b. The number 24 has 8 factors, 1, 2, 3, 4, 6, 8, 12, and 24. So, it is composite.

Example 2 **Determine the prime factorization of 48.**

Use a factor tree.



The prime factorization of 48 is $2 \times 2 \times 2 \times 2 \times 3$ or $2^4 \times 3$.

Exercises

Determine whether each number is prime or composite.

1. 27 **2.** 31 **3.** 46 **4.** 53

5. 11 **6.** 72 **7.** 17 **8.** 51

Determine the prime factorization of the following numbers.

9. 64 **10.** 100 **11.** 45 **12.** 81

4-2 Study Guide and Intervention

6NS2.4

Greatest Common Factor

The **greatest common factor (GCF)** of two or more numbers is the largest number that is a factor of each number. The GCF of prime numbers is 1.

Example 1 **Find the GCF of 72 and 108 by listing factors.**

factors of 72: 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

factors of 108: 1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108

common factors: 1, 2, 3, 4, 6, 9, 12, 18, 36

The GCF of 72 and 108 is 36.

Example 2 **Find the GCF of 42 and 60 using prime factors.**

Method 1 Write the prime factorization.

$60 = 2 \times \boxed{2} \times \boxed{3} \times 5$

$42 = \quad \boxed{2} \times \boxed{3} \times 7$

Method 2 Divide by prime numbers.
Divide both 42 and 60 by 2.
Then divide the quotients by 3.

$$\begin{array}{r|rr} & 7 & 10 \\ 3 & 21 & 30 \\ 2 & 42 & 60 \end{array}$$

← Start here

The common prime factors are 2 and 3. The GCF of 42 and 60 is 2×3, or 6.

Exercises

Find the GCF of each set of numbers.

1. 18, 30

2. 60, 45

3. 24, 72

4. 32, 48

5. 100, 30

6. 54, 36

7. 3, 97, 5

8. 4, 20, 24

9. 36, 9, 45

4-3 Study Guide and Intervention

6MR1.1, 6SDAP3.1

Problem-Solving Investigation: Make an Organized List

When solving problems often times it is useful to make an organized list. By doing so you can see all the possible solutions to the problem being posed.

Example 1 LUNCH **Walnut Hills School has a deli line where students are able to select a meat sandwich, a side, and fruit. Meat choices are ham or turkey. The side choices are pretzels or chips. Fruit options are an apple or a pear. How many different combinations are possible?**

Explore You know that students can choose a sandwich, a side, and fruit. There are 2 meat choices, 2 side choices, and 2 fruit choices. You need to find all possible combinations.

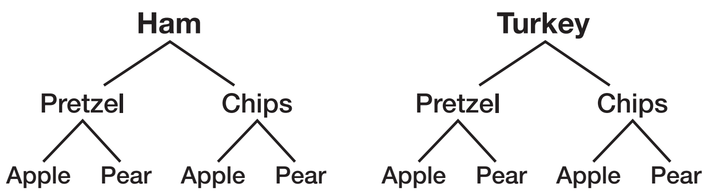
Plan Make an organized list.

Solve

	1	2	3	4	5	6	7	8
Meat	Ham	Ham	Ham	Ham	Turkey	Turkey	Turkey	Turkey
Side	Pretzel	Pretzel	Chips	Chips	Pretzel	Pretzel	Chips	Chips
Fruit	Apple	Pear	Apple	Pear	Apple	Pear	Apple	Pear

There are 8 possibilities.

Check Draw a tree diagram to check the result.



Exercises

1. Susan has 3 shirts; red, blue, and green; 2 pants; jeans and khakis; and 3 shoes; white, black, and tan, to choose from for her school outfit. How many different outfits can she create?

2. The Motor Speedway is awarding money to the first two finishers in their annual race. If there are four cars in the race numbered 1 through 4, how many different ways can they come in first and second?

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4-4 Study Guide and Intervention

6NS2.4

Simplifying Fractions

Fractions that have the same value are called **equivalent fractions**. A fraction is in **simplest form** when the GCF of the numerator and denominator is 1.

Example 1 **Write $\frac{36}{54}$ in simplest form.**

First, find the GCF of the numerator and denominator.
factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36
factors of 54: 1, 2, 3, 6, 9, 18, 27, 54
The GCF of 36 and 54 is 18.

Then, divide the numerator and the denominator by the GCF.

$\frac{36}{54} = \frac{36 \div 18}{54 \div 18} = \frac{2}{3}$ So, $\frac{36}{54}$ written in simplest form is $\frac{2}{3}$.

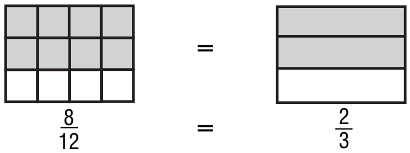
Example 2 **Write $\frac{8}{12}$ in simplest form.**

Find the GCF of the numerator and the denominator.

factors of 8 = 4 · 2

factors of 12 = 4 · 3

The GCF of 8 and 12 is 4.



$\frac{8 \div 4}{12 \div 4} = \frac{2}{3}$

So, $\frac{8}{12}$ written in simplest form is $\frac{2}{3}$.

Exercises

Write each fraction in simplest form.

1. $\frac{42}{72}$ **2.** $\frac{40}{64}$ **3.** $\frac{21}{35}$

4. $\frac{25}{100}$ **5.** $\frac{99}{132}$ **6.** $\frac{17}{85}$

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4-5 Study Guide and Intervention

6NS1.1

Fractions and Decimals

To write a decimal as a fraction, divide the numerator of the fraction by the denominator. Use a power of ten to change a decimal to a fraction.

Example 1 **Write $\frac{5}{9}$ as a decimal.**

Method 1 Use pencil and paper.

$$\begin{array}{r} 0.555... \\ 9\overline{)5.000} \\ \underline{4\ 5} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 5 \end{array}$$

The remainder after each step is 5.

Method 2 Use a calculator.

5 [÷] 9 [=] 0.55555556

You can use bar notation $0.\overline{5}$ to indicate that 5 repeats forever. So, $\frac{5}{9} = 0.\overline{5}$.

Example 2 **Write 0.32 as a fraction in simplest form.**

$0.32 = \frac{32}{100}$ The 2 is in the hundredths place.

$= \frac{8}{25}$ Simplify.

Exercises

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

1. $\frac{8}{10}$

2. $\frac{3}{5}$

3. $\frac{7}{11}$

4. $4\frac{7}{8}$

5. $\frac{13}{15}$

6. $3\frac{47}{99}$

Write each decimal as a fraction in simplest form.

7. 0.14

8. 0.3

9. 0.94

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4-6 Study Guide and Intervention

6NS1.1

Fractions and Percents

A **ratio** is a comparison of two numbers by division. When a ratio compares a number to 100, it can be written as a **percent**. To write a ratio or fraction as a percent, find an equivalent fraction with a denominator of 100. You can also use the meaning of percent to change percents to fractions.

Example 1 **Write $\frac{19}{20}$ as a percent.**

$$\frac{19}{20} \xrightarrow{\times 5} \frac{95}{100} = 95\%$$

Since 100 ÷ 20 = 5, multiply the numerator and denominator by 5.

Example 2 **Write 92% as a fraction in simplest form.**

$92\% = \frac{92}{100}$ Definition of percent

$= \frac{23}{25}$ Simplify.

Exercises

Write each ratio as a percent.

1. $\frac{14}{100}$ **2.** $\frac{27}{100}$ **3.** 34.5 per 100

4. 18 per 100 **5.** 21:100 **6.** 96:100

Write each fraction as a percent.

7. $\frac{3}{100}$ **8.** $\frac{14}{100}$ **9.** $\frac{2}{5}$

10. $\frac{1}{20}$ **11.** $\frac{13}{25}$ **12.** $\frac{4}{10}$

Write each percent as a fraction in simplest form.

13. 35% **14.** 18% **15.** 75%

16. 80% **17.** 16% **18.** 15%

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4-7 Study Guide and Intervention

6NS1.1

Percents and Decimals

To write a percent as a decimal, divide the percent by 100 and remove the percent symbol. To write a decimal as a percent, multiply the decimal by 100 and add the percent symbol.

Example 1 **Write 42.5% as a decimal.**

$42.5\% = \frac{42.5}{100}$ Write the percent as a fraction.

$= \frac{42.5 \times 10}{100 \times 10}$ Multiply by 10 to remove the decimal in the numerator.

$= \frac{425}{1,000}$ Simplify.

$= 0.425$ Write the fraction as a decimal.

Example 2 **Write 0.625 as a percent.**

$0.625 = 062.5$ Multiply by 100.

$= 62.5\%$ Add the % symbol.

Exercises

Write each percent as a decimal.

1. 6%

2. 28%

3. 81%

4. 84%

5. 35.5%

6. 12.5%

7. 14.2%

8. 11.1%

Write each decimal as a percent.

9. 0.47

10. 0.03

11. 0.075

12. 0.914

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4-8 Study Guide and Intervention

6NS2.4

Least Common Multiple

A **multiple** of a number is the product of that number and any whole number. The least nonzero multiple of two or more numbers is the **least common multiple (LCM)** of the numbers.

Example 1 **Find the LCM of 15 and 20 by listing multiples.**

List the multiples.

multiples of 15: 15, 30, 45, **60**, 75, 90, 105, **120**, ...

multiples of 20: 20, 40, **60**, 80, 100, **120**, 140, ...

Notice that 60, 120, …, are common multiples. So, the LCM of 15 and 20 is 60.

Example 2 **Find the LCM of 8 and 12 using prime factors.**

Write the prime factorization.

$8 = 2 \times 2 \times 2 = 2^3$

$12 = 2 \times 2 \times 3 = 2^2 \times 3$

The prime factors of 8 and 12 are 2 and 3.
Multiply the greatest power of both 2 and 3.

The LCM of 8 and 12 is $2^3 \times 3$, or 24.

Exercises

Find the LCM of each set of numbers.

1. 4, 6

2. 6, 9

3. 5, 9

4. 8, 10

5. 12, 15

6. 15, 21

7. 4, 15

8. 8, 20

9. 8, 16

10. 6, 14

11. 12, 20

12. 9, 12

13. 14, 21

14. 6, 15

15. 4, 6, 8

16. 3, 5, 6

4-9 Study Guide and Intervention

6NS1.1, 6NS2.4

Comparing and Ordering Rational Numbers

To compare fractions, rewrite them so they have the same denominator. The **least common denominator (LCD)** of two fractions is the LCM of their denominators.

Another way to compare fractions is to express them as decimals. Then compare the decimals.

Example 1 **Which fraction is greater, $\frac{3}{4}$ or $\frac{4}{5}$?**

Method 1 Rename using the LCD.

$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

$\frac{4}{5} = \frac{4 \times 4}{5 \times 4} = \frac{16}{20}$

The LCD is 20.

Because the denominators are the same, compare numerators.

Since $\frac{16}{20} > \frac{15}{20}$, then $\frac{4}{5} > \frac{3}{4}$.

Method 2 Write each fraction as a decimal. Then compare decimals.

$\frac{3}{4} = 0.75$

$\frac{4}{5} = 0.8$

Since $0.8 > 0.75$, then $\frac{4}{5} > \frac{3}{4}$.

Exercises

Find the LCD of each pair of fractions.

1. $\frac{1}{2}, \frac{1}{8}$

2. $\frac{1}{3}, \frac{3}{4}$

3. $\frac{3}{4}, \frac{7}{10}$

Replace each ● with <, >, or = to make a true sentence.

4. $\frac{1}{2}$ ● $\frac{4}{9}$

5. $\frac{4}{5}$ ● $\frac{8}{10}$

6. $\frac{3}{4}$ ● $\frac{7}{8}$

7. $\frac{1}{2}$ ● $\frac{5}{9}$

8. $\frac{9}{14}$ ● $\frac{10}{17}$

9. $\frac{5}{7}$ ● $\frac{6}{11}$

10. $\frac{8}{17}$ ● $\frac{1}{2}$

11. $\frac{9}{10}$ ● $\frac{17}{19}$

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5-1 Study Guide and Intervention

6NS2.1

Estimating with Fractions

Use rounding to estimate with fractions.

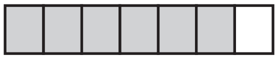
Estimating:	For mixed numbers, round to the nearest whole number.	For fractions, round to 0, $\frac{1}{2}$, or 1.
	$4\frac{1}{6} + 3\frac{7}{8} \rightarrow 4 + 4 = 8$	$\frac{11}{12} - \frac{4}{9} \rightarrow 1 - \frac{1}{2} = \frac{1}{2}$
	$4\frac{1}{6} + 3\frac{7}{8}$ is *about* 8.	$\frac{11}{12} - \frac{4}{9}$ is *about* $\frac{1}{2}$.

Example 1 **Estimate $2\frac{2}{3} \times 4\frac{1}{4}$.**

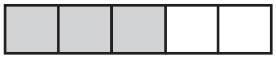
$2\frac{2}{3} \times 4\frac{1}{4} \rightarrow 3 \times 4 = 12$

The product is *about* 12.

Example 2 **Estimate $\frac{6}{7} - \frac{3}{5}$.**



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



$\frac{3}{5}$ is about $\frac{1}{2}$.

$\frac{6}{7} - \frac{3}{5} \rightarrow 1 - \frac{1}{2} = \frac{1}{2}$

The difference is *about* $\frac{1}{2}$.

Exercises

Estimate.

1. $4\frac{1}{3} + 3\frac{4}{5}$

2. $2\frac{1}{6} \times 3\frac{2}{3}$

3. $\frac{7}{12} - \frac{1}{10}$

4. $5\frac{1}{4} - 1\frac{1}{2}$

5. $4\frac{3}{4} + 1\frac{1}{5}$

6. $\frac{5}{9} \times \frac{13}{14}$

7. $\frac{1}{6} \div \frac{8}{9}$

8. $\frac{6}{7} \div \frac{9}{10}$

9. $13\frac{4}{5} \div 1\frac{7}{8}$

10. $12\frac{1}{4} \div 5\frac{7}{8}$

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5-2 Study Guide and Intervention

6NS2.1, 6NS2.4

Adding and Subtracting Fractions

Like fractions are fractions that have the same denominator. To add or subtract like fractions, add or subtract the numerators and write the result over the denominator.

Simplify if necessary.

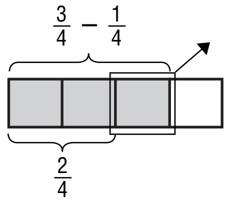
To add or subtract *unlike fractions*, rename the fractions with a least common denominator. Then add or subtract as with like fractions.

Example 1 **Subtract $\frac{3}{4} - \frac{1}{4}$. Write in simplest form.**

$\frac{3}{4} - \frac{1}{4} = \frac{3 - 1}{4}$ Subtract the numerators.

$= \frac{2}{4}$ Write the difference over the denominator.

$= \frac{1}{2}$ Simplify.



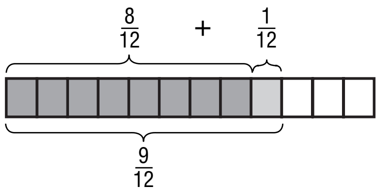
Example 2 **Add $\frac{2}{3} + \frac{1}{12}$. Write in simplest form.**

The least common denominator of 3 and 12 is 12.

$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$ Rename $\frac{2}{3}$ using the LCD.

$$\begin{array}{rcr} \frac{2}{3} & \rightarrow & \frac{8}{12} \\ +\frac{1}{12} & \rightarrow & +\frac{1}{12} \\ \hline & & \frac{9}{12} \text{ or } \frac{3}{4} \end{array}$$

Add the numerators and simplify.



Exercises

Add or subtract. Write in simplest form.

1. $\frac{5}{8} + \frac{1}{8}$

2. $\frac{7}{9} - \frac{2}{9}$

3. $\frac{1}{2} + \frac{3}{4}$

4. $\frac{7}{8} - \frac{5}{6}$

5. $\frac{5}{9} + \frac{5}{6}$

6. $\frac{3}{8} - \frac{1}{12}$

7. $\frac{3}{10} + \frac{7}{12}$

8. $\frac{2}{5} - \frac{1}{3}$

9. $\frac{7}{15} + \frac{5}{6}$

10. $\frac{7}{9} - \frac{1}{2}$

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5-3 Study Guide and Intervention

6NS2.1, 6NS2.4

Adding and Subtracting Mixed Numbers

To add or subtract mixed numbers:

1. Add or subtract the fractions. Rename using the LCD if necessary.
2. Add or subtract the whole numbers.
3. Simplify if necessary.

Example 1 **Find $14\frac{1}{2} + 18\frac{2}{3}$.**

$14\frac{1}{2} \rightarrow 14\frac{3}{6}$	Rename the fractions.
$+18\frac{2}{3} \rightarrow +18\frac{4}{6}$	Add the whole numbers and add the fractions.
$32\frac{7}{6}$ or $33\frac{1}{6}$	Simplify.

Example 2 **Find $21 - 12\frac{5}{8}$.**

$21 \rightarrow 20\frac{8}{8}$	Rename 21 as $20\frac{8}{8}$.
$-12\frac{5}{8} \rightarrow -12\frac{5}{8}$	First subtract the whole numbers and then the fractions.
$8\frac{3}{8}$	

Exercises

Add or subtract. Write in simplest form.

