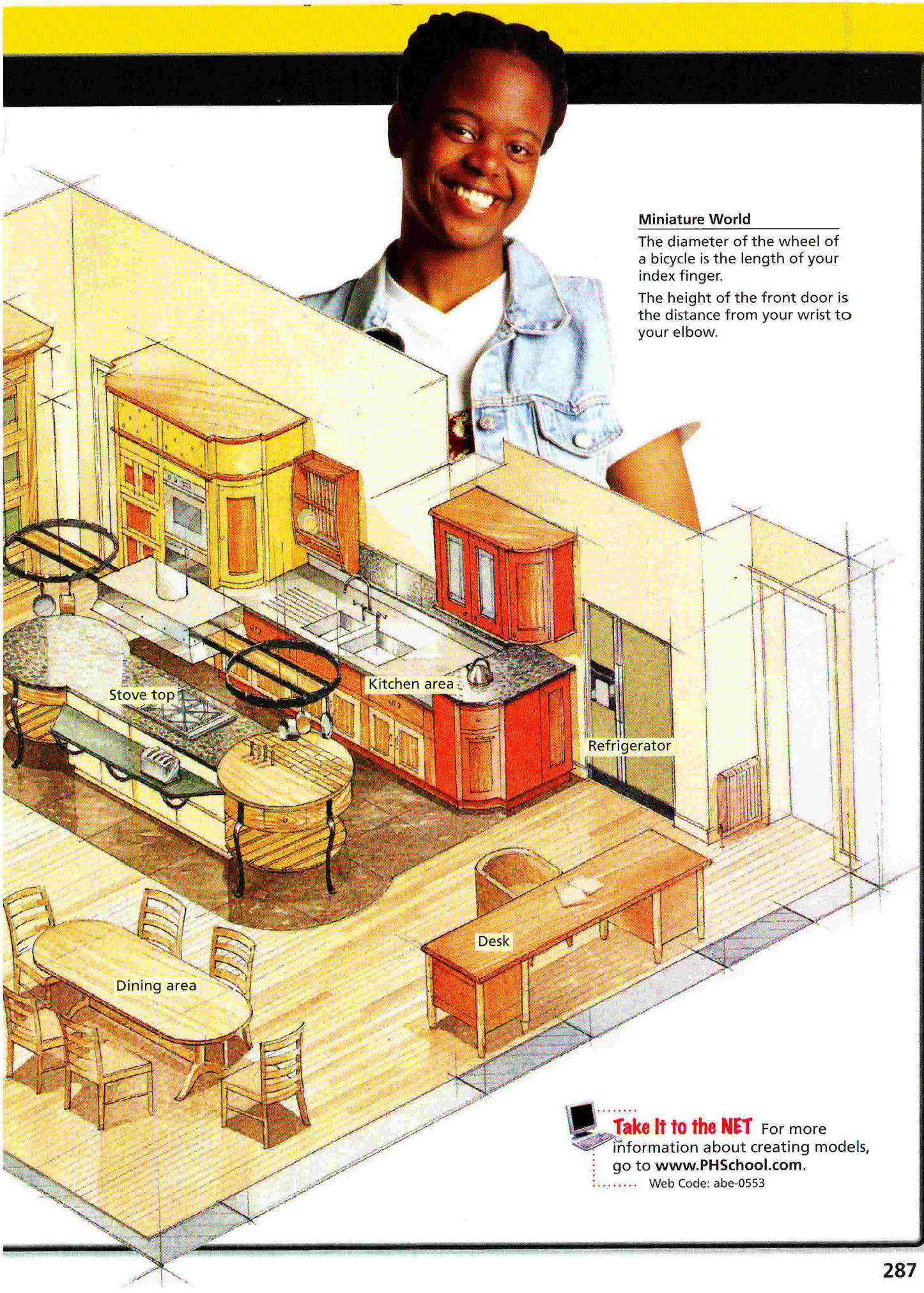


Miniature World

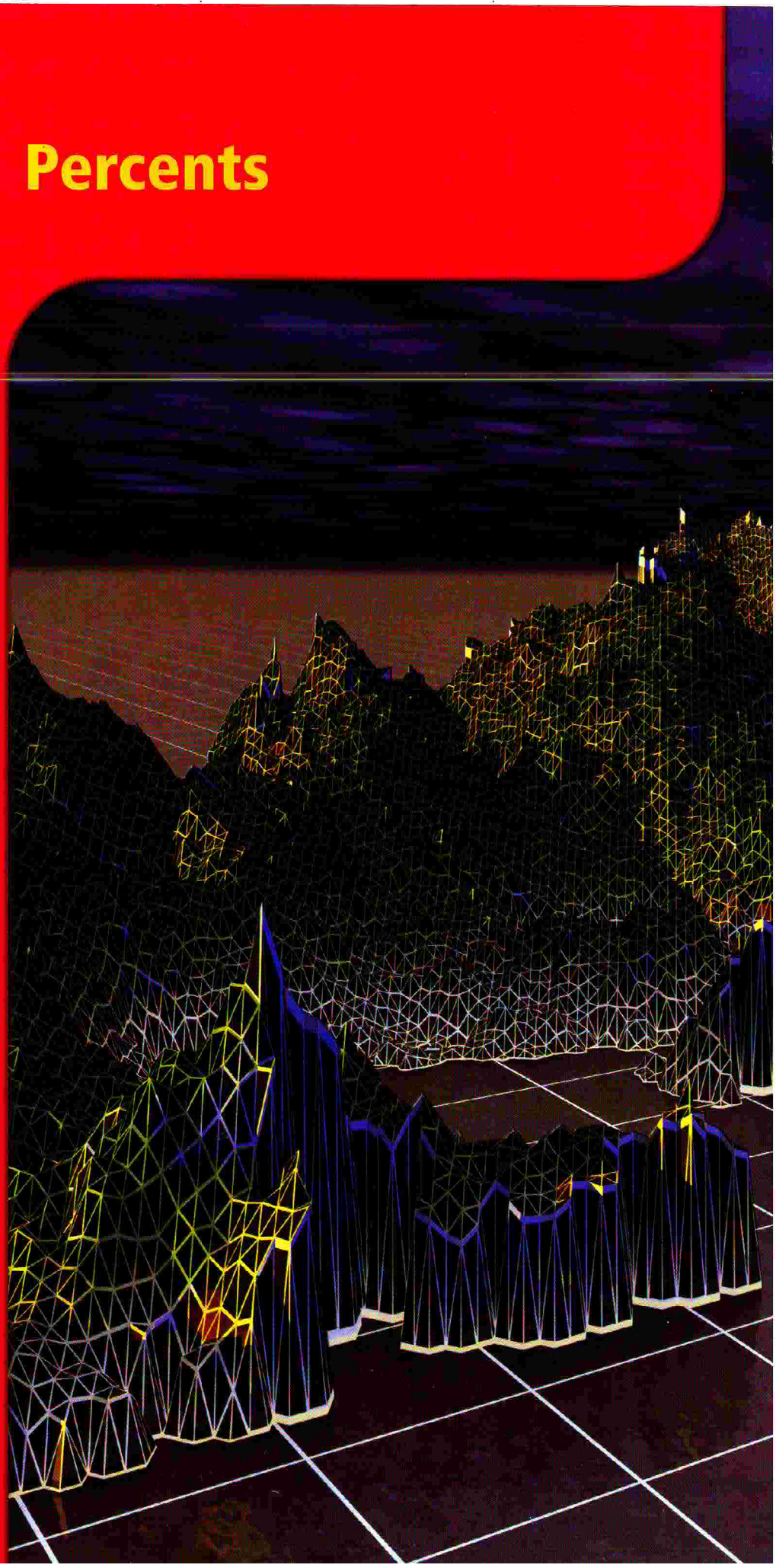
The diameter of the wheel of a bicycle is the length of your index finger.

The height of the front door is the distance from your wrist to your elbow.

Take It to the NET For more information about creating models, go to **www.PHSchool.com**.
Web Code: abe-0553

CHAPTER 6

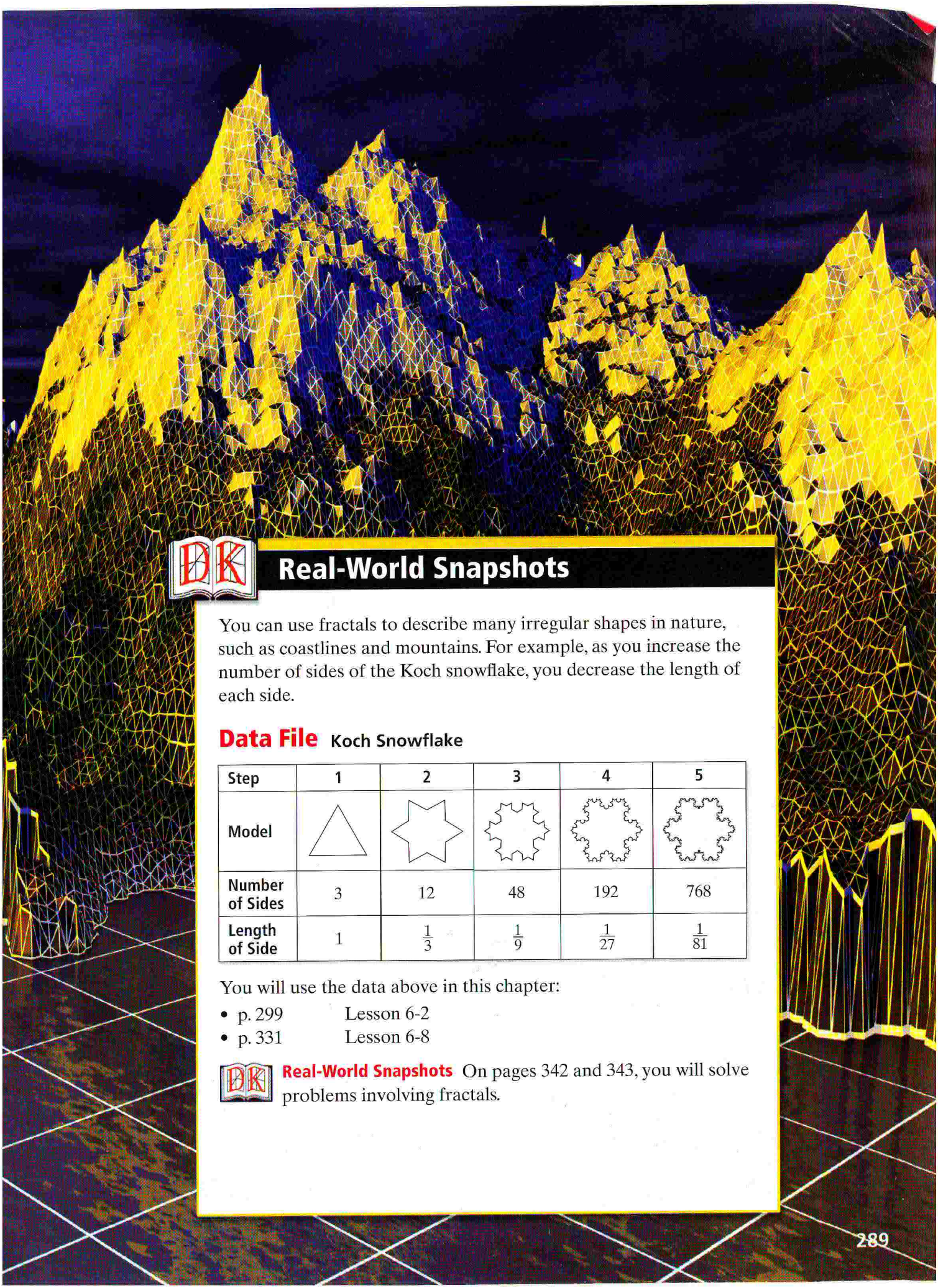
Percents



Lessons

Key Vocabulary

- commission (p. 324)
- discount (p. 329)
- markup (p. 328)
- percent (p. 291)
- percent of change (p. 327)



Real-World Snapshots

You can use fractals to describe many irregular shapes in nature, such as coastlines and mountains. For example, as you increase the number of sides of the Koch snowflake, you decrease the length of each side.

Data File Koch Snowflake

Step	1	2	3	4	5
Model					
Number of Sides	3	12	48	192	768
Length of Side	1	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{27}$	$\frac{1}{81}$

You will use the data above in this chapter:

- p. 299 Lesson 6-2
- p. 331 Lesson 6-8

Real-World Snapshots On pages 342 and 343, you will solve problems involving fractals.

