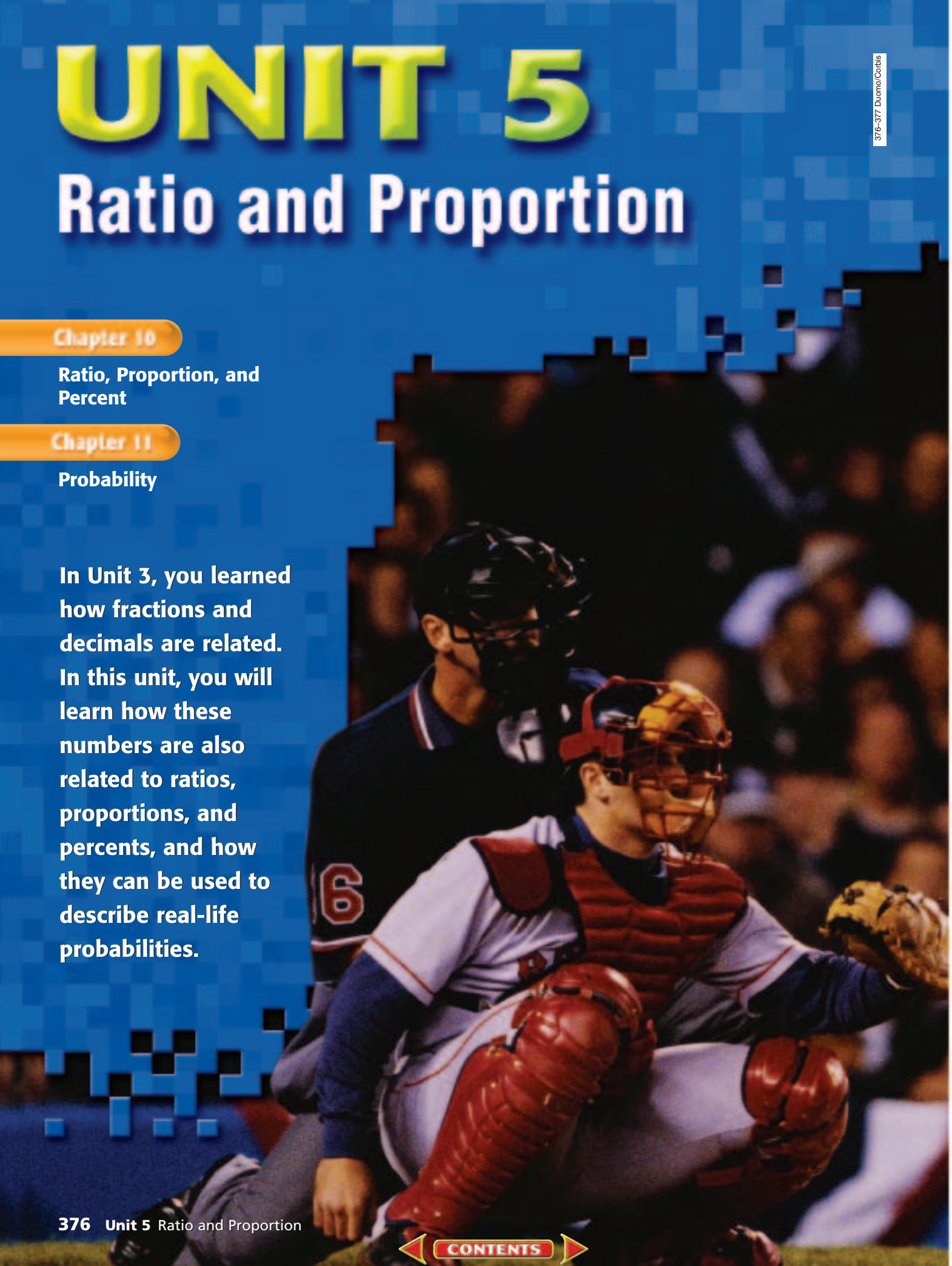
UNIT 5
Ratio and Proportion



376–377 Duomo/Corbis

Chapter 10

Ratio, Proportion, and Percent

Chapter 11

Probability

In Unit 3, you learned how fractions and decimals are related. In this unit, you will learn how these numbers are also related to ratios, proportions, and percents, and how they can be used to describe real-life probabilities.

INTERDISCIPLINARY PROJECT

Take Me Out To The Ballgame

Math and Sports Baseball, one of America's favorite pastimes, is overflowing with mathematics. The National Baseball Statisticians Organization has asked you to step up to the plate! They need your help to analyze several seasons of baseball data. You'll also be asked to create a scale drawing of a professional baseball field. The game is about to begin. Let's see if you can hit a homerun!

WebQuest **Log on to msmath1.net/webquest to begin your WebQuest.**

CHAPTER 10

Ratio, Proportion, and Percent

JH Pete Carmichael/Getty Images

"What do insects have to do with math?"

Most insects are very small. A drawing or photograph of an insect often shows the insect much larger than it is in real life. **For example, this photograph shows a praying mantis about three times as large as an actual praying mantis.**

You will find the actual dimensions of certain insects in Lesson 10-3.

GETTING STARTED

Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 10. Refer to the lesson number in parentheses for review.

Vocabulary Review

Choose the correct number to complete each sentence.

1. To write 0.28 as a fraction, write the decimal as a fraction using (100, 1,000) as the denominator. (Lesson 5-6)

2. The fraction $\frac{5}{8}$ is equivalent to (0.875, 0.625). (Lesson 5-7)

Prerequisite Skills

Multiply. (Lesson 4-2)

3. 0.28×25
4. 364×0.88
5. 154×0.18
6. 0.03×16

Draw a model to represent each fraction. (Lesson 5-5)

7. $\frac{2}{4}$
8. $\frac{1}{6}$
9. $\frac{3}{5}$
10. $\frac{2}{3}$

Write each fraction as a decimal. (Lesson 5-7)

11. $\frac{3}{8}$
12. $\frac{46}{100}$
13. $\frac{7}{10}$
14. $\frac{1}{5}$

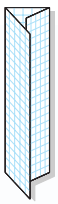
Multiply. (Lesson 7-2)

15. $\frac{1}{4} \times 360$
16. $\frac{3}{4} \times 96$
17. $\frac{2}{5} \times 125$
18. $\frac{7}{9} \times 27$

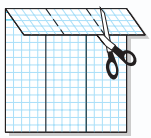
FOLDABLES Study Organizer

Ratio, Proportion, and Percent Make this Foldable to help you organize your notes. Begin with a piece of graph paper.

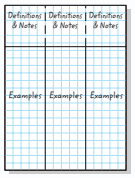
STEP 1 **Fold**
Fold one sheet of grid paper in thirds lengthwise.



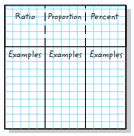
STEP 2 **Fold and Cut**
Unfold lengthwise and fold one-fourth down widthwise. Cut to make three tabs as shown.



STEP 3 **Unfold and Label**
With the tabs unfolded, label the paper as shown.



STEP 4 **Refold and Label**
Refold the tabs and label as shown.



Noteables™ **Chapter Notes** Each time you find this logo throughout the chapter, use your *Noteables™: Interactive Study Notebook with Foldables™* or your own notebook to take notes. Begin your chapter notes with this Foldable activity.

Math nline **Readiness** To prepare yourself for this chapter with another quiz, visit **msmath1.net/chapter_readiness**

10-1 Ratios

What You'll LEARN

Express ratios and rates in fraction form.

NEW Vocabulary

ratio
equivalent ratios
rate
unit rate

WHEN am I ever going to use this?

CLOTHES The table shows how many socks of each color are in a drawer.

Socks	
Color	**Number**
Black	6
White	12
Navy	2

1. Write a sentence that compares the number of navy socks to the number of white socks. Use the word *less* in your sentence.
2. Write a sentence that compares the number of black socks to the number of white socks. Use the word *half* in your sentence.
3. Write a sentence comparing the number of white socks to the total number of socks. Use a fraction in your sentence.

There are many ways to compare numbers. A **ratio** is a comparison of two numbers by division. If there are 6 black socks and a total of 20 socks, then the ratio comparing the black socks to the total socks can be written as follows.

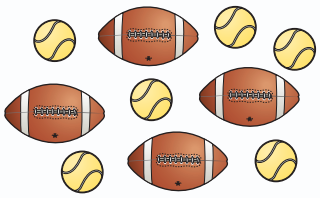
$\frac{6}{20}$ 6 to 20 6 out of 20 6 : 20

A common way to express a ratio is as a fraction in simplest form.

The GCF of 6 and 20 is 2. → $\frac{6}{20} \overset{\div 2}{=} \frac{3}{10}$ ← The simplest form of $\frac{6}{20}$ is $\frac{3}{10}$.

EXAMPLE 1 Write a Ratio in Simplest Form

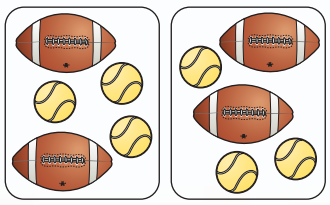
SPORTS **Write the ratio that compares the number of footballs to the number of tennis balls.**



footballs → 4
tennis balls → 6
$\frac{4}{6} \overset{\div 2}{=} \frac{2}{3}$ ← The GCF of 4 and 6 is 2.

The ratio of footballs to tennis balls is $\frac{2}{3}$, 2 to 3, or 2:3.

For every 2 footballs, there are 3 tennis balls.



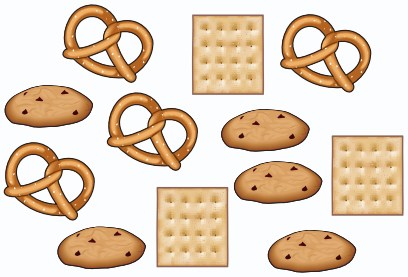
STUDY TIP

Look Back To review simplifying fractions, see Lesson 5-2.

The two ratios in Example 1 are **equivalent ratios** since $\frac{4}{6} = \frac{2}{3}$.

EXAMPLE 1 Use Ratios to Compare Parts of a Whole

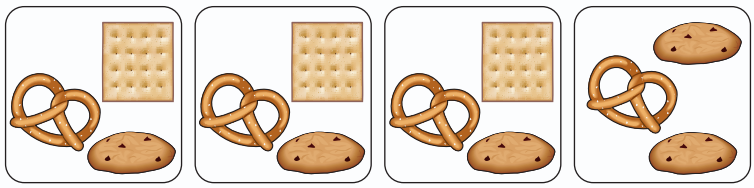
FOOD **Write the ratio that compares the number of pretzels to the total number of snacks.**



pretzels → 4, snacks → 12, $\frac{4}{12} = \frac{1}{3}$ (÷4 above and below)

The GCF of 4 and 12 is 4.

The ratio of pretzels to the total number of snacks is $\frac{1}{3}$, 1 to 3, or 1 : 3. For every one pretzel, there are three total snacks.



Your Turn **Write each ratio as a fraction in simplest form.**

a. 3 drums to 18 trumpets **b.** 8 gerbils to 36 pets

A **rate** is a ratio of two measurements having different kinds of units. Two examples are shown below.

Dollars and pounds are different kinds of units.

$12 for 3 pounds

Miles and hours are different kinds of units.

60 miles in 3 hours

When a rate is simplified so that it has a denominator of 1, it is called a **unit rate**. An example of a unit rate is $3 per pound, which means $3 per 1 pound.

REAL-LIFE MATH

BIRDS The roadrunner is the state bird of New Mexico. Roadrunners prefer running to flying. It would take 4 hours for a roadrunner to run about 54 miles.

Source: www.50states.com

EXAMPLE 2 Find Unit Rate

BIRDS **Use the information at the left to find how many miles a roadrunner can run in one hour.**

$\frac{54 \text{ miles}}{4 \text{ hours}} = \frac{13.5 \text{ miles}}{1 \text{ hour}}$ (÷4 above and below)

Divide the numerator and the denominator by 4 to get a denominator of 1.

So, a roadrunner can run about 13.5 miles in one hour.

msmath1.net/extra_examples

CONTENTS

Skill and Concept Check

1. **Write** the ratio 6 geese out of 15 birds in three different ways.

2. Writing Math Explain the difference between a rate and a unit rate. Give an example of each.

3. **FIND THE ERROR** Brian and Marta are writing the rate $56 in 4 weeks as a unit rate. Who is correct? Explain.

Brian: $\frac{\$56}{4 \text{ weeks}} = \frac{\$14}{1 \text{ week}}$

Marta: $\frac{\$56}{4 \text{ weeks}} = \frac{\$28}{2 \text{ weeks}}$

4. **NUMBER SENSE** The ratio of videocassettes to digital videodiscs is 1 to 4. Explain the meaning of this ratio.

GUIDED PRACTICE

Write each ratio as a fraction in simplest form.

5. 6 wins to 8 losses
6. 15 pens to 45 pencils
7. 9 salmon out of 21 fish
8. 4 roses out of 24 flowers

Write each ratio as a unit rate.