1. $7\frac{3}{4} + 2\frac{3}{4}$

2. $14\frac{2}{9} - 6\frac{1}{9}$

3. $9\frac{1}{5} - 4\frac{3}{4}$

4. $7\frac{1}{8} + 5\frac{3}{8}$

5. $7\frac{3}{4} + 2\frac{2}{3}$

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

7. $5\frac{1}{2} - 3\frac{1}{4}$

8. $6\frac{1}{3} + 2\frac{1}{6}$

9. $9 - 3\frac{2}{5}$

10. $2\frac{2}{3} + 7\frac{1}{2}$

11. $6\frac{1}{2} - 6\frac{1}{3}$

12. $18\frac{1}{2} + 5\frac{5}{8}$

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5-4 Study Guide and Intervention

6MR1.1, 6NS2.1

Problem-Solving Investigation: Eliminate Possibilities

By **eliminating possibilities** when problem solving, you can methodically reduce the number of potential answers.

Example

Joan has $20 to spend on her sister for her birthday. She has already bought her a DVD for $9.75. There are three shirts that she likes which cost $8.75, $10.00, and $11.00. Which shirt should she buy so that she spends most of her money without going over $20?

Explore	You know that the total amount of money she has to spend must be $20 or less.
Plan	Eliminate answers that are not reasonable.
Solve	She couldn't spend $11.00 because $9.75 + $11.00 = $20.75. So eliminate that choice. Now check $10.00 $9.75 + 10.00 = $19.75 Since this is less than $20, this is the correct choice. She should buy her sister the $10.00 shirt.
Check	By buying the $8.75 shirt, she would only spend a total of $9.75 + $8.75 = $18.50. This is less than the $20 minimum, but not the most she could possibly spend.

Exercises

Solve the following problems by eliminating possibilities first.

1. **TELEPHONE** Susan talked on her cellular telephone for 120 minutes last month. Her plan charges her a $15.00 fee per month plus $0.10 a minute after the first 60 minutes, which are included in the $15 fee. What was her total bill for last month?

   A. $12.00 B. $27.00 C. $21.00 D. $6.00

2. **HOME SALES** 450 homes sold in your area in the last year. What number shows a good estimate of the number of homes sold per month?

   A. 38 homes B. 32.5 homes C. 2 homes D. 45 homes

3. **CAR SALES** Derrick sells cars for a living. He sells an average of 22 cars a month. What will his total average car sales be in 5 years?

   A. 110 cars B. 264 cars C. 1320 cars D. 27 cars

4. **TELEVISION** Myra is allowed to watch 6 hours of television on a weekend. She watched $2\frac{1}{2}$ hours this morning. How much television will she be allowed to watch at most this afternoon?

   A. 4 hours B. $4\frac{1}{2}$ hours C. $2\frac{1}{2}$ hours D. $3\frac{1}{2}$ hours

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5-5 Study Guide and Intervention

6NS2.1, 6NS2.2

Multiplying Fractions and Mixed Numbers

To multiply fractions, multiply the numerators and multiply the denominators.

$$\frac{5}{6} \times \frac{3}{5} = \frac{5 \times 3}{6 \times 5} = \frac{15}{30} = \frac{1}{2}$$

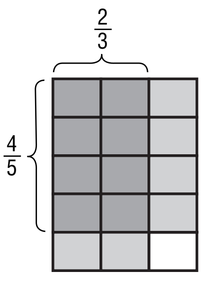
To multiply mixed numbers, rename each mixed number as a fraction. Then multiply the fractions.

$$2\frac{2}{3} \times 1\frac{1}{4} = \frac{8}{3} \times \frac{5}{4} = \frac{40}{12} = 3\frac{1}{3}$$

Example 1 **Find $\frac{2}{3} \times \frac{4}{5}$. Write in simplest form.**

$\frac{2}{3} \times \frac{4}{5} = \frac{2 \times 4}{3 \times 5}$ ← Multiply the numerators. ← Multiply the denominators.

$= \frac{8}{15}$ Simplify.



Example 2 **Find $\frac{1}{3} \times 2\frac{1}{2}$. Write in simplest form.**

$\frac{1}{3} \times 2\frac{1}{2} = \frac{1}{3} \times \frac{5}{2}$ Rename $2\frac{1}{2}$ as an improper fraction, $\frac{5}{2}$.

$= \frac{1 \times 5}{3 \times 2}$ Multiply.

$= \frac{5}{6}$ Simplify.

Exercises

Multiply. Write in simplest form.

1. $\frac{2}{3} \times \frac{2}{3}$

2. $\frac{1}{2} \times \frac{7}{8}$

3. $\frac{1}{3} \times \frac{3}{5}$

4. $\frac{5}{9} \times 4$

5. $1\frac{2}{3} \times \frac{3}{5}$

6. $3\frac{3}{4} \times 1\frac{1}{6}$

7. $\frac{3}{4} \times 1\frac{2}{3}$

8. $3\frac{1}{3} \times 2\frac{1}{2}$

9. $4\frac{1}{5} \times \frac{1}{7}$

10. $\frac{7}{5} \times 8$

11. $2\frac{1}{3} \times \frac{4}{6}$

12. $\frac{1}{8} \times 2\frac{3}{4}$

5-6 Study Guide and Intervention

6AF1.1

Algebra: Solving Equations

Multiplicative inverses, or **reciprocals**, are two numbers whose product is 1. To solve an equation in which the coefficient is a fraction, multiply each side of the equation by the reciprocal of the coefficient.

Example 1 **Find the multiplicative inverse of $3\frac{1}{4}$.**

$3\frac{1}{4} = \frac{13}{4}$ — Rename the mixed number as an improper fraction.

$\frac{13}{4} \cdot \frac{4}{13} = 1$ — Multiply $\frac{13}{4}$ by $\frac{4}{13}$ to get the product 1.

The multiplicative inverse of $3\frac{1}{4}$ is $\frac{4}{13}$.

Example 2 **Solve $\frac{4}{5}x = 8$. Check your solution.**

$\frac{4}{5}x = 8$ — Write the equation.

$\left(\frac{5}{4}\right)\frac{4}{5}x = \left(\frac{5}{4}\right)8$ — Multiply each side by the reciprocal of $\frac{4}{5}$, $\frac{5}{4}$.

$x = 10$ — Simplify.

The solution is 10.

Exercises

Find the multiplicative inverse of each number.

1. $\frac{4}{9}$

2. $\frac{12}{13}$

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

4. $6\frac{1}{7}$

Solve each equation. Check your solution.

5. $\frac{3}{5}x = 12$

6. $16 = \frac{10}{3}a$

7. $\frac{c}{2} = 7$

8. $\frac{15}{7}y = 3$

9. $\frac{m}{6} = -4$

10. $14 = -\frac{7}{9}b$

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5-7 Study Guide and Intervention

6NS2.1, 6NS2.2

Dividing Fractions and Mixed Numbers

To divide by a fraction, multiply by its multiplicative inverse or reciprocal. To divide by a mixed number, rename the mixed number as an improper fraction.

Example 1 **Find $3\frac{1}{3} \div \frac{2}{9}$. Write in simplest form.**

$3\frac{1}{3} \div \frac{2}{9} = \frac{10}{3} \div \frac{2}{9}$ Rename $3\frac{1}{3}$ as an improper fraction.

$= \frac{10}{3} \cdot \frac{9}{2}$ Multiply by the reciprocal of $\frac{2}{9}$, which is $\frac{9}{2}$.

$= \frac{\overset{5}{\cancel{10}}}{\underset{1}{\cancel{3}}} \cdot \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{2}}}$ Divide out common factors.

$= 15$ Multiply.

Exercises

Divide. Write in simplest form.

1. $\frac{2}{3} \div \frac{1}{4}$

2. $\frac{2}{5} \div \frac{5}{6}$

3. $\frac{1}{2} \div \frac{1}{5}$

4. $5 \div \frac{1}{2}$

5. $\frac{5}{8} \div 10$

6. $7\frac{1}{3} \div 2$

7. $\frac{5}{6} \div 3\frac{1}{2}$

8. $36 \div 1\frac{1}{2}$

9. $2\frac{1}{2} \div 10$

10. $5\frac{2}{5} \div 1\frac{4}{5}$

11. $6\frac{2}{3} \div 3\frac{1}{9}$

12. $4\frac{1}{4} \div \frac{3}{8}$

13. $4\frac{6}{7} \div 2\frac{3}{7}$

14. $12 \div 2\frac{1}{2}$

15. $4\frac{1}{6} \div 3\frac{1}{6}$

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6-1 Study Guide and Intervention

6NS1.2

Ratios

Any ratio can be written as a fraction. To write a ratio comparing measurements, such as units of length or units of time, both quantities must have the same unit of measure. Two ratios that have the same value are **equivalent ratios**.

Example 1 **Write the ratio 15 to 9 as a fraction in simplest form.**

$15 \text{ to } 9 = \frac{15}{9}$ Write the ratio as a fraction.

$= \frac{5}{3}$ Simplify.

Written as a fraction in simplest form, the ratio 15 to 9 is $\frac{5}{3}$.

Example 2 **Determine whether the ratios *10 cups of flour in 4 batches of cookies* and *15 cups of flour in 6 batches of cookies* are equivalent ratios.**

Compare ratios written in simplest form.

10 cups:4 batches $= \frac{10 \div 2}{4 \div 2}$ or $\frac{5}{2}$ Divide the numerator and denominator by the GCF, 2

15 cups:6 batches $= \frac{15 \div 3}{6 \div 3}$ or $\frac{5}{2}$ Divide the numerator and denominator by the GCF, 3

Since the ratios simplify to the same fraction, the ratios of cups to batches are equivalent.

Exercises

Write each ratio as a fraction in simplest form.

1. 30 to 12

2. 5:20

3. 49:42

4. 15 to 13

5. 28 feet:35 feet

6. 24 minutes to 18 minutes

7. 75 seconds:150 seconds

8. 12 feet:60 feet

Determine whether the ratios are equivalent. Explain.

9. $\frac{3}{4}$ and $\frac{12}{16}$

10. 12:17 and 10:15

11. $\frac{25}{35}$ and $\frac{10}{14}$

12. 2 lb:36 oz and 3 lb:44 oz

13. 1 ft:4 in. and 3 ft:12 in.

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6-2 Study Guide and Intervention

6NS1.2, 6AF2.2 , 6AF2.3

Rates

A ratio that compares two quantities with different kinds of units is called a **rate**. When a rate is simplified so that it has a denominator of 1 unit, it is called a **unit rate**.

Example 1 DRIVING **Alita drove her car 78 miles and used 3 gallons of gas. What is the car's gas mileage in miles per gallon?**

Write the rate as a fraction. Then find an equivalent rate with a denominator of 1.

78 miles using 3 gallons	$= \dfrac{78 \text{ mi}}{3 \text{ gal}}$	Write the rate as a fraction.
	$= \dfrac{78 \text{ mi} \div 3}{3 \text{ gal} \div 3}$	Divide the numerator and the denominator by 3.
	$= \dfrac{26 \text{ mi}}{1 \text{ gal}}$	Simplify.

The car's gas mileage, or unit rate, is 26 miles per gallon.

Example 2 SHOPPING **Joe has two different sizes of boxes of cereal from which to choose. The 12-ounce box costs $2.54, and the 18-ounce box costs $3.50. Which box costs less per ounce?**

Find the unit price, or the cost per ounce, of each box. Divide the price by the number of ounces.

12-ounce box	$2.54 ÷ 12 ounces ≈ $0.21 per ounce
18-ounce box	$3.50 ÷ 18 ounces ≈ $0.19 per ounce

The 18-ounce box costs less per ounce.

Exercises

Find each unit rate. Round to the nearest hundredth if necessary.

1. 18 people in 3 vans

2. $156 for 3 books

3. 115 miles in 2 hours

4. 8 hits in 22 games

5. 65 miles in 2.7 gallons

6. 2,500 Calories in 24 hours

Choose the best unit price.

7. $12.95 for 3 pounds of nuts or $21.45 for 5 pounds of nuts

8. A 32-ounce bottle of apple juice for $2.50 or a 48-ounce bottle for $3.84.

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6-3 Study Guide and Intervention

6AF2.1

Measurement: Changing Customary Units

Customary Units		
Length	Weight	Capacity
1 foot (ft) = 12 inches (in.)	1 pound (lb) = 16 ounces (oz)	1 cup (c) = 8 fluid ounces (fl oz)
1 yard (yd) = 3 feet	1 ton (T) = 2,000 pounds	1 pint (pt) = 2 cups
1 mile (mi) = 5,280 feet		1 quart (qt) = 2 pints
		1 gallon (gal) = 4 quarts

Example 1 $5\frac{1}{2}$ **lb = ___?___ oz**

To change from larger units to smaller units, multiply.

$5\frac{1}{2} \times 16 = 88$ Since 1 pound is 16 ounces, multiply by 16.

$5\frac{1}{2}$ pounds = 88 ounces

Example 2 **28 fl oz = ___?___ c**

To change from smaller units to larger units, divide.

$28 \div 8 = 3\frac{1}{2}$ Since 8 fluid ounces are in 1 cup, divide by 8.

28 fluid ounces = $3\frac{1}{2}$ cups

Exercises

Complete.

1. 5 lb = ______ oz

2. 48 in. = ______ ft

3. 6 yd = ______ ft

4. 7 qt = ____ pt

5. 8,000 lb = ____ T

6. $3\frac{1}{4}$ mi = _____ ft

7. 4 c = ______ fl oz

8. 6 c = ______ pt

9. $\frac{1}{2}$ gal = ______ qt

10. 3 ft = ______ in.

11. 9 qt = ______ gal

12. 30 fl oz = ______ c

13. 6,864 ft = _____ mi

14. 40 oz = ______ lb

15. 9 pt = ______ c

16. 18 ft = ______ yd

17. 11 pt = ______ qt

18. $2\frac{3}{4}$ T = ______ lb

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6-4 Study Guide and Intervention

6AF2.1

Measurement: Changing Metric Units

The table below is a summary of how to convert measures in the metric system.

	Larger Units → Smaller Units	Smaller Units → Larger Units
Units of Length (meter)	km to m – multiply by 1,000 m to cm – multiply by 100 m to mm – multiply by 1,000 cm to mm – multiply by 10	mm to cm – divide by 10 mm to m – divide by 1,000 cm to m – divide by 100 m to km – divide by 1,000
Units of Mass (kilogram)	kg to g – multiply by 1,000 g to mg – multiply by 1,000	mg to g – divide by 1,000 g to kg – divide by 1,000
Units of Capacity (liter)	kL to L – multiply by 1,000 L to mL – multiply by 1,000	mL to L – divide by 1,000 L to kL – divide by 1,000

Example 1 **Complete. 62 cm = ____ m**

To convert from centimeters to meters, divide by 100.

62 ÷ 100 = 0.62

62 cm = 0.62 m

Example 2 **Complete. 2.6 kL = ____ L**

To convert from kiloliters to liters, multiply by 1,000.

2.6 × 1,000 = 2,600

2.6 kL = 2,600 L

Exercises

Complete.

1. 650 cm = ____ m

2. 57 kg = ____ g

3. 751 mg = ____ g

4. 8.2 L = ____ mL

5. 52 L = ____ kL

6. 892 mm = ____ m

7. 121.4 kL = ____ L

8. 0.72 cm = ____ mm

9. 67.3 g = ____ kg

10. 5.2 g = ____ mg

11. 0.05 m = ____ mm

12. 2,500 mg = ____ g

13. 32 mm = ____ cm

14. 96 m = ____ cm

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6-5 Study Guide and Intervention

6NS1.3

Algebra: Solving Proportions

A **proportion** is an equation stating that two ratios are equivalent. Since rates are types of ratios, they can also form proportions. In a proportion, a **cross product** is the product of the numerator of one ratio and the denominator of the other ratio.

Example 1 **Determine whether $\frac{2}{3}$ and $\frac{10}{15}$ form a proportion.**

$\frac{2}{3} \stackrel{?}{=} \frac{10}{15}$	Write a proportion.
$2 \times 15 \stackrel{?}{=} 3 \times 10$	Find the cross products.
$30 = 30$ ✓	Multiply.

The cross products are equal, so the ratios form a proportion.

Example 2 **Solve $\frac{8}{a} = \frac{10}{15}$.**

$\frac{8}{a} = \frac{10}{15}$	Write the proportion.
$8 \times 15 = a \times 10$	Find the cross products.
$120 = 10a$	Multiply.
$\frac{120}{10} = \frac{10a}{10}$	Divide each side by 10.
$12 = a$	Simplify.

The solution is 12.

Exercises

Determine if the quantities in each pair of ratios are proportional. Explain.

1. $\frac{8}{10} = \frac{4}{5}$

2. $\frac{9}{4} = \frac{11}{6}$

3. $\frac{6}{14} = \frac{9}{21}$

4. $\frac{15}{12} = \frac{9}{6}$

5. $\frac{\$2.48}{4 \text{ oz}} = \frac{\$3.72}{6 \text{ oz}}$

6. $\frac{125 \text{ mi}}{5.7 \text{ gal}} = \frac{120 \text{ mi}}{5.6 \text{ gal}}$

Solve each proportion.

7. $\frac{y}{7} = \frac{16}{28}$

8. $\frac{5}{15} = \frac{15}{w}$

9. $\frac{20}{b} = \frac{70}{28}$

10. $\frac{52}{8} = \frac{m}{9}$

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6-6 Study Guide and Intervention

6MR2.5

Problem-Solving Investigation: Draw a Diagram

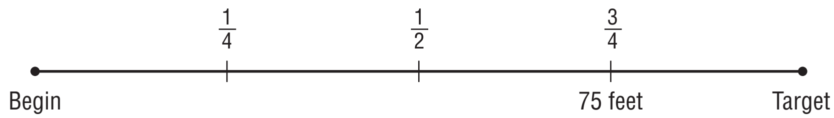
When solving problems, draw a diagram to show what you have and what you need to find.