Chapter 6 Preview

Where You've Been

- In Chapters 2 and 4, you learned to solve equations.
- In Chapter 5, you learned to write ratios and solve proportions.

Where You're Going

- In Chapter 6, you will compare percents with decimals and fractions and solve percent problems using proportions and equations.
- Applying what you learn, you will find an appropriate tip to give for a service that you receive.

Many factors affect the fare for a taxi, but the passenger determines the tip.

Instant self-check online and on CD-ROM

Diagnosing Readiness

For help, go to the lesson in green.

Using Estimation Strategies (Lesson 1-1)

Use compatible numbers to estimate each quotient.

1. $74.89 \div 14.7$ **2.** $1{,}409 \div 102.4$ **3.** $495.89 \div 99.3$

Solving Equations by Multiplying or Dividing (Lesson 2-4)

Solve each equation.

4. $0.8t = 24$ **5.** $0.35w = 280$ **6.** $\frac{n}{0.6} = 14$ **7.** $\frac{z}{0.25} = 12$

Fractions and Decimals (Lesson 3-9)

Write each decimal as a fraction in simplest form.

8. 0.85 **9.** 0.4 **10.** 0.68 **11.** 1.25 **12.** 0.01

Solving Equations With Fractions (Lesson 4-6)

Solve each equation.

13. $\frac{2}{3}x = 8$ **14.** $\frac{1}{5}y = 11$ **15.** $\frac{3}{4}t = 15$

Using Proportional Reasoning (Lesson 5-5)

Solve each proportion using cross products.

16. $\frac{4}{5} = \frac{n}{100}$ **17.** $\frac{x}{8} = \frac{27}{100}$ **18.** $\frac{6}{a} = \frac{3}{100}$

6-1 Understanding Percents

What You'll Learn

OBJECTIVE 1 To model percents

OBJECTIVE 2 To write percents using equal ratios

. . . And Why

To find a percent grade on a quiz, as in Example 4

Check Skills You'll Need

For help, go to Lesson 3-5.

Use multiples to write two fractions equivalent to each fraction.

1. $\frac{2}{5}$
2. $\frac{13}{50}$
3. $\frac{3}{25}$
4. $\frac{1}{10}$
5. $\frac{17}{20}$
6. $\frac{3}{4}$

New Vocabulary

- **percent**

iTEXT Interactive lesson includes instant self-check, tutorials, and activities.

OBJECTIVE 1 Modeling Percents

A **percent** is a ratio that compares a number to 100. You can write the ratio $\frac{25}{100}$ as 25%.

1 EXAMPLE Finding Percents From a Model

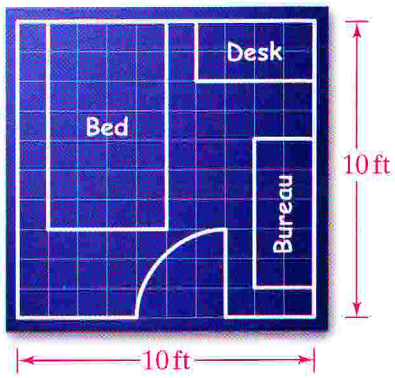
Real World

Decorating The floor plan shows a bedroom that is 10 ft × 10 ft. Write a ratio and a percent to represent the floor space needed for each piece of furniture in the room.

Count the number of grid spaces for each piece. Write as a ratio to the total number of grid spaces, 100. Then write as a percent.

bed $\frac{28}{100} = 28\%$ **bureau** $\frac{10}{100} = 10\%$

desk $\frac{8}{100} = 8\%$



Reading Math

Percent means "per hundred." The root *cent* appears in words such as century, centimeter, and centipede.

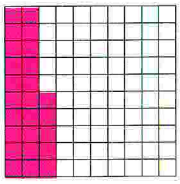
Check Understanding 1 Write a ratio and a percent for the unused floor space.

You can model a percent using a 10 × 10 grid.

2 EXAMPLE Writing Percents as a Model

Model 25% on a 10 × 10 grid.

Shade 25 of the 100 grid spaces. →



Check Understanding 2 Model each percent on a 10 × 10 grid.

a. 97% **b.** 4% **c.** 59.5%

OBJECTIVE 2

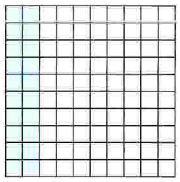
Writing Percents Using Equal Ratios

The factors of 100 are 1, 2, 4, 5, 10, 20, 25, 50, and 100. Ratios that have these numbers as their denominators are easy to write as percents by finding equal ratios.

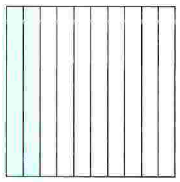
Need Help?
To find equal ratios, multiply the numerator and denominator of a ratio by the same nonzero number.
$\frac{a}{b} = \frac{a \cdot c}{b \cdot c}$, $c \neq 0$

3 EXAMPLE Finding Percents From Models

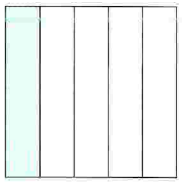
What percent does each shaded area represent?

a. 

$\frac{20}{100} = 20\%$

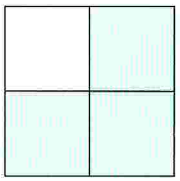
b. 

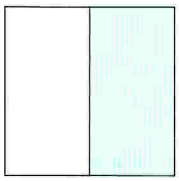
$\frac{2}{10} = \frac{20}{100} = 20\%$

c. 

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

Check Understanding 3 Write a ratio and a percent for each shaded area.

a. 

b. 

c. 

d. **Number Sense** You shade 4 squares in a grid. How many squares are there if the shaded portion represents 20% of the grid?

You can write ratios with different denominators as percents by writing an equal ratio with a denominator of 100.

4 EXAMPLE Using Equal Ratios

Real World

Grades You take a quiz that has 20 questions and get 17 correct answers. What is your percent grade on the quiz?

number of correct answers → $\frac{17}{20}$ ← Write a ratio.

number of total answers →

$\frac{17 \cdot 5}{20 \cdot 5}$ ← Since $20 \cdot 5$ is 100, multiply numerator and denominator by 5.

$\frac{85}{100}$ ← Simplify.

85% ← Write as a percent.

Your percent grade is 85%.

Check Understanding 4 Write each ratio as a percent.

a. $\frac{6}{25}$ **b.** $\frac{3}{4}$ **c.** $\frac{1}{50}$ **d.** $\frac{9}{20}$

e. **Reasoning** How can you use percents to compare two ratios with different denominators?

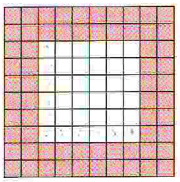
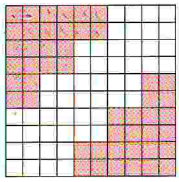
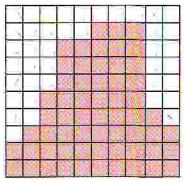
EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Write a ratio and a percent for each shaded figure.

Example 1 (page 291)

1. 
2. 
3. 

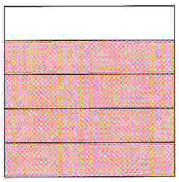
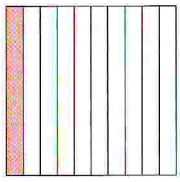
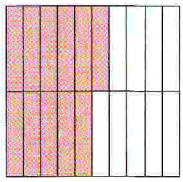
Example 2 (page 291)

Model each percent on a 10 × 10 grid.

4. 17%
5. 35%
6. 78%
7. 10%
8. 8%
9. 1.5%
10. 90.5%
11. 65%

Example 3 (page 292)

Write a ratio and a percent for each shaded area.

12. 
13. 
14. 

Example 4 (page 292)

Write each ratio as a percent. Exercise 15 has been started for you.

15. $\frac{3}{5} = \frac{60}{100}$
16. $\frac{1}{2}$
17. $\frac{21}{25}$
18. $\frac{9}{50}$
19. $\frac{11}{20}$
20. $\frac{1}{4}$
21. $\frac{3}{10}$
22. $\frac{24}{25}$
23. $\frac{1}{5}$

24. **Clothing** Six of your ten pairs of jeans are blue. What percent of your jeans are blue?

B Apply Your Skills

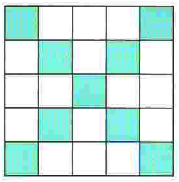
Find what percent of a dollar each set of coins makes.

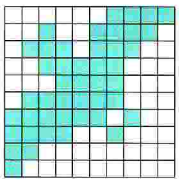
25. 2 quarters and 2 dimes
26. 3 quarters, 1 dime, 3 pennies
27. 1 nickel and 4 pennies
28. 1 quarter, 4 nickels, 7 pennies

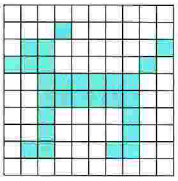
Social Studies Write each ratio as a percent.

29. **Government** An amendment to the U. S. Constitution must be ratified by at least three fourths of the states to become law.
30. **Geography** The area of Argentina is about three tenths the area of the United States.
31. **History** In the Battle of Tippecanoe, General William Harrison applauded his troops because nineteen twentieths of his soldiers had never before been in a battle.
32. **Writing in Math** Explain how to change $\frac{11}{25}$ into a percent.

Write a ratio and a percent for each shaded figure.

33. 

34. 

35. 

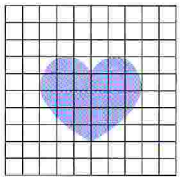
36. Open-Ended Draw and shade the first letter of your name on a 10×10 grid. Determine what percent of the grid is shaded.

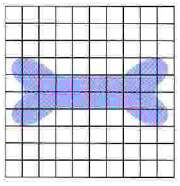
Number Sense **Use percents to compare each pair of ratios. Use <, >, or =.**

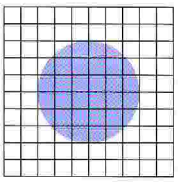
37. $\frac{3}{5}$ and $\frac{7}{10}$ **38.** $\frac{3}{4}$ and $\frac{19}{25}$ **39.** $\frac{1}{2}$ and $\frac{23}{50}$

C Challenge

Estimate the percent of each figure that is shaded.

40. 

41. 

42. 

43. Stretch Your Thinking Andy has twice as many books as Kathi. Morey has one-third as many books as Kira. Kira has 4 more books than Andy. If Kathi has 16 books, how many books does Morey have?

Test Prep

Gridded Response

Use the table at the right to find the percent of people surveyed who prefer each yogurt flavor.

44. strawberry

45. blueberry

46. vanilla

47. peach

Most Popular Yogurt Flavors

Personal Favorite	Ratio
Strawberry	$\frac{2}{5}$
Blueberry	$\frac{3}{25}$
Vanilla	$\frac{3}{50}$
Peach	$\frac{3}{100}$

Take It to the NET
Online lesson quiz at
www.PHSchool.com
Web Code aba-0601

Mixed Review

Lesson 4-3 **Find each sum or difference.**

48. $7\frac{4}{5} + 9\frac{7}{10}$ **49.** $17\frac{2}{9} - 12\frac{1}{3}$ **50.** $9\frac{3}{11} - 8\frac{3}{8}$ **51.** $21\frac{2}{5} + 15\frac{1}{4}$

Lesson 3-9 **Write each fraction as a decimal.**

52. $\frac{8}{12}$ **53.** $\frac{3}{18}$ **54.** $\frac{7}{9}$ **55.** $\frac{5}{9}$

6-2 Percents, Fractions, and Decimals

What You'll Learn

OBJECTIVE 1 To connect percents and decimals

OBJECTIVE 2 To connect percents and fractions

. . . And Why

To find percent of fat content in food, as in Example 4

Check Skills You'll Need

For help, go to Lesson 3-9.

Write each fraction as a decimal.

1. $\frac{5}{16}$
2. $\frac{1}{8}$
3. $\frac{11}{40}$
4. $\frac{5}{6}$
5. $\frac{4}{9}$
6. $\frac{2}{15}$

7. **Reasoning** Compare $\frac{1}{3}$ to $0.3\overline{3}$. Explain your reasoning.

OBJECTIVE 1

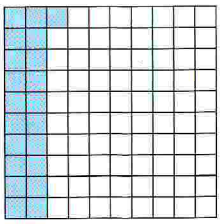
Percents and Decimals

Investigation: Relating Fractions, Decimals, and Percents

Patterns Copy the table. Use the pattern you see in the first two columns to complete the table.