9. $9 for 3 cases of soda
10. 25 meters in 2 seconds

11. **MONEY** Two different packages of batteries are shown. Determine which is less expensive per battery, the 4-pack or the 8-pack. Explain.

4-pack **$3.60**

8-pack **$6.80**

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
12–19, 26, 27	1, 2
20–23, 28	3

Extra Practice
See pages 613, 633.

Write each ratio as a fraction in simplest form.

12. 14 dimes to 24 nickels
13. 15 rubies to 25 emeralds
14. 16 pigs to 10 cows
15. 8 circles to 22 squares
16. 6 mustangs out of 21 horses
17. 4 cellular phones out of 18 phones
18. 10 girls out of 24 students
19. 32 apples out of 72 pieces of fruit

Write each ratio as a unit rate.

20. 180 words in 3 minutes
21. $36 for 4 tickets
22. $1.50 for 3 candy bars
23. $1.44 for a dozen eggs

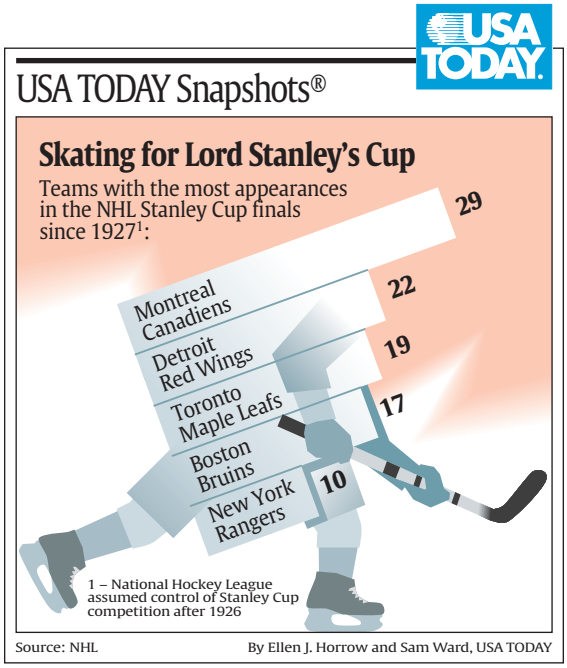
24. **MONEY** Luke purchased a 16-ounce bag of potato chips for $2.56 and a 32-ounce bag of tortilla chips for $3.52. Which of these snack foods is less expensive per ounce? Explain.

25. **SCHOOL** Draw a picture showing 4 pencils and a number of pens in which the ratio of pencils to pens is 2:3.

HOCKEY For Exercises 26 and 27, use the graphic at the right. Write each ratio in simplest form.

26. What ratio compares the appearances of the Rangers to the appearances of the Red Wings?

27. What ratio compares the appearances of the Maple Leafs to the appearances of the Bruins?



28. **DINOSAURS** A pterodactyl could fly 75 miles in three hours. At this rate, how far could a pterodactyl travel in 1 hour?

29. **CRITICAL THINKING** If 9 out of 24 students received below a 75% on the test, what ratio of students received a 75% or above?

Spiral Review with Standardized Test Practice

30. **MULTIPLE CHOICE** Dr. Rodriguez drove 384.2 miles on 17 gallons of gasoline. At this rate, how many miles could he drive on 1 gallon?

(A) 22.5 mi (B) 22.6 mi (C) 126 mi (D) none of the above

31. **SHORT RESPONSE** Find the ratio of the number of vowels in the word *Mississippi* to the number of consonants as a fraction in simplest form.

32. Make a function table for the rule $y = -2x$. Use input values of -1, 0, and 1. Then graph the function. (Lesson 9-7)

Find the rule for each function table. (Lesson 9-6)

33.

x	■
0	−2
1	−1
2	0

34.

x	■
−2	−1
0	1
3	4

35.

x	■
−3	0
−1	2
2	5

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Multiply. (Page 590)

36. 6×15 37. 5×9 38. 12×3 39. 8×12

10-1b HANDS-ON LAB

A Follow-Up of Lesson 10-1

Ratios and Tangrams

What You'll LEARN

Explore ratios and the relationship between ratio and area.

Materials

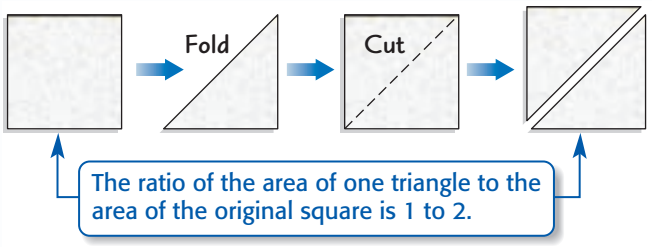
- 2 sheets of patty paper
- scissors

INVESTIGATE *Work with a partner.*

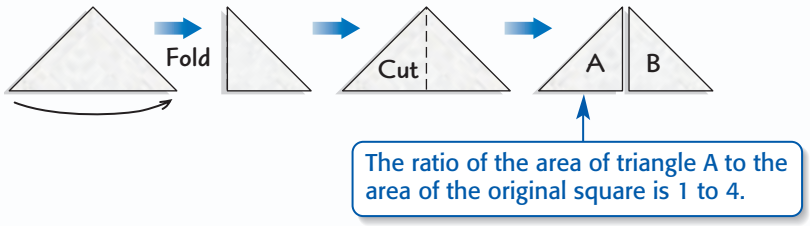
A tangram is a puzzle that is made by cutting a square into seven geometric figures. The puzzle can be formed into many different figures.

In this lab, you will use a tangram to explore ratios and the relationship between ratio and area.

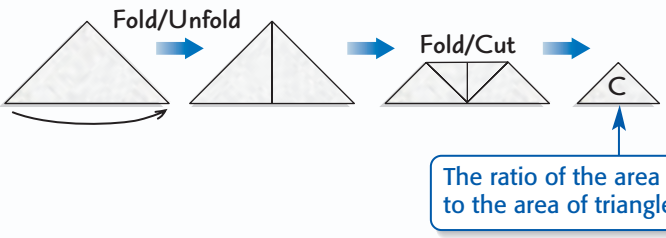
STEP 1 Begin with one sheet of patty paper. Fold the top left corner to the bottom right corner. Unfold and cut along the fold so that two large triangles are formed.



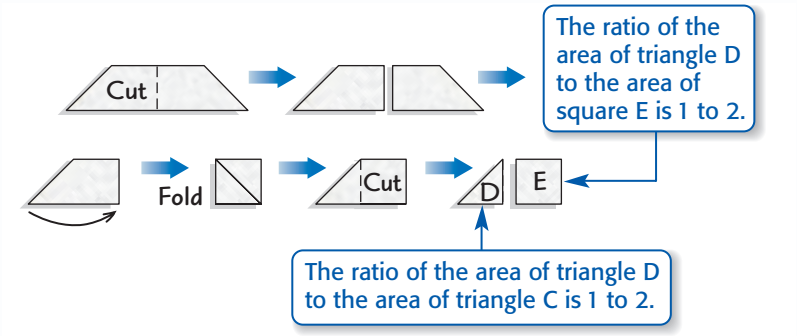
STEP 2 Use one of the cut triangles. Fold the bottom left corner to the bottom right corner. Unfold and cut along the fold. Label the triangles A and B.



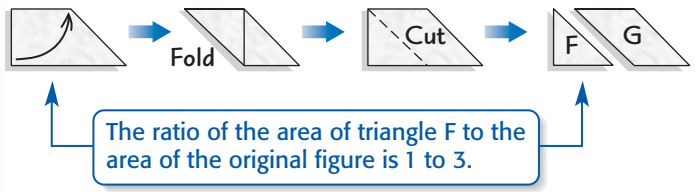
STEP 3 Use the other large triangle from step 1. Fold the bottom left corner to the bottom right corner. Make a crease and unfold. Next, fold the top down along the crease as shown. Make a crease and cut along the second crease line. Cut out the small triangle and label it C.



STEP 4 Use the remaining piece. Fold it in half from left to right. Cut along the fold. Using the left figure, fold the bottom left corner to the bottom right corner. Cut along the fold and label the triangle D and the square E.



STEP 5 Use the remaining piece. Fold the bottom left corner to the top right corner. Cut along the fold. Label the triangle F and the other figure G.



Writing Math

Work with a partner.

1. Suppose the area of triangle B is 1 square unit. Find the area of each triangle below.
   a. triangle C
   b. triangle F
2. Explain how the area of each of these triangles compares to the area of triangle B.
3. **Explain** why the ratio of the area of triangle C to the original large square is 1 to 8.
4. **Tell** why the area of square E is equal to the area of figure G.
5. **Find** the ratio of the area of triangle F to the original large square. Explain your reasoning.
6. Complete the table. Write the fraction that compares the area of each figure to the original square. What do you notice about the denominators?

Figure	A	B	C	D	E	F	G
Fractional Part of the Large Square							

10-2 Algebra: Solving Proportions

What You'll LEARN

Solve proportions by using cross products.

NEW Vocabulary

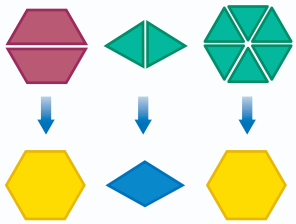
proportion
cross products

HANDS-ON Mini Lab

Materials
- pattern blocks

Work with a partner.

Pattern blocks can be used to explore ratios that are equivalent. The pattern blocks at the right show how each large figure is made using smaller figures.



1. Complete each ratio so that the ratios comparing the areas are equivalent.

a. $\frac{\text{hexagon}}{\text{rhombus}} = \frac{\text{trapezoid}}{?}$

b. $\frac{\text{triangle, triangle}}{\text{hexagon}} = \frac{\text{triangle}}{?}$

2. How did you find which figure made the ratios equivalent?
3. Suppose a green block equals 2, a blue block equals 4, a yellow block equals 6, and a red block equals 3. Write a pair of equivalent ratios.
4. What relationship exists in these equivalent ratios?

The ratios $\frac{4}{6}$ and $\frac{2}{3}$ are equivalent. That is, $\frac{4}{6} = \frac{2}{3}$. The equation $\frac{4}{6} = \frac{2}{3}$ is an example of a **proportion**.

Noteables™ **Key Concept: Proportion**

Words A proportion is an equation stating that two ratios are equivalent.

Symbols

Arithmetic	Algebra
$\frac{2}{5} = \frac{6}{15}$ ($\times 3$ above, $\times 3$ below)	$\frac{a}{b} = \frac{c}{d}, b \neq 0, d \neq 0$

For two ratios to form a proportion, their **cross products** must be equal.

2×9 is one cross product. → $\frac{2}{3} = \frac{6}{9}$ ← 3×6 is the other cross product.

$2(9) \stackrel{?}{=} 3(6)$

$18 = 18$ ← The cross products are equal.

READING in the Content Area

For strategies in reading this lesson, visit msmath1.net/reading.

Noteables™ Key Concept: Property of Proportions

Words The cross products of a proportion are equal.

Symbols

Arithmetic	Algebra
If $\frac{2}{5} = \frac{6}{15}$, then $2 \times 15 = 5 \times 6$.	If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

When one value in a proportion is unknown, you can use cross products to *solve the proportion*.

STUDY TIP

Mental Math In some cases, you can solve a proportion mentally by using equivalent fractions. Consider the proportion $\frac{3}{4} = \frac{x}{16}$. Since $4 \times 4 = 16$ and $3 \times 4 = 12$, $x = 12$.

EXAMPLES Solve a Proportion

Solve each proportion.

1 $\frac{5}{7} = \frac{25}{m}$

$5 \times m = 7 \times 25$ Cross products

$5m = 175$ Multiply.

$\frac{5m}{5} = \frac{175}{5}$ Divide each side by 5.

$m = 35$

The solution is 35.

2 $\frac{y}{5} = \frac{1.2}{1.5}$

$y \times 1.5 = 5 \times 1.2$ Cross products

$1.5y = 6$ Multiply.

$\frac{1.5y}{1.5} = \frac{6}{1.5}$ Divide each side by 1.5.

$y = 4$

The solution is 4.

Your Turn **Solve each proportion.**

a. $\frac{5}{9} = \frac{z}{54}$ b. $\frac{5}{8} = \frac{40}{x}$ c. $\frac{k}{7} = \frac{18}{6}$

REAL-LIFE CAREERS

How Does a Dentist Use Math?

Dentists use math when determining the amount of material needed to fill a cavity in a patient's tooth.

Math Tutor Research

For information about a career as a dentist, visit: msmath1.net/careers

Proportions can be used to solve real-life problems.

EXAMPLE Use a Proportion to Solve a Problem

1 **TOOTHPASTE** **Out of the 32 students in a health class, 24 prefer using gel toothpaste. Based on these results, how many of the 500 students in the school can be expected to prefer using gel toothpaste?**

Write and solve a proportion. Let s represent the number of students who can be expected to prefer gel toothpaste.

prefer gel toothpaste → $\frac{24}{32} = \frac{s}{500}$ ← prefer gel toothpaste
total students in class → ← total students in school

$24 \times 500 = 32 \times s$ Cross products

$12{,}000 = 32s$ Multiply.