Example CARNIVAL **Jim has to reach a target at a carnival game to win a prize. After 3 throws he has gone 75 feet, which is $\frac{3}{4}$ of the way to the target. How far away is the target?**

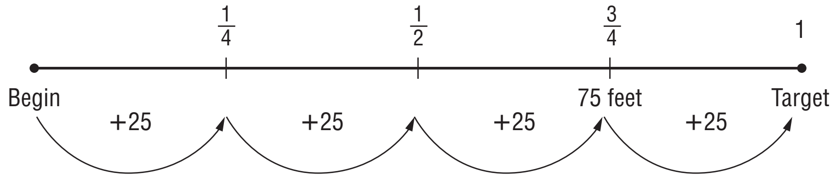
Explore We know that 75 feet is $\frac{3}{4}$ of the way to the target.

Plan Draw a diagram to show the distance already thrown and the fraction it represents.

Solve



If $\frac{3}{4}$ of the distance is 75 feet, then $\frac{1}{4}$ of the distance is 25 feet. So, the missing $\frac{1}{4}$ must be another 25 feet.



The total distance that Jim must throw to hit the target is 100 feet.

Check Since $\frac{3}{4}$ of the total distance is 75 feet, the equation $\frac{3}{4}x = 75$ represents this problem. Solving, we get $x = 100$ feet. So, the solution checks.

Exercises

1. SALES Sharon wants to buy a new car. She has saved up $ 1,500, which is approximately $\frac{1}{5}$ of the price of the car. How much does she need to save in order to buy the new car?

2. TRAVEL The Jones family has traveled 360 miles. They are $\frac{4}{5}$ of the way to their destination. How far away is their destination?

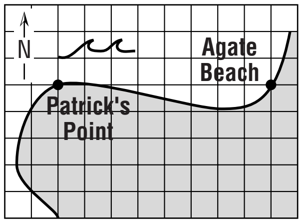
6-7 Study Guide and Intervention

6NS1.3

Scale Drawings

A **scale drawing** represents something that is too large or too small to be drawn or built at actual size. Similarly, a **scale model** can be used to represent something that is too large or built too small for an actual-size model. The **scale** gives the relationship between the drawing/model measure and the actual measure.

Example **On this map, each grid unit represents 50 yards. Find the distance from Patrick's Point to Agate Beach.**



	Scale		**Patrick's Point to Agate Beach**	
map → / actual →	$\frac{1 \text{ unit}}{50 \text{ yards}}$	=	$\frac{8 \text{ units}}{x \text{ yards}}$	← map / ← actual

$1 \times x = 50 \times 8$ Cross products

$x = 400$ Simplify.

It is 400 yards from Patrick's Point to Agate Beach.

Exercises

Find the actual distance between each pair of cities. Round to the nearest tenth if necessary.

	Cities	Map Distance	Scale	Actual Distance
1.	Los Angeles and San Diego, California	6.35 cm	1 cm = 20 mi	
2.	Lexington and Louisville, Kentucky	15.6 cm	1 cm = 5 mi	
3.	Des Moines and Cedar Rapids, Iowa	16.27 cm	2 cm = 15 mi	
4.	Miami and Jacksonville, Florida	11.73 cm	$\frac{1}{2}$ cm = 20 mi	

Suppose you are making a scale drawing. Find the length of each object on the scale drawing with the given scale. Then find the scale factor.

5. an automobile 16 feet long; 1 inch:6 inches

6. a lake 85 feet across; 1 inch = 4 feet

7. a parking lot 200 meters wide; 1 centimeter:25 meters

8. a flag 5 feet wide; 2 inches = 1 foot

6-8 Study Guide and Intervention

5NS1.2

Fractions, Decimals, and Percents

Example **Write $4\frac{3}{8}\%$ as a fraction in simplest form.**

$4\frac{3}{8}\% = \frac{4\frac{3}{8}}{100}$ Write a fraction.

$= 4\frac{3}{8} \div 100$ Divide.

$= \frac{35}{8} \div 100$ Write $4\frac{3}{8}$ as an improper fraction.

$= \frac{35}{8} \times \frac{1}{100}$ Multiply by the reciprocal of 100, which is $\frac{1}{100}$.

$= \frac{35}{800}$ or $\frac{7}{160}$ Simplify.

Example 2 **Write $\frac{5}{16}$ as a percent.**

$\frac{5}{16} = \frac{n}{100}$ Write a proportion using $\frac{n}{100}$.

$500 = 16n$ Find the cross products.

$\frac{500}{16} = \frac{16n}{16}$ Divide each side by 16.

$31\frac{1}{4} = n$ Simplify.

So, $\frac{5}{16} = 31\frac{1}{4}\%$ or 31.25%.

Exercises

Write each percent as a fraction in simplest form.

1. 60%

2. $68\frac{3}{4}\%$

3. $27\frac{1}{2}\%$

4. 37.5%

Write each fraction as a percent. Round to the nearest hundredth if necessary.

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

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

7. $\frac{9}{16}$

8. $\frac{2}{3}$

6-9 Study Guide and Intervention

5NS1.2

Percents Greater Than 100% and Percents Less Than 1%

A percent greater than 100% equals a number greater than 1. A percent less than 1% equals a number less than 0.01 or $\frac{1}{100}$.

Examples **Write each percent as a decimal and as a mixed number or fraction in simplest form.**

1 **280%**

$280\% = \frac{280}{100}$ Definition of percent

$= 2.8 \text{ or } 2\frac{4}{5}$

2 **0.12%**

$0.12\% = \frac{0.12}{100}$ Definition of percent

$= 0.0012 \text{ or } \frac{3}{2,500}$

Examples **Write each decimal as a percent.**

3 **2.17**

$2.17 = 217.$ Multiply by 100.

$= 217\%$

4 **0.0034**

$0.0034 = 000.34$ Multiply by 100.

$= 0.34\%$

Exercises

Write each percent as a decimal and as a mixed number or fraction in simplest form.

1. 200%

2. 750%

3. 325%

4. 0.3%

5. 0.8%

6. 0.48%

Write each decimal as a percent.

7. 2.6

8. 19

9. 5.14

10. 0.008

11. 0.0014

12. 0.0067

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7-1 Study Guide and Intervention

6NS1.4

Percent of a Number

You can use a proportion or multiplication to find the percent of a number.

Example 1 **Find 25% of 80.**

$25\% = \frac{25}{100}$ or $\frac{1}{4}$ — Write 25% as a fraction and reduce to lowest terms.

$\frac{1}{4}$ of $80 = \frac{1}{4} \times 80$ or 20 — Multiply.

So, 25% of 80 is 20.

Example 2 **What number is 15% of 200?**

15% of $200 = 15\% \times 200$ — Write a multiplication expression.

$= 0.15 \times 200$ — Write 15% as a decimal.

$= 30$ — Multiply.

So, 15% of 200 is 30.

Exercises

Find each number.

1. Find 20% of 50.

2. What is 55% of $400?

3. 5% of 1,500 is what number?

4. Find 190% of 20.

5. What is 24% of $500?

6. 8% of $300 is how much?

7. What is 12.5% of 60?

8. Find 0.2% of 40.

9. Find 3% of $800.

10. What is 0.5% of 180?

11. 0.25% of 42 is what number?

12. What is 0.02% of 280?

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7-2 Study Guide and Intervention

6NS1.3, 6NS1.4

The Percent Proportion

A percent proportion compares part of a quantity to a whole quantity for one ratio and lists the percent as a number over 100 for the other ratio.

$$\frac{part}{whole} = \frac{percent}{100}$$

Example 1 **What percent of 24 is 18?**

$\frac{part}{whole} = \frac{percent}{100}$ Percent proportion

Let $n\%$ represent the percent.

$\frac{18}{24} = \frac{n}{100}$ Write the proportion.

$18 \times 100 = 24 \times n$ Find the cross products.

$1{,}800 = 24n$ Simplify.

$\frac{1{,}800}{24} = \frac{24n}{24}$ Divide each side by 24.

$75 = n$

So, 18 is 75% of 24

Example 2 **What number is 60% of 150?**

$\frac{part}{whole} = \frac{percent}{100}$ Percent proportion

Let a represent the part.

$\frac{a}{150} = \frac{60}{100}$ Write the proportion.

$a \times 100 = 150 \times 60$ Find the cross products.

$100a = 9{,}000$ Simplify.

$\frac{100a}{100} = \frac{9{,}000}{100}$ Divide each side by 24.

$a = 90$

So, 90 is 60% of 150.

Exercises

Find each number. Round to the nearest tenth if necessary.

1. What number is 25% of 20?

2. What percent of 50 is 20?

3. 30 is 75% of what number?

4. 40% of what number is 36?

5. What number is 20% of 625?

6. 12 is what percent of 30?

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7-3 Study Guide and Intervention

6NS1.4

Percent and Estimation

To estimate the percent of a number, you can use a fraction or a multiple of 10% or 1%.

Example 1 **Estimate 77% of 800.**

77% is about 75% or $\frac{3}{4}$.

77% of $800 \approx \frac{3}{4} \cdot 800$ Use $\frac{3}{4}$ to estimate.

≈ 600 Multiply.

So, 77% of 800 is about 600.

Example 2 **Estimate 137% of 50.**

137% is more than 100%, so 137% of 50 is greater than 50.
137% is about 140%.

140% of $50 = (100\%$ of $50) + (40\%$ of $50)$ $140\% = 100\% + 40\%$

$= (1 \cdot 50) + \left(\frac{2}{5} \cdot 50\right)$ $100\% = 1$ and $40\% = \frac{2}{5}$

$= 50 + 20$ or 70 Simplify.

So, 137% of 50 is about 70.

Example 3 **Estimate 0.5% of 692.**

0.5% is half of 1%. 692 is about 700.

1% of $700 = 0.01 \cdot 700$ To mutiply by 1%, move the decimal point two places to the left.

$= 7$

One half of 7 is $\frac{1}{2} \cdot 7$ or 3.5.

So, 0.5% of 697 is about 3.5.

Exercises

Estimate.

1. 24% of 36 **2.** 81% of 25 **3.** 11% of 67

4. 150% of 179 **5.** 67% of 450 **6.** 79% of 590

7. 0.4% of 200 **8.** 42% of 61 **9.** 19% of 41

10. 129% of 54 **11.** 32% of 66 **12.** 0.2% of 150

7-4 Study Guide and Intervention

Algebra: The Percent Equation

6NS1.4, 6AF1.1

To solve any type of percent problem, you can use the **percent equation**, part = percent · base, where the percent is written as a decimal.

Example 1 **600 is what percent of 750?**

600 is the part and 750 is the whole. Let n represent the percent.

$\underbrace{\text{part}} = \underbrace{\text{percent}} \cdot \underbrace{\text{whole}}$

$600 = n \cdot 750$	Write an equation.
$\frac{600}{750} = \frac{750n}{750}$	Divide each side by 750.
$0.8 = n$	Simplify.
$80\% = n$	Write 0.8 as a percent.

So, 600 is 80% of 750.

Example 2 **45 is 90% of what number?**

45 is the part and 90% or 0.9 is the percent. Let n represent the whole.

$\underbrace{\text{part}} = \underbrace{\text{percent}} \cdot \underbrace{\text{whole}}$

$45 = 0.9 \cdot n$	Write an equation.
$\frac{45}{0.9} = \frac{0.9n}{0.9}$	Divide each side by 0.9.
$50 = n$	The whole is 50.

So, 45 is 90% of 50.

Exercises

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

1. What percent of 56 is 14?

2. 36 is what percent of 40?

3. 80 is 40% of what number?

4. 65% of what number is 78?

5. What percent of 2,000 is 8?

6. What is 110% of 80?

7. 85 is what percent of 170?

8. Find 30% of 70.

7-5 Study Guide and Intervention

6NS1.4, 6MR3.1

Problem-Solving Investigation: Determine Reasonable Answers

When solving problems, often times it is helpful to determine reasonable answers by using rounding and estimation. Checking answers with a calculator is always helpful in determining if the answer found is in fact reasonable.

Example SALES TAX **There is 4.8% sales tax on all clothing items purchased. Danielle wants to buy a shirt, which costs \$18.95. Danielle figures that if she has \$20 she will have enough to buy the shirt. After adding in sales tax, is \$20 a reasonable amount for Danielle to bring?**

Explore The cost of the shirt is \$18.95. Sales tax is 4.8%. Danielle has \$20.

Plan Round \$18.95 to \$19.00 and 4.8% to 5%. Then use mental math to find 5% of \$19.00.

Solve Round \$18.95 to \$19.00

Round 4.8% to 5%

10% of \$19.00 = 0.1×19 or \$1.90 — Use mental math. 10% = 0.1

Round \$1.90 to \$2.00

5% is $\frac{1}{2}$ of 10%

So $\frac{1}{2}$ of \$2.00 is \$1.00 — \$1.00 is the amount of sales tax.

\$19.00 + \$1.00 = \$20.00 — Add \$1.00 to \$19.00.

So \$20 is a reasonable amount of money for Danielle to bring to pay for the shirt.

Check Use a calculator to check.

$0.048 \times 18.95 = 0.9096$

Since 0.9096 is close to 1, the answer is reasonable.

Exercises

1. TIP The total bill at a restaurant for a family of 5 is \$64.72. They want to leave a 20% tip. They decide to leave \$10.00. Is this estimate reasonable? Explain your reasoning.

2. TELEVISION A recent survey shows that 67% of students watch 3 or more hours of television a night. Suppose there are 892 students in your school. What would be a reasonable estimate of the number of students in your school who watch 3 or more hours of television a night? Explain your reasoning.

7-6 Study Guide and Intervention

6NS1.2

Percent of Change

A **percent of change** is a ratio that compares the change in quantity to the original amount. If the original quantity is increased, it is a **percent of increase**. If the original quantity is decreased, it is a **percent of decrease**.

Example 1 **Last year, 2,376 people attended the rodeo. This year, attendance was 2,950. What was the percent of change in attendance to the nearest whole percent?**

Since this year's attendance is greater than last year's attendance, this is a percent of increase.

The amount of increase is 2,950 – 2,376 or 574.

$$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}} \quad \leftarrow \text{new amount} - \text{original amount}$$

$$= \frac{574}{2{,}376} \quad \text{Substitution}$$

$$\approx 0.24 \text{ or } 24\% \quad \text{Simplify.}$$

Rodeo attendance increased by about 24%.

Example 2 **John's grade on the first math exam was 94. His grade on the second math exam was 86. What was the percent of change in John's grade to the nearest whole percent?**

Since the second grade is less than the first grade, this is a percent of decrease. The amount of decrease is 94 − 86 or 8.

$$\text{percent of decrease} = \frac{\text{amount of decrease}}{\text{original amount}} \quad \leftarrow \text{original amount} - \text{new amount}$$

$$= \frac{8}{94} \quad \text{Substitution}$$

$$\approx 0.09 \text{ or } 9\% \quad \text{Simplify.}$$

John's math grade decreased by about 9%.

Exercises

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

1. original: 4
new: 5

2. original: 1.0
new: 1.3

3. original: 15
new: 12

4. original: $30
new: $18

5. original: 60
new: 63

6. original: 160
new: 136

7. original: 7.7
new: 10.5

8. original: 9.6
new: 5.9

7-7 Study Guide and Intervention

6NS1.4

Sales Tax and Discount

Sales tax is a percent of the purchase price and is an amount paid in addition to the purchase price.
Discount is the amount by which the regular price of an item is reduced.

Example 1 SOCCER **Find the total price of a $17.75 soccer ball if the sales tax is 6%.**

Method 1

First, find the sales tax.
6% of $\$17.75 = 0.06 \cdot 17.75$
≈ 1.07
The sales tax is $1.07.

Next, add the sales tax to the regular price.

$1.07 + 17.75 = 18.82$

The total cost of the soccer ball is $18.82.

Method 2

$100\% + 6\% = 106\%$ Add the percent of tax to 100%.

The total cost is 106% of the regular price.

106% of $\$17.75 = 1.06 \cdot 17.75$

≈ 18.82

Example 2 TENNIS **Find the price of a $69.50 tennis racket that is on sale for 20% off.**

First, find the amount of the discount d.

$$\underbrace{\text{part}} = \underbrace{\text{percent}} \cdot \underbrace{\text{whole}}$$

$d = 0.2 \cdot 69.50$ Use the percent equation.
$d = 13.90$ The discount is $13.90.

So, the sale price of the tennis racket is $69.50 − $13.90 or $55.60.

Exercises

Find the total cost or sale price to the nearest cent.

1. $22.95 shirt; 7% sales tax

2. $39.00 jeans; 25% discount

3. $35 belt; 40% discount

4. $115.48 watch; 6% sales tax

5. $16.99 book; 5% off

6. $349 television; 6.5% sales tax

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7-8 Study Guide and Intervention

6NS1.4

Simple Interest

Simple interest is the amount of money paid or earned for the use of money. To find simple interest I, use the formula $I = prt$. Principal p is the amount of money deposited or invested. Rate r is the annual interest rate written as a decimal. Time t is the amount of time the money is invested in years.

Example 1 **Find the simple interest earned in a savings account where $136 is deposited for 2 years if the interest rate is 7.5% per year.**

$I = prt$ — Formula for simple interest

$I = 136 \cdot 0.075 \cdot 2$ — Replace p with $136, r with 0.075, and t with 2.

$I = 20.40$ — Simplify.

The simple interest earned is $20.40.

Example 2 **Find the simple interest for $600 invested at 8.5% for 6 months.**

6 months $= \frac{6}{12}$ or 0.5 year — Write the time as years.