Fraction	$\frac{83}{100}$	$\frac{13}{100}$	$\frac{29}{100}$	■	■
Decimal	0.83	0.13	■	0.67	■
Percent	83%	13%	■	■	19%

1. Describe the pattern of writing the decimals in the table as percents.
2. Describe the pattern of writing the fractions in the table as percents.



You can use a model to compare percents and decimals. From Lesson 6-1, you know that the shaded portion of the grid is 21 out of 100, or 21%.

Consider each square to be 0.01 of the whole. The shaded portion is 21×0.01, or 0.21. The model represents 0.21, or 21%.

To write a decimal as a percent, multiply the decimal by 100, or move the decimal point two places to the right. Then write a % sign.

$0.45 \times 100 \rightarrow \quad 0.45. \quad \rightarrow 45\%$

1 EXAMPLE Writing Decimals as Percents

Write each decimal as a percent.

a. 0.05 $0.05. = 5\%$

b. 0.759 $0.75.9 = 75.9\%$

c. 0.4 $0.40. = 40\%$

← Move the decimal point two places to the right.

Check Understanding 1 Write each decimal as a percent.

a. 0.07 **b.** 0.607 **c.** 0.9 **d.** 0.25

To write a percent as a decimal, divide it by 100, or move the decimal point two places to the left.

$64.5\% \rightarrow .64.5 \rightarrow 0.645$

2 EXAMPLE Writing Percents as Decimals

Write each percent as a decimal.

a. 12% $0.12. \rightarrow 0.12$

b. 47.5% $0.47.5 \rightarrow 0.475$

c. 2% $0.02. \rightarrow 0.02$

← Move the decimal point two places to the left.

Check Understanding 2 Write each percent as a decimal.

a. 35% **b.** 12.5% **c.** 9% **d.** 7.8%

You can order numbers by first writing each number as a decimal. Sometimes it is helpful to use a number line.

3 EXAMPLE Ordering Percents, Fractions, and Decimals

Order 0.52, 37%, 0.19, and $\frac{1}{4}$ from least to greatest. Use a number line.

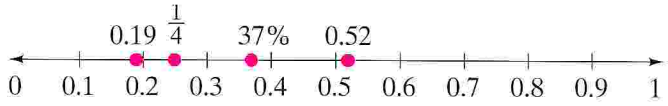
Write all numbers as decimals. Then locate each on a number line.

0.52 ← This number is already in decimal form.

$37\% = 0.37$ ← Move the decimal point two places to the left.

0.19 ← This number is already in decimal form.

$\frac{1}{4} = 0.25$ ← Divide the numerator by the denominator.



Need Help?
For help converting a fraction to a decimal, see Lesson 3-9.

Check Understanding 3 Order from least to greatest.

a. $\frac{3}{10}$, 0.74, 29%, $\frac{11}{25}$ **b.** 15%, $\frac{7}{20}$, 0.08, 50%

OBJECTIVE 2

Percents and Fractions

When the denominator of a fraction is a factor of 100, you can easily use equal ratios to convert the fraction to a percent. For fractions with other denominators, you can use a calculator to convert the fraction into a decimal, and then rewrite the decimal as a percent.

4 EXAMPLE Real-World Problem Solving

Nutrition In a slice of cheese pizza, 45 Calories are from fat. There are 158 total Calories in each slice. What percent of the Calories are from fat? Round to the nearest tenth of a percent.

Estimate $\frac{45}{158} \approx \frac{40}{160}$, which is $\frac{1}{4}$, or 25%.

Calories from fat → 45 / total Calories → 158 ← Write the ratio.

45 ÷ 158 = 0.284810127 ← Use a calculator.

$= 28.4810127\%$ ← Write as a percent.

$\approx 28.5\%$ ← Round to the nearest tenth of a percent.

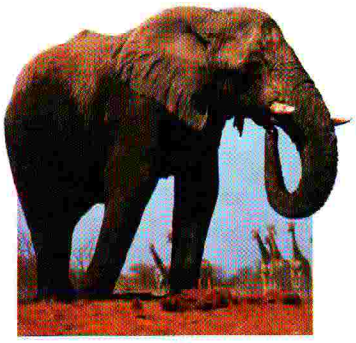
About 28.5% of the Calories are from fat.

Check for Reasonableness 28.5% is close to 25%, so the answer is reasonable.

Check Understanding 4 Write each fraction as a percent. When necessary, round to the nearest tenth of a percent.

a. $\frac{3}{5}$ **b.** $\frac{9}{75}$ **c.** $\frac{21}{40}$ **d.** $\frac{11}{16}$

You can write a percent as a fraction. First write the percent as a fraction with a denominator of 100. Then simplify the fraction.



Real-World Connection

An elephant eats about 6% of its body weight in vegetation each day.

5 EXAMPLE Writing Percents as Fractions Real World

Biology An elephant sleeps about 15% of each day. What fraction of each day does an elephant sleep?

$15\% = \frac{15}{100}$ ← Write 15% as a fraction with a denominator of 100.

$= \frac{15 \div 5}{100 \div 5}$ ← Divide the numerator and the denominator by the GCF, 5.

$= \frac{3}{20}$ ← Simplify the fraction.

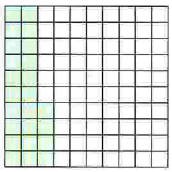
An elephant sleeps about $\frac{3}{20}$ of each day.

Check Understanding 5 Write each percent as a fraction in simplest form.

a. 95% **b.** 8% **c.** 79% **d.** 10%

e. Number Sense When you write a percent as a fraction with a denominator of 100, what are the only possibilities for the GCF of the numerator and the denominator of the fraction?

Key Concepts Percent Summary

Model	Fraction	Decimal	Percent
	$\frac{24}{100}$, or $\frac{6}{25}$	0.24	24%

Here is a table of frequently used fractions, decimals, and percents.

Fraction	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$
Decimal	0.125	0.25	$0.33\overline{3}$	0.5	$0.66\overline{6}$	0.75
Percent	12.5%	25%	$33\frac{1}{3}\%$	50%	$66\frac{2}{3}\%$	75%

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Example 1 (page 296)

Write each decimal as a percent.

1. 0.52 **2.** 0.375 **3.** 0.09 **4.** 0.155 **5.** 0.6

Example 2 (page 296)

Write each percent as a decimal.

6. 32% **7.** 88% **8.** 19.1% **9.** 3% **10.** 1.25%

Example 3 (page 296)

Order from least to greatest.

11. $\frac{1}{2}$, 12%, 0.25 **12.** 68%, 0.37, $\frac{3}{10}$ **13.** 0.81, $\frac{4}{5}$, 90%

14. 72%, $\frac{3}{4}$, 0.68 **15.** $\frac{1}{8}$, 18%, 0.19 **16.** 0.52, 14%, $\frac{5}{8}$

Example 4 (page 297)

Write each fraction as a percent. When necessary, round to the nearest tenth of a percent. Exercise 17 has been started for you.

17. $\frac{45}{50} = 0.90$ **18.** $\frac{7}{8}$ **19.** $\frac{1}{12}$

20. $\frac{5}{6}$ **21.** $\frac{7}{9}$ **22.** $\frac{3}{11}$

23. In your class, 9 of the 26 students are in the chorus. What percent of your class is in the chorus? Round to the nearest tenth of a percent.

Example 5 (page 297)

Write each percent as a fraction in simplest form.

24. 12% **25.** 6% **26.** 20%

27. 45% **28.** 17% **29.** 30%

30. Computers A computer screen shows the print on a page at 75% of full size. Write 75% as a fraction.

B Apply Your Skills

Compare. Use <, >, or =.

31. 0.32 ■ 3.2%

32. $\frac{18}{36}$ ■ 50%

33. 80% ■ $\frac{7}{8}$

34. 53% ■ 0.532

35. 24% ■ 0.24

36. $\frac{1}{3}$ ■ 33%

Potato Facts

Nutrient	RDA
Magnesium	14%
Iron	34%
Vitamin B6	35%

SOURCE: National Institutes of Health

37. Nutrition The table at the left shows the percent of the Recommended Daily Allowance for some of the nutrients in a 6-oz baked potato.

a. Write each percent as a fraction and as a decimal.

b. Suppose you eat a 6-oz baked potato. What percent of each nutrient do you still need to meet the Recommended Daily Allowance?

38. Grades Your teacher uses different methods of grading quizzes. You have had six quizzes with grades of 85%, $\frac{9}{10}$, $\frac{16}{20}$, 92%, $\frac{21}{25}$, and 79%.

a. Write your grades in order from least to greatest.

b. Find the average percent grade of your six quizzes.

39. **Data File, p. 289** Find the difference in the length of the sides from Step 1 to Step 2. Write your answer as a percent.

Number Sense **To write percents containing mixed numbers as fractions, you multiply the mixed number by $\frac{1}{100}$. Simplify where possible. Write each percent as a fraction.**

Sample $33\frac{1}{3}\% = 33\frac{1}{3} \times \frac{1}{100} = \frac{100}{3} \times \frac{1}{100} = \frac{1}{3}$

40. $62\frac{1}{2}\%$

41. $16\frac{2}{3}\%$

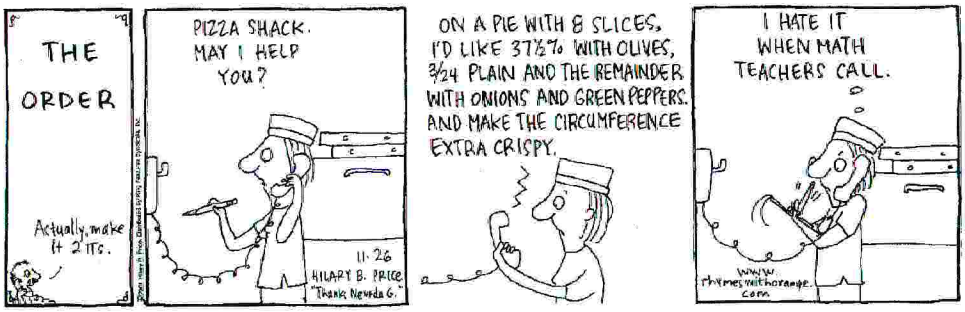
42. $6\frac{1}{4}\%$

43. $2\frac{1}{2}\%$

44. $3\frac{1}{3}\%$

45. $13\frac{1}{3}\%$

Math in the Media **Use the cartoon for Exercises 46–48.**



46. a. Write the percent of the pizza with olives as a fraction.

b. How many slices of pizza will have olives?

47. a. Find the percent of the pizza that is plain.

b. How many slices of the pizza will be plain?

48. What percent of the pizza will have onions and green peppers?

49. **Writing in Math** Does 0.4 equal 0.4%? Explain.

Match each percent with an equal fraction or decimal.

50. 3% **51.** 30% **52.** $33\frac{1}{3}\%$ **53.** 3.3% **54.** 33%

A. $\frac{1}{3}$ **B.** 0.033 **C.** 0.33 **D.** $\frac{3}{10}$ **E.** 0.03

Challenge

Write each percent as a fraction. Simplify where possible.

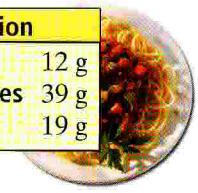
55. 19.1% **56.** 1.25% **57.** 67.8% **58.** 3.75%

Macaroni & Cheese

Nutrition	
Fat	33 g
Carbohydrates	40 g
Protein	17 g

Spaghetti & Meat Sauce

Nutrition	
Fat	12 g
Carbohydrates	39 g
Protein	19 g



59. **Nutrition** Before a race, runners usually eat foods high in carbohydrates. A gram of fat has 9 Calories. A gram of protein and a gram of carbohydrates each has 4 Calories.

a. How many Calories does one serving of macaroni and cheese have?

b. How many Calories does one serving of spaghetti and meat sauce have?

c. What percent of the Calories in each meal is from carbohydrates? Round to the nearest percent.

d. **Reasoning** Which meal is the better choice for a runner? Why?

60. **Stretch Your Thinking** Use a whole number, a fraction, and one plus sign to make four 2's add to 23.