$\frac{12{,}000}{32} = \frac{32s}{32}$ Divide.

$375 = s$

So, 375 students can be expected to prefer gel toothpaste.

Skill and Concept Check

1. **Writing Math** Determine whether each pair of ratios form a proportion. Explain your reasoning.

   a. $\frac{1}{8}, \frac{8}{64}$ b. $\frac{7}{12}, \frac{8}{15}$ c. $\frac{0.7}{0.9}, \frac{2.1}{2.7}$

2. **OPEN ENDED** Write a proportion with $\frac{7}{8}$ as one of the ratios.

3. **Which One Doesn't Belong?** Identify the ratio that does not form a proportion with the others. Explain your reasoning.

$\frac{8}{12}$ $\frac{40}{60}$ $\frac{36}{44}$ $\frac{24}{36}$

GUIDED PRACTICE

Solve each proportion.

4. $\frac{5}{4} = \frac{a}{36}$ 5. $\frac{3}{4} = \frac{x}{20}$ 6. $\frac{w}{1.8} = \frac{3.5}{1.4}$

7. **SCHOOL** At West Boulevard Middle School, the teacher to student ratio is 3 to 78. If there are 468 students enrolled at the school, how many teachers are there at the school?

Practice and Applications

Solve each proportion.

8. $\frac{2}{5} = \frac{w}{15}$ 9. $\frac{3}{4} = \frac{z}{28}$ 10. $\frac{7}{d} = \frac{35}{10}$ 11. $\frac{4}{x} = \frac{16}{28}$

12. $\frac{p}{3} = \frac{25}{15}$ 13. $\frac{h}{8} = \frac{6}{16}$ 14. $\frac{6}{7} = \frac{18}{c}$ 15. $\frac{21}{35} = \frac{3}{r}$

16. $\frac{1.4}{2.6} = \frac{4.2}{n}$ 17. $\frac{g}{4.7} = \frac{0.6}{9.4}$ 18. $\frac{1.8}{b} = \frac{9}{2.5}$ 19. $\frac{1.6}{6.4} = \frac{k}{1.6}$

HOMEWORK HELP

For Exercises	See Examples
8–21	1, 2
22–24, 26–28	3

Extra Practice
See pages 614, 633.

20. What is the solution of $\frac{1}{3} = \frac{x}{14}$? Round to the nearest tenth.

21. Find the solution of $\frac{m}{2} = \frac{5}{12}$ to the nearest tenth.

22. **MONEY** Suppose you buy 2 CDs for $21.99. How many CDs can you buy for $65.97?

SURVEYS **For Exercises 23 and 24, use the table at the right. It shows which physical education class activities are favored by a group of students.**

Favorite Physical Education Class Activity

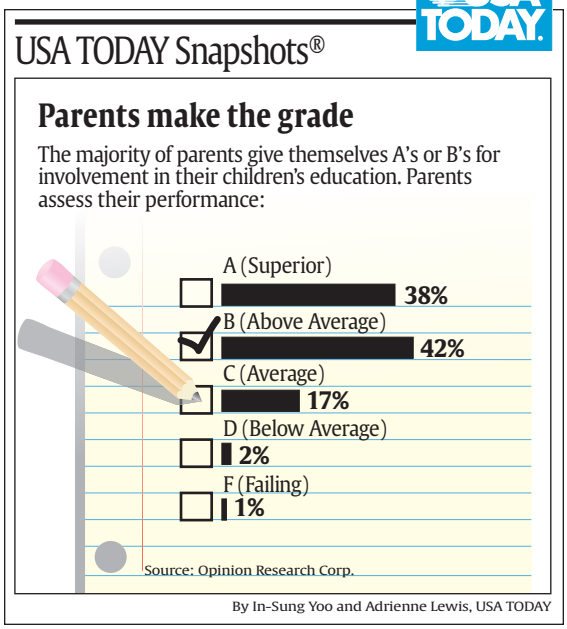
Activity	Number of Responses
pull-ups	2
running	7
push-ups	3
sit-ups	8

23. Write a proportion that could be used to find the number of students out of 300 that can be expected to pick sit-ups as their favorite physical education activity.

24. How many of the students can be expected to pick sit-ups as their favorite physical education class activity?

CONTENTS

PARENTS **For Exercises 25–27, use the graphic that shows what grade parents gave themselves for their involvement in their children's education.**



25. What fraction of the parents gave themselves a B?

26. Suppose 500 parents were surveyed. Write a proportion that could be used to find how many of them gave themselves a B.

27. How many of the 500 parents gave themselves a B?

28. **PRIZES** A soda company is having a promotion. Every 3 out of 72 cases of soda contains a $5 movie rental certificate. If there are 384 cases of soda on display in a store, how many of the cases can be expected to contain a $5 movie rental certificate?

29. **CRITICAL THINKING** Suppose 24 out of 180 people said they like hiking, and 5 out of every 12 hikers buy Turf-Tuff hiking boots. In a group of 270 people, how many would you expect to have Turf-Tuff hiking boots?

Spiral Review with Standardized Test Practice

30. **MULTIPLE CHOICE** If you work 22 hours a week and earn $139.70, how much money do you earn per hour?

(A) $6.50 (B) $6.35 (C) $6.05 (D) $5.85

31. **SHORT RESPONSE** If an airplane travels 438 miles per hour, how many miles will it travel in 5 hours?

Express each ratio as a unit rate. (Lesson 10-1)

32. 56 wins in 8 years

33. $12 for 5 hot dogs

Copy and complete each function table. Then graph the function. (Lesson 9-7)

34.

Input	Output ($n - 3$)
−2	■
0	■
2	■

35.

Input	Output ($3n$)
−2	■
0	■
2	■

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Multiply or divide.** (Page 590, Lessons 4-2 and 4-3)

36. 9×3 37. 1.5×4 38. $56 \div 4$ 39. $161.5 \div 19$

10-2b Spreadsheet Investigation

A Follow-Up of Lesson 10-2

What You'll LEARN

Use a spreadsheet to solve problems involving proportions.

Solving Proportions

Spreadsheets can be used to help solve proportion problems.

ACTIVITY

Your class is going to make peanut butter cocoa cookies for a school party. The ingredients needed to make enough cookies for 16 people are shown. Find how much of each ingredient is needed to make enough cookies for the school party.

Peanut Butter Cocoa Cookies

Ingredients:
2 cups sugar
1/4 cup cocoa
1/2 cup milk
1/4 pound margarine
1 teaspoon vanilla
1/2 cup peanut butter
3 cups quick cooking oats
Directions: Mix sugar, cocoa, milk, and margarine in a saucepan. Cook the mixture and ... medium heat

Set up a spreadsheet like the one shown to find the amount of ingredients needed to serve a given number of people.

Cell B1 is where you enter how many people will be served.

One recipe yields enough cookies for 16 people.

Peanut Butter Cocoa Cookies

	A	B	C	D
1	People to Serve			
2	Batches Needed	=B1/16		
3	Ingredient	Recipe	Amount	Unit
4	Sugar	2	=B4*B2	Cups
5	Cocoa Mix	0.25		Cups
6	Milk	0.5		Cups
7	Margarine	0.25		Pound
8	Vanilla	1		Teaspoon
9	Peanut Butter	0.5		Cups
10	Quick Cook Oats	3		Cups

The spreadsheet will calculate the amount of each ingredient you must have to make the number of cookies needed.

EXERCISES

1. Explain the formula in B2.
2. What does the formula in C4 represent?
3. What formulas should be entered in cells C5 through C10?
4. How does the spreadsheet use proportions?
5. Adjust your spreadsheet to find the amount of ingredients needed for 128 students.

10-3 Geometry: Scale Drawings and Models

What You'll LEARN

Use scale drawings and models to find actual measurements.

NEW Vocabulary

scale drawing
scale model
scale

WHEN am I ever going to use this?

MAPS A map of a portion of Tennessee is shown. On the map, one inch equals 14 miles.

1. Explain how you would use a ruler to find the number of miles between any two cities on the map.
2. Use the method you described in Exercise 1 to find the actual distance between Haletown and Jasper.
3. What is the actual distance between Kimball and Signal Mountain?

A map is an example of a scale drawing. **Scale drawings** and **scale models** are used to represent objects that are too large or too small to be drawn or built at actual size.

The **scale** gives the ratio that compares the measurements on the drawing or model to the measurements of the real object. The measurements on a drawing or model are proportional to measurements on the actual object.

EXAMPLE 1 Find Actual Measurements

INSECTS **A scale model of a firefly has a scale of 1 inch = 0.125 inch. If the length of the firefly on the model is 3 inches, what is the actual length of the firefly?**

Let x represent the actual length.

Scale Model		Firefly	
model length →	$\frac{1}{0.125}$	$= \frac{3}{x}$	← model length
actual length →			← actual length

$1 \times x = 0.125 \times 3$ Find the cross products.

$x = 0.375$ Multiply.

The actual length of the firefly is 0.375 inch.

EXAMPLE 2 Find Actual Measurements

GEOGRAPHY **On a map of Arizona, the distance between Meadview and Willow Beach is 14 inches. If the scale on the map is 2 inches = 5 miles, what is the actual distance between Meadview and Willow Beach?**

Let d represent the actual distance.

Map Scale		Actual Distance
map distance →	$\frac{2}{5} = \frac{14}{d}$	← map distance
actual distance →		← actual distance
	$2 \times d = 5 \times 14$	Find the cross products.
	$2d = 70$	Multiply.
	$\frac{2d}{2} = \frac{70}{2}$	Divide.
	$d = 35$	

The distance between Meadview and Willow Beach is 35 miles.

Skill and Concept Check

1. Writing Math Describe the scale given in a scale drawing.

2. **OPEN ENDED** Give an example of an object that is often shown as a scale model.

3. **FIND THE ERROR** Greg and Jeff are finding the actual distance between Franklin and Ohltown on a map. The scale is 1 inch = 12 miles, and the distance between the cities on the map is 3 inches. Who is correct? Explain.

Greg: $\frac{1}{12} = \frac{3}{x}$

Jeff: $\frac{1}{12} = \frac{x}{3}$

GUIDED PRACTICE

ARCHITECTURE **For Exercises 4–7, use the following information.**
On a set of blueprints, the scale is 2 inches = 3 feet. Find the actual length of each object on the drawing.

	Object	Drawing Length
4.	porch	4 inches
5.	window	3 inches

	Object	Drawing Length
6.	garage door	15 inches
7.	chimney	0.5 inch

8. **TREES** A model of a tree has a height of 4 inches. If the scale of the tree is 1 inch = 3 feet, what is the actual height of the tree?

9. **HOUSES** A scale model of a house has a scale of 1 inch = 2.5 feet. If the width of the house on the model is 12 inches, what is the actual width of the house?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
10–14	1, 2

Extra Practice
See pages 614, 633.

BICYCLES On a scale model of a bicycle, the scale is 1 inch = 0.5 foot. Find the actual measurements.

	Object	Model Measurement
10.	diameter of the wheel	4.5 inches
11.	height of the bicycle	7 inches

INSECTS On a scale drawing of a praying mantis, the scale is 1 inch = $\frac{3}{4}$ inch. Find the actual measurements.

	Praying Mantis	Model Measurement
12.	height	$2\frac{1}{2}$ inches
13.	body length	$1\frac{3}{4}$ inches

14. **HISTORY** A model of the Titanic has a length of 2.5 feet. If the scale of the ship is 1 foot = 350 feet, what is the actual length of the Titanic?

15. **CRITICAL THINKING** Some toys that replicate actual vehicles have scales of 1:10, 1:18, or 1:64. For a model representing a motorcycle, which scale would be best to use? Explain.

Spiral Review with Standardized Test Practice

16. **MULTIPLE CHOICE** A drawing of a paperclip has a scale of 1 inch = $\frac{1}{8}$ inch. Find the actual length of the paperclip if the length on the drawing is 10 inches.

(A) 2 in. (B) $1\frac{1}{2}$ in. (C) $1\frac{1}{4}$ in. (D) $\frac{1}{2}$ in.

17. **MULTIPLE CHOICE** A drawing of a room measures 8 inches by 10 inches. If the scale is 1 inch = 5 feet, find the dimensions of the room.

(F) 40 ft by 50 ft (G) 35 ft by 45 ft
(H) 20 ft by 25 ft (I) 4 ft by 5 ft

18. Solve $\frac{7.3}{h} = \frac{14.6}{10.8}$. (Lesson 10-2)

Express each ratio as a fraction in simplest form. (Lesson 10-1)

19. 2 out of 18 games played

20. 180 out of 365 days worked

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Model each fraction.** (Lesson 5-3)

21. $\frac{1}{2}$ 22. $\frac{1}{4}$ 23. $\frac{3}{4}$ 24. $\frac{3}{5}$ 25. $\frac{2}{3}$

10-3b HANDS-ON LAB

A Follow-Up of Lesson 10-3

Construct Scale Drawings

What You'll LEARN

Construct scale drawings.