$I = prt$ — Formula for simple interest

$I = 600 \cdot 0.085 \cdot 0.5$ — $p = \$600$, $r = 0.085$, $t = 0.5$

$I = 25.50$ — Simplify.

The simple interest is $25.50.

Exercises

Find the interest earned to the nearest cent for each principal, interest rate, and time.

1. $300, 5%, 2 years

2. $650, 8%, 3 years

3. $575, 4.5%, 4 years

4. $735, 7%, $2\frac{1}{2}$ years

5. $1,665, 6.75%, 3 years

6. $2,105, 11%, $1\frac{3}{4}$ years

7. $903, 8.75%, 18 months

8. $4,275, 19%, 3 months

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8-1 Study Guide and Intervention

6SDAP1.1, 6SDAP1.2

Line Plots

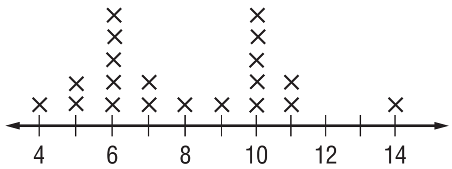
A **line plot** is a diagram that shows the frequency of data on a number line.

Example 1 **SHOE SIZE The table shows the shoe size of students in Mr. Kowa's classroom. Make a line plot of the data.**

Shoe Sizes			
10	6	4	6
5	11	10	10
6	9	6	8
7	11	7	14
5	10	6	10

Step 1 Draw a number line. Because the smallest size is 4 and the largest size is 14, you can use a scale of 4 to 14 and an interval of 2.

Step 2 Put an "×" above the number that represents the shoe size of each student.



Example 2 **Use the line plot in Example 1. Identify any clusters, gaps, or outliers and analyze the data by using these values. What is the range of data?**

Many of the data cluster around 6 and 10. You could say that most of the shoe sizes are 6 or 10. There is a gap between 11 and 14, so there are no shoe sizes in this range. The number 14 appears removed from the rest of the data, so it would be considered an outlier. This means that the shoe size of 14 is very large and is not representative of the whole data set.

The greatest shoe size is 14, and the smallest is 4. The range is 14 – 4 or 10.

Exercises

PETS For Exercises 1–3 use the table at the right that shows the number of pets owned by different families.

Number of Pets			
2	1	2	0
3	1	1	2
8	3	1	4

1. Make a line plot of the data.

2. Identify any clusters, gaps, or outliers.

3. What is the range of the data?

8-2 Study Guide and Intervention

6SDAP1.1, 6SDAP1.2, 6SDAP1.4

Measures of Central Tendency and Range

The **mean** is the sum of the data divided by the number of data items. The **median** is the middle number of the ordered data, or the mean of the middle two numbers. The **mode** is the number (or numbers) that occur most often. The mean, median, and mode are each **measures of central tendency**.

Example **The table shows the number of hours students spent practicing for a music recital. Find the mean, median, and mode of the data.**

Numbers of Hours Spent Practicing				
3	12	10	8	7
18	11	12	10	3
8	6	0	1	5
8	2	15	9	12

mean $= \frac{3 + 12 + 10 + \ldots + 12}{20} = \frac{160}{20}$ or 8.

To find the median, the data must be ordered.

$0, 1, 2, 3, 3, 5, 6, 7, 8, \underbrace{8, 8}, 9, 10, 10, 11, 12, 12, 12, 15, 18$

$\frac{8 + 8}{2} = 8$

To find the mode, look for the number that occurs most often. Since 8 and 12 each occur 3 times, the modes are 8 and 12.

Exercises

Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary.

1. 27, 56, 34, 19, 41, 56, 27, 25, 34, 56

2. 7, 3, 12, 4, 6, 3, 4, 8, 7, 3, 20

3. 1, 23, 4, 6, 7, 20, 7, 5, 3, 4, 6, 7, 11, 6

4. 3, 3, 3, 3, 3, 3, 3

5. 2, 4, 1, 3, 5, 6, 1, 1, 3, 4, 3, 1

6. 4, 0, 12, 10, 0, 5, 7, 16, 12, 10, 12, 12

8-3 Study Guide and Intervention

Stem-and-Leaf Plots

In a **stem-and-leaf plot**, the data are organized from least to greatest. The digits of the least place value usually form the **leaves**, and the next place value digits form the **stems**.

Example **Make a stem-and-leaf plot of the data below. Then find the range, median, and mode of the data.**
42, 45, 37, 46, 35, 49, 47, 35, 45, 63, 45

Order the data from least to greatest.

35, 35, 37, 42, 45, 45, 45, 46, 47, 49, 63

The least value is 35, and the greatest value is 63. So, the tens digits form the stems, and the ones digits form the leaves.

Stem	Leaf
3	5 5 7
4	2 5 5 5 6 7 9
5	
6	3

6 | 3 = 63

range: greatest value − least value = 63 − 35 or 28
median: middle value, or 45
mode: most frequent value, or 45

Exercises

Make a stem-and-leaf plot for each set of data. Then find the range, median, and mode of the data.

1. 15, 25, 16, 28, 1, 27, 16, 19, 28

2. 1, 2, 3, 2, 3, 1, 4, 2, 5, 7, 12, 11, 11, 3, 10

3. 3, 5, 1, 17, 11, 45, 17

4. 4, 7, 10, 5, 8, 12, 7, 6

8-4 Study Guide and Intervention

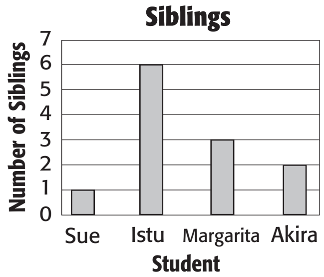
6SDAP2.3

Bar Graphs and Histograms

A **bar graph** is one method of comparing data by using solid bars to represent quantities. A **histogram** is a special kind of bar graph. It uses bars to represent the frequency of numerical data that have been organized into intervals.

Example 1 SIBLINGS **Make a bar graph to display the data in the table below.**

Student	Number of Siblings
Sue	1
Isfu	6
Margarita	3
Akira	2

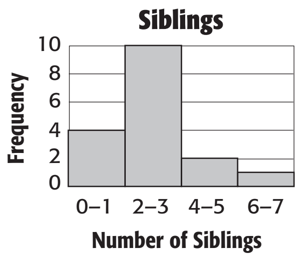


Step 1 Draw a horizontal and a vertical axis. Label the axes as shown. Add a title.

Step 2 Draw a bar to represent each student. In this case, a bar is used to represent the number of siblings for each student.

Example 2 SIBLINGS **The number of siblings of 17 students have been organized into a table. Make a histogram of the data.**

Number of Siblings	Frequency
0–1	4
2–3	10
4–5	2
6–7	1



Step 1 Draw and label horizontal and vertical axes. Add a title.

Step 2 Draw a bar to represent the frequency of each interval.

Exercises

1. Make a bar graph for the data in the table.

Student	Number of Free Throws
Luis	6
Laura	10
Opal	4
Gad	14

2. Make a histogram for the data in the table.

Number of Free Throws	Frequency
0–1	1
2–3	5
4–5	10
6–7	4

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8-5 Study Guide and Intervention

6MR2.3, 6SDAP2.3

Problem-Solving Investigation: Use a Graph

When solving problems, a **graph** can show a visual representation of the situation and help you make conclusions about the particular set of data.

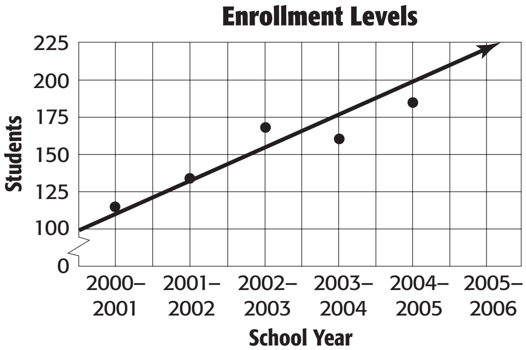
Example **POPULATION** The table below shows the enrollment of Mill High School students over five years. Estimate the enrollment for the 2005–2006 school year.

Mill High School Enrollment				
00–01	01–02	02–03	03–04	04–05
115	134	168	160	185

Explore You know the enrollment of students for five years. You need to estimate the enrollment for the 2005–2006 school year.

Plan Organize the data in a graph so that you can see a trend in the enrollment levels.

Solve



The graph shows that the enrollment increases over the years. By using the graph you can conclude that Mill High School had about 225 students enrolled for the 2005–2006 school year.

Check Draw a line through as close to as many points as possible. The estimate is close to the line so the answer is reasonable.

Exercises

1. **TEMPERATURE** The chart to the right shows the average December temperatures in Fahrenheit over four years. Predict the average temperature for the next year.

December Temperatures (F°)			
2002	2003	2004	2005
22°	17°	18°	16°

2. **POPULATION** Every five years the population of your neighborhood is recorded. What do you predict the population will be in 2010?

Neighborhood Population		
1995	2000	2005
2,072	2,250	2,376

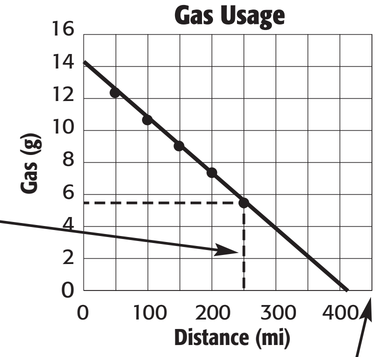
8-6 Study Guide and Intervention

6MR2.3, 6SDAP2.5

Using Graphs to Predict

A **line graph** shows trends over time and can be useful for predicting future events. A **scatter plot** displays two sets of data on a graph and can be useful for predictions by showing trends in the data.

Example **Use the line graph of the Moralez family car trip shown below to answer the following questions.**



1. After 250 miles, how much gas did the Moralez family have left?

Draw a dotted line up from 250 m until it reaches the graph and then find the corresponding gas measure.

They will have about 5.5 g left.

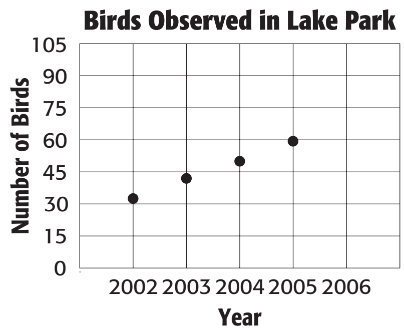
2. How far can the Moralez family travel before they run out of gas?

When they run out of gas, the tank will be at 0 so find where the line reaches 0.

They can travel about 430 miles.

Exercises

Use the scatter plot to answer the questions.



1. How many birds were there in 2004?

2. What relationship do you see between the number of birds and year?

3. Predict the number of birds there were in the year 2001?

4. Predict the number of birds there will be in in the year 2006?

5. In what year do you think the bird population will reach 100?

8-7 Study Guide and Intervention

6SDAP2.2, 6SDAP2.5

Using Data to Predict

Data gathered by surveying a random sample of the population may be used to make predictions about the entire population.

Example 1 **In a survey, 200 people from a town were asked if they thought the town needed more bicycle paths. The results are shown in the table. Predict how many of the 28,000 people in the town think more bicycle paths are needed.**

More Bicycle Paths Needed?	
Response	**Percent**
yes	39%
no	42%
undecided	19%

Use the percent proportion.

$\frac{part}{whole} = \frac{percent}{100}$ Percent proportion

part of the population → $\frac{n}{28{,}000} = \frac{39}{100}$ Let n represent the number. Survey results: $39\% = \frac{39}{100}$

Whole population →

$100n = 28{,}000(39)$ Cross products

$n = 10{,}920$ Simplify.

So, about 10,920 people in the town think more bicycle paths are needed.

Exercises

1. **VOTES** In a survey of voters in Binghamton, 55% of those surveyed said they would vote for Armas for city council. If 24,000 people vote in the election, about how many will vote for Armas?

2. **LUNCH** A survey shows that 43% of high school and middle school students buy school lunches. If a school district has 2,900 high school and middle school students, about how many buy school lunches?

3. **CLASS TRIP** Students of a seventh grade class were surveyed to find out how much they would be willing to pay to go on a class trip. 24% of the students surveyed said they would pay \$21 to \$30. If there are 360 students in the seventh grade class, about how many would be willing to pay for a trip that costs \$21 to \$30?

8-8 Study Guide and Intervention

6SDAP2.1, 6SDAP2.2, 6SDAP2.5

Using Sampling to Predict

In an **unbiased sample** the whole population is represented. In a **biased sample** one or more parts of the population are favored over the others.

Example 1 Look at the following table to determine the favorite sport of middle school students.

Favorite Sports of Middle School Students			
Basketball	Baseball	Football	Soccer
10	5	17	52

Based on the table, it would appear that soccer is the favorite sport of middle school students. However, suppose the data collected for this survey was taken at a World Cup soccer match. It can then be concluded that our sample is **biased** because students who are at a soccer match may be more likely to choose soccer as their favorite sport.

To receive an **unbiased** sample of middle school students, the sports survey could be completed at randomly selected middle schools throughout the country.

Exercises **Determine whether the given situations represent a *biased* or *unbiased* sample. Then tell the type of sample.**

1. Writers of a popular teen magazine want to write a story about which movies their readers like. The writers decide to interview the first 50 people that walk out of a movie theater.

2. The student council wanted to raise money for their school by selling homemade cookies during lunch time. To find out the favorite kind of cookie for the majority of their school, they conducted a survey. They gave the survey to 20 randomly selected students from each grade level.

3. To determine the most frequently used gas station, a researcher randomly selected every 10th person from a drive-through fast food restaurant and asked them where they last filled up with gas.

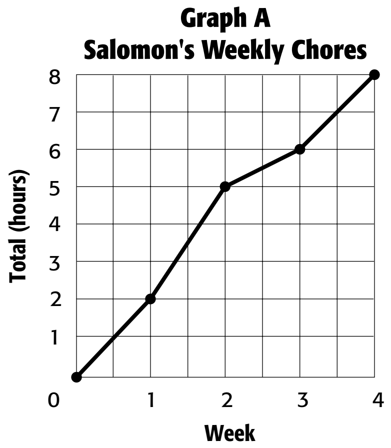
8-9 Study Guide and Intervention

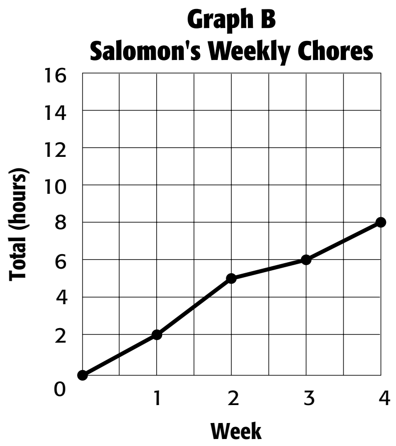
6SDAP2.3, 6SDP2.4

Misleading Statistics

Graphs can be misleading for many reasons: there is no title, the scale does not include 0; there are no labels on either axis; the intervals on a scale are not equal; or the size of the graphics misrepresents the data.

Example **WEEKLY CHORES The line graphs below show the total hours Salomon spent doing his chores one month. Which graph would be best to use to convince his parents he deserves a raise in his allowance? Explain.**

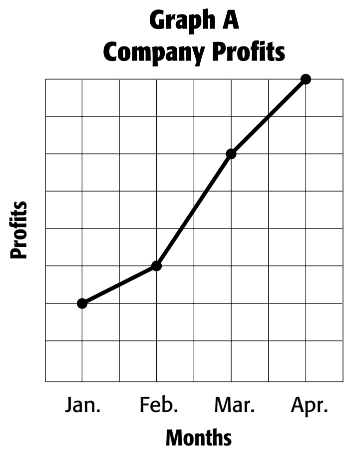


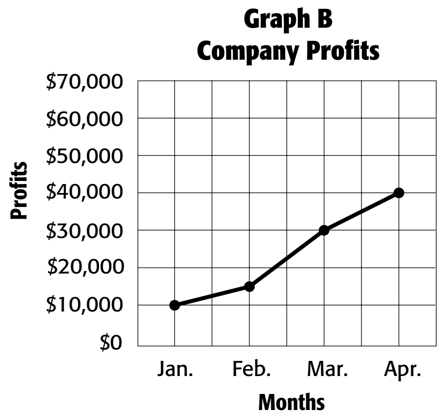


He should use graph A because it makes the total hours seem much larger.

Exercises

PROFITS For Exercises 1 and 2, use the graphs below. It shows a company's profits over a four-month period.





1. Which graph would be best to use to convince potential investors to invest in this company?

2. Why might the graph be misleading?

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9-1 Study Guide and Intervention

6SDAP3.3

Simple Events

The **probability** of a simple event is a ratio that compares the number of favorable outcomes to the number of possible outcomes. Outcomes occur at **random** if each outcome occurs by chance.

Two events that are the only ones that can possibly happen are **complementary events**. The sum of the probabilities of complementary events is 1.

Example 1 **What is the probability of rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces.**

$P(\text{multiple of 3}) = \dfrac{\text{multiples of 3 possible}}{\text{total numbers possible}}$

$= \dfrac{2}{6}$ Two numbers are multiples of 3: 3 and 6.

$= \dfrac{1}{3}$ Simplify.

The probability of rolling a multiple of 3 is $\frac{1}{3}$ or about 33.3%.

Example 2 **What is the probability of *not* rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces?**

$P(A) + P(\text{not } A) = 1$

$\frac{1}{3} + P(\text{not } A) = 1$ Substitute $\frac{1}{3}$ for $P(A)$.

$-\frac{1}{3} \qquad -\frac{1}{3}$ Subtract $\frac{1}{3}$ from each side

$P(\text{not } A) = \frac{2}{3}$ Simplify.