Test Prep

Multiple Choice

61. Which fraction equals $66\frac{2}{3}\%$?

A. $\frac{66}{100}$ **B.** $\frac{200}{3}$ **C.** $\frac{68}{3}$ **D.** $\frac{18}{27}$

62. Which decimal equals $6\frac{1}{4}\%$?

F. 0.00625 **G.** 0.0625 **H.** 0.625 **I.** 6.25

63. Which quantity has the least value?

A. $\frac{3}{8}$ **B.** 0.38 **C.** 3.9% **D.** 3.7

Short Response

64. Explain how to rewrite a fraction as a percent. Give an example.

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Web Code aba-0602

Mixed Review

Lesson 3-9 **Write each decimal as a fraction or mixed number in simplest form.**

65. 1.8 **66.** 2.25 **67.** 0.004 **68.** 0.7

69. 2.3 **70.** 1.04 **71.** 0.35 **72.** 0.005

Lesson 1-3 **Find each product.**

73. 0.35×80 **74.** 0.05×42 **75.** 1.02×0.9 **76.** 2.4×0.7

6-3 Percents Greater Than 100% or Less Than 1%

What You'll Learn

OBJECTIVE 1 To use percents greater than 100% or less than 1%

. . . And Why

To find a percent in the U.S. House, as in Example 4

Check Skills You'll Need

For help, go to Lesson 6-1.

Model each percent.

1. 40%
2. 1%
3. 100%

Write each ratio as a percent.

4. $\frac{1}{100}$
5. $\frac{49}{50}$
6. $\frac{19}{20}$
7. $\frac{2}{25}$

OBJECTIVE 1

Using Percents Greater Than 100% or Less Than 1%

INTERACTIVE TEXT Interactive lesson includes instant self-check, tutorials, and activities.

A percent is a ratio that compares a number to 100. If the number compared to 100 is greater than 100, the percent is greater than 100%. If the number compared to 100 is less than 1, the percent is less than 1%.

1 EXAMPLE Rewriting Percents Greater Than 100

Real World

Nutrition You get 110% of the Recommended Daily Allowance of vitamin C from one half of a grapefruit. Write 110% as a decimal and as a fraction.

$110\% = 1.10$ ← To write as a decimal, move the decimal point two places to the left.

$110\% = \frac{110}{100}$ ← To write as a fraction, use the definition of percent.

$= \frac{11}{10}$, or $1\frac{1}{10}$ ← Simplify the fraction.

110% equals 1.10 in decimal form and $1\frac{1}{10}$ in fraction form.

Check Understanding 1 Write 125% as a decimal and as a fraction in simplest form.

2 EXAMPLE Rewriting Percents Less Than 1

Write 0.7% as a decimal and a fraction.

$0.7\% = 0.007$ ← To write as a decimal, move the decimal point two places to the left.

$0.7\% = \frac{0.7}{100}$ ← To write as a fraction, use the definition of percent.

$= \frac{0.7 \cdot 10}{100 \cdot 10}$ ← Multiply numerator and denominator by 10.

$= \frac{7}{1{,}000}$ ← Simplify as a fraction with a whole number numerator.

0.7% equals 0.007 in decimal form and $\frac{7}{1{,}000}$ in fraction form.

Check Understanding 2 Write 0.35% as a decimal and as a fraction in simplest form.

A mixed number represents a percent greater than 100%.

3 EXAMPLE Writing Mixed Numbers as Percents

Real World

Entertainment You want to see a movie. The cost of admission to a movie is $1\frac{7}{8}$ times the cost of renting a video. Write this mixed number as a percent.

$1\frac{7}{8} = 1 \boxed{+} 7 \boxed{\div} 8 \boxed{=} 1.875$ ← Use a calculator.

$= 1.87.5 = 187.5\%$ ← Move the decimal point two places to the right.

The cost of admission to a movie is 187.5% of the cost of renting a video.

Check Understanding 3 Write each mixed number or decimal as a percent. When necessary, round to the nearest hundredth of a percent.

a. $3\frac{5}{12}$ **b.** $2\frac{4}{5}$ **c.** 1.71 **d.** 4.005

A proper fraction represents a percent less than 100%.

4 EXAMPLE Real-World Problem Solving

Government West Virginia has 3 members in the U.S. House of Representatives. There are a total of 435 representatives. What percent of the representatives are from West Virginia? Round to the nearest hundredth of a percent.

$$\frac{\text{West Virginia representatives}}{\text{total number of representatives}} = \frac{3}{435}$$ ← Write the fraction.

$= 0.0068965517$ ← Use a calculator.

$\approx 0.69\%$ ← Write as a percent, and round.

About 0.69% of the representatives are from West Virginia.

Check Understanding 4 Idaho has two members in the U.S. House of Representatives. Find the percent of the representatives that are from Idaho. Round to the nearest hundredth of a percent.

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

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

Example 1 (page 301)

1. 180% **2.** 130% **3.** 175%

4. 345% **5.** 240% **6.** 452%

Example 2 (page 301)

7. 0.1% **8.** 0.75% **9.** 0.09%

10. 0.16% **11.** 0.5% **12.** 0.05%

Write each number as a percent. When necessary, round to the nearest hundredth of a percent.

Example 3 (page 302)

13. $4\frac{3}{4}$ **14.** $1\frac{3}{5}$ **15.** $1\frac{1}{100}$

16. $2\frac{29}{50}$ **17.** $3\frac{7}{20}$ **18.** $2\frac{3}{8}$

19. 1.034 **20.** 2.65 **21.** 4.81

Example 4 (page 302)

22. $\frac{7}{1{,}000}$ **23.** $\frac{1}{400}$ **24.** $\frac{3}{500}$

25. $\frac{7}{998}$ **26.** $\frac{5}{684}$ **27.** $\frac{2}{329}$

28. 0.00675 **29.** 0.0028 **30.** 0.0001

31. Reading A library finds that borrowing reference books between libraries is $1\frac{9}{10}$ of what it was 15 years ago. Write this fraction as a percent.

B Apply Your Skills

Write each percent as a decimal and a fraction.

32. Sales Jewelry sales in December were 166% of sales in November.

33. Weather On March 1, the snowpack in the Northern Great Basin of Nevada was 126% of the average snowpack.

34. Environment Some studies indicate that the desert shrublands could increase as much as 185% in the next century due to global warming.

Model each percent using one or more 10 × 10 grids.

35. 175% **36.** 120% **37.** 0.5%

Write each number as a percent.

38. $\frac{6}{5}$ **39.** 1.55 **40.** $\frac{51}{25}$ **41.** $1\frac{3}{4}$ **42.** $\frac{15}{8}$

Decide whether each percent is reasonable. Explain why or why not.

43. Buttermilk is 105% milk fat.

44. Rainfall in Oklahoma this year is reported to be 120% of the average.

45. A scientific study concluded that 0.5% of the seeds will not grow.

46. The addition raised the school's value to 0.7% of its previous value.

47. Writing in Math What does it mean to reach 120% of a savings goal?

Real-World Connection

Shrubs are the leading plant form in places where there is little rainfall.

C Challenge

Write each percent as a decimal.

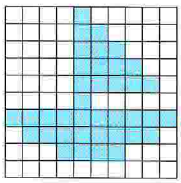
48. $152\frac{1}{8}\%$ **49.** $114\frac{3}{16}\%$ **50.** $190\frac{5}{7}\%$ **51.** $210\frac{7}{40}\%$

52. Auctions Recently, a near-mint copy of the Baltimore Orioles 1966 Yearbook was auctioned for $15. The yearbook cost $.50 in 1966. Write a ratio of the auction price to the original price. Find the percent.

Test Prep

Multiple Choice

53. Which set of numbers represents the shaded area of the figure at the right?



A. 0.38%, $\frac{38}{100}$, 0.038 **B.** 3.8%, $\frac{38}{100}$, 0.38

C. 38%, $\frac{38}{100}$, 0.038 **D.** 38%, $\frac{38}{100}$, 0.38

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54. The fraction $\frac{9}{1{,}000}$ is equal to which set of numbers?

F. 0.9%, 0.009 **G.** 0.9%, 90 **H.** 9%, 0.9 **I.** 90%, 0.90

55. One hour is what percent of one week? Round to the nearest tenth.

A. 0.5% **B.** 0.6% **C.** 5.9% **D.** 6.0%

Short Response

56. You miss 1 day of school out of 180 days in the school year.

a. Explain how to express 1 day out of school as a percent.

b. Round to the nearest tenth of a percent.

Mixed Review

Lesson 6-2 **Write each percent as a fraction in simplest form.**

57. 28% **58.** 37.5% **59.** 80% **60.** 74%

61. 19% **62.** 10% **63.** 95% **64.** 3%

Lesson 4-4 **Find each product.**

65. $\frac{3}{5} \cdot 40$ **66.** $\frac{5}{9} \cdot 144$ **67.** $\frac{7}{8} \cdot 280$ **68.** $\frac{1}{6} \cdot 423$

Practice Game

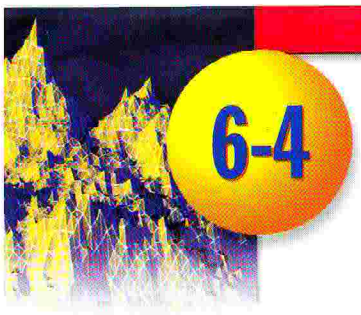
Order, Please!

What You'll Need

- 30 pieces of construction paper, each with a fraction, decimal, or a percent written on it. Include mixed numbers or the equivalent decimals and percents.

How to Play

- Select two teams of five players. Each player receives one piece of construction paper.
- When play begins, team members must order themselves from the least to the greatest numbers.
- The first team to order their numbers correctly is the winner.



6-4 Finding a Percent of a Number

What You'll Learn

OBJECTIVE 1 To use a percent to find part of a whole

OBJECTIVE 2 To use mental math and estimation with percents

. . . And Why

To find the number of students, as in Example 2

Check Skills You'll Need

For help, go to Lesson 1-9.

Find each product using the Distributive Property and mental math.

1. $80 \cdot 15$
2. $61 \cdot 15$
3. $75 \cdot 18$
4. $42 \cdot 1.5$
5. $78 \cdot 0.9$
6. $27 \cdot 1.1$
7. Explain how you could use the Distributive Property to find $\$38 \times 15$ using mental math.

OBJECTIVE 1

Using a Percent to Find Part of a Whole

Investigation: Using Percent Data From a Graph

1. What do most people have on their gift list?
2. How many people answered the survey?
3. a. What do about $\frac{1}{3}$ of the people have on their lists?
   b. About how many people does that represent?
4. a. What do about $\frac{1}{4}$ of the people have on their lists?
   b. About how many people does that represent?
5. Why do you think the sum of the percents is greater than 100%?

To find 25% of 44, you can write 25% either as a decimal or a fraction and then multiply by 44.

1 EXAMPLE Finding a Percent of a Whole

Find 25% of 44.

Method 1 Write 25% as a fraction and multiply.

$25\% = \frac{25}{100} = \frac{1}{4}$ ← Write the percent as a fraction in simplest form.

$\frac{1}{4} \cdot 44 = 11$ ← Multiply.

Method 2 Write 25% as a decimal and multiply.

$25\% = 0.25$ ← Write the percent as a decimal.

$0.25 \cdot 44 = 11$ ← Multiply.

Check Understanding 1

a. Find 45% of 130.

b. Reasoning When would you use a decimal to find a percent? When would you use a fraction to find a percent?

2 EXAMPLE Real-World Problem Solving

Sports There are 75 students at tryouts for the basketball team. Of this number, 64% are in the seventh grade. How many seventh-grade students are trying out for the team?

Need Help?
For help in writing a percent as a fraction, go to Lesson 6-2.

Estimate 64% of 75 $\approx \frac{2}{3} \cdot 75$, or 50

$64\% = 0.64$ ← Change the percent to a decimal.

$0.64 \cdot 75 = 48$ ← Multiply.

There are 48 seventh-grade students attending tryouts for the basketball team.

Check for Reasonableness The answer 48 is close to the estimate 50. The answer is reasonable.

Check Understanding 2 Of the seventh-grade students who tried out, 37.5% made the team. How many seventh-grade students made the team?

OBJECTIVE 2

Using Mental Math and Estimation With Percents

You can use mental math to find percents of numbers involving percents such as 100%, 50%, 10%, and 1%.

- 100% of a number is the number itself. 100% of 190 = 190
- 50% of a number is $\frac{1}{2}$ of the number. 50% of 190 = 95
- 10% of a number is 0.1 of the number. 10% of 190 = 19.0.
- 1% of a number is 0.01 of the number. 1% of 190 = 1.90.

3 EXAMPLE Using Mental Math

Find 11% of 840.

What you think

11% is 10% + 1%.
10% of 840 is 0.1 · 840, or 84.
1% of 840 is 0.01 · 840, or 8.4.
So 84 + 8.4 = 92.4.

Why it works

$0.11 \cdot 840$	← Write 11% as a decimal.
$(0.10 + 0.01) \cdot 840$	← Substitute 0.10 + 0.01 for 0.11.
$(0.10 \cdot 840) + (0.01 \cdot 840)$	← Use the Distributive Property.
$84 + 8.4$	← Multiply.
92.4	← Simplify.