Materials

- grid paper

INVESTIGATE *Work with a partner.*

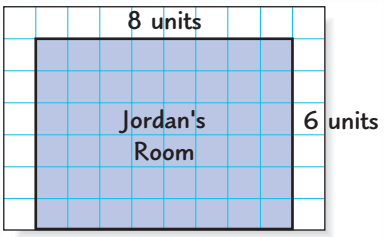
Jordan's bedroom measures 16 feet long and 12 feet wide. A scale drawing of the room can be drawn so that it is proportional to the actual room. In this lab, you will construct a scale drawing of Jordan's room.

STEP 1 Choose a scale. Since $\frac{1}{4}$-inch grid paper is being used, use a scale of $\frac{1}{4}$ inch $= 2$ feet.

STEP 2 Find the length and width of the room on the scale drawing. The scale tells us that each unit represents 2 feet. Since the room is 16 feet long, divide 16 by 2. Since the room is 12 feet wide, divide 12 by 2.

$$16 \div 2 = 8 \qquad 12 \div 2 = 6$$

STEP 3 Construct the scale drawing. On the drawing, the length of the room is 8 units and the width is 6 units.



Your Turn

a. A rectangular flower bed is 4 feet wide and 14 feet long. Make a scale drawing of the flower bed that has a scale of $\frac{1}{4}$ inch $= 2$ feet.

b. A playground has dimensions 150 feet wide and 75 feet long. Make a scale drawing of the playground that has a scale of $\frac{1}{4}$ inch $= 10$ feet.

Writing Math

1. **Explain** how the scale is used to determine the dimensions of the object on the scale drawing.
2. **Describe** $\frac{1}{2}$-inch grid paper.
3. Suppose you were making a scale drawing of a football field. What size grid paper would you use? What would be an appropriate scale?

10-4 Modeling Percents

What You'll LEARN

Use models to illustrate the meaning of percent.

NEW Vocabulary

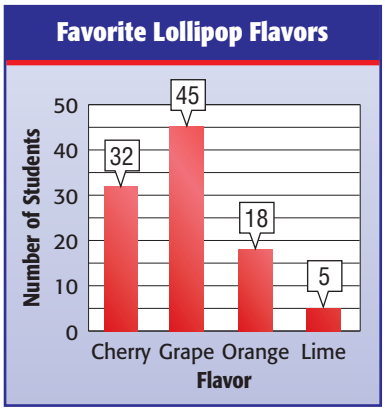
percent

MATH Symbols

% percent

WHEN am I ever going to use this?

CANDY Kimi asked 100 students in the cafeteria to tell which lollipop flavor was their favorite, cherry, grape, orange, or lime. The results are shown in the bar graph at the right.



1. What ratio compares the number of students who prefer grape flavored lollipops to the total number of students?
2. What decimal represents this ratio?
3. Draw a decimal model to represent this ratio.

Ratios like 32 out of 100, 45 out of 100, 18 out of 100, or 5 out of 100, can be written as percents. A **percent** (%) is a ratio that compares a number to 100.

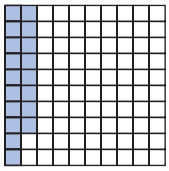
Noteables™ **Key Concept: Percent**

Words	A percent is a ratio that compares a number to 100.
Symbols	75% = 75 out of 100

In Lesson 3-1, you learned that a 10 × 10 grid can be used to represent *hundredths*. Since the word percent means *out of one hundred*, you can also use a 10 × 10 grid to model percents.

EXAMPLE 1 Model a Percent

Model 18%.



18% means 18 out of 100.

So, shade 18 of the 100 squares.

STUDY TIP

Percent To model 100%, shade all of the squares since 100% means 100 out of 100.

Your Turn **Model each percent.**

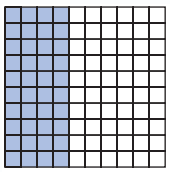
a. 75% b. 8% c. 42%

You can use what you know about decimal models and percents to identify the percent of a model that is shaded.

EXAMPLES Identify a Percent

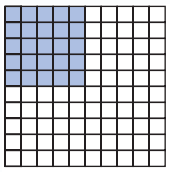
Identify each percent that is modeled.

1



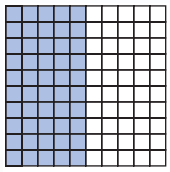
There are 40 out of 100 squares shaded.
So, the model shows 40%.

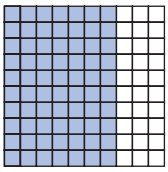
2

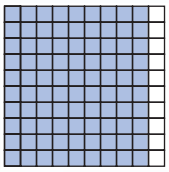


There are 25 out of 100 squares shaded.
So, the model shows 25%.

Your Turn **Identify each percent modeled.**

d. 

e. 

f. 

Skill and Concept Check

1. **Writing Math** Explain what it means if you have 50% of a pizza.

2. **OPEN ENDED** Draw a model that shows 23%.

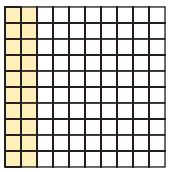
3. **NUMBER SENSE** Santino has 100 marbles, and he gives 43% of them to Michael. Would it be reasonable to say that Santino gave Michael less than 50 marbles? Explain?

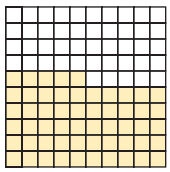
GUIDED PRACTICE

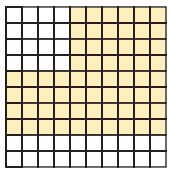
Model each percent.

4. 85%
5. 43%
6. 4%

Identify each percent that is modeled.

7. 

8. 

9. 

10. **MUSIC** Of the 100 CDs in a CD case, 67% are pop music and 33% are country. For which type of CDs are there more in the case? Use a model in your explanation.

Practice and Applications

HOMEWORK HELP

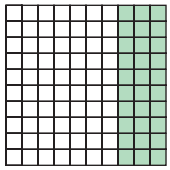
For Exercises	See Examples
11–16, 23	1
17–22	2

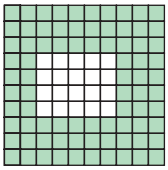
Extra Practice
See pages 614, 633.

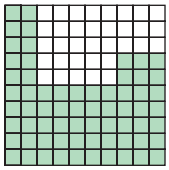
Model each percent.

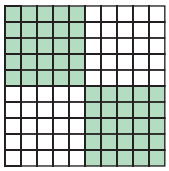
11. 15% **12.** 65% **13.** 48% **14.** 39% **15.** 9% **16.** 3%

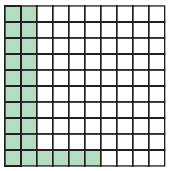
Identify each percent that is modeled.

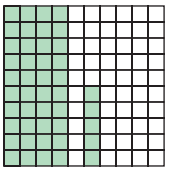
17. 

18. 

19. 

20. 

21. 

22. 

23. SNOWBOARDING At a popular ski resort, 35% of all people who buy tickets are snowboarders. Make a model to show 35%.

24. Use a model to show which percent is greater, 27% or 38%.

25. CRITICAL THINKING The size of a photograph is increased 200%. Model 200%. What does an increase of 200% mean?

Spiral Review with Standardized Test Practice

For Exercises 26 and 27, use the table at the right.

Nightly Study Time for 13-year olds

Time	Percent
Do not study	24%
Less than 1 hour	37%
1–2 hours	26%
More than 2 hours	8%

Source: National Center for Education Statistics

26. MULTIPLE CHOICE How much time do most 13-year olds spend studying?

(A) do not study at all (B) less than 1 h

(C) 1–2 h (D) more than 2 h

27. SHORT RESPONSE Which study time has the least percent of students?

28. GEOGRAPHY On a map, 1 inch = 20 miles. If the distance on the map between two cities is $2\frac{3}{4}$ inches, what is the actual distance? (Lesson 10-3)

Solve each proportion. (Lesson 10-2)

29. $\frac{2}{5} = \frac{x}{15}$ **30.** $\frac{x}{10} = \frac{18}{30}$ **31.** $\frac{2.5}{8} = \frac{10}{x}$

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Write each fraction in simplest form. (Lesson 5-2)

32. $\frac{26}{100}$ **33.** $\frac{54}{100}$ **34.** $\frac{10}{100}$ **35.** $\frac{75}{100}$

CHAPTER 10

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **Define** *ratio*. (Lesson 10-1)
2. **State** the property of proportions. (Lesson 10-2)

Skills and Applications

Write each ratio as a fraction in simplest form. (Lesson 10-1)

3. 12 boys out of 20 students
4. 15 cookies to 40 brownies

Write each ratio as a unit rate. (Lesson 10-1)

5. 171 miles in 3 hours
6. $15 for 3 pounds

Solve each proportion. (Lesson 10-2)

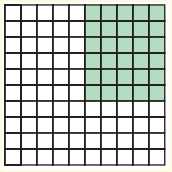
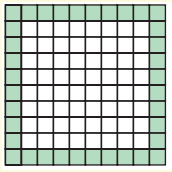
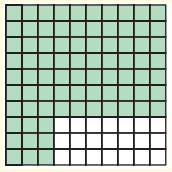
7. $\frac{x}{6} = \frac{12}{18}$
8. $\frac{8}{20} = \frac{30}{x}$
9. $\frac{3}{d} = \frac{9}{4.8}$
10. $\frac{2.4}{7.2} = \frac{x}{3.6}$

11. **HEALTH** Suppose 27 out of 50 people living in one neighborhood of a community exercise regularly. How many people in a similar community of 2,600 people can be expected to exercise regularly? (Lesson 10-2)

ANIMALS **A model of an African elephant has a scale of 1 inch = 2 feet. Find the actual dimensions of the elephant.** (Lesson 10-3)

	Feature	Model Length
12.	trunk	4 inches
13.	shoulder height	7 inches
14.	ear	2 inches
15.	tusk	5 inches

Identify each percent modeled. (Lesson 10-4)

16. 
17. 
18. 

Standardized Test Practice

19. **GRID IN** A team made four of 10 attempted goals. Which ratio compares the goals made to the goals attempted? (Lesson 10-1)

20. **SHORT RESPONSE** Use a model to explain which is less, 25% or 20%. (Lesson 10-4)

The Game Zone

A Place To Practice Your Math Skills

Math Skill: Equivalent Ratios

Fishin' for Ratios

GET READY!

Players: two or three
Materials: scissors, 18 index cards

GET SET!

- Cut all index cards in half.
- Write the ratios shown on half of the cards.
- Write a ratio equivalent to each of these ratios on the remaining cards.
- Two cards with equivalent ratios are considered matching cards.

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{3}$
$\frac{2}{5}$	$\frac{3}{7}$	$\frac{1}{5}$	$\frac{4}{5}$	$\frac{3}{5}$	$\frac{7}{8}$
$\frac{5}{7}$	$\frac{5}{9}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{2}{7}$	$\frac{2}{9}$

GO!

- Shuffle the cards. Then deal 7 cards to each player. Place the remaining cards facedown in a pile. Players set aside any pairs of matching cards that they were dealt.
- The first player asks for a matching card. If a match is made, then the player sets aside the match, and it is the next player's turn. If no match is made, then the player picks up the top card from the pile. If a match is made, then the match is set aside, and it is the next player's turn. If no match is made, then it is the next player's turn.
- **Who Wins?** After all of the cards have been drawn or when a player has no more cards, the player with the most matches wins.

10-5 Percents and Fractions

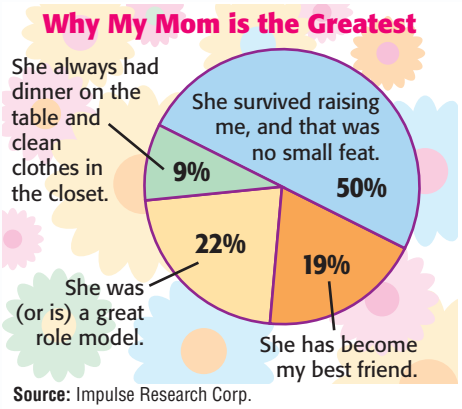
What You'll LEARN

Express percents as fractions and vice versa.

WHEN am I ever going to use this?

SURVEYS A group of adults were asked to give a reason why they honor their mom.

1. What was the second most popular reason?
2. What percent represents this section of the graph?
3. Based on the meaning of 22%, make a conjecture as to how you would write this percent as a fraction.



All percents can be written as fractions in simplest form.

Noteables™ **Key Concept: Percent as Fraction**

To write a percent as a fraction, write the percent as a fraction with a denominator of 100. Then simplify.

EXAMPLES Write a Percent as a Fraction

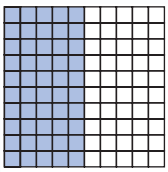
Write each percent as a fraction in simplest form.

1 **50%**

50% means *50 out of 100*.

$$50\% = \frac{50}{100}$$ Write the percent as a fraction with a denominator of 100.

$$= \frac{\overset{1}{\cancel{50}}}{\underset{2}{\cancel{100}}} \text{ or } \frac{1}{2}$$ Simplify. Divide the numerator and the denominator by the GCF, 50.