The probability of *not* rolling a multiple of 3 is $\frac{2}{3}$ or about 66.7%.

Exercises

A set of 30 cards is numbered 1, 2, 3, …, 30. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. $P(12)$

2. $P(2 \text{ or } 3)$

3. $P(\text{odd number})$

4. $P(\text{a multiple of } 5)$

5. $P(\text{not a multiple of } 5)$

6. $P(\text{less than or equal to } 10)$

9-2 Study Guide and Intervention

6SDAP3.1

Sample Spaces

A game in which players of equal skill have an equal chance of winning is a **fair game**. A **tree diagram** or table is used to show all of the possible outcomes, or **sample space**, in a probability experiment.

Example 1 WATCHES **A certain type of watch comes in brown or black and in a small or large size. Find the number of color-size combinations that are possible.**

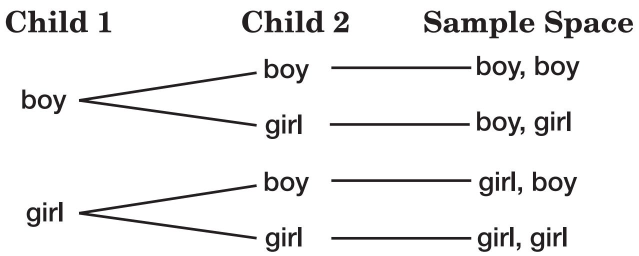
Make a table to show the sample space. Then give the total number of outcomes.

Color	Size
Brown	Small
Brown	Large
Black	Small
Black	Large

There are four different color and size combinations.

Example 2 CHILDREN **The chance of having either a boy or a girl is 50%. What is the probability of the Smiths having two girls?**

Make a tree diagram to show the sample space. Then find the probability of having two girls.



The sample space contains 4 possible outcomes. Only 1 outcome has both children being girls. So, the probability of having two girls is $\frac{1}{4}$.

Exercises

For each situation, make a tree diagram or table to show the sample space. Then give the total number of outcomes.

1. choosing an outfit from a green shirt, blue shirt, or a red shirt, and black pants or blue pants

2. choosing a vowel from the word COUNTING and a consonant from the word PRIME

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9-3 Study Guide and Intervention

6SDAP3.1

The Fundamental Counting Principle

If event M can occur in m ways and is followed by event N that can occur in n ways, then the event M followed by N can occur in $m \times n$ ways. This is called the **Fundamental Counting Principle**.

Example 1 CLOTHING **Andy has 5 shirts, 3 pairs of pants, and 6 pairs of socks. How many different outfits can Andy choose with a shirt, pair of pants, and pair of socks?**

$$\underbrace{5}_{\text{number of shirts}} \cdot \underbrace{3}_{\text{number of pants}} \cdot \underbrace{6}_{\text{number of socks}} = \underbrace{90}_{\text{total number of outfits}}$$

Andy can choose 90 different outfits.

Exercises

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. rolling two number cubes

2. tossing 3 coins

3. picking one consonant and one vowel

4. choosing one of 3 processor speeds, 2 sizes of memory, and 4 sizes of hard drive

5. choosing a 4-, 6-, or 8-cylinder engine and 2- or 4-wheel drive

6. rolling 2 number cubes and tossing 2 coins

7. choosing a color from 4 colors and a number from 4 to 10

9-4 Study Guide and Intervention

6SDAP3.1

Permutations

A **permutation** is an arrangement, or listing, of objects in which order is important. You can use the Fundamental Counting Principle to find the number of possible arrangements.

Example 1 **Find the value of $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$.**

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$
$= 120$ Simplify.

Example 2 **Find the value of $4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$.**

$4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$
$= 48$ Simplify.

Example 3 **BOOKS How many ways can 4 different books be arranged on a bookshelf?**

This is a permutation. Suppose the books are placed on the shelf from left to right.

There are **4** choices for the first book.
There are **3** choices that remain for the second book.
There are **2** choices that remain for the third book.
There is **1** choice that remains for the fourth book.

$4 \cdot 3 \cdot 2 \cdot 1$
$= 24$ Simplify.

So, there are 24 ways to arrange 4 different books on a bookshelf.

Exercises

Find the value of each expression.

1. $3 \cdot 2 \cdot 1$

2. $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

3. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 3 \cdot 2 \cdot 1$

4. $9 \cdot 8 \cdot 7$

5. How many ways can you arrange the letters in the word GROUP?

6. How many different 4-digit numbers can be created if no digit can be repeated? Remember, a number cannot begin with 0.

9-5 Study Guide and Intervention

6SDAP3.1

Combinations

An arrangement, or listing, of objects in which order is *not* important is called a **combination**. You can find the number of combinations of objects by dividing the number of permutations of the entire set by the number of ways each smaller set can be arranged.

Example 1 **Jill was asked by her teacher to choose 3 topics from the 8 topics given to her. How many different three-topic groups could she choose?**

There are $8 \cdot 7 \cdot 6$ permutations of three-topic groups chosen from eight. There are $3 \cdot 2 \cdot 1$ ways to arrange the groups.

$$\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{336}{6} = 56$$

So, there are 56 different three-topic groups.

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

Example 2 **On a quiz, you are allowed to answer any 4 out of the 6 questions. How many ways can you choose the questions?**

This is a combination because the order of the 4 questions is not important. So, there are $6 \cdot 5 \cdot 4 \cdot 3$ permutations of four questions chosen from six. There are $4 \cdot 3 \cdot 2 \cdot 1$ orders in which these questions can be chosen.

$$\frac{6 \cdot 5 \cdot 4 \cdot 3}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{360}{24} = 15$$

So, there are 15 ways to choose the questions.

Example 3 **Five different cars enter a parking lot with only 3 empty spaces. How many ways can these spaces be filled?**

This is a permutation because each arrangement of the same 3 cars counts as a distinct arrrangement. So, there are $5 \cdot 4 \cdot 3$ or 60 ways the spaces can be filled.

Exercises

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

1. How many ways can 4 people be chosen from a group of 11?

2. How many ways can 3 people sit in 4 chairs?

3. How many ways can 2 goldfish be chosen from a tank containing 15 goldfish?

9-6 Study Guide and Intervention

6SDAP3.2, 6SDAP2.4

Problem-Solving Investigation: Act It Out

By acting out a problem, you are able to see all possible solutions to the problem being posed.

Example CLOTHING **Ricardo has two shirts and three pairs of pants to choose from for his outfit to wear on the first day of school. How many different outfits can he make by wearing one shirt and one pair of pants?**

Explore We know that he has two shirts and three pairs of pants to choose from. We can use a coin for the shirts and an equally divided spinner labeled for the pants.

Plan Let's make a list showing all possible outcomes of tossing a coin and then spinning a spinner.

Solve H = Heads
T = Tails
Spinner = 1, 2, 3

Flip a Coin	Spin a Spinner
H	1
H	2
H	3
T	1
T	2
T	3

There are six possible outcomes of flipping a coin and spinning a spinner. So, there are 6 different possible outfits that Ricardo can wear for the first day of school.

Check Flipping a coin has two outcomes and there are two shirts. Spinning a three-section spinner has three outcomes and there are three pairs of pants. Therefore, the solution of 6 different outcomes with a coin and spinner represent the 6 possible outfit outcomes for Ricardo.

Exercises

1. SCIENCE FAIR There are 4 students with projects to present at the school science fair. How many different ways can these 4 projects be displayed on four tables in a row?

2. GENDER Determine whether flipping a coin is a good way to predict the gender of the next 5 babies born at General Hospital. Justify your answer.

3. OLYMPICS Four runners are entered in the first hurdles heat of twelve heats at the Olympics. The first two move on to the next round. Assuming no ties, how many different ways can the four runners come in first and second place?

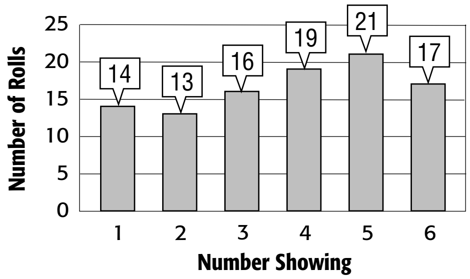
9-7 Study Guide and Intervention

6SDAP3.2

Theoretical and Experimental Probability

Experimental probability is found using frequencies obtained in an experiment or game. **Theoretical probability** is the expected probability of an event occurring.

Example 1 **The graph shows the results of an experiment in which a number cube was rolled 100 times. Find the experimental probability of rolling a 3 for this experiment.**



$P(3) = \frac{\text{number of times 3 occurs}}{\text{number of possible outcomes}}$

$= \frac{16}{100}$ or $\frac{4}{25}$

The experimental probability of rolling a 3 is $\frac{4}{25}$, which is close to its theoretical probabilityof $\frac{1}{6}$.

Example 2 **In a telephone poll, 225 people were asked for whom they planned to vote in the race for mayor. What is the experimental probability of Juarez being elected?**

Candidate	Number of People
Juarez	75
Davis	67
Abramson	83

Of the 225 people polled, 75 planned to vote for Juarez.

So, the experimental probability is $\frac{75}{225}$ or $\frac{1}{3}$.

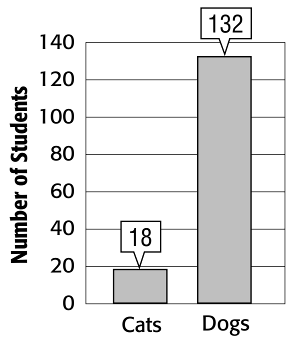
Example 3 **Suppose 5,700 people vote in the election. How many can be expected to vote for Juarez?**

$\frac{1}{3} \cdot 5{,}700 = 1{,}900$

About 1,900 will vote for Juarez.

Exercises

For Exercises 1–3, use the graph of a survey of 150 students asked whether they prefer cats or dogs.



1. What is the probability of a student preferring dogs?

2. Suppose 100 students were surveyed. How many can be expected to prefer dogs?

3. Suppose 300 students were surveyed. How many can be expected to prefer cats?

9-8 Study Guide and Intervention

6SDAP3.4, 6SDAP3.5

Compound Events

A **compound event** consists of two or more simple events. If the outcome of one event does not affect the outcome of a second event, the events are called **independent events**. The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Example 1 **A coin is tossed and a number cube is rolled. Find the probability of tossing tails and rolling a 5.**

$P(\text{tails}) = \frac{1}{2}$ $\quad$ $P(5) = \frac{1}{6}$

$P(\text{tails and } 5) = \frac{1}{2} \cdot \frac{1}{6}$ or $\frac{1}{12}$

So, the probability of tossing tails and rolling a 5 is $\frac{1}{12}$.

Example 2 MARBLES **A bag contains 7 blue, 3 green, and 3 red marbles. If Agnes randomly draws two marbles from the bag, replacing the first before drawing the second, what is the probability of drawing a green and then a blue marble?**

$P(\text{green}) = \frac{3}{13}$ $\quad$ 13 marbles, 3 are green

$P(\text{blue}) = \frac{7}{13}$ $\quad$ 13 marbles, 7 are blue

$P(\text{green, then blue}) = \frac{3}{13} \cdot \frac{7}{13} = \frac{21}{169}$

So, the probability that Agnes will draw a green, then a blue marble is $\frac{21}{169}$.

Exercises

1. Find the probability of rolling a 2 and then an even number on two consecutive rolls of a number cube.

2. A penny and a dime are tossed. What is the probability that the penny lands on heads and the dime lands on tails?

3. Lazlo's sock drawer contains 8 blue and 5 black socks. If he randomly pulls out one sock, what is the probability that he picks a blue sock?

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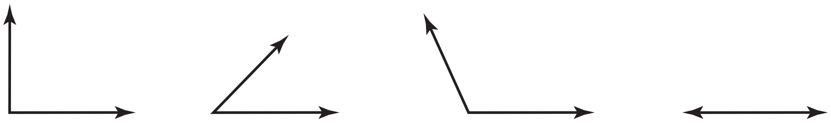
10-1 Study Guide and Intervention

6MG2.1

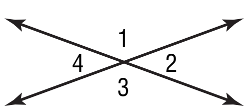
Angle Relationships

- An **angle** has two sides that share a common endpoint. The point where the sides meet is called the **vertex.** Angles are measured in **degrees,** where 1 degree is one of 360 equal parts of a circle.
- Angles are classified according to their measure.

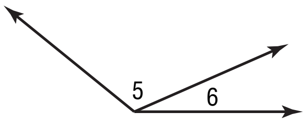
Right Angle **Acute Angle** **Obtuse Angle** **Straight Angle**



- Two angles are **vertical** if they are opposite angles formed by the intersection of two lines.
- Two angles are **adjacent** if they share a common vertex, a common side, and do not overlap.



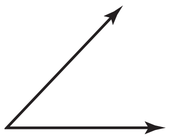
∠1 and ∠3 are vertical angles.
∠4 and ∠2 are vertical angles.



∠5 and ∠6 are adjacent angles

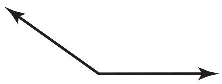
Example 1 **Classify each angle as *acute, obtuse, right,* or *straight*.**

A.



The angle is less than 90°, so it is an acute angle.

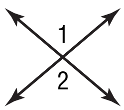
B.



The angle is greater than 90°, so it is an obtuse angle.

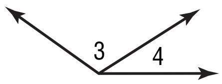
Example 2 **Label the two angles *vertical* or *adjacent*.**

C.



These angles are vertical because they are opposite each other and formed by two intersecting lines.

D.

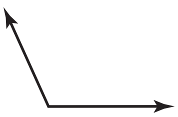


These angles are adjacent because they share a common vertex, a common side, and do not overlap.

Exercises

Classify each angle as *acute, obtuse, right,* or *straight*.

1.



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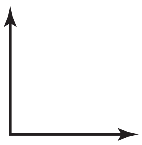

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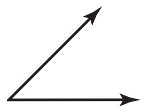
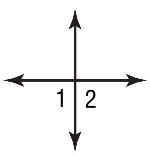


4.

Label the angles *vertical* or *adjacent*.

5.



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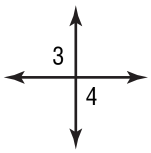

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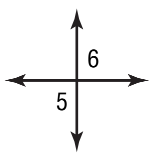

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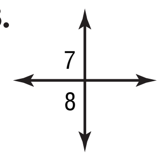

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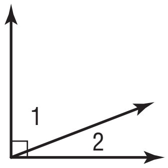
10-2 Study Guide and Intervention

6MG2.1, 6MG2.2

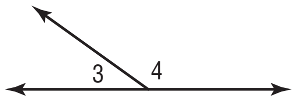
Complementary and Supplementary Angles

- Two angles are **complementary** if the sum of their measure is 90°.



$m\angle 1 + m\angle 2 = 90°$

- Two angles are **supplementary** if the sum of their measure is 180°.

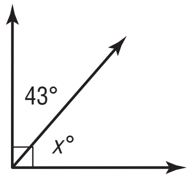


$m\angle 3 + m\angle 4 = 180°$

- To **find a missing angle measure,** first determine if the angles are complementary or supplementary. Then write an equation and subtract to find the missing measure.

Example 1 **Find the value of *x*.**

The two angles form a right angle or 90°, so they are complementary,

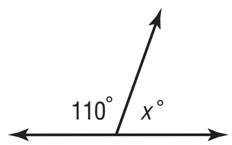


$43 + x = 90$	Write the equation.
$-43 \qquad -43$	Subtract 43 from each side.
$x = 47$	

so the value of x is 47°.

Example 2 **Find the value of *x*.**

The two angles form a straight line or 180°, so they are supplementary,



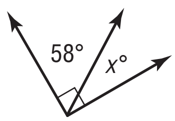
$110 + x = 180$	Write the equation.
$-110 \qquad -110$	Subtract 110 from each side.
$x = 70$	

so the value of x is 70°.

Exercises

Find the value of *x* in each figure.

1.



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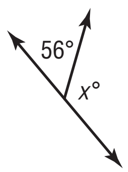

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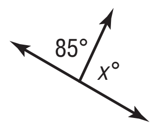

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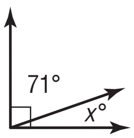

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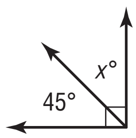

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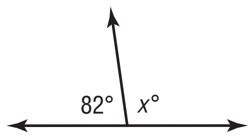


10-3 Study Guide and Intervention

5SDAP1.2

Statistics: Display Data in a Circle Graph

A graph that shows data as parts of a whole circle is called a **circle graph**. In a circle graph, the percents add up to 100. When percents are not given, you must first determine what part of the whole each item represents.

Example 1 ENERGY **Make a circle graph of the data in the table.**

Nuclear Reactors in Operation, 2001	
Country	**Number of Reactors**
United States	104
France	59
Japan	54
Other Countries	222

Step 1 Find the total number of reactors: $104 + 59 + 54 + 222 = 439$.

Step 2 Find the ratio that compares each number with the total. Write the ratio as a decimal rounded to the nearest hundredth.

United States: $\frac{104}{439} \approx 0.24$ Japan: $\frac{54}{439} \approx 0.12$

France: $\frac{59}{439} \approx 0.13$ Other: $\frac{222}{439} \approx 0.51$

Step 3 Find the number of degrees for each section of the graph.

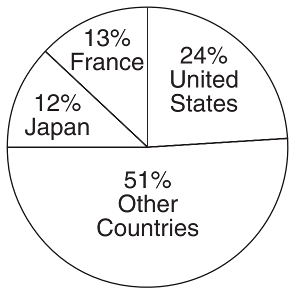
United States: $0.24 \cdot 360° \approx 86°$ Japan: $0.12 \cdot 360° \approx 43°$

France: $0.13 \cdot 360° \approx 47°$ Other: $0.51 \cdot 360° \approx 183°$

Step 4 Use a compass to construct a circle and draw a radius. Then use a protractor to draw an 86° angle. This represents the percent of nuclear reactors in the United States.