Check Understanding 3 Use mental math to find each percent of 2,400.

a. 40% **b.** 99% **c.** 9% **d.** 61%

Need Help?
For help using compatible numbers, go to Lesson 1-1.

You can use compatible numbers to estimate a percent.

4 EXAMPLE Estimating a Percent

Estimate 32% of 912.

$32\% \cdot 912$ ← Write an expression.
↓ ↓
$\frac{1}{3} \cdot 900 = 300$ ← Use compatible numbers such as $\frac{1}{3}$ and 900.

Check for Reasonableness 32% of 912 is $0.32 \cdot 912$, or 291.84, which is close to the estimate 300. The answer is reasonable.

Check Understanding 4 Estimate each answer.

a. 24% of 238 **b.** 19% of 473 **c.** 82% of 747 **d.** 63% of 810

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Examples 1, 2 (page 306)

Find each answer. Exercise 1 has been started for you.

1. 6% of 90
6% of 90 = $0.06 \cdot 90$

2. 125% of 64

3. 12.5% of 56

4. 12% of 230

5. 75% of 240

6. 15% of 45

7. 3% of 12

8. 150% of 17

9. 7% of 300

10. 27% of 120

11. 60% of 120

12. 20% of 80

13. Four hundred students attended a school dance. If 35% of the students were boys, how many boys attended the dance?

14. Of 90 coins in a bank, 20% are quarters. Find the number of quarters in the bank.

Example 3 (page 307)

Mental Math **Find each answer using mental math.**

15. 11% of 536 **16.** 9% of 780 **17.** 50% of 948

18. 40% of 216 **19.** 51% of 840 **20.** 30% of 714

21. 60% of 520 **22.** 49% of 150 **23.** 90% of 345

Example 4 (page 307)

Estimate each answer.

24. 27% of 162 **25.** 33% of 88 **26.** 53% of 721

27. 19% of 399 **28.** 98% of 65 **29.** 73% of 522

30. 66% of 243 **31.** 48% of 658 **32.** 13% of 326

B Apply Your Skills

33. **Number Sense** Is 32% of 96 the same value as 96% of 32? Explain your reasoning.

34. **a.** **Books** A large bookcase contains 75 books. If 64% of the books are novels, how many novels are in the bookcase?

b. Robert Louis Stevenson wrote 12.5% of the novels in part (a). How many Stevenson novels are in the bookcase?

Sewing **Use the advertisement at the left for Exercises 35–38.**

35. **a.** What percent of the original price of the calico fabric is the sale price?

b. What is the sale price?

36. What is the sale price of the patterns?

37. Find the sale price of the scissors.

38. Which costs less on sale, the calico or the cotton knit fabric? How much less?

Find each answer.

39. Find 37.5% of 12. **40.** What is 8% of 25? **41.** Find 30% of 40.

42. What is 25% of 95? **43.** Find 190% of 13. **44.** What is 20% of 20?

45. What is 120% of 34? **46.** Find 12% of 33. **47.** Find 30% of 120.

48. **Sales** The regular price of a calculator is $15.40. Today only, you can buy it for 70% of the regular price. If you buy the calculator today, how much will you pay for it?

49. **Salary** A nurse earning an annual salary of $39,235 gets a 4% raise. What is the amount of the raise?

Real-World Connection

Helicopters drop water, foam, or fire retardant to prevent fires from spreading.

50. Forestry Russia had 17,000 forest fires in 2001. Aircraft extinguished 40% of the fires. How many of the fires were put out by aircraft?

51. Sales Suppose you want to buy a $450 stereo. With a down payment of 30%, the store will charge no interest and will let you make payments of $35 per month. How many months will it take you to buy the stereo?

Estimate each answer.

52. Find 40.5% of 321.

53. What is 13% of 475?

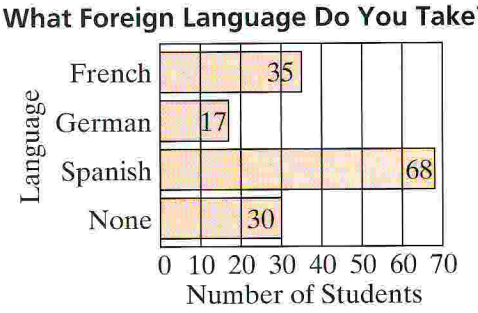
54. What is 63% of 123?

55. Find 59.7% of 91.

56. What is 110% of 478?

57. Find 122% of 850.

58. Data Analysis At a high school, 150 students are surveyed about their foreign language classes. The graph below shows their responses.



a. How many students take French? What percent of the 150 students surveyed take French?

b. Find the percent of students taking each of the other languages.

c. Estimation The high school population is 2,500. Use the percents that you found in parts (a) and (b). Estimate the number of students at the school taking each language.

59. Grades You take a test with 25 questions on it. Your grade on the test is 84%. How many questions do you get right?

60. Writing in Math Explain how you would find 99% of 800.

Challenge

Find each amount.

61. $\frac{1}{2}$% of $32,000

62. $\frac{1}{4}$% of $65,000

63. $\frac{3}{4}$% of $41,000

64. a. Reasoning The number of students in this year's seventh-grade class is 110% of the number in last year's class. When you write 110% as a ratio, what number is in the denominator? Why?

b. Are there more or fewer students in this year's class? Why?

c. There were 260 students in last year's class. How many students are in this year's class?

65. Stretch Your Thinking I am a 2-digit number. I am the difference of two numbers whose sum is 36. The larger of these numbers is twice the smaller. What number am I?

Test Prep

Multiple Choice

66. Find 0.1% of 560.

A. 0.056 **B.** 0.56 **C.** 5.6 **D.** 56

67. Which expression provides the best estimate for 37% of 621?

F. 40% of 600 **G.** $33\frac{1}{3}\%$ of 600

H. $33\frac{1}{3}\%$ of 630 **I.** 35% of 700

Take It to the NET
Online lesson quiz at
www.PHSchool.com
Web Code aba-0604

68. At a sale where everything is 70% of the original price, you find a jacket originally priced at \$58.90 and a pair of jeans originally priced at \$29.95. Estimate the total cost.

A. \$30 **B.** \$60 **C.** \$90 **D.** \$120

Extended Response

69. A woman with a salary of \$41,820 gets a raise of 4%. Her expenses have increased by \$1,800. Explain whether she now has enough money to pay her expenses.

Mixed Review

Lesson 6-2 **Write each decimal as a percent.**

70. 0.04 **71.** 0.92 **72.** 0.45

Lesson 5-5 **Algebra** **Solve each proportion using cross products.**

73. $\frac{13}{39} = \frac{n}{60}$ **74.** $\frac{7}{15} = \frac{28}{m}$ **75.** $\frac{21}{x} = \frac{5}{8}$

Lesson 4-6 **Algebra** **Solve each equation.**

76. $y + \frac{1}{2} = \frac{7}{8}$ **77.** $x - \frac{3}{10} = 6$ **78.** $a - \frac{3}{4} = \frac{1}{2}$

Checkpoint Quiz 1 — Lessons 6-1 through 6-4

TEXT Instant self-check quiz online and on CD-ROM

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

1. 45% **2.** 135% **3.** 0.98%

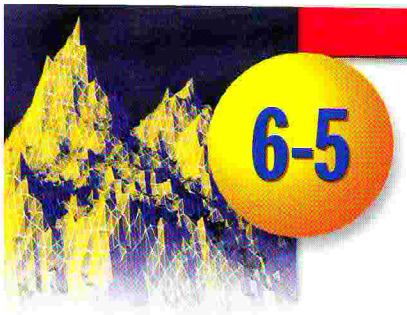
Write each fraction as a percent.

4. $\frac{14}{25}$ **5.** $\frac{3}{15}$ **6.** $\frac{1}{250}$

Find each answer.

7. What is 29% of 58? **8.** Find 190% of 16. **9.** Find 0.5% of 48.

10. A club has 100 members. Each of the five officers gets six other members to help decorate for a club party. What percent of the club members help decorate?



6-5 Solving Percent Problems Using Proportions

Algebra

What You'll Learn

OBJECTIVE 1 To find the percent using proportions

OBJECTIVE 2 To find the whole using proportions

. . . And Why

To find total earnings, as in Example 4

Check Skills You'll Need

For help, go to Lesson 5-5.

Solve each proportion using cross products.

1. $\frac{n}{32} = \frac{1}{4}$
2. $\frac{6}{n} = \frac{2}{5}$
3. $\frac{7}{8} = \frac{n}{100}$
4. $\frac{7}{20} = \frac{35}{n}$
5. $\frac{42}{n} = \frac{3}{4}$
6. $\frac{9}{25} = \frac{n}{100}$
7. Explain how you would solve the proportion $\frac{n}{60} = \frac{75}{100}$.

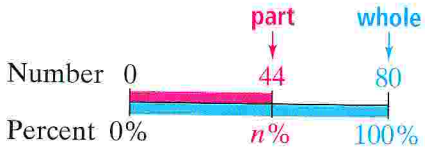
TEXT Interactive lesson includes instant self-check, tutorials, and activities.

OBJECTIVE 1 Finding the Percent Using Proportions

Real-World Connection

Many growers sell their produce at markets in nearby cities.

In a market, 44 of the 80 types of vegetables are grown locally. What percent of the vegetables are grown locally? You can use a model to help find this percent.



$\frac{44}{80} = \frac{n}{100}$ ← The part, 44, corresponds to n in the model. ← The whole, 80, corresponds to 100.

1 EXAMPLE Finding a Percent

What percent of 80 is 44?

Using the model above, you can write a proportion and find the percent.

$\frac{44}{80} = \frac{n}{100}$ ← Write a proportion.

$80n = 44(100)$ ← Write the cross products.

$\frac{80n}{80} = \frac{44(100)}{80}$ ← Divide each side by 80.

$n = 55$ ← Simplify.

44 is 55% of 80.

Check Understanding

1 Use a proportion to solve.

a. What percent of 92 is 23?

b. 36 is what percent of 125?

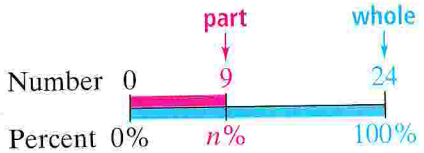
c. **Number Sense** Is the answer to "What percent of 44 is 80?" the same as the answer to Example 1? Explain.

2 EXAMPLE Real-World Problem Solving

Real-World Connection

The brass instruments are trumpet, trombone, French horn, and tuba.

Music In a school band of 24 students, 9 students play brass instruments. What percent of the band members play brass instruments?



← The model shows the relationship.

$\frac{9}{24} = \frac{n}{100}$ ← Write a proportion.

$24n = 9(100)$ ← Write the cross products.

$\frac{24n}{24} = \frac{9(100)}{24}$ ← Divide each side by 24.

$n = 37.5$ ← Simplify.

37.5% of the band members play brass instruments.

Check Understanding 2

a. Reasoning In Example 2, how do you know to use $\frac{9}{24}$ and not $\frac{24}{9}$?

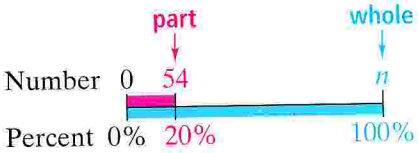
b. In Example 2, 3 of the 9 students are girls. What percent of the band is made up of girls who play brass instruments?

OBJECTIVE 2 Finding the Whole Using Proportions

You can use the same proportion model to show other relationships between a number, a percent, and the whole.

3 EXAMPLE Finding the Whole

54 is 20% of what number?



← The model shows the relationship.

$\frac{54}{n} = \frac{20}{100}$ ← Write the proportion.

$20n = 54(100)$ ← Write the cross products.

$\frac{20n}{20} = \frac{54(100)}{20}$ ← Divide each side by 20.

$n = 270$ ← Simplify.

54 is 20% of 270.

Check Understanding 3 Use a proportion to solve.

a. 42 is 56% of what number?

b. 65% of what number is 39?

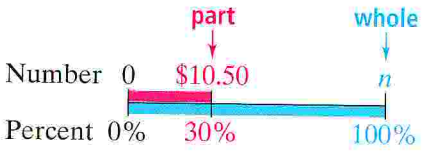
c. Number Sense Is the answer to "70 is 125% of what number?" greater than or less than 70? Explain.

You can find the whole if you know a percent and the amount that the percent represents.