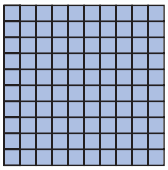


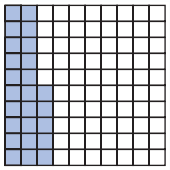
2 **125%**

125% means *125 for every 100*.

$$125\% = \frac{125}{100}$$

$$= 1\frac{\overset{1}{\cancel{25}}}{\underset{4}{\cancel{100}}} \text{ or } 1\frac{1}{4}$$





STUDY TIP

Percents A percent can be greater than 100%. Since percent means *hundredths*, or *per 100*, a percent like 150% means 150 hundredths, or 150 per 100.

Your Turn **Write each percent as a fraction in simplest form.**

a. 10% **b.** 97% **c.** 135%

EXAMPLE Write a Percent as a Fraction

1 PATRIOTISM **Use the table at the right. What fraction of those surveyed are extremely proud to be American?**

The table shows that 65% of adults are extremely proud to be an American.

$$65\% = \frac{65}{100}$$ Write the percent as a fraction with a denominator of 100.

$$= \frac{13}{20}$$ Simplify.

So, $\frac{13}{20}$ of those surveyed are extremely proud to be American.

Proud To Be An American

Answer	Percent
no opinion	1%
a little/not at all	3%
moderately	6%
very	25%
extremely	65%

Source: Gallup Poll

Fractions can be written as percents. To write a fraction as a percent, write a proportion and solve it.

EXAMPLES Write a Fraction as a Percent

4 **Write $\frac{9}{10}$ as a percent.**

$$\frac{9}{10} = \frac{n}{100}$$ Set up a proportion.

$$9 \times 100 = 10 \times n$$ Write the cross products.

$$900 = 10n$$ Multiply.

$$\frac{900}{10} = \frac{10n}{10}$$ Divide each side by 10.

$$90 = n$$ Simplify.

So, $\frac{9}{10}$ is equivalent to 90%.

5 **Write $\frac{7}{5}$ as a percent.**

$$\frac{7}{5} = \frac{c}{100}$$ Set up a proportion.

$$5 \times c = 7 \times 100$$ Write the cross products.

$$5c = 700$$ Multiply.

$$\frac{5c}{5} = \frac{700}{5}$$ Divide each side by 5.

$$c = 140$$ Simplify.

So, $\frac{7}{5}$ is equivalent to 140%.

Your Turn **Write each fraction as a percent.**

d. $\frac{3}{5}$ **e.** $\frac{1}{4}$ **f.** $\frac{1}{5}$

STUDY TIP

Percents Remember that a percent is a number compared to 100. So, one ratio in the proportion is the fraction. The other ratio is an unknown number compared to 100.

Skill and Concept Check

1. Writing Math Explain how to write any percent as a fraction.

2. **Which One Doesn't Belong?** Identify the number that does not have the same value as the other three. Explain your reasoning.

25%	$\frac{2}{8}$	$\frac{7}{25}$	$\frac{25}{100}$

3. **NUMBER SENSE** List three fractions that are less than 75%.

GUIDED PRACTICE

Write each percent as a fraction in simplest form.

4. 15%
5. 80%
6. 180%

Write each fraction as a percent.

7. $\frac{1}{4}$
8. $\frac{2}{5}$
9. $\frac{9}{4}$

10. **SOCCER** During the 2002 regular season, the Atlanta Beat women's soccer team won about 52% of their games. What fraction of their games did they win?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
11–16, 27	1, 2
30–32	3
17–26, 28–29	4, 5

Extra Practice See pages 615, 633.

Write each percent as a fraction in simplest form.

11. 14%
12. 47%
13. 2%
14. 20%
15. 185%
16. 280%

Write each fraction as a percent.

17. $\frac{7}{10}$
18. $\frac{7}{20}$
19. $\frac{5}{4}$
20. $\frac{7}{4}$
21. $\frac{1}{100}$
22. $\frac{5}{100}$
23. $\frac{3}{8}$
24. $\frac{5}{6}$

25. **MONEY** What percent of a dollar is a nickel?

26. **MONEY** What percent of a dollar is a penny?

27. Write *ninety-eight percent* as a fraction in simplest form.

28. How is *sixty-four hundredths* written as a percent?

BASKETBALL **For Exercises 29 and 30, use the table at the right.**

29. What percent of the baskets did Kendra make?
30. What fraction of the baskets did Kendra miss?

Kendra's Basketball Chart

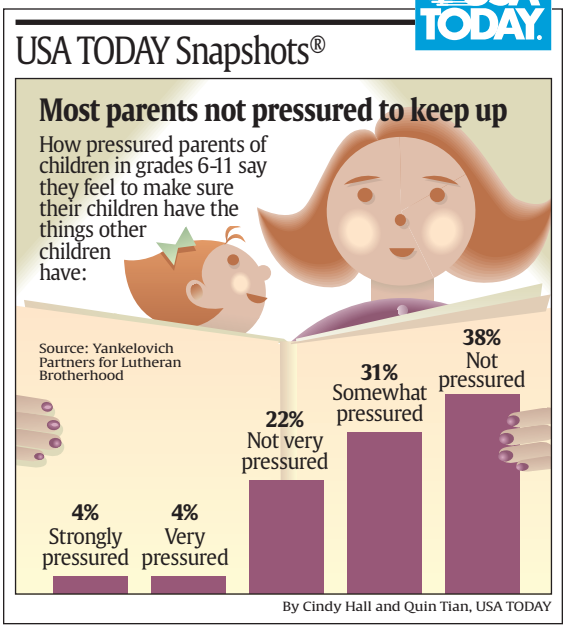
Baskets Made	Baskets Missed
𝍸 𝍸 𝍸 III	𝍸 II

SURVEY **For Exercises 31–33, use the graph that shows how pressured parents feel about making sure their children have the things that other children have.**

31. What fraction of the parents do not feel pressured? Write the fraction in simplest form.

32. What fraction of the parents feel not very pressured? Write the fraction in simplest form.

33. Write a sentence describing what fraction of the parents surveyed feel very pressured.



34. **CRITICAL THINKING** The table shows what fraction of the daily chores a father assigned to his son and daughters. If the remaining chores are for the father to complete, what percent of chores was left for him? Round to the nearest whole percent.

Person	son	daughter	daughter
Fraction	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{7}$

Spiral Review with Standardized Test Practice

35. **MULTIPLE CHOICE** Four-fifths of the sixth-grade students have siblings. What percent of these students do *not* have siblings?

(A) 15% (B) 20% (C) 25% (D) 80%

36. **MULTIPLE CHOICE** Suppose 75% of teenagers use their home computers for homework. What fraction of teenagers is this?

(F) $\frac{3}{4}$ (G) $\frac{7}{10}$ (H) $\frac{3}{5}$ (I) $\frac{1}{4}$

Model each percent. (Lesson 10-4)

37. 32% 38. 65% 39. 135%

40. **ROLLER COASTERS** On a model of a roller coaster, the scale is 1 inch = 2 feet. If the width of the track on the model is 2.5 inches, what is the actual width? (Lesson 10-3)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Write each fraction as a decimal.** (Lesson 5-7)

41. $\frac{65}{100}$ 42. $\frac{1}{8}$ 43. $\frac{0.5}{100}$ 44. $\frac{1}{5}$

10-6 Percents and Decimals

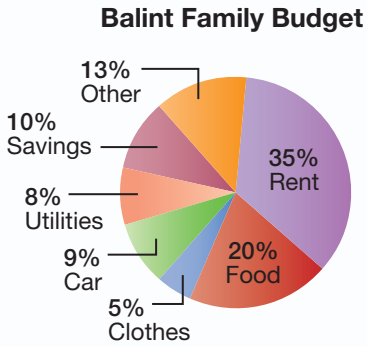
What You'll LEARN

Express percents as decimals and vice versa.

WHEN **am I ever going to use this?**

BUDGETS The graph shows the Balint's monthly budget.

1. What percent does the circle graph represent?
2. What fraction represents the section of the graph labeled rent?
3. Write the fraction from Exercise 2 as a decimal.



Percents can be written as decimals.

Noteables™ **Key Concept: Percent as Decimal**

To write a percent as a decimal, rewrite the percent as a fraction with a denominator of 100. Then write the fraction as a decimal.

EXAMPLES Write a Percent as a Decimal

Write each percent as a decimal.

1 **56%**

$56\% = \frac{56}{100}$ Rewrite the percent as a fraction with a denominator of 100.

$= 0.56$ Write the fraction as a decimal.

2 **120%**

$120\% = \frac{120}{100}$ Rewrite the percent as a fraction with a denominator of 100.

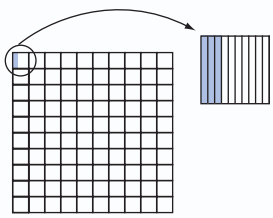
$= 1.2$ Write the fraction as a decimal.

STUDY TIP

Mental Math To write a percent as a decimal, you can use a shortcut. Move the decimal point two places to the left, which is the same as dividing by 100.

3 **0.3%**

0.3% means three-tenths of one percent.



$0.3\% = \frac{0.3}{100}$ Rewrite the percent as a fraction with a denominator of 100.

$= \frac{0.3}{100} \times \frac{10}{10}$ Multiply by $\frac{10}{10}$ to eliminate the decimal in the numerator.

$= \frac{3}{1{,}000}$ or 0.003 Write the fraction as a decimal.

Your Turn **Write each percent as a decimal.**

a. 32% **b.** 190% **c.** 0.6%

You can also write a decimal as a percent.

Noteables™ **Key Concept: Decimal as Percent**

To write a decimal as a percent, write the decimal as a fraction whose denominator is 100. Then write the fraction as a percent.

EXAMPLES Write a Decimal as a Percent

Write each decimal as a percent.

4 **0.38**

$0.38 = \frac{38}{100}$ Write the decimal as a fraction.

$= 38\%$ Write the fraction as a percent.

5 **0.189**

$0.189 = \frac{189}{1{,}000}$ Write the decimal as a fraction.

$= \frac{189 \div 10}{1{,}000 \div 10}$ Divide the numerator and the denominator by 10 to get a denominator of 100.

$= \frac{18.9}{100}$ or 18.9% Write the fraction as a percent.

STUDY TIP

Mental Math To write a decimal as a percent, you can use this shortcut. Move the decimal point two places to the right, which is the same as multiplying by 100.

Your Turn **Write each decimal as a percent.**

d. 0.47 **e.** 0.235 **f.** 1.75

Skill and Concept Check

1. **Writing Math** Explain how to write 0.34 as a percent.

2. **Which One Doesn't Belong?** Identify the decimal that cannot be written as a percent greater than 1. Explain your reasoning.

0.4	0.048	0.0048	0.484

GUIDED PRACTICE

Write each percent as a decimal.

3. 27% **4.** 15% **5.** 0.9% **6.** 115%

Write each decimal as a percent.

7. 0.32 **8.** 0.15 **9.** 0.125 **10.** 0.291

11. **PASTA** According to the *American Pasta Report*, 12% of Americans say that lasagna is their favorite pasta. What decimal is equivalent to 12%?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
12–19, 29, 30, 31	1, 2, 3
20–27, 28	4, 5

Extra Practice
See pages 615, 633.

Express each percent as a decimal.

12. 2% **13.** 6% **14.** 17% **15.** 35%

16. 0.7% **17.** 0.3% **18.** 125% **19.** 104%

Express each decimal as a percent.

20. 0.5 **21.** 0.4 **22.** 0.22 **23.** 0.99

24. 0.175 **25.** 0.355 **26.** 0.106 **27.** 0.287

28. How is seventy-two thousandths written as a percent?

29. Write four and two tenths percent as a decimal.

30. LIFE SCIENCE About 95% of all species of fish have skeletons made of bone. Write 95% as a decimal.

31. TAXES The sales tax in Allen County is 5%. Write 5% as a decimal.

Data Update Use the Internet or another source to find the sales tax for your state. Visit: msmath1.net/data_update to learn more.

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

32. 25% ● 0.20 **33.** 0.46 ● 46% **34.** 2.3 ● 23%

CRITICAL THINKING

35. Order 23.4%, 2.34, 0.0234, and 20.34% from least to greatest.

36. Order $2\frac{1}{4}$, 0.6, 2.75, 40%, and $\frac{7}{5}$ from greatest to least.

37. Graph $\frac{2}{5}$, 1, 0.5, 30%, −1, 2.0%, on a number line.

Spiral Review with Standardized Test Practice

38. MULTIPLE CHOICE Which percent is greater than 0.5?

(A) 56% (B) 49% (C) 45% (D) 44%

39. SHORT RESPONSE The sales tax on the baseball cap Tionna is buying is 8.75%. Write the percent as a decimal.

Write each percent as a fraction in simplest form. (Lesson 10-5)

40. 24% **41.** 38% **42.** 125% **43.** 35%

44. 36 out of 100 is what percent? (Lesson 10-4)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Multiply.** (Lesson 7-2)

45. $\frac{1}{5} \times 200$ **46.** $\frac{1}{2} \times 1{,}500$ **47.** $\frac{3}{5} \times 35$ **48.** $\frac{3}{4} \times 32$

Enzo & Paolo Ragazzini/CORBIS

msmath1.net/self_check_quiz

CONTENTS

10-7a HANDS-ON LAB

A Preview of Lesson 10-7

Percent of a Number

What You'll LEARN

Use a model to find the percent of a number.