Step 5 From the new radius, draw a 47° angle for France. Repeat this step for the other two sections. Label each section and give the graph a title.

Nuclear Reactors in Operation, 2001

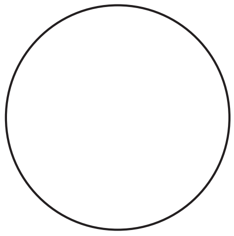


Exercises

1. **SWIMMING** The table shows the number of members of the swim team who competed at the swim meet. Each competed in only one event. Make a circle graph of the data.

Swim Team Member Participation	
Event	**Number**
Freestyle	18
Breaststroke	7
Backstroke	5
Butterfly	2

Swim Team Member Participation



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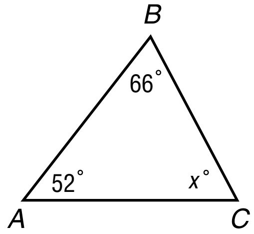
10-4 Study Guide and Intervention

6MG2.2, 6MG2.3

Triangles

A **triangle** is a figure with three sides and three angles. The symbol for triangle is △. The sum of the measures of the angles of a triangle is 180°. You can use this to find a missing angle measure in a triangle.

Example 1 **Find the value of x in △ABC.**



$x + 66 + 52 = 180$ — The sum of the measures is 180.

$x + 118 = 180$ — Simplify.

$-118 \quad -118$ — Subtract 118 from each side.

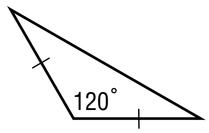
$x = 62$

The missing angle is 62°.

Triangles can be classified by the measures of their angles. An **acute triangle** has three acute angles. An **obtuse triangle** has one obtuse angle. A **right triangle** has one right angle.

Triangles can also be classified by the lengths of their sides. Sides that are the same length are **congruent segments** and are often marked by tick marks. In a **scalene triangle**, all sides have different lengths. An **isosceles** triangle has at least two congruent sides. An **equilateral triangle** has all three sides congruent.

Example 2 **Classify the triangle by its angles and by its sides.**

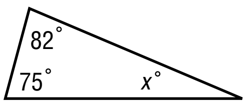


The triangle has one obtuse angle and two sides the same length. So, it is an obtuse, isosceles triangle.

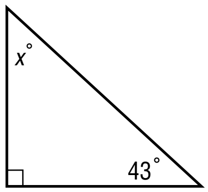
Exercises

Find the missing measure in each triangle. Then classify the triangle as *acute*, *right*, or *obtuse*.

1.



2.



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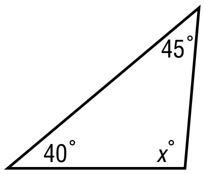
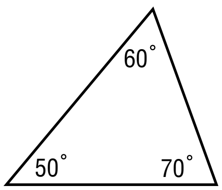
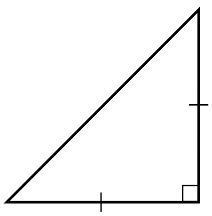


Classify each triangle by its angles and by its sides.

4.



5.



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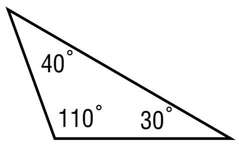

10-5 Study Guide and Intervention

6MR1.2, 6MG2.3

Problem-Solving Investigation: Use Logical Reasoning

Logical reasoning is a method of problem solving that uses **inductive reasoning,** making a rule after seeing several examples or **deducting reasoning,** use a rule to make a decision.

Example **Use the formula $d = rt$ where d is distance, r is rate, and t is time to determine how far a car has traveled after 4 hours if it is traveling at a rate of 65 mi/hr.**

Explore You know the car has traveled for 4 hours at 65 mi/hr.

Plan Try a few examples to find a pattern. Make a table.

Solve

Hours Passed	Distance Traveled (miles)
1	65
1.5	97.5
2	130
2.5	162.5
3	195
t	$65t$

After each hour the car has traveled 65 more miles. So after 4 hours the car will have traveled 260 mi.

Examine The formula is $d = rt$ so $d = 65 \times 4$ or 260 mi.

Exercises

Solve the following problems using logical reasoning.

1. **TRAVEL** Use the formula $d = rt$ where d is the distance, r is the rate, and t is the time to determine how far the Moralez family has traveled if they are driving at a rate of 72 miles per hour for 9 hours.

2. **CELL PHONES** Determine the cost per phone call if Maria made 30 calls last month and her total bill for the month was $45.00.

3. **MUSIC** Sarah, Juan, and Derrick play the piano, trumpet, and violin, but not necessarily in that order. Sarah and Derrick sit on either side of the trumpet player. Sarah does not play the violin. Who plays the violin?

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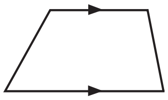
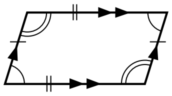
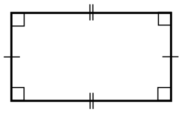
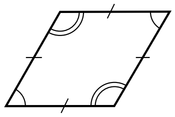
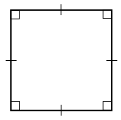
10-6 Study Guide and Intervention

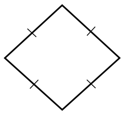
6MG2.3

Quadrilaterals

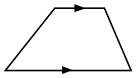
Quadrilaterals can be classified using their angles and sides. The best description of a quadrilateral is the one that is the most specific.

				
Trapezoid one pair of parallel sides	**Parallelogram** opposite sides parallel and opposite sides congruent	**Rectangle** parallelogram with 4 right angles	**Rhombus** parallelogram with 4 congruent sides	**Square** parallelogram with 4 right angles and 4 congruent sides

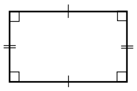
Examples **Classify the quadrilateral using the name that *best* describes it.**

1 

The quadrilateral is a parallelogram with 4 congruent sides. It is a rhombus.

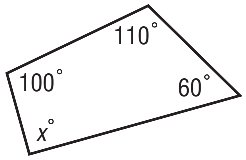
2 

The quadrilateral has one pair of parallel sides. It is a trapezoid.

3 

The quadrilateral is a parallelogram with 4 right angles. It is a rectangle.

Example **Find the missing measure in the quadrilateral.**



$100 + 110 + 60 + x = 360$ *Write the equation.*

$270 + x = 360$ *Simplify.*

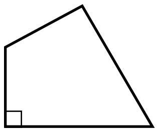
$-270 \quad -270$ *Subtract 270 from each side.*

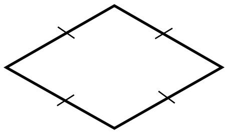
$x = 90$

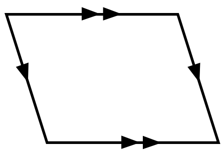
So, the missing measure is 90°.

Exercises

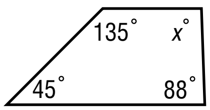
Classify the quadrilateral using the name that *best* describes it.

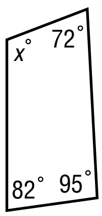
1. 

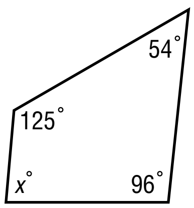
2. 

3. 

Find the missing angle measure in each quadrilateral.

4. 

5. 

6. 

10-7 Study Guide and Intervention

6NS1.3

Similar Figures

Figures that have the same shape but not necessarily the same size are *similar figures.* The symbol ~ means *is similar to*. You can use proportions to find the missing length of a side in a pair of similar figures.

For example $\triangle ABC \sim \triangle DEF$.

Corresponding angles

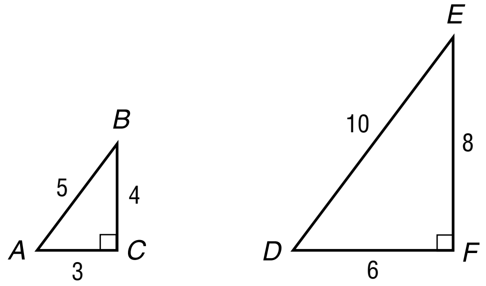
$\angle A \cong \angle D$

$\angle B \cong \angle E$

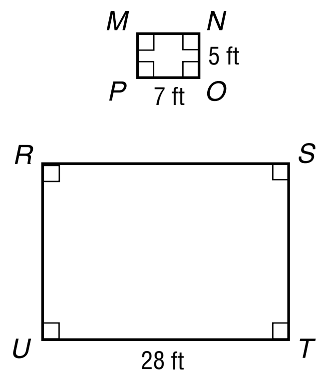
$\angle C \cong \angle F$

Corresponding sides

$\frac{5}{10} = \frac{4}{8} = \frac{3}{6}$



Example 1 **If $MNOP \sim RSTU$, find the length of $\overline{ST}$.**



Since the two figures are similar, the ratios of their corresponding sides are equal. You can write and solve a proportion to find $\overline{ST}$.

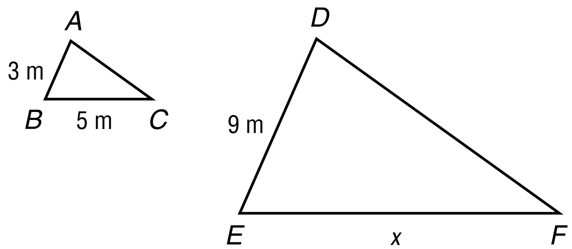
$\frac{PO}{UT} = \frac{NO}{ST}$	Write a proportion.
$\frac{7}{28} = \frac{5}{n}$	Let n represent the length of ST. Then substitute.
$7n = 28(5)$	Find the cross products.
$7n = 140$	Simplify.
$n = 20$	Divide each side by 7.

The length of $\overline{ST}$ is 20 feet.

Exercises

Find the value of *x* in each pair of similar figures.

1.



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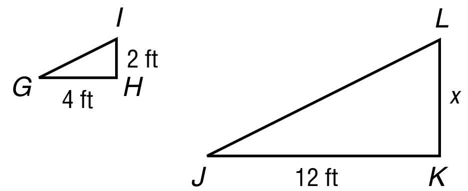

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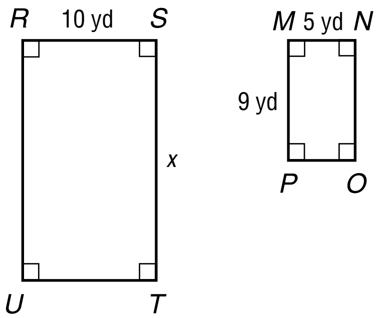

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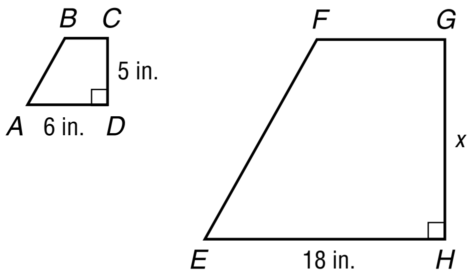

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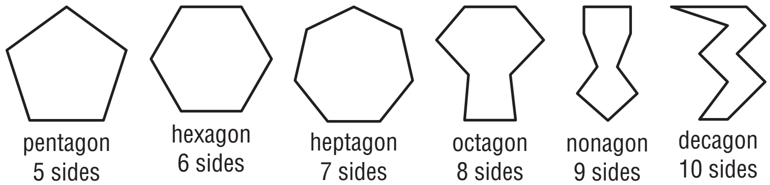
10-8 Study Guide and Intervention

6MR2.2 , 6AF3.2

Polygons and Tessellations

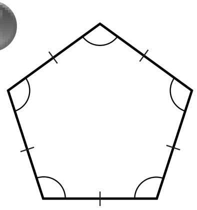
A **polygon** is a simple, closed figure formed by three or more straight lines. A simple figure does not have lines that cross each other. You have drawn a closed figure when your pencil ends up where it started. Polygons can be classified by the number of sides they have.



A polygon that has all sides congruent and all angles congruent is called a **regular polygon**.

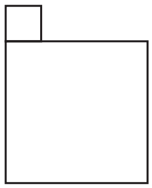
Examples **Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.**

1



The figure has 5 congruent sides and 5 congruent angles. It is a regular pentagon.

2

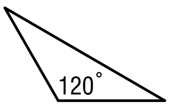


The figure is not a polygon because it has sides that overlap.

Exercises

Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.

1.



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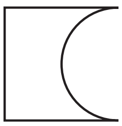

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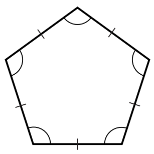

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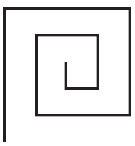

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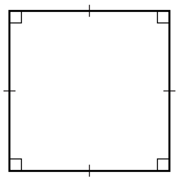
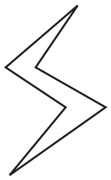


6.



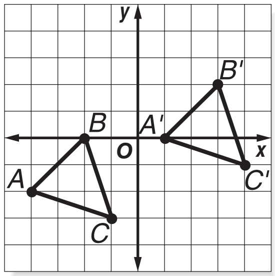
10-9 Study Guide and Intervention

7MG3.2

Translations

A **translation** is the movement of a geometric figure in some direction without turning the figure. When translating a figure, every point of the original figure is moved the same distance and in the same direction. To graph a translation of a figure, move each vertex of the figure in the given direction. Then connect the new vertices.

Example **Triangle *ABC* has vertices *A*(−4, −2), *B*(−2, 0), and *C*(−1, −3). Find the vertices of triangle *A′B′C′* after a translation of 5 units right and 2 units up.**



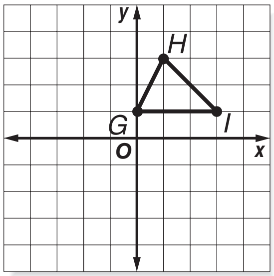
Add 5 to each *x*-coordinate. Add 2 to each *y*-coordinate.

Vertices of △*ABC*	(*x* + 5, *y* + 2)	Vertices of △*A′B′C′*
A(−4, −2)	(−4 + 5, −2 + 2)	*A′*(1, 0)
B(−2, 0)	(−2 + 5, 0 + 2)	*B′*(3, 2)
C(−1, −3)	(−1 + 5, −3 + 2)	*C′*(4, −1)

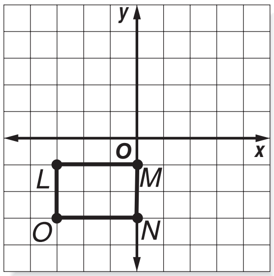
The coordinates of the vertices of △*A′B′C′* are *A′*(1, 0), *B′*(3, 2), and *C′*(4, −1).

Exercises

1. Translate △*GHI* 1 unit left and 5 units down.

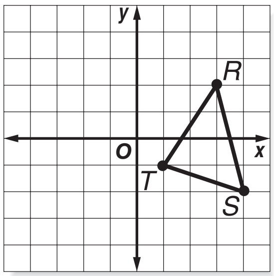


2. Translate rectangle *LMNO* 4 units right and 3 units up.

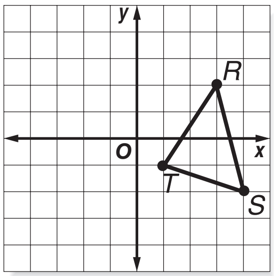


Triangle *RST* has vertices *R*(3, 2), *S*(4, −2), and *T*(1, −1). Find the vertices of *R′S′T′* after each translation. Then graph the figure and its translated image.

3. 5 units left, 1 unit up



4. 3 units left, 2 units down



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10-10 Study Guide and Intervention

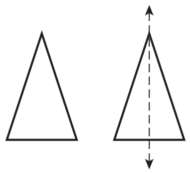
7MG3.2

Reflections

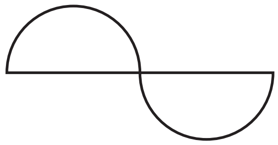
Figures that match exactly when folded in half have **line symmetry**. Each fold line is called a **line of symmetry**. Some figures have more than one line of symmetry.

Examples **Determine whether each figure has line symmetry. If so, draw all lines of symmetry.**

1



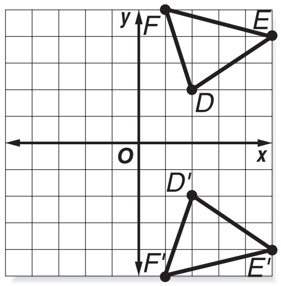
2



no symmetry

A type of transformation where a figure is flipped over a line of symmetry is a **reflection**. To draw the reflection of a polygon, find the distance from each vertex of the polygon to the line of symmetry. Plot the new vertices the same distance from the line of symmetry but on the other side of the line. Then connect the new vertices to complete the reflected image.

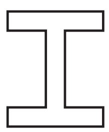
Example 3 **Triangle DEF has vertices $D(2, 2)$, $E(5, 4)$, and $F(1, 5)$. Find the coordinates of the reflected image. Graph the figure and its reflected image over the x-axis.**

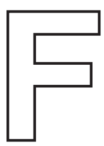


Plot the vertices and connect to form $\triangle DEF$. The x-axis is the line of symmetry. The distance from a point on $\triangle DEF$ to the line of symmetry is the same as the distance from the line of symmetry to the reflected image. The image coordinates are $D'(2, -2)$, $E'(5, -4)$, and $F'(1, -5)$.

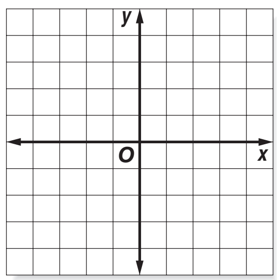
Exercises

For Exercises 1 and 2, determine which figures have line symmetry. Write *yes* or *no*. If *yes*, draw all lines of symmetry.