4 EXAMPLE **Real-World Problem Solving**

Budgeting Suppose you have a part-time summer job. You decide that 30% of your earnings can be spent on entertainment. You plan a movie and pizza night with friends that will cost you \$10.50. How much will you need to earn at your job in order to stay within your budget?

Model the relationship.



← The model shows the relationship.

$\frac{10.50}{n} = \frac{30}{100}$ ← Write the proportion.

$30n = 10.50(100)$ ← Write the cross products.

$\frac{30n}{30} = \frac{10.50(100)}{30}$ ← Divide each side by 30.

$n = 35$ ← Simplify.

You need to earn \$35 to stay within your budget.

Check 30% of 35 = 0.30 · 35 = 10.50 ✔

Check Understanding 4 Use a proportion to solve.

a. 60 is 24% of what number? **b.** 40% of what number is 96?

c. Reasoning Is it reasonable to budget 30% for entertainment, 50% for savings, and 25% for clothes? Why or why not?

Percent problems involve a part, a percent, and a whole. If you know two of the three pieces, you can find the missing piece. The easiest piece to identify is the percent. The word *of* is usually followed by the whole.

Here is a summary of what you have learned.

Key Concepts **Percents and Proportions**

Finding a Part

20% of 25 is what number?

$\frac{n}{25} = \frac{20}{100}$

$n = 5$

20% of 25 is 5.

Finding a Percent

5 is what percent of 25?

$\frac{5}{25} = \frac{n}{100}$

$n = 20$

5 is 20% of 25.

Finding a Whole

20% of what number is 5?

$\frac{5}{n} = \frac{20}{100}$

$n = 25$

20% of 25 is 5.

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Use a proportion to solve.

Example 1 (page 311)

1. 24 is what percent of 32?
2. What percent of 230 is 23?
3. What percent of 25 is 23?
4. What percent of 400 is 8?
5. 21 is what percent of 168?
6. 246 is what percent of 656?
7. 364 is what percent of 455?
8. What percent of 600 is 84?

Example 2 (page 312)

9. **Time** A school holds classes from 8:00 A.M. to 2:00 P.M. For what percent of a 24-h day does this school hold classes?
10. **Government** Based on the 2000 census, Arizona gained 2 seats in the U.S. House of Representatives. Arizona had 6 seats. What percent of the representatives from Arizona was gained in 2000?
11. **Work** You have a paper route with 40 customers. What percent of the paper route have you completed when you have delivered 28 papers?

Example 3 (page 312)

Use a proportion to solve.

12. 80% of what number is 15?
13. 68% of what number is 51?
14. 42 is 12% of what number?
15. 21 is 84% of what number?
16. 108 is 225% of what number?
17. 342 is 36% of what number?
18. 36 is 72% of what number?
19. 28 is 35% of what number?

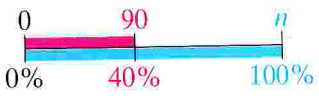
Example 4 (page 313)

20. **Sales** A sweater is on sale for \$33. This is 75% of the original price. Find the original price.
21. **Tax** You purchase a telescope in a state with a 5% sales tax. You pay \$12.45 in tax. What is the price of the telescope?
22. **School** You have answered 12 questions on a homework assignment and are now 60% done. How many questions are in the assignment?

B Apply Your Skills

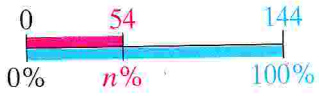
Write a proportion for each model. Solve for n.

23.

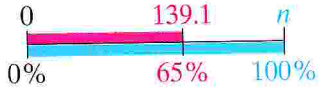


24.

25.



26.



27. **a.** 50 is what percent of 75? **b.** 75 is what percent of 50?
c. Which results in a percent greater than 100%—your answer to part (a) or your answer to part (b)? Why?

Real-World Connection

Some schools award ribbons for outstanding academic performance.

28. Awards An awards banquet is attended by 120 people. Ribbons are awarded for first, second, and third place in each of 25 categories. No one gets more than one ribbon. What percent of the people attending the banquet receives a ribbon?

29. Sports At a track meet, there are 8 runners for each of 6 qualifying runs. The top 25% of the field will qualify for a regional race. How many of the runners at the meet will qualify for the regional race?

30. Open-Ended Write a percent problem that compares the number of boys to the number of girls in your class.

Match each question with the proportion you could use to solve it.

31. What is 40% of 15?

32. 15 is what percent of 40?

33. 40% of what number is 15?

A. $\frac{15}{40} = \frac{n}{100}$

B. $\frac{15}{n} = \frac{40}{100}$

C. $\frac{n}{15} = \frac{40}{100}$

Use a proportion to solve.

34. What percent of 128 is 6.4?

35. 272 is 80% of what number?

36. 72.5% of what number is 29?

37. 2.5 is what percent of 20?

38. 74% of what number is 29.6?

39. What percent of 1,800 is 972?

Reading Math

For help solving Exercise 40, go to page 317.

40. Research At the library, you find 9 books on a certain topic. The librarian tells you that 55% of the books on this topic have been signed out. How many books does the library have on the topic?

41. Error Analysis Your friend solves, "32 is 15% of what number?" by solving the proportion $\frac{n}{32} = \frac{15}{100}$. Explain why your friend is not correct.

42. Writing in Math In every percent proportion, there are four quantities. One of the four is always the same quantity. Explain why.

C Challenge

Use a proportion to solve.

43. 29 is $16\frac{2}{3}$% of what number?

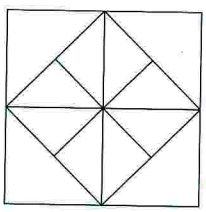
44. $66\frac{2}{3}$% of what number is 13?

45. Number Sense What percent of the numbers from 1 to 20 is prime?

46. Supplies Your school orders 210 boxes of chalk, which is 70% of last year's order. Find the decrease in the number of boxes of chalk.

47. Automobiles A car dealer advertises "All cars 19% off sticker price!" A buyer pays $10,930.95 for a car. What is the sticker price?

48. Stretch Your Thinking How many different squares are shown in the figure at the right?



Test Prep

Multiple Choice

49. Which proportion can you use to find what percent 13 is of 20?

A. $\frac{13}{20} = \frac{n}{100}$ B. $\frac{n}{20} = \frac{13}{100}$ C. $\frac{13}{n} = \frac{100}{20}$ D. $\frac{n}{13} = \frac{20}{100}$

50. Use the table. Of the 129 people who responded to the survey, how many say that lizards or snakes are their favorite pets?

Favorite Pet	
Amphibians	3%
Lizards	48%
Snakes	28%
Turtles	11%
Can't choose	3%
Other	7%

SOURCE: www.tkreptiles.com

F. 26 G. 76 H. 98 I. 100

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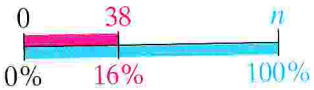
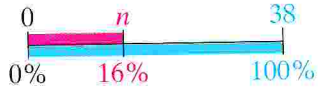
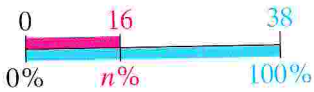
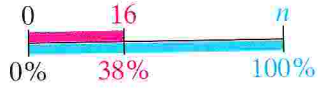
51. Which of the following models can you use to answer the question, "16 is 38% of what number?"

A. 

B. 

C. 

D. 

Short Response

52. You participate in a 50-mi fund-raising walk. You walk 40% of the distance the first day and $\frac{1}{3}$ of the remaining distance on the second day. How many more miles do you have to walk? Explain.

Mixed Review

Lesson 6-4 **Find each answer.**

53. 56% of 144 **54.** 81% of 63 **55.** 43% of 92

56. 3% of 200 **57.** 17% of 360 **58.** 22% of 84

Lesson 3-5 **Write each fraction in simplest form.**

59. $\frac{8}{10}$ **60.** $\frac{4}{12}$ **61.** $\frac{5}{100}$ **62.** $\frac{16}{24}$ **63.** $\frac{18}{54}$

Lesson 2-5 Algebra **Write an equation for each sentence. Then solve.**

64. The product of 3 and a number is equal to -48.

65. Two more than 5 times a number is 37.

66. The sum of 6 times a number and 7 is the same as 91.

Reading Math

Understanding Word Problems

For Use With Exercise 40, Page 315

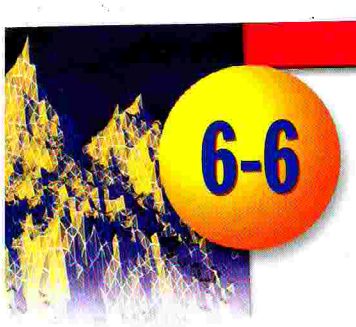
Read through the problem below and then follow along with what Karen thinks as she solves the problem. Check your understanding with the exercise at the bottom of the page.

40. Research At the library, you find 9 books on a certain topic. The librarian tells you that 55% of the books on this topic have been signed out. How many books does the library have on the topic?

What Karen Thinks	What Karen Writes
What information is given? I'll copy and underline the important information.	You find 9 books on a shelf. 55% of the books have been signed out.
What am I trying to find out? I'll write the question.	How many books does the library have on this topic?
If 55% of the books have been signed out, what percent is on the shelf?	$100\% - 55\% = 45\%$
I know that 9 is the part and 45 is the percent. I can write a proportion to find the whole.	$\frac{9}{n} = \frac{45}{100}$
To solve the proportion, I find the cross products.	$45n = 900$
To solve for n, I divide both sides by 45.	$\frac{45n}{45} = \frac{900}{45}$
Is 20 books a reasonable answer? The number of books on the shelf is about half the number of books on the topic. Yes, my answer is reasonable.	$n = 20$
	The library has 20 books on this topic.

EXERCISE

1. There are 144 students in a school one day. Four percent of the students are absent. How many students go to this school?



Algebra

6-6 Solving Percent Problems Using Equations

What You'll Learn

OBJECTIVE 1 To write and solve percent equations

. . . And Why

To find a percent in a survey, as in Example 3

Check Skills You'll Need

For help, go to Lesson 2-4.

Write an equation for each sentence. Then solve the equation.

1. Three times a number is 51.
2. A number divided by 4 is 12.
3. Seventy is 5 times a number.
4. Five is a number divided by 11.
5. One hundred times a number is 33.
6. A number divided by 10 is 6.

HMTEXT Interactive lesson includes instant self-check, tutorials, and activities.

OBJECTIVE 1 Writing and Solving Percent Equations

You can translate percent problems into equations.

1 EXAMPLE Finding the Part

What number is 39% of 377?

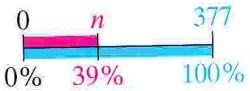
Words A number is 39% of 377.

Let n = the number.

Equation $n = 0.39 \cdot 377$

$n = 0.39 \cdot 377 = 147.03$ ← Simplify.

Need Help?



This model shows that n is 39% of 377.

Check Understanding 1 27% of 60 is what number?

When you know the percent and the part, you can find the whole.

2 EXAMPLE Finding the Whole

Real World

Skiing In New Hampshire, a ski resort is able to open 60% of its runs to skiers. There are 27 runs open. How many runs are there at this resort?

Words 60% of the number of ski runs is 27.

Let x = the number of ski runs at the resort.

Equation $0.60 \cdot x = 27$

$0.60x = 27$

$\frac{0.60x}{0.60} = \frac{27}{0.60}$ ← Divide each side by 0.60.

$x = 45$ ← Simplify.

There are 45 ski runs at the resort.

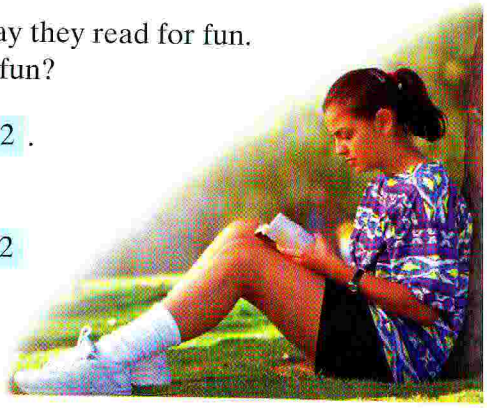
Check Understanding 2 Use an equation to solve: 54% of what number is 81?

When you know the part and the whole, you can find the percent.

3 EXAMPLE Finding the Percent

Real World

Recreation Of 3,072 teens surveyed, 2,212 say they read for fun. What percent of the teens say they read for fun?



Words A percent of 3,072 is 2,212.

Let p = the percent.