Materials

- grid paper

At a department store, a backpack is on sale for 30% off the original price. If the original price of the backpack is $50, how much will you save?

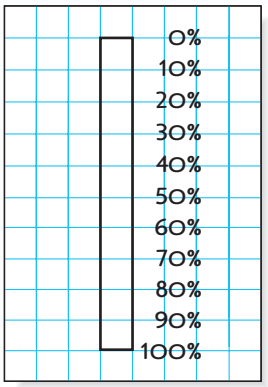
In this situation, you know the percent. You need to find what part of the original price you will save. To find the percent of a number by using a model, follow these steps:

- Draw a percent model that represents the situation.
- Use the percent model to find the percent of the number.

ACTIVITY *Work with a partner.*

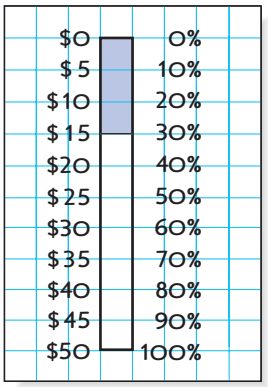
1 **Use a model to find 30% of $50.**

STEP 1 Draw a rectangle as shown on grid paper. Since percent is a ratio that compares a number to 100, label the units on the right from 0% to 100% as shown.



STEP 2 Since $50 represents the original price, mark equal units from $0 to $50 on the left side of the model as shown.

STEP 3 Draw a line from 30% on the right side to the left side of the model as shown.



The model shows that 30% of $50 is $15. So, you will save $15.

Your Turn

Draw a model to find the percent of each number.

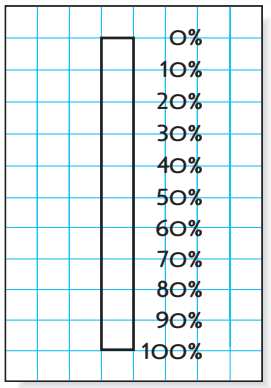
a. 20% of 120 **b.** 60% of 70 **c.** 90% of 400

Suppose a bicycle is on sale for 35% off the original price. How much will you save if the original price of the bicycle is $180?

ACTIVITY *Work with a partner.*

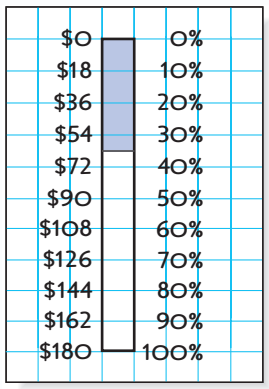
2 **Use a model to find 35% of $180.**

STEP 1 Draw a rectangle as shown on grid paper. Label the units on the right from 0% to 100% to represent the percents as shown.



STEP 2 The original price is $180. So, mark equal units from $0 to $180 on the left side of the model as shown.

STEP 3 Draw a line from 35% on the right side to the left side of the model.



The model shows that 35% of $180 is halfway between $54 and $72, or $63. So, you will save $63.

Your Turn **Draw a model to find the percent of each number. If it is not possible to find an exact answer from the model, estimate.**

d. 25% of 140 **e.** 7% of 50 **f.** 0.5% of 20

Writing Math

1. **Explain** how to determine the units that get labeled on the left side of the percent model.
2. **Write** a sentence explaining how you can find 7% of 50.
3. **Explain** how knowing 10% of a number will help you find the percent of a number when the percent is a multiple of 10%.
4. **Explain** how knowing 10% of a number can help you determine whether a percent of a number is a reasonable amount.

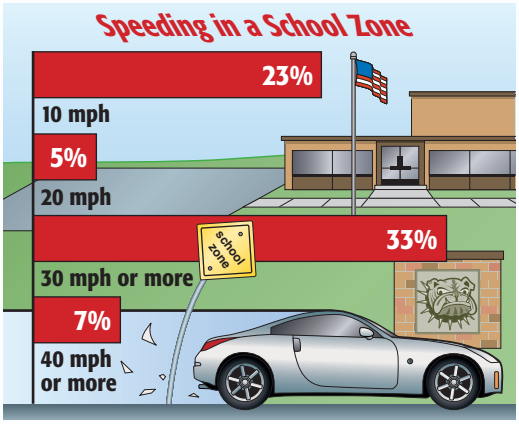
10-7 Percent of a Number

What You'll LEARN

Find the percent of a number.

WHEN am I ever going to use this?

SAFETY A local police department wrote a report on how fast over the speed limit cars were traveling in a school zone. The results are shown in the graph.



1. What percent of the cars were traveling 20 miles per hour over the speed limit?
2. Write a multiplication sentence that involves a percent that could be used to find the number of cars out of 300 that were traveling 20 miles an hour over the speed limit.

To find the percent of a number such as 23% of 300, 33% of 300, or 7% of 300, you can use one of the following methods.

- Write the percent as a fraction and then multiply, or
- Write the percent as a decimal and then multiply.

EXAMPLE 1 Find the Percent of a Number

Find 5% of 300.

To find 5% of 300, you can use either method.

Method 1 Write the percent as a fraction.

$5\% = \frac{5}{100}$ or $\frac{1}{20}$

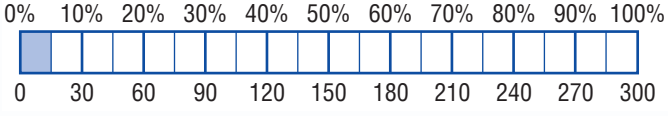
$\frac{1}{20}$ of $300 = \frac{1}{20} \times 300$ or 15

Method 2 Write the percent as a decimal.

$5\% = \frac{5}{100}$ or 0.05

0.05 of $300 = 0.05 \times 300$ or 15

So, 5% of 300 is 15. Use a model to check the answer.



The model confirms that 5% of 300 is 15.

STUDY TIP

Percent of a Number A calculator can also be used to find the percent of a number. For example, to find 5% of 300, push 5 [2nd] [%] [×] 300 [ENTER]. The result is 15.

EXAMPLES Find the Percent of a Number

1 **Find 120% of 75.**

Method 1 Write the percent as a fraction.

$$120\% = \frac{120}{100} \text{ or } 1\frac{1}{5}$$

$$1\frac{1}{5} \text{ of } 75 = 1\frac{1}{5} \times 75$$

$$= \frac{6}{5} \times 75$$

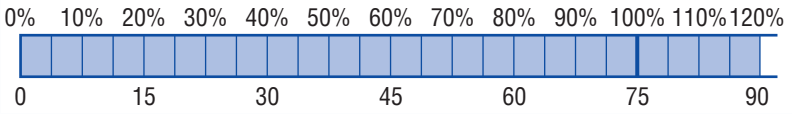
$$= \frac{6}{5} \times \frac{75}{1} \text{ or } 90$$

Method 2 Write the percent as a decimal.

$$120\% = \frac{120}{100} \text{ or } 1.2$$

$$1.2 \text{ of } 75 = 1.2 \times 75 \text{ or } 90$$

So, 120% of 75 is 90. Use a model to check the answer.

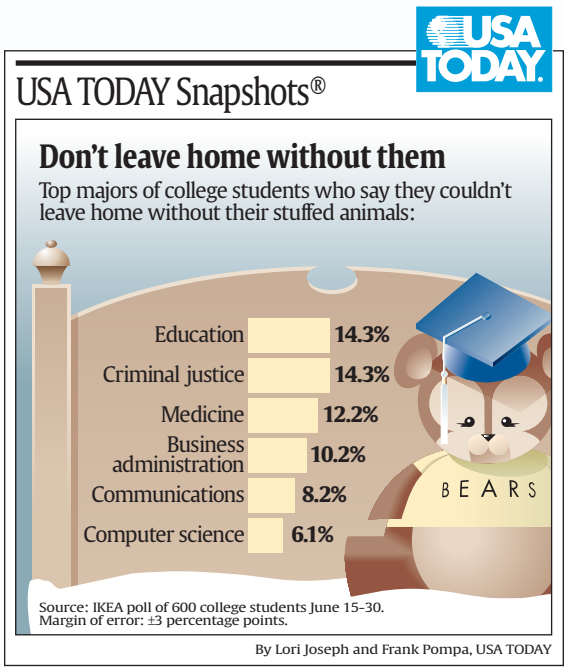


The model confirms that 120% of 75 is 90.

STUDY TIP

Mental Math 120% is a little more than 100%. So, the answer should be a little more than 100% of 75 or a little more than 75.

2 **STATISTICS** **The graphic shows that 12.2% of college students majoring in medicine say they couldn't leave home for college without their stuffed animals. If a college has 350 students majoring in medicine, how many can be expected to have stuffed animals in their dorm room?**



To find 12.2% of 350, write the percent as a decimal. Then use a calculator to multiply.

$$12.2\% = \frac{12.2}{100} \text{ or } 0.122$$ Divide 12.2 by 100 to get 0.122.

$$0.122 \text{ of } 350 = 0.122 \times 350 = 42.7$$ Use a calculator.

So, about 43 students can be expected to have stuffed animals in their dorm room.

Your Turn **Find the percent of each number.**

a. 55% of 160 **b.** 140% of 125 **c.** 0.3% of 500

Skill and Concept Check

1. **Writing Math** Explain how to find 40% of 65 by changing the percent to a decimal.

2. **OPEN ENDED** Write a problem in which the percent of the number results in a number greater than the number itself.

3. **FIND THE ERROR** Gary and Belinda are finding 120% of 60. Who is correct? Explain your reasoning.

Gary	Belinda
120% of 60 = $1\frac{1}{5} \times 60$	120% of 60 = 12.0 x 60
= 72	= 720

GUIDED PRACTICE

Find the percent of each number.

4. 30% of 90
5. 50% of 78
6. 4% of 65
7. 7% of 7
8. 150% of 38
9. 0.4% of 20

10. **MONEY** A skateboard is on sale for 85% of the regular price. If it is regularly priced at $40, how much is the sale price?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
11–24	1, 2, 3
25–32	3

Extra Practice
See pages 615, 633.

Find the percent of each number.

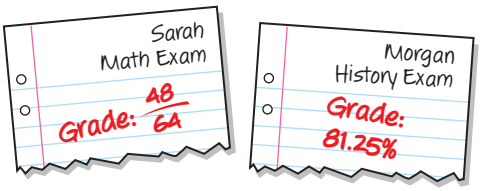
11. 15% of 60
12. 12% of 800
13. 75% of 120
14. 25% of 80
15. 2% of 25
16. 4% of 9
17. 7% of 85
18. 3% of 156
19. 150% of 90
20. 125% of 60
21. 0.5% of 85
22. 0.3% of 95

23. What is 78% of 265?
24. Find 24% of 549.

25. **BOOKS** Chad and Alisa donated 30% of their book collection to a local children's hospital. If they had 180 books, how many did they donate to the hospital?

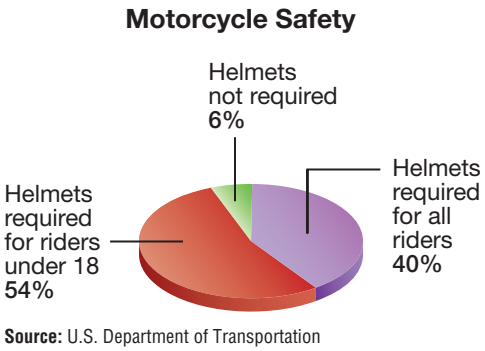
26. **FOOTBALL** The Mooney High School football team won 75% of their football games. If they played 12 games, how many did they win?

SCHOOL For Exercises 27–29, use the diagram at the right that shows Sarah's and Morgan's test scores.



27. What percent of the questions did Sarah score correctly?
28. What percent did Sarah score incorrectly?
29. If there were 64 questions on the test, how many did Morgan answer correctly?

SAFETY **For Exercises 30–32, use the graph that shows what percent of the 50 states require motorcycle riders to wear a helmet.**



30. How many states require helmets for all riders?

31. How many states require helmets for riders under 18?

32. How many states do not require a helmet?

33. **MULTI STEP** Suppose you buy a sweater and a pair of jeans. The total of the two items before tax is $65.82. If sales tax is 6%, how much money will you need for the total cost of the items, including tax?

CRITICAL THINKING **Solve each problem.**

34. What percent of 70 is 14?

35. What percent of 240 is 84?

36. 45 is 15% of what number?

37. 21 is 30% of what number?

EXTENDING THE LESSON Simple interest is the amount of money paid or earned for the use of money. $I = prt$ is a formula that can be used to find the simple interest. I is the interest, p is the principal, r is the rate, and t is the time. Suppose you place $750 in a savings account that pays 2.9% interest for one year.