1. 

2. 

3. Triangle ABC has vertices $A(0, 4)$, $B(2, 1)$, and $C(4, 3)$. Find the coordinates of the vertices of ABC after a reflection over the x-axis. Then graph the figure and its reflected image.



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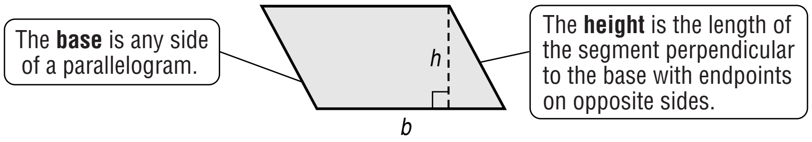
11-1 Study Guide and Intervention

6AF3.1, 6AF3.2

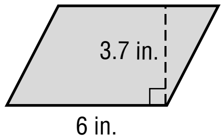
Area of Parallelograms

The area A of a parallelogram equals the product of its base b and its height h.

$$A = bh$$



Example 1 **Find the area of a parallelogram if the base is 6 inches and the height is 3.7 inches.**



Estimate $A = 6 \cdot 4$ or 24 in^2

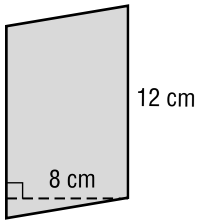
$A = bh$ Area of a parallelogram

$A = 6 \cdot 3.7$ Replace b with 6 and h with 3.7.

$A = 22.2$ Multiply.

The area of the parallelogram is 22.2 square inches. This is close to the estimate.

Example 2 **Find the area of the parallelogram at the right.**



Estimate $A = 10 \cdot 10$ or 100 cm^2

$A = bh$ Area of a parallelogram

$A = 12 \cdot 8$ Replace b with 12 and h with 8.

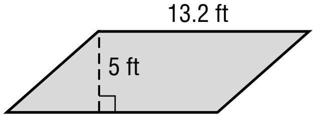
$A = 96$ Multiply.

The area of the parallelogram is 96 square centimeters. This is close to the estimate.

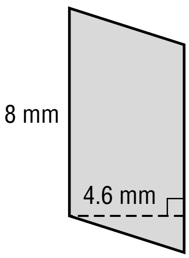
Exercises

Find the area of each parallelogram. Round to the nearest tenth if necessary.

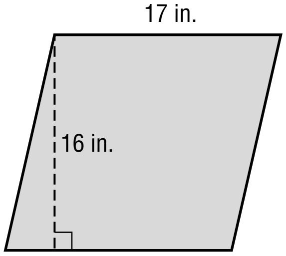
1.



2.



3.



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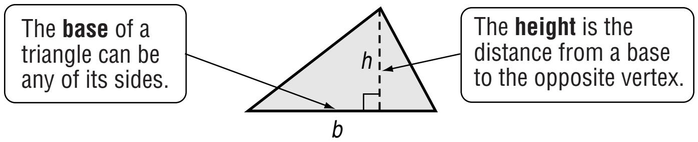
11-2 Study Guide and Intervention

6AF3.1, 6AF3.2

Area of Triangles and Trapezoids

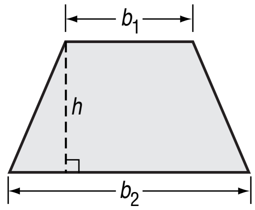
The area A of a triangle equals half the product of its base b and its height h.

$A = \frac{1}{2}bh$

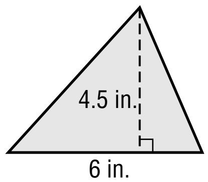


A trapezoid has two bases, b_1 and b_2. The height of a trapezoid is the distance between the two bases. The area A of a trapezoid equals half the product of the height h and the sum of the bases b_1 and b_2.

$$A = \frac{1}{2}h(b_1 + b_2)$$



Example 1 **Find the area of the triangle.**

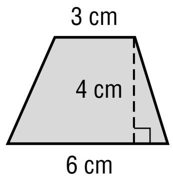


Estimate $\frac{1}{2}(6)(5) = 15$

$A = \frac{1}{2}bh$	Area of a triangle
$A = \frac{1}{2} \cdot 6 \cdot 4.5$	Replace b with 6 and h with 4.5.
$A = 13.5$	Multiply.

The area of the triangle is 13.5 square inches. This is close to the estimate.

Example 2 **Find the area of the trapezoid.**



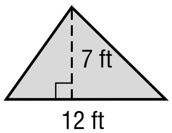
$A = \frac{1}{2}h(b_1 + b_2)$	Area of a trapezoid
$A = \frac{1}{2}(4)(3 + 6)$	Replace h with 4, b_1 with 3, and b_2 with 6.
$A = 18$	Simplify.

The area of the trapezoid is 18 square centimeters.

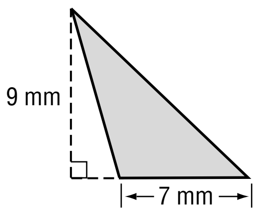
Exercises

Find the area of each figure. Round to the nearest tenth if necessary.

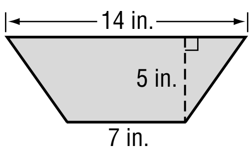
1.



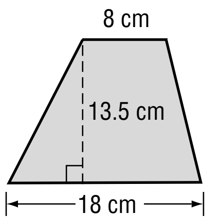
2.



3.



4.



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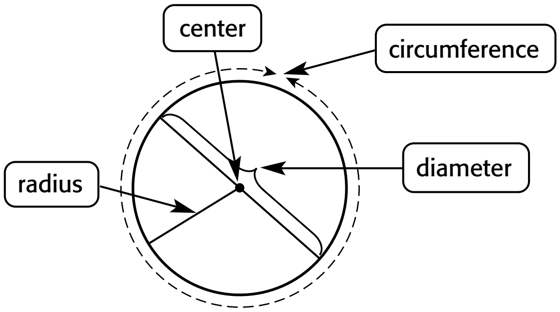
11-3 Study Guide and Intervention

6MG1.1, 6MG1.2

Circles and Circumference

A **circle** is the set of all points in a plane that are the same distance from a given point, called the **center**. The **diameter** *d* is the distance across the circle through its center. The **radius** *r* is the distance from the center to any point on the circle. The **circumference** *C* is the distance around the circle. The circumference *C* of a circle is equal to its diameter *d* times π, or 2 times its radius *r* times π.



Example 1 **Find the circumference of a circle with a diameter of 7.5 centimeters.**

$C = \pi d$ Circumference of a circle.

$C \approx 3.14 \times 7.5$ Replace π with 3.14 and *d* with 7.5.

$C \approx 23.55$ The circumference of the circle is about 23.55 centimeters.

Example 2 **If the radius of a circle is 14 inches, what is its circumference?**

$C = 2\pi r$

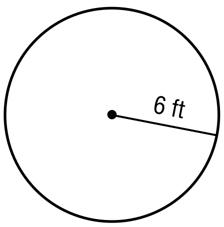
$C \approx 2 \times 3.14 \times 14$ Replace π with 3.14 and *r* with 14.

$C \approx 88$ The circumference of the circle is about 88 inches.

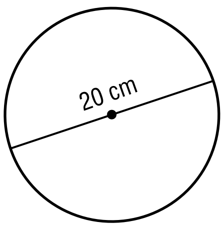
Exercises

Find the circumference of each circle. Use 3.14 for π. Round to the nearest tenth if necessary.

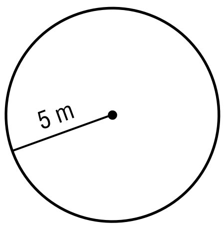
1.



2.



3.



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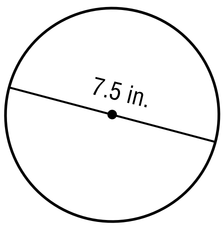

5. diameter = 15 km

6. radius = 21 mi

7. radius = 50 m

8. diameter = 600 ft

9. radius = 62 mm

10. diameter = 7 km

11. radius = 95 in.

12. diameter = 6.3 m

13. diameter = $5\frac{1}{4}$ cm

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11-4 Study Guide and Intervention

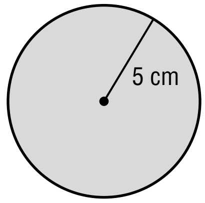
Area of Circles

6MG1.1, 6MG1.2

The area *A* of a circle equals the product of pi (π) and the square of its radius *r*.

$$A = \pi r^2$$

Example 1 **Find the area of the circle.**



$A = \pi r^2$	Area of circle
$A \approx 3.14 \cdot 5^2$	Replace π with 3.14 and r with 5.
$A \approx 78.5$	

The area of the circle is approximately 78.5 square centimeters.

Example 2 **Find the area of a circle that has a diameter of 9.4 millimeters.**

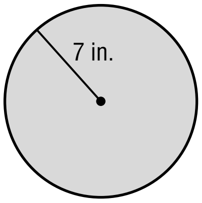
$A = \pi r^2$	Area of a circle
$A \approx 3.14 \cdot 4.7^2$	Replace π with 3.14 and r with 9.4 ÷ 2 or 4.7.
$A \approx 69.4$	

The area of the circle is approximately 69.4 square millimeters.

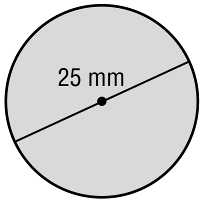
Exercises

Find the area of each circle. Use 3.14 for π. Round to the nearest tenth.

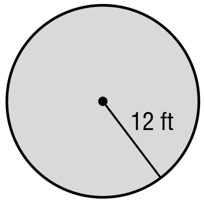
1.



2.



3.



4. radius = 2.6 cm

5. radius = 14.3 in.

6. diameter = $5\frac{1}{2}$ yd

7. diameter = $4\frac{3}{4}$ mi

8. diameter = 7.9 mm

9. radius = $2\frac{1}{5}$ ft

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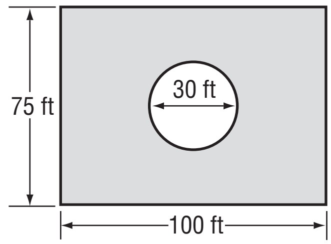
11-5 Study Guide and Intervention

6MR1.3, 6MR2.2, 6NS2.1

Problem-Solving Investigation: Solve a Simpler Problem

When problem solving, sometimes it is easier to **solve a simpler problem** first to find the correct strategy for solving a more difficult problem.

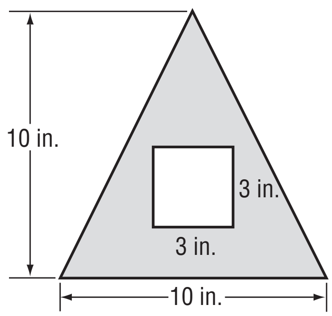
Example SPORTS **West High School wants to paint field blue, but not the center. The diagram below shows the dimensions of the field and center circle. How much area will they need to paint blue?**



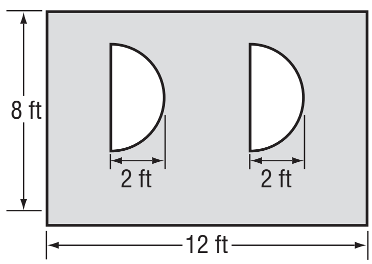
Explore	You know that the field is one large rectangle and the center symbol is a large circle.
Plan	You can find the area of the rectangle and the area of the circle and subtract.
Solve	Area of rectangle: $A = \ell w$ $A = 100 \times 75$ or 7500 Area if circle: $A = \pi r^2$ $A = 3.14 \times 15^2$ or 706.5 Subtract: $7500 - 706.5$ or 6793.5 ft^2 So, they would need to paint 6,793.5 square feet of field.
Check	Use estimation to check. The area of the entire field is 7,500 ft and the circle is approximately 700 feet so the area should be less than 6,800 feet. Since 6,793.5 is less than 6,800 ft, the answer is reasonable.

Exercises

1. **FRAMES** Joan wants to paint her favorite picture frame. How much paint would she need to use in order to cover just the frame?



2. **WALLPAPER** Richard wants to wallpaper one wall of his bathroom. He has two semi-circular windows along the wall. How much wallpaper must he purchase?



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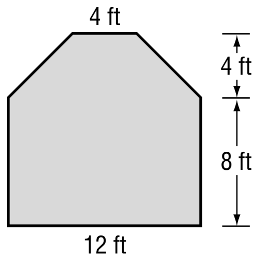
11-6 Study Guide and Intervention

6AF3.1, 6AF3.2

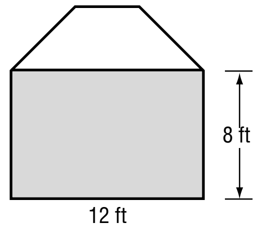
Area of Complex Figures

Complex figures are made of triangles, quadrilaterals, semicircles, and other two-dimensional figures. To find the area of a complex figure, separate it into figures whose areas you know how to find, and then add the areas.

Example 1 **Find the area of the figure at the right in square feet.**

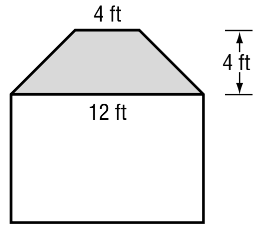


The figure can be separated into a rectangle and a trapezoid. Find the area of each.



Area of Rectangle

$A = \ell w$	Area of a rectangle
$A = 12 \cdot 8$	Replace ℓ with 12 and w with 8.
$A = 96$	Multiply.



Area of Trapezoid

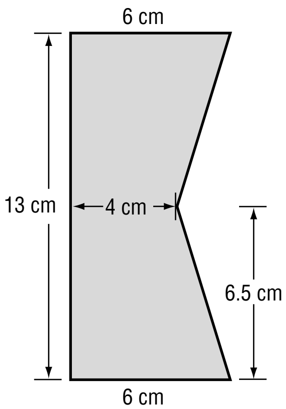
$A = \frac{1}{2}h(b_1 + b_2)$	Area of a trapezoid
$A = \frac{1}{2}(4)(4 + 12)$	Replace h with 4, b_1 with 4, and b_2 with 12.
$A = 32$	Multiply.

The area of the figure is 96 + 32 or 128 square feet.

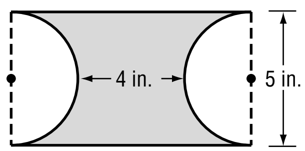
Exercises

Find the area of each figure. Round to the nearest tenth if necessary.

1.



2.



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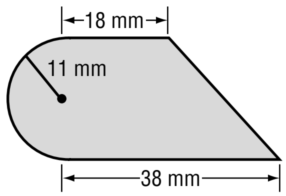

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11-7 Study Guide and Intervention

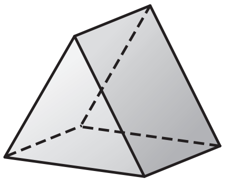
7MG3.6

Three-Dimensional Figures

Prisms	At least 3 rectangular lateral faces	Top and bottom bases are parallel	Shape of the base tells the name of the prism
Pyramids	At least three triangular lateral faces	One base shaped like any 3-sided closed figure	Shape of the base tells the name of the pyramid
Cones	Only one base	Base is a circle	One vertex and no edges
Cylinders	Only two bases	Bases are circles	No vertices and no edges
Spheres	All points are the same distance from the center	No faces or bases	No edges or vertices

Example **For each figure, name the shape of the base(s). Then classify each figure.**

A.



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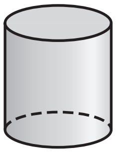
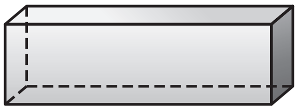


Exercises

For each figure name the shape of the base(s). Then classify each figure.

1.



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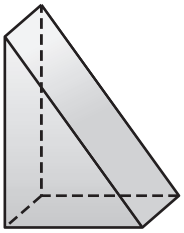

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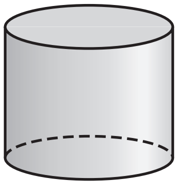

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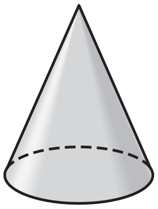

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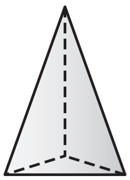
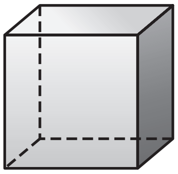


6.



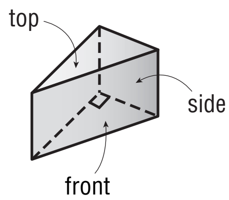
11-8 Study Guide and Intervention

5MG2.3, 6MR2.4

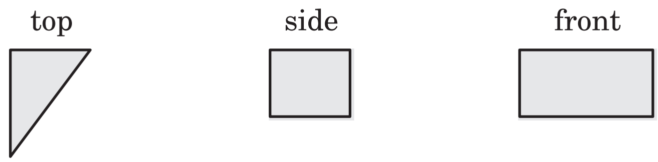
Drawing Three-Dimensional Figures

A solid is a three-dimensional figure.