Equation $p \cdot 3{,}072 = 2{,}212$

$p \cdot 3{,}072 = 2{,}212$

$3{,}072p = 2{,}212$ ← Simplify.

$\frac{3{,}072p}{3{,}072} = \frac{2{,}212}{3{,}072}$ ← Divide each side by 3,072.

$p = 0.7200520833$ ← Use a calculator.

$p \approx 72\%$ ← Write the decimal as a percent.

Of the teens surveyed, 72% say they read for fun.

Check Understanding 3 Use an equation to solve: What percent of 325 is 65?

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Write and solve an equation to find the part of a whole.

Example 1 (page 318)

1. 18% of 90 is what number?
2. What number is 41% of 800?
3. What number is 5% of 522?
4. 70% of 279 is what number?
5. What number is 90% of 13?
6. 9% of 351 is what number?
7. 36% of 95 is what number?
8. What number is 56% of 48?

9. **Food** A person is on a 1,500-Calorie eating plan of which 24% of the Calories are from protein. How many Calories are from protein?

Write and solve an equation to find the whole.

Example 2 (page 318)

10. 96% of what number is 24?
11. 40% of what number is 30?
12. 50.4 is 36% of what number?
13. 48% of what number is 216?
14. 12% of what number is 72?
15. 12.8 is 32% of what number?
16. 684 is 95% of what number?
17. 72% of what number is 630?

18. Sports The school basketball team won 24 games. This is 60% of the games played. How many games has the team played?

19. Climate Today's high temperature is 45°F. This is 90% of the normal high temperature for this day. What is the normal high temperature?

Example 3 (page 319)

Write and solve an equation to find the percent.

20. What percent of 496 is 124?

21. What percent of 625 is 550?

22. 39 is what percent of 260?

23. 18 is what percent of 48?

24. What percent of 1,120 is 56?

25. What percent of 620 is 372?

26. 140 is what percent of 224?

27. What percent of 400 is 41?

28. Grades You take a 25-question test and answer 22 questions correctly. What percent of the questions do you answer correctly?

B Apply Your Skills

29. Singing Of the 60 students who belong to a chorus, 30% sing alto and 45% sing soprano. What number of students sings alto or soprano?

30. Food You make 72 cookies for a bake sale. This number is 20% of the cookies at the bake sale. How many cookies are at the bake sale?

Real-World Connection
Many schools fund extracurricular activites through bake sales.

Match each question with its answer.

31. What is 36% of 90?

32. What is 48% of 60?

33. What percent of 90 is 36?

34. What percent of 36 is 90?

35. 90% of what number is 36?

36. 48% of what number is 60?

A. 125

B. 40%

C. 40

D. 32.4

E. 28.8

F. 250%

37. Writing in Math Write and solve a problem that involves a percent and a number of students.

38. Education The average daily attendance of one school is about 92% of the school's enrollment. The average daily attendance is 422 students. How many students are enrolled in this school?

Use the table. Find the percent of a 365-day year that are school days in each country.

39. China **40.** Israel **41.** Russia

42. What percent of the number of school days in Scotland is the number of school days in the United States?

Length of School Year

Country	Days
China	251
Israel	215
Russia	210
Scotland	200
United States	180

SOURCE: *The Top 10 of Everything*

43. **a.** Your club has a "name the mascot" contest. Of the 28 votes submitted, Nanook is the winning name with 12 votes. Did more than half of the voting members select the name Nanook?

b. What percent of the votes submitted are for Nanook?

44. **Theater** The attendance at the school play on Friday night was 95% of the attendance on Saturday night. If 300 people attended on Saturday night, how many attended on Friday night?

45. **Gardening** You plant 40 pots with seedlings. Eight of the pots contain tomato plants. What percent of your seedlings are tomato plants?

Write an equation for each question. Then solve the equation.

46. What is 29% of 1,974?

47. What percent of 840 is 546?

48. 606.9 is 85% of what number?

49. What is 77% of 413?

50. What percent of 950 is 399?

51. 24.3 is 18% of what number?

Challenge

52. What number is 80% of $3\frac{1}{8}$?

53. $2\frac{1}{10}$ is what percent of $2\frac{4}{5}$?

54. What percent of $4x$ is x?

55. What percent of $12n$ is $36n$?

56. **Stretch Your Thinking** A substance doubles in volume every minute. At 9:00 A.M., a small amount is placed in a container. At 10:00 A.M., the container is just full. At what time was the container one-quarter full?

Test Prep

Multiple Choice

57. Which expression can be used to find 6% of 92?

A. $6 \cdot 92$ B. $0.6 \cdot 92$ C. $0.06 \cdot 92$ D. $92 \div 0.06$

58. 36 is approximately what percent of 33?

F. 1.09% G. 12% H. 92% I. 109%

59. Which expression can be used to solve: 45 is 30% of what number?

A. $45 \cdot 0.30$ B. $45 \cdot 30$ C. $0.30 \div 45$ D. $45 \div 0.30$

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Web Code aba-0606

Short Response

60. Twenty-nine out of 40 students go on a field trip. What percent of the students do NOT go on the trip? Show your work.

Mixed Review

Lesson 4-8 **Complete.**

61. 6 ft 3 in. = ■ ft

62. 4 lb 2 oz = ■ oz

63. $5\frac{1}{2}$ c = ■ fl oz

Lesson 3-4 **Find all the factors of each number.**

64. 48

65. 75

66. 140

6-7 Applications of Percent

What You'll Learn

OBJECTIVE 1 To find tax and tips

OBJECTIVE 2 To find commissions

. . . And Why

To find cost including sales tax, as in Example 1

Check Skills You'll Need

For help, go to Lesson 6-3.

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

1. 105%
2. 118%
3. 250%
4. 0.5%
5. 0.3%
6. 0.8%

New Vocabulary

- commission

OBJECTIVE 1 Finding Tax and Tips

In many states, you pay a sales tax on items you buy. The sales tax is a percent of the purchase price. A tax percent is also called a tax rate.

$$\text{sales tax} = \text{tax rate} \cdot \text{purchase price}$$

1 EXAMPLE Finding Sales Tax

Real World

Shopping A desk you plan to buy costs \$159.99. In the state where you are shopping, the sales tax rate is 6%. What will you pay for the desk?

$0.06 \cdot 159.99 = 9.60$ ← Find the sales tax. Round to the nearest cent.

$159.99 + 9.60 = 169.59$ ← Add the purchase price to the sales tax.

You will pay \$169.59 for the desk.

Check Understanding 1 **a.** The store has a bigger desk that costs \$182.99. You have only \$200 to spend. Do you have enough money for the bigger desk?

b. Find the payment for a purchase of \$37.50 with a sales tax rate of 4%.

A tip is a percent of a bill that you give to the person providing a service. Often 15% is considered to be a reasonable percent for good service. You can find 15% using estimation and mental math.

Step 1 Round the bill to the nearest dollar.

Step 2 Find 10% of the bill by moving the decimal point one place to the left.

Step 3 Find 5% of the bill by taking one half of the result of Step 2.

Step 4 Add the amounts of Step 2 and Step 3 together to find 15%.

2 EXAMPLE Estimating a Tip Real World

Consumer Your family takes a taxi to the train. The taxi fare is $17.85. Find the amount of a 15% tip for the taxi driver.

$17.85 \approx 18$ ← Round to the nearest dollar.

$0.1 \cdot 18 = 1.8$ ← Find 10% of the bill.

$\frac{1}{2} \cdot 1.8 = 0.9$ ← Find 5% of the bill. 5% is $\frac{1}{2}$ of the 10% amount.

$1.8 + 0.9 = 2.7$ ← Add 10% amount and 5% amount to get 15%.

For a $17.85 taxi fare, a 15% tip is about $2.70.

Check Understanding 2 Estimate a 15% tip for each amount.

a. $58.20 **b.** $61.80 **c.** $49.75 **d.** $29.59

e. Reasoning How could you estimate a 20% tip for exceptional service?

In some real-world situations, you must add both the tax and the tip.

Real-World Connection

Careers Waiters and waitresses use arithmetic skills to total bills without a calculator.

3 EXAMPLE Real-World Problem Solving

Restaurants Suppose you treat a friend to lunch. The total cost of the food items is $9.68. A 7% sales tax will be added and you want to give a tip of 20% for excellent service. How much will you pay for lunch?

Step 1 Find the sales tax.

$0.07 \cdot 9.68 = 0.68$

The sales tax is $.68.

Step 2 Find the tip.

$9.68 \approx 10$ ← Round to the nearest dollar.

$0.2 \cdot 10 = 2$ ← Find 20% of the bill.

The tip is $2.

Step 3 Add the tax and tip to the bill to find the total.

$\text{total} = \text{food bill} + \text{tax} + \text{tip}$

$= 9.68 + 0.68 + 2.00$

$= 12.36$

You will pay $12.36 for lunch.

Check Understanding 3 **a. Reasoning** Find 127% of $9.68. Is your answer the same as the answer to Example 3? Explain.

b. You order a pizza for home delivery. There is a 5% delivery fee, and you want to give the driver a 20% tip. If the pizza costs $12.60, how much should you pay the driver?

OBJECTIVE 2

Finding Commissions

Some sales jobs pay you a percent of the amount you sell. This percent is called a commission. A commission may be paid in addition to a salary.

commission = commission rate · sales

4 EXAMPLE Finding a Commission

Real World

Find the commission on a $500 sale, with a commission rate of 12.5%.

$0.125 \cdot 500$ ← Change 12.5% to 0.125.

62.5 ← Simplify.

The commission is $62.50 for a $500 sale.

Check Understanding 4 Find the commission on a $3,200 sale when the commission rate is 6%.

5 EXAMPLE Real-World Problem Solving

Earnings A salesperson receives a salary of $650 each week, plus a commission of 4% of all sales. In one week, his sales are $1,250. What does the salesperson earn that week?

Words total earnings = salary + commission

Let t = total earnings.

Equation $t = 650 + 0.04 \cdot 1{,}250$

$t = 650 + 0.04 \cdot 1{,}250$ ← Write the equation.

$= 650 + 50$ ← Multiply.

$= 700$ ← Simplify.

The salesperson earns $700.

Check Understanding 5 A salesperson has a weekly salary of $800 and a commission rate of 3.5% of sales. Find the salesperson's earnings for a week when sales are $1,400.

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Example 1 (page 322)

Find each total.

1. $35.99 with a 5% sales tax
2. $72.75 with a 6% sales tax
3. $81 with a 5.5% sales tax
4. $258 with a 5.7% sales tax

5. **Shopping** The price of a coat is $114 before sales tax. The sales tax is 7%. Find the total cost of the coat.

Example 2 (page 323) **Estimate a 15% tip for each amount.**

6. $68.50 **7.** $30.80 **8.** $9.89 **9.** $27.59

10. Grooming You go to a stylist for a haircut. The cost of the haircut is $12.50. Estimate the amount of a 15% tip for the stylist.

Example 3 (page 323) **Find the total payment, given the cost, tax rate, and tip rate.**

11. $35.75, 5% tax, 15% tip **12.** $51.80, 6.7% tax, 20% tip

13. Shopping You buy a book for $12.99 in a store that has a city tax of 0.5% and a state tax of 6.25%. How much will you pay for the book?

Example 4 (page 324) **Find each commission, given the sale and the commission rate.**

14. $800, 12% **15.** $2,500, 8% **16.** $2,000, 7.5% **17.** $600, 4.5%

Example 5 (page 324) **Find total earnings, given the salary, commission rate, and sales.**

18. $2,500 plus 4% on sales of $1,500 **19.** $750 plus 6.5% on sales of $600

20. $800 plus 2.5% on sales of $1,000 **21.** $400 plus 5% on sales of $1,800

B Apply Your Skills

Find the sales tax rate for each purchase.

22. purchase, $25.79; tax, $1.29 **23.** purchase, $312; tax, $9.36

24. Shopping You select four packages of modeling clay and a set of tools for a craft project. If there is a 6% sales tax, how much money will you need to buy these supplies?

25. A real estate agent earns a weekly salary of $200. This week, he sells one home for $120,000 and is paid a commission rate of 5%. Find his total earnings for the week.

26. Sales A company pays commissions of 6% on the first $500 in sales and 8% on sales over $500. What is the commission on an $800 sale?

27. Writing in Math Explain how you can estimate the tax on a sale of $2,500 when the tax rate is 5.9%.

Find the cost of each service, given the percent and the amount of the tip.

28. 15% tip; $11.10 **29.** 20% tip; $19.70 **30.** 15% tip; $20.04

C Challenge

Find the commission rate.