$I = 750 \times 0.029 \times 1$ You will earn $21.75 in one year.

Find the interest earned on $550 for each rate for one year.

38. 0.3%

39. 12%

40. 19.5%

Spiral Review with Standardized Test Practice

41. **MULTIPLE CHOICE** At Langley High School, 19% of the 2,200 students walk to school. How many students walk to school?

(A) 400 (B) 418 (C) 428 (D) 476

42. **MULTIPLE CHOICE** Which number is 124% of 260?

(F) 3.224 (G) 32.24 (H) 322.4 (I) 3,224

43. Write 1.35 as a percent. (Lesson 10-6)

Write each percent as a fraction in simplest form. (Lesson 10-5)

44. 30%

45. 28%

46. 145%

47. 85%

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Multiply.** (Lesson 7-2)

48. $\frac{1}{2} \times 150$

49. $\frac{2}{5} \times 25$

50. $\frac{3}{4} \times 48$

51. $\frac{2}{3} \times 21$

10-8a Problem-Solving Strategy

A Preview of Lesson 10-8

Solve a Simpler Problem

What You'll LEARN

Solve problems by solving a simpler problem.

Hey Yutaka, a total of 350 students voted on whether a tiger or a dolphin should be the new school's mascot. I heard that 70% of the students voted for the tiger.

Well Justin, I'm glad the tiger won! I wonder how many students voted for the tiger. We could find 70% of 350. But, I know a way to **solve a simpler problem** using mental math.

Explore	We know the number of students who voted and that 70% of the students voted for the tiger. We need to find the number of students who voted for the tiger.
Plan	Solve a simpler problem by finding 10% of 350 and then use the result to find 70% of 350.
Solve	10% of 350 = 35 Since there are seven 10%s in 70%, multiply 35 by 7. $35 \times 7 = 245$ So, 245 students voted for the tiger.
Examine	Since 70% of 350 is 245, the answer is correct.

Analyze the Strategy

1. **Explain** when you would use the solve a simpler problem strategy.
2. **Explain** why the students found it simpler to work with 10%.
3. **Think** of another way the students could have solved the problem.
4. **Write** a problem than can be solved by working a simpler problem. Then write the steps you would take to find the solution.

Apply the Strategy

Solve. Use the solve a simpler problem strategy.

5. **SCHOOL** Refer to the example on page 413. If 30% of the students voted for the dolphin as a school mascot, how many of the 350 students voted for the dolphin?

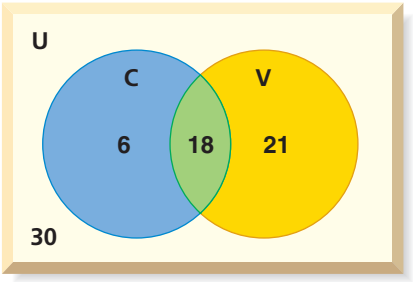
6. **GEOGRAPHY** The total area of Minnesota is 86,939 square miles. Of that, about 90% is land area. About how much of Minnesota is not land area?

Mixed Problem Solving

Solve. Use any strategy.

7. **MONEY** A total of 32 students are going on a field trip. Each student must pay $4.75 for travel and $5.50 for dining. About how much money should the teacher collect in all from the students?

8. **VENN DIAGRAMS** The Venn diagram shows information about the members in Jacob's scout troop.



U = all members in the troop
C = members with a camping badge
V = members with a volunteer badge

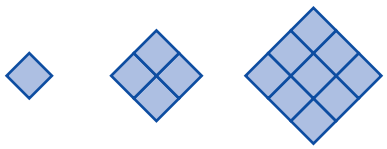
How many more members have a badge than do not have a badge?

9. **MONEY** Kip wants to leave a 15% tip on a $38.79 restaurant bill. About how much money should he leave for the tip?

10. **SCIENCE** Sound travels through air at a speed of 1,129 feet per second. At this rate, how far will sound travel in 1 minute?

11. **TRAVEL** Mr. Ishikawa left Houston at 3:00 P.M. and arrived in Dallas at 8:00 P.M., driving a distance of approximately 240 miles. During his trip, he took a one-hour dinner break. What was Mr. Ishikawa's average speed?

12. **PATTERNS** Find the area of the sixth figure in the pattern shown.



13. **SALES** A sales manager reported to his sales team that sales increased 34.7% over last month's sales total of $98,700. About how much did the team sell this month?

14. **SCHOOL** Jewel's math scores for her last four tests were 94, 87, 90, and 89. What score does she need on the next test to average a score of 91?

15. **STANDARDIZED TEST PRACTICE**
The circle graph shows the results of a favorite juice survey. Which percents best describe the data?

	Apple	Grape	Orange	Mixed Fruit
A	25%	30%	15%	60%
B	32%	18%	21%	29%
C	10%	35%	10%	45%
D	45%	15%	35%	5%

CONTENTS

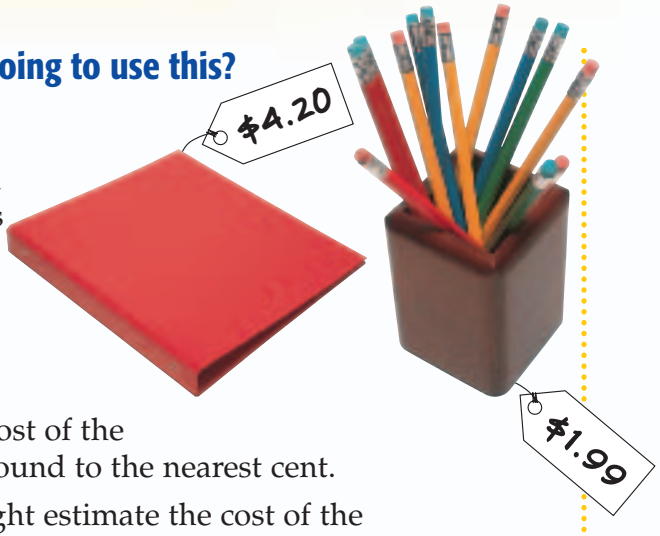
10-8 Estimating with Percents

What You'll LEARN

Estimate the percent of a number.

WHEN am I ever going to use this?

SHOPPING A store is having a back-to-school sale. All school supplies are on sale.



1. What would be the cost of the notebook at 10% off?
2. What would be the cost of the pencils at 25% off? Round to the nearest cent.
3. Explain how you might estimate the cost of the notebook at 10% off and the cost of the pencils at 25% off.

Sometimes when finding the percent of a number, an exact answer is not needed. So, you can estimate. The table below shows some commonly used percents and their fraction equivalents.

Noteables™ **Key Concept: Percent-Fraction Equivalents**

$20\% = \frac{1}{5}$	$50\% = \frac{1}{2}$	$80\% = \frac{4}{5}$	$25\% = \frac{1}{4}$	$33\frac{1}{3}\% = \frac{1}{3}$
$30\% = \frac{3}{10}$	$60\% = \frac{3}{5}$	$90\% = \frac{9}{10}$	$75\% = \frac{3}{4}$	$66\frac{2}{3}\% = \frac{2}{3}$
$40\% = \frac{2}{5}$	$70\% = \frac{7}{10}$	$100\% = 1$		

EXAMPLES Estimate the Percent of a Number

Estimate each percent.

1 **52% of 298**

52% is close to 50% or $\frac{1}{2}$.

Round 298 to 300.

$\frac{1}{2}$ of 300 is 150.

So, 52% of 298 is about 150.

2 **60% of 27**

60% is $\frac{3}{5}$.

Round 27 to 25 since it is divisible by 5.

$$\frac{3}{5} \times 25 = \frac{3}{\cancel{5}_{1}} \times \frac{\cancel{25}^{5}}{1}$$

$$= 15$$

So, 60% of 27 is about 15.

Your Turn **Estimate each percent.**

a. 48% of \$76 b. 18% of 42 c. 25% of 41

EXAMPLE 3 Use Estimation to Solve a Problem

MONEY **A DVD that originally costs $15.99 is on sale for 50% off. If you have $9, would you have enough money to buy the DVD?**

To determine whether you have enough money to buy the DVD, you need to estimate 50% of $15.99.

$50\% \times \$15.99 \rightarrow \frac{1}{2} \times \$16$ or $8

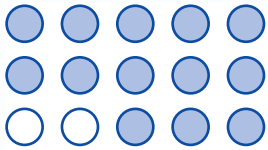
Since $8 is less than $9, you should have enough money.

Estimation can be used to find what percent of a figure is shaded.

Standardized Test Practice

EXAMPLE 4 Estimate the Percent of a Figure

MULTIPLE-CHOICE TEST ITEM Which of the following is a reasonable percent for the percent of the figure that is shaded?



(A) 25% (B) 40%

(C) 60% (D) 80%

Test-Taking Tip

When taking a multiple-choice test, eliminate the choices you know to be incorrect. The percent of the model shaded is clearly greater than 50%. So, eliminate choices A and B.

Read the Test Item

You need to find what percent of the circles are shaded.

Solve the Test Item

13 out of 15 circles are shaded.

$\frac{13}{15}$ is about $\frac{12}{15}$ or $\frac{4}{5}$.

$\frac{4}{5} = 80\%$

So, about 80% of the figure is shaded. The answer is D.

Skill and Concept Check

1. **List** three commonly used percent-fraction equivalents.

2. **OPEN ENDED** Write about a real-life situation when you would need to estimate the percent of a number.

GUIDED PRACTICE

Estimate each percent.

3. 38% of $50
4. 59% of 16
5. 75% of 33

6. **TIPS** Abigail wants to give a 20% tip to a taxi driver. If the fare is $23.78, what would be a reasonable amount to tip the driver?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
7–18	1, 2
19–20, 24	3
21–23	4

Extra Practice
See pages 616, 633.

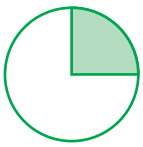
Estimate each percent.

7. 21% of 96
8. 42% of 16
9. 79% of 82
10. 74% of 45
11. 26% of 125
12. 89% of 195
13. 31% of 157
14. 77% of 238
15. 69% of 203
16. 33% of 92
17. 67% of 296
18. 99% of 350

19. **TIPS** Dakota and Emma want to give a 20% tip for a food bill of $64.58. About how much should they leave for the tip?

20. **BANKING** Louisa deposited 25% of the money she earned baby-sitting into her savings account. If she earned $237.50, about how much did she deposit into her savings account?

Estimate the percent that is shaded in each figure.

21. 

22. 

23. 

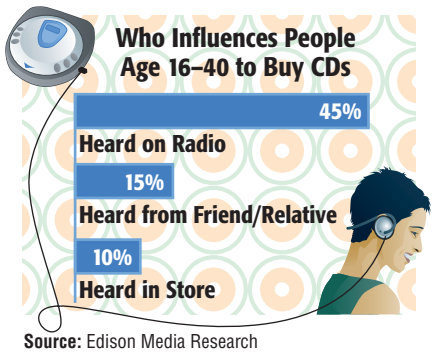
24. **GEOGRAPHY** The Atlantic coast has 2,069 miles of coastline. Of that, about 28% is located in Florida. About how many miles of coastline does Florida have?

25. **MULTI STEP** If you answered 9 out of 25 problems incorrectly on a test, about what percent of answers were correct? Explain.

26. **CRITICAL THINKING** Order the percents 40% of 50, 50% of 50, and $\frac{1}{2}$% of 50 from least to greatest.

Spiral Review with Standardized Test Practice

27. **MULTIPLE CHOICE** Refer to the graph at the right. If 3,608 people were surveyed, which expression could be used to estimate the number of people that are influenced by a friend or relative when buying a CD?



Source: Edison Media Research

(A) $\frac{1}{8} \times 3{,}600$
(B) $\frac{1}{5} \times 3{,}600$
(C) $\frac{1}{4} \times 3{,}600$
(D) $\frac{1}{6} \times 3{,}600$

28. **SHORT RESPONSE** Estimate 35% of 95.

29. Find 20% of 129. (Lesson 10-7)

Express each decimal as a percent. (Lesson 10-6)

30. 0.31
31. 0.05
32. 0.113
33. 0.861

CHAPTER 10

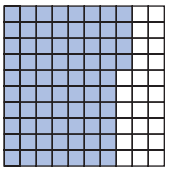
Study Guide and Review

Vocabulary and Concept Check

cross products (p. 386)
equivalent ratios (p. 381)
percent (%) (p. 395)
proportion (p. 386)
rate (p. 381)
ratio (p. 380)
scale (p. 391)
scale drawing (p. 391)
scale model (p. 391)
unit rate (p. 381)

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

1. A ratio is a comparison of two numbers by multiplication.
2. A rate is a ratio of two measurements that have different units.
3. Three tickets for $7.50 expressed as a rate is $1.50 per ticket.
4. A percent is an equation that shows that two ratios are equivalent.
5. The model shown at the right represents 85%.
6. The cross products of a proportion are equal.
7. A scale drawing shows an object exactly as it looks, but it is generally larger or smaller.
8. A percent is a ratio that compares a number to 10.
9. The decimal 0.346 can be expressed as 3.46%.