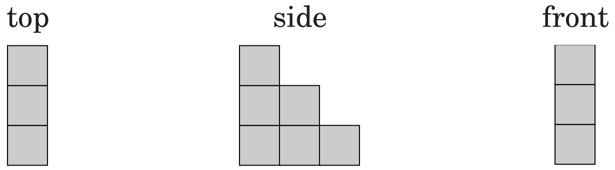
Example 1 **Draw a top, a side, and a front view of the solid at the right.**

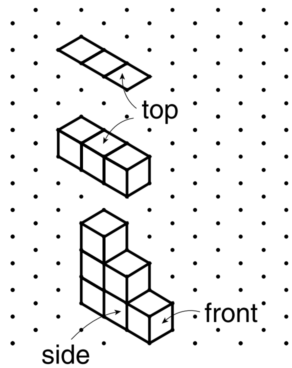


The top view is a triangle. The side and front views are rectangles.



Example 2 **Draw the solid using the top, side, and front views shown below.**





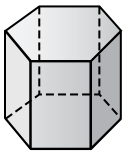
Step 1 Use the top view to draw the base of the figure, a 1-by-3 rectangle.

Step 2 Add edges to make the base a solid figure.

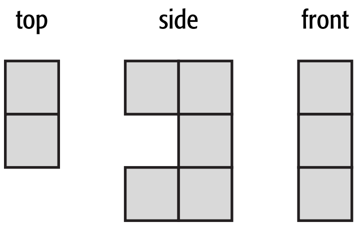
Step 3 Use the side and front views to complete the figure.

Exercises

1. Draw a top, a side, and front view of the solid.



2. Draw the solid whose top, side, and front views are shown. Use isometric dot paper.

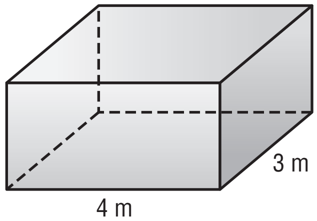


11-9 Study Guide and Intervention

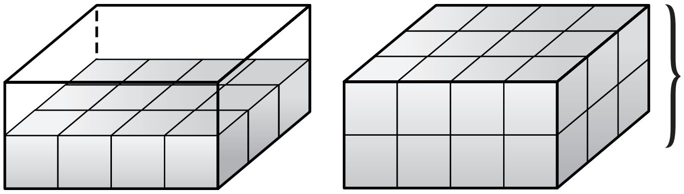
6MG1.3

Volume of Prisms

The **volume** of a three-dimensional figure is the measure of space occupied by it. It is measured in cubic units such as cubic centimeters (cm^3) or cubic inches (in^3). The volume of the figure at the right can be shown using cubes.



The bottom layer, or base, has 4 · 3 or 12 cubes. →



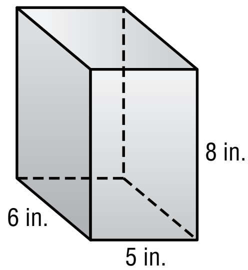
There are two layers.

It takes 12 · 2 or 24 cubes to fill the box. So, the volume of the box is 24 cubic meters.

A **rectangular prism** is a three-dimensional figure that has two parallel and congruent sides, or bases, that are rectangles. To find the volume of a rectangular prism, multiply the area of the base and the height, or find the product of the length ℓ, the width w, and the height h.

$V = Bh$ or $V = \ell wh$

Example **Find the volume of the rectangular prism.**



$V = \ell wh$ Volume of a rectangular prism

$V = 5 \cdot 6 \cdot 8$ Replace ℓ with 5, w with 6, and h with 8.

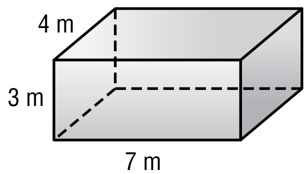
$V = 240$ Multiply.

The volume is 240 cubic inches.

Exercises

Find the volume of each rectangular prism. Round to the nearest tenth if necessary.

1.



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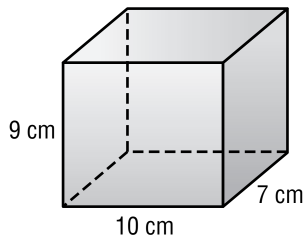

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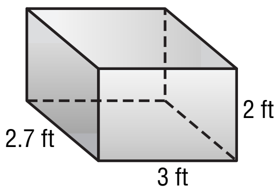

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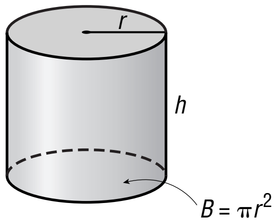
11-10 Study Guide and Intervention

6MG1.3

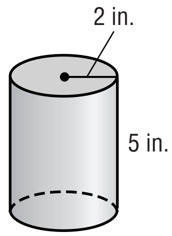
Volume of Cylinders

As with prisms, the area of the base of a **cylinder** tells the number of cubic units in one layer. The height tells how many layers there are in the cylinder. The volume V of a cylinder with radius r is the area of the base B times the height h.

$V = Bh$ or $V = \pi r^2 h$, where $B = \pi r^2$



Example **Find the volume of the cylinder. Use 3.14 for π. Round to the nearest tenth.**



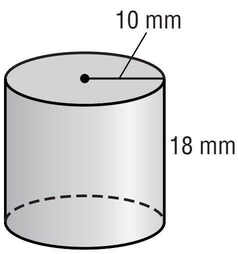
$V = \pi r^2 h$	Volume of a cylinder
$V \approx 3.14(2)^2(5)$	Replace π with 3.14, r with 2, and h with 5.
$V \approx 62.8$	Simplify.

The volume is approximately 62.8 cubic inches. Check by using estimation.

Exercises

Find the volume of each cylinder. Use 3.14 for π. Round to the nearest tenth.

1.



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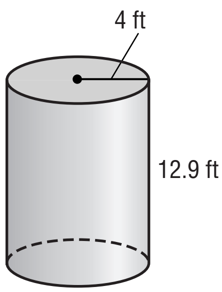

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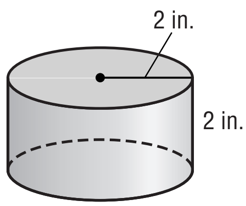

4. radius = 9.5 yd
height = 2.2 yd

5. diameter = 6 cm
height = 11 cm

6. diameter = $3\frac{2}{5}$ m
height = $1\frac{1}{4}$ m

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12-1 Study Guide and Intervention

7NS2.4

Estimating Square Roots

Recall that a perfect square is a square of a rational number. In Lesson 5-8, you learned that any number that can be written as a fraction is a rational number. A number that cannot be written as a fraction is an **irrational number**.

Example 1 **Estimate $\sqrt{40}$ to the nearest whole number.**

List some perfect squares.

1, 4, 9, 16, 25, 36, 49, …

$36 < 40 < 49$	40 is between the perfect squares 36 and 49.
$\sqrt{36} < \sqrt{40} < \sqrt{49}$	Find the square root of each number.
$6 < \sqrt{40} < 7$	$\sqrt{36} = 6$ and $\sqrt{49} = 7$

So, $\sqrt{40}$ is between 6 and 7. Since 40 is closer to 36 than to 49, the best whole number estimate is 6.

Example 2 **Use a calculator to find the value of $\sqrt{28}$ to the nearest tenth.**

2nd [√] 28 ENTER **5.291502622**

$\sqrt{28} \approx 5.3$

Check Since $5^2 = 25$ and 25 is close to 28, the answer is reasonable.

Exercises

Estimate each square root to the nearest whole number.

1. $\sqrt{3}$

2. $\sqrt{8}$

3. $\sqrt{26}$

4. $\sqrt{41}$

5. $\sqrt{61}$

6. $\sqrt{94}$

7. $\sqrt{152}$

8. $\sqrt{850}$

Use a calculator to find each square root to the nearest tenth.

9. $\sqrt{2}$

10. $\sqrt{27}$

11. $\sqrt{73}$

12. $\sqrt{82}$

13. $\sqrt{105}$

14. $\sqrt{395}$

15. $\sqrt{846}$

16. $\sqrt{2,298}$

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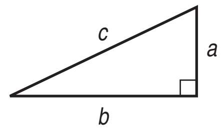
12-2 Study Guide and Intervention

7MG3.3

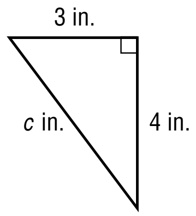
The Pythagorean Theorem

The sides of a right triangle have special names. The sides adjacent to the right angle are the **legs**. The side opposite the right angle is the **hypotenuse**. The **Pythagorean Theorem** describes the relationship between the length of the hypotenuse and the lengths of the legs. In a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.

$c^2 = a^2 + b^2$



Example 1 **Find the missing measure of a right triangle if $a = 4$ inches and $b = 3$ inches.**



$c^2 = a^2 + b^2$	Pythagorean Theorem
$c^2 = 4^2 + 3^2$	Replace a with 4 and b with 3.
$c^2 = 16 + 9$	Evaluate 4^2 and 3^2.
$c^2 = 25$	Add.
$\sqrt{c^2} = \sqrt{25}$	Take the positive square root of each side.
$c = 5$	Simplify.

The length of the hypotenuse is 5 inches.

Example 2 **Determine whether a triangle with side lengths of 6 meters, 9 meters, and 12 meters is a right triangle.**

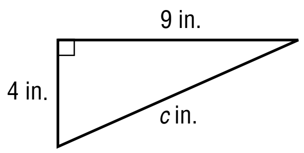
$c^2 = a^2 + b^2$	Pythagorean Theorem
$12^2 \stackrel{?}{=} 6^2 + 9^2$	Replace a with 6, b with 9, and c with 12.
$144 \stackrel{?}{=} 36 + 81$	Simplify.
$144 \neq 117$	Add.

The triangle is *not* a right triangle.

Exercises

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

1.



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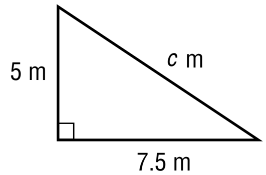

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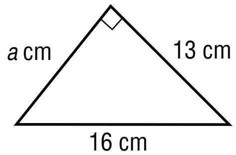


Determine whether each triangle with the given side lengths is a right triangle. Write *yes* or *no*.

4. 15 ft, 8 ft, 17 ft

5. 5 in., 13 in., 17 in.

6. 9 yd, 40 yd, 41 yd

12-3 Study Guide and Intervention

Problem-Solving Investigation: Make a Model

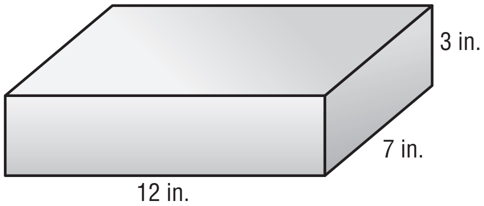
When solving problems, make a model to represent the given situation in order to determine the best plan for a solution.

Example GIFT WRAP **Rita wants to wrap a rectangular box. The box is 12 inches by 7 inches by 3 inches high. What must be the area of the paper so that she has a 1 inch overlap to neatly wrap the paper?**

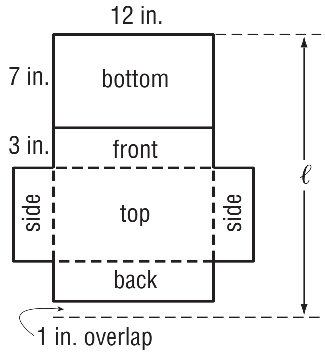
Explore You know that the box is $12 \times 7 \times 3$ and that you need to add 1 inch to some measures for the overlap. You also know that the wrapping paper will be a rectangle.

Plan Draw a sketch of the box and then make a model of the box if it were cut apart and laid flat. You need the overlap going around the box.

Solve Sketch the box.



Make a model of the box unfolded.



The length of the paper needed is the distance around the box plus 1 inch. So, $\ell = 7 + 3 + 7 + 3 + 1$ or 21 inches.

The width of the paper would be $3 + 12 + 3$ or 18 inches.

The area would be 21×18 or 378 in^2.

Check Make a box using centimeters instead of inches. Then cut a piece of paper 18 centimeters by 21 centimeters to see if you can wrap the box neatly.

Exercises

1. **GARDENING** Peg wants to put a stone path 3 feet wide around her rectangular garden measuring 10 feet by 15 feet. What will be the perimeter of her garden including the stone path?

2. **DRAWING** Dante is making a full-size drawing of his favorite cartoon character. If the figure is 1 inch by 0.5 inches and his scale is 1 inch = 10 inches, how large will the full size character be?

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12-4 Study Guide and Intervention

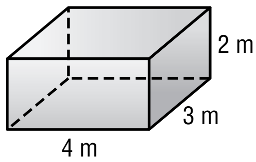
7MG2.1

Surface Area of Rectangular Prisms

The sum of the areas of all the surfaces, or faces, of a three-dimensional figure is the **surface area**. The surface area S of a rectangular prism with length ℓ, width w, and height h is found using the following formula.

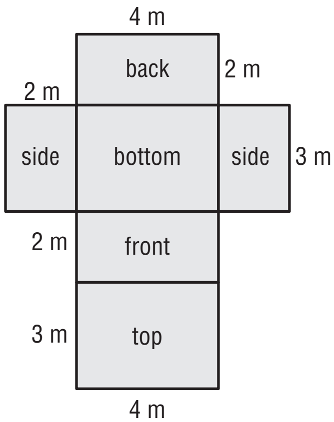
$S = 2\ell w + 2\ell h + 2wh$

Example **Find the surface area of the rectangular prism.**



You can use the net of the rectangular prism to find its surface area. There are three pairs of congruent faces in a rectangular prism:

- top and bottom
- front and back
- two sides



Faces	Area
top and bottom	$(4 \cdot 3) + (4 \cdot 3) = 24$
front and back	$(4 \cdot 2) + (4 \cdot 2) = 16$
two sides	$(2 \cdot 3) + (2 \cdot 3) = 12$
Sum of the areas	$24 + 16 + 12 = 52$

Alternatively, replace ℓ with 4, w with 3, and h with 2 in the formula for surface area.

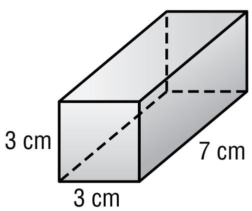
$S = 2\ell w + 2\ell h + 2wh$
$= 2 \cdot 4 \cdot 3 + 2 \cdot 4 \cdot 2 + 2 \cdot 3 \cdot 2$ Follow order of operations.
$= 24 + 16 + 12$
$= 52$

So, the surface area of the rectangular prism is 52 square meters.

Exercises

Find the surface area of each rectangular prism.

1.



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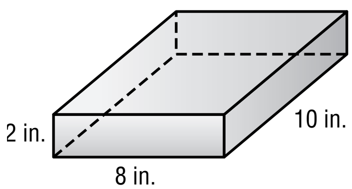

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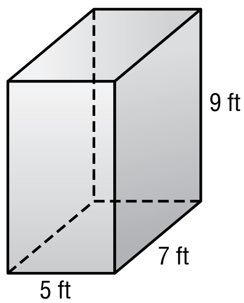

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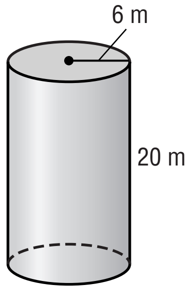
12-5 Study Guide and Intervention

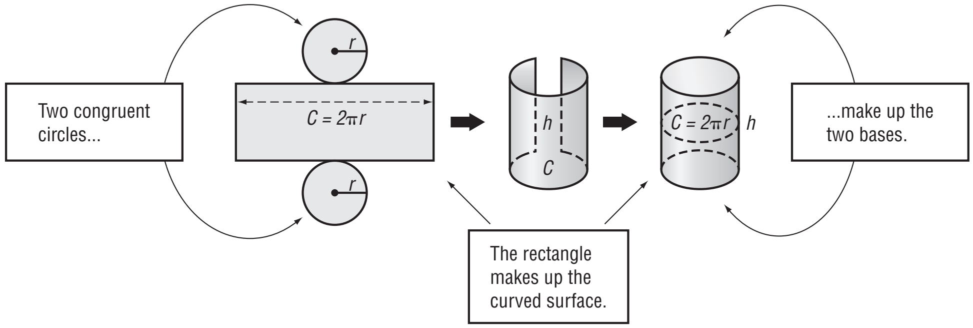
7MG2.1

Surface Area of Cylinders

The diagram below shows how you can put two circles and a rectangle together to make a cylinder.

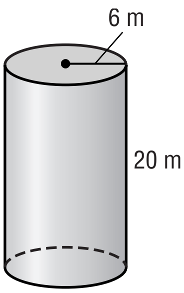


The surface area of a cylinder	equals	the area of two bases	plus	the area of the curved surface.
S	$=$	$2(\pi r^2)$	$+$	$(2\pi r)h$



In the diagram above, the length of the rectangle is the same as the circumference of the circle. Also, the width of the rectangle is the same as the height of the cylinder.

Example **Find the surface area of the cylinder. Use 3.14 for π. Round to the nearest tenth.**



$S = 2\pi r^2 + 2\pi rh$ Surface area of a cylinder.

$S = 2 \cdot 3.14(6)^2 + 2 \cdot 3.14(6)(20)$ Replace π with 3.14, r with 6, and h with 20.

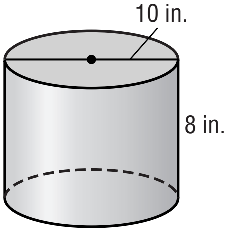
≈ 979.7 Simplify.

The surface area is about 979.7 square meters.

Exercises

Find the surface area of each cylinder. Use 3.14 for π. Round to the nearest tenth.

1.



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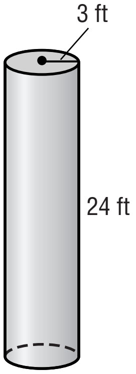
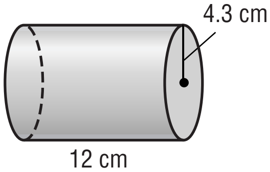


3.



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