Lesson-by-Lesson Exercises and Examples

10-1 Ratios (pp. 380–383)

Write each ratio as a fraction in simplest form.

10. 12 blue marbles out of 20 marbles
11. 9 goldfish out of 36 fish
12. 15 carnations out of 40 flowers
13. 18 boys out of 21 students

Write each ratio as a unit rate.

14. 3 inches of rain in 6 hours
15. 189 pounds of garbage in 12 weeks
16. $24 for 4 tickets
17. 78 candy bars in 3 packages

Example 1 **Write the ratio 30 sixth graders out of 45 students as a fraction in simplest form.**

$$\frac{30}{45} = \frac{2}{3}$$ (÷ 15 on both)

The GCF of 30 and 45 is 15.

Example 2 **Write the ratio 150 miles in 4 hours as a unit rate.**

$$\frac{150 \text{ miles}}{4 \text{ hours}} = \frac{37.5 \text{ miles}}{1 \text{ hour}}$$ (÷ 4 on both)

Divide the numerator and the denominator by 4 to get the denominator of 1.

10-2 Algebra: Solving Proportions (pp. 386–389)

Solve each proportion.

18. $\frac{7}{11} = \frac{m}{33}$

19. $\frac{12}{20} = \frac{15}{k}$

20. $\frac{g}{20} = \frac{9}{12}$

21. $\frac{25}{h} = \frac{10}{12}$

22. **SCHOOL** At Rio Middle School, the teacher to student ratio is 3 to 42. If there are 504 students enrolled at the school, how many teachers are there at the school?

Example 3 **Solve the proportion $\frac{9}{12} = \frac{g}{8}$.**

$9(8) = 12g$ Cross products

$72 = 12g$ Multiply.

$\frac{72}{12} = \frac{12g}{12}$ Divide each side by 12.

$6 = g$ The solution is 6.

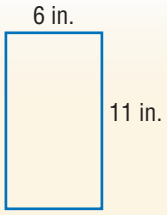
10-3 Geometry: Scale Drawings and Models (pp. 391–393)

On a scale model of a fire truck, the scale is 2 inches = 5 feet. Find the actual measurements.

	Truck	Model
23.	length	12 inches
24.	width	4 inches
25.	height	7.2 inches

26. **BUILDINGS** On an architectural drawing, the height of a building is $15\frac{3}{4}$ inches. If the scale on the drawing is $\frac{1}{2}$ inch = 1 foot, find the height of the actual building.

Example 4 **On a scale drawing of a room, the scale is 1 inch = 2 feet. What is the actual length of the room?**



Write a proportion.

drawing width → $\frac{1 \text{ in.}}{2 \text{ ft}} = \frac{11 \text{ in.}}{x \text{ ft}}$ ← drawing width
actual width → ← actual width

$1 \cdot x = 2 \cdot 11$ Find cross products.

$1x = 22$ Simplify.

$x = 22$ Multiply.

The actual length of the room is 22 feet.

10-4 Modeling Percents (pp. 395–397)

Model each percent.

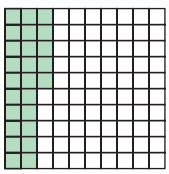
27. 20%

28. 75%

29. 5%

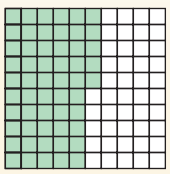
30. 50%

31. Tell what percent is modeled in the figure shown.



Example 5 **Model 55%.**

55% means 55 out of 100. So, shade 55 of the 100 squares.



Mixed Problem Solving
For mixed problem-solving practice, see page 633.

10-5 Percents and Fractions (pp. 400–403)

Write each percent as a fraction in simplest form.

32. 3%
33. 18%
34. 48%
35. 120%

Write each fraction as a percent.

36. $\frac{3}{5}$
37. $\frac{7}{8}$
38. $\frac{8}{5}$
39. $\frac{3}{100}$

Example 6 Write 24% as a fraction in simplest form.

$24\% = \frac{24}{100}$ Express the percent as a fraction with a denominator of 100.

$= \frac{\overset{6}{\cancel{24}}}{\underset{25}{\cancel{100}}}$ Simplify. Divide numerator and denominator by the GCF, 4.

$= \frac{6}{25}$

10-6 Percents and Decimals (pp. 404–406)

Write each percent as a decimal.

40. 2.2%
41. 38%
42. 140%
43. 66%
44. 90%
45. 55%

Write each decimal as a percent.

46. 0.003
47. 1.3
48. 0.65
49. 0.591
50. 1.75
51. 0.73

Example 7 Write 46% as a decimal.

$46\% = \frac{46}{100}$ Rewrite the percent as a fraction with a denominator of 100.

$= 0.46$ Write the fraction as a decimal.

Example 8 Write 0.85 as a percent.

$0.85 = \frac{85}{100}$ Write the decimal as a fraction.

$= 85\%$ Write the fraction as a percent.

10-7 Percent of a Number (pp. 409–412)

Find the percent of each number.

52. 40% of 150
53. 5% of 340
54. 18% of 90
55. 8% of 130
56. 170% of 30
57. 125% of 120

Example 9 Find 42% of 90.

42% of $90 = 0.42 \times 90$ Change the percent to a decimal.

$= 37.8$ Multiply.

10-8 Estimating with Percents (pp. 415–417)

Estimate each percent.

58. 40% of 78
59. 73% of 20
60. 25% of 122
61. 19% of 99
62. 48% of 48
63. 41% of 243

64. **SCHOOL** Jenna answered 8 out of 35 questions incorrectly on a test. About what percent of the answers did she answer correctly?

Example 10 Estimate 33% of 60.

33% is close to $33\frac{1}{3}\%$ or $\frac{1}{3}$.

$\frac{1}{3} \times 60 = \frac{1}{\underset{1}{\cancel{3}}} \times \frac{\overset{20}{\cancel{60}}}{1}$ Rewrite 60 as a fraction with a denominator of 1.

$= 20$ Simplify.

So, 33% of 60 is about 20.

CONTENTS

CHAPTER 10

Practice Test

Vocabulary and Concepts

1. **Draw** a model that shows 90%.
2. **Explain** how to change a percent to a fraction.

Skills and Applications

Write each ratio as a fraction in simplest form.

3. 12 red blocks out of 20 blocks
4. 24 chips out of 144 chips
5. **BIRDS** If a hummingbird flaps its wings 250 times in 5 seconds, how many times does a hummingbird flap its wings each second?

Solve each proportion.

6. $\frac{4}{6} = \frac{x}{15}$
7. $\frac{10}{p} = \frac{2.5}{8}$
8. $\frac{n}{1.3} = \frac{6}{5.2}$
9. **GEOGRAPHY** On a map of Texas, the scale is 1 inch = 30 miles. Find the actual distance between Dallas and Houston if the distance between these cities on the map is 8 inches.

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

10. 42%
11. 20%
12. 4%
13. 110%
14. Write $\frac{2}{5}$ as a percent.
15. Write 0.8% as a decimal.

Express each decimal as a percent.

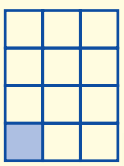
16. 0.3
17. 0.87
18. 0.149
19. **MONEY** Ian used 35% of his allowance to buy a book. If Ian received $20 for his allowance, how much did he use to buy the book?
20. Find 60% of 35.
21. What is 2% of 50?

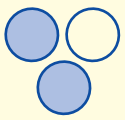
Estimate each percent.

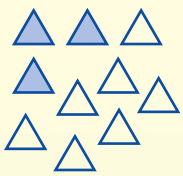
22. 9.5% of 51
23. 49% of 26
24. 308% of 9

Standardized Test Practice

25. **MULTIPLE CHOICE** In which model is about 25% of the figure shaded?

A 

B 

C 

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CHAPTER 10

Standardized Test Practice

PART 1 Multiple Choice

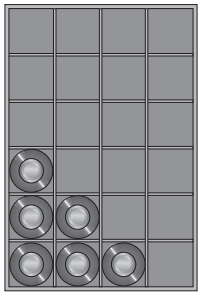
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

1. Use the table to find the total weight of one jar of jam, one package of cookies, and one box of crackers. (Lesson 3-5)

Gourmet Food Catalog	
Item	**Weight (oz)**
jam	6.06
cookies	18.73
crackers	12.12

(A) 26.81 oz (B) 36.00 oz
(C) 36.91 oz (D) 37.45 oz

2. The box shown originally contained 24 bottles of juice. What fraction represents the number of juice bottles that remain? (Lesson 5-2)



(F) $\frac{5}{24}$ (G) $\frac{1}{4}$ (H) $\frac{1}{2}$ (I) $\frac{6}{13}$

3. At a party, the boys ate $\frac{1}{3}$ of a pizza. The girls ate $\frac{1}{4}$ of another pizza. What fraction of a whole pizza did they eat altogether? (Lesson 6-4)

(A) $\frac{1}{12}$ (B) $\frac{2}{7}$ (C) $\frac{7}{12}$ (D) $\frac{5}{6}$

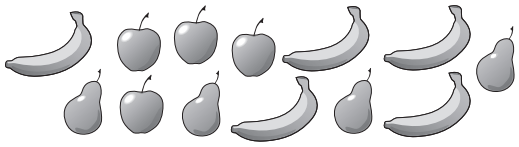
4. There are $3\frac{3}{4}$ pies to be shared equally among 5 people. How much of a pie will each person get? (Lesson 7-5)

(F) $\frac{1}{5}$ (G) $\frac{1}{3}$ (H) $\frac{1}{2}$ (I) $\frac{3}{4}$

TEST-TAKING TIP

Question 6 When setting up a proportion, make sure the numerators and the denominators in each ratio have the same units, respectively.

5. Which ratio compares the number of apples to the total number of pieces of fruit? (Lesson 10-1)



(A) $\frac{1}{9}$ (B) $\frac{1}{4}$
(C) $\frac{4}{13}$ (D) $\frac{4}{9}$

6. A car travels 150 miles in 3 hours. What equation can be used to find the distance the car will travel in 10 hours? (Lesson 10-2)

(F) $\frac{3}{150} = \frac{d}{10}$ (G) $\frac{3}{d} = \frac{150}{10}$
(H) $\frac{3}{150} = \frac{10}{d}$ (I) $\frac{150}{3} = \frac{10}{d}$

7. Which figures have more than 25% of their area shaded? (Lesson 10-4)

Figure 1

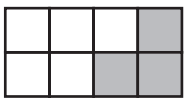


Figure 2

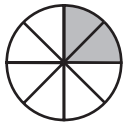


Figure 3

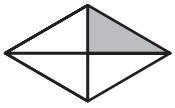
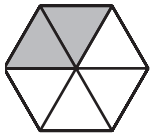


Figure 4



(A) 1 and 2 (B) 1 and 4
(C) 2 and 3 (D) 3 and 4

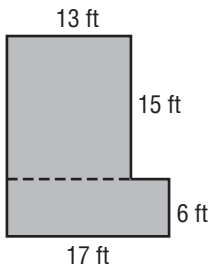
PART 2 Short Response/Grid In

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

8. What is the quotient of 315 divided by 5? (Prerequisite Skill, p. 590)

9. What are the next 3 numbers in the pattern 960, 480, 240, 120, …? (Lesson 1-1)

10. What is the total area of the figure shown? (Lesson 1-8)



11. The stem-and-leaf plot shows the cost of different pairs of jeans. How many of the jeans cost more than \$34? (Lesson 2-5)

Stem	Leaf
2	5 6 7 9
3	0 0 4 5 8
4	0 0 0 0 2

3 | 8 = \$38

12. Nina buys a sports magazine that costs \$3.95 for a monthly issue. How much will it cost her if she buys one magazine each month for a year? (Lesson 4-1)

13. Write the mixed number modeled below in simplest form. (Lesson 5-3)

14. Evaluate $a - b$ if $a = \frac{2}{5}$ and $b = \frac{1}{4}$. (Lesson 6-4)

15. What value of m satisfies the equation $m + 16 = 40$? (Lesson 9-2)

16. What is the value of y in $3y + 24 = 30$? (Lesson 9-5)

17. What is the function rule for the x- and y-values shown? (Lesson 9-6)

x	y
0	−3
1	−1
2	1
3	3
4	5

18. In a survey, 12 out of 15 adults preferred a certain brand of chewing gum. How many adults would prefer that particular brand if 100 adults were surveyed? (Lesson 10-2)

19. What is 25% written as a fraction? (Lesson 10-5)

20. Melissa bought a sweatshirt that originally cost \$30. If the sweatshirt was on sale for 25% off, what was the discount? (Lesson 10-7)

PART 3 Extended Response

Record your answers on a sheet of paper. Show your work.

21. Dante made a scale model of a tree. The actual tree is 32 feet tall, and the height of the model he made is 2 feet. (Lessons 10-2 and 10-3)

a. Write a proportion that Dante could use to find the actual height that one foot on the drawing represents.

b. How many actual feet does one foot on the model represent?

c. Suppose a branch on the actual tree is 4 feet long. How long would this branch be on the model of the tree?