31. Total earnings are $515 including a salary of $200 and sales of $3,000.

32. Total earnings are $970 including a salary of $350 and sales of $12,400.

Test Prep

Reading Comprehension **Read the passage and answer the questions below.**

To Insure Proper Service

You can say that TIPS are given *To Insure Proper Service*. When you read "Gratuity Not Included," you want to give an appropriate tip for the type of service you receive. A good tip for taxi drivers or hairstylists is 15%. Restaurant and laundry workers can expect between 15% and 20%.

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33. What is the cost of a haircut if the tip is $4.50?

34. How much should you offer in order to give the maximum tip for a laundry service of $11.50?

35. What percent is a tip of $6 for a taxi fare of $20? How does this tip compare to the recommended tip for a $20 taxi ride?

Short Response

36. A salesperson earns a salary of $150 plus 8% commission on all sales. How much will he earn if his sales are $2,990? Show your work.

Mixed Review

Lesson 5-2 **Write each unit rate.**

37. 408 mi on 12 gal of gasoline

38. $16.45 for 7 lb of fish

Lesson 2-4 **Algebra** **Solve.**

39. $-13t = 52$

40. $-5x = -30$

41. $-2 = \frac{x}{24}$

42. $\frac{g}{-17} = -51$

Checkpoint Quiz 2 — Lessons 6-5 through 6-7

TEXT Instant self-check quiz online and on CD-ROM

Find each answer using a proportion.

1. 35 is what percent of 60?

2. 14.4 is 90% of what number?

3. What percent of 75 is 63?

4. 56% of what number is 75.6?

Find each answer using an equation.

5. What percent of 120 is 54?

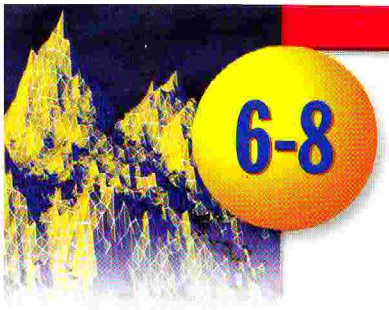
6. What is 72% of 95?

7. What is 120% of 185?

8. 459 is 85% of what number?

9. **Sales** Find the commission for a rate of 5.5% and $1,400 in sales.

10. **Shopping** Find the total for items costing $56.72 with a sales tax of 7%.



6-8 Finding Percent of Change

Algebra

What You'll Learn

- OBJECTIVE 1 To find percent of increase
- OBJECTIVE 2 To find percent of decrease

. . . And Why

To find a percent of discount, as in Example 3

Check Skills You'll Need

For help, go to Lesson 6-5.

Use a proportion to solve.

1. 18 is 36% of what number?
2. 120 is 160% of what number?
3. What percent of 64 is 52?
4. What percent of 105 is 42?
5. 46% of what number is 36.8?
6. 33 is what percent of 55?

New Vocabulary

- **percent of change**
- **markup**
- **discount**

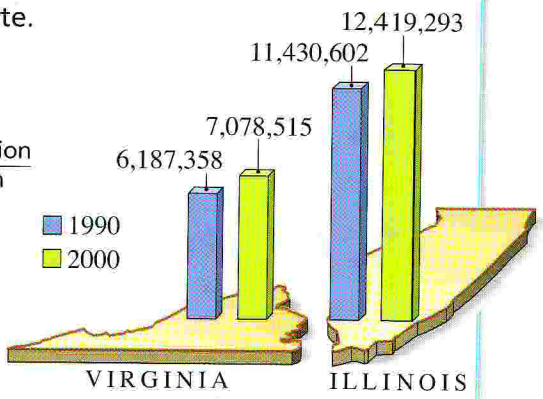
TEXT Interactive lesson includes instant self-check, tutorials, and activities.

OBJECTIVE 1 Finding Percent of Increase

Investigation: Exploring Percent of Change

1. Find the change in population from 1990 to 2000 for each state.
2. Which state had the greater change in population?
3. Write the ratio $\frac{\text{change in population}}{\text{1990 population}}$ for each state. Then write each ratio as a percent.
4. Compare the two percents. Which state had the greater population change in terms of percent?

Populations of Two States



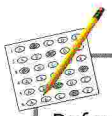
SOURCE: U.S. Census Bureau.
Go to **www.PHSchool.com** for a data update.
Web Code abg-2041

The number of representatives that your state sends to Washington, D.C. depends on the population of your state. Every ten years, the number of representatives may change, based on your state's population. You can find the percent of change for representatives.

The **percent of change** is the percent a quantity increases or decreases from its original amount. To find a percent of change, use these two steps.

Step 1 Subtract to find the amount of change.

Step 2 Use the proportion $\frac{\text{amount of change}}{\text{original amount}} = \frac{\text{percent of change}}{100}$.



Test-Prep Tip

Before you find the percent of change, decide whether the change is an increase or a decrease.

1 EXAMPLE Finding a Percent of Increase

Real World

Government North Carolina had 12 seats in the U.S. House of Representatives in the 1990s. After the 2000 census, North Carolina had 13 seats. Find the percent of increase in the number of representatives.

$$\begin{aligned} 13 - 12 &= 1 && \leftarrow \text{Find the amount of change.} \\ \frac{1}{12} &= \frac{n}{100} && \leftarrow \text{Write a proportion.} \\ 12n &= 1(100) && \leftarrow \text{Find the cross products.} \\ \frac{12n}{12} &= \frac{1(100)}{12} && \leftarrow \text{Divide each side by 12.} \\ n &= 8.\overline{3} && \leftarrow \text{Simplify.} \end{aligned}$$

The number of representatives from North Carolina increased by 8.3%.

Check Understanding 1

a. In 2000, California went from 52 to 53 representatives. Find the percent of increase for California.

b. **Reasoning** The amount of increase is the same for North Carolina and California. The percent of increase is different. Why?

To make a profit, stores charge more for merchandise than they pay for it. The difference between the selling price and the original cost, or the store's cost, of an item is called the **markup.** The percent of increase is the percent of markup.

Markup = selling price − original cost.

To find a percent of markup, you use the proportion below.

$$\frac{\text{amount of markup}}{\text{original cost}} = \frac{\text{percent of markup}}{100}$$

2 EXAMPLE Finding a Percent of Markup

Real World

Shopping An electronics store orders sets of walkie-talkies for $14.85 each. The store sells each set for $19.90. What is the percent of markup?

$$\begin{aligned} 19.90 - 14.85 &= 5.05 && \leftarrow \text{Find the amount of markup.} \\ \frac{5.05}{14.85} &= \frac{n}{100} && \leftarrow \text{Write the proportion.} \\ 14.85n &= 5.05(100) && \leftarrow \text{Find the cross products.} \\ \frac{14.85n}{14.85} &= \frac{5.05(100)}{14.85} && \leftarrow \text{Divide each side by 14.85.} \\ n &\approx 34 && \leftarrow \text{Simplify.} \end{aligned}$$

The percent of markup is 34%.

Check Understanding 2

a. Find the percent of markup for a headset that a store buys for $17.95 and sells for $35.79.

b. Find the percent of markup for a model boat that costs you $14.80 and you sell for $20.

c. **Reasoning** Is it possible to have a markup of 200%? Explain. Include an example.

OBJECTIVE 2

Finding Percent of Decrease

The difference between the original price and the sale price of an item is called a **discount.** The percent of decrease is the percent of discount.

3 EXAMPLE Finding a Percent of Discount

Real World

Music During a clearance sale, a keyboard that normally sells for $49.99 is discounted to $34.99. What is the percent of discount?

$$49.99 - 34.99 = 15.00 \quad \leftarrow \text{Find the amount of discount.}$$

$$\frac{15}{49.99} = \frac{n}{100} \quad \leftarrow \text{Write the proportion.}$$

$$49.99n = 15(100) \quad \leftarrow \text{Find the cross products.}$$

$$\frac{49.99n}{49.99} = \frac{15(100)}{49.99} \quad \leftarrow \text{Divide each side by 49.99.}$$

$$n \approx 30 \quad \leftarrow \text{Simplify.}$$

The percent of discount for the keyboard is 30%.

Check Understanding 3 Find the percent of discount of a $24.95 novel that is discounted to $14.97.

More Than One Way

A jacket goes on sale with a discount of 40% off the original price. The original price of the jacket was $42.95. What is the sale price of the jacket?

Anna's Method

I can find the amount of the discount by multiplying $42.95 by 40%. I then subtract the amount of the discount from the original price.

$$42.95 \cdot 0.40 = 17.18 \quad \leftarrow \text{Find the amount of the discount.}$$

$$42.95 - 17.18 = 25.77 \leftarrow \text{Subtract the discount from the original price.}$$

The jacket costs $25.77 on sale.

Chris's Method

Since 40% is discounted, I will still have to pay 60% of the original price. I multiply the original price of $42.95 by the percent I need to pay.

$$42.95 \cdot 0.60 = 25.77 \leftarrow \text{Find the discounted price.}$$

The jacket costs $25.77 on sale.

Choose a Method

You get a discount of 20% on a $27.50 ticket. How much will your ticket cost? Describe your method, and explain why you chose it.

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Example 1 (page 328)

Find each percent of increase. Round to the nearest tenth of a percent.

1. 60 to 75 **2.** 88 to 99 **3.** 120 to 240 **4.** 15 to 35

5. 2 to 7 **6.** 12 to 63 **7.** 135 to 200 **8.** 12 to 18

9. Business A restaurant worker earning $5.15/h receives a raise. He now earns $6/h. Find the percent of increase in his hourly rate of pay.

10. Groceries If the cost of a dozen eggs rises from $.99 to $1.34, what is the percent of the increase?

Example 2 (page 328)

Find each percent of markup. Round to the nearest tenth of a percent.

11. original cost $22; selling price $33

12. original cost $15; selling price $60

13. original cost $10; selling price $22

14. original cost $13.50; selling price $25

15. original cost $40; selling price $59.75

16. Find the percent of markup for a pillow that a store buys for $3.25 and sells for $7.50.

Example 3 (page 329)

Find each percent of discount. Round to the nearest tenth of a percent.

17. original price $70; sale price $63 **18.** original price $9; sale price $4

19. original price $110; sale price $88 **20.** original price $10; sale price $7

21. original price $480; sale price $300 **22.** original price $29; sale price $25

23. Crafts One package of poster boards usually sells for $8.40. This week, the package is on sale for $6.30. What is the percent of the discount?

B Apply Your Skills

Find each percent of change. Round to the nearest tenth of a percent. State whether the change is an increase or a decrease.

24. 56 to 78 **25.** 6 to 9 **26.** 150 to 147 **27.** 60 to 54

28. 30 to 16 **29.** 27 to 20 **30.** 16 to 54 **31.** 12.5 to 8.4

32. Sports A football player gained 1,200 yd last season and 900 yd this season. Find the percent of change. State whether the change is an increase or a decrease.

33. Entertainment A television is on sale for $449.95. This is $30 off the original price. Find the percent of the discount.

34. Fund-Raising You pay $9.68 for supplies to make three cakes for a bake sale. Each cake sells for $4. What is the percent of the markup?

35. Business A toy store opened five years ago. The owner uses a computer to track yearly income. She uses a program that prints @@@ in some cells instead of numbers. Copy and complete the spreadsheet.

	A	B	C	D
1	Year	Sales ($)	Change From Last Year ($)	Change From Last Year (%)
2	1	200,000	(not open last year)	(not open last year)
3	2	240,000	40,000	@@@
4	3	300,000	@@@	@@@
5	4	330,000	@@@	@@@

A percent of depreciation in value for property is a percent of decrease. Find the percent of depreciation for Exercises 36–38.

36. Consumer You bought a new mountain bike for $525 one year ago. That same bike is now worth $472.50.

37. Clothing One year ago, your coat cost $70. This coat is now worth $59.

38. Music A new stereo costs $425. The one-year-old stereo costs $382.50.

39. a. Data File, p. 289 Find the percent of increase in the number of sides between each step and the following step.

b. Patterns How many sides does the snowflake have at Step 6?

Find the price of each item.

40. originally $36.75; 65% markup

41. originally $82; 35% discount

42. originally $942; 28% discount

43. originally $91; 120% markup

Real-World Connection

Careers Biological scientists develop new vaccines and medical treatments.

44. Salary A biological scientist earning an annual salary of $49,239 gets a 4% raise. What is the new annual salary for this scientist?

45. Occupations According to the U.S. Department of Labor, the fastest growing occupation is computer engineer. In 1998, there were 299,000 jobs in this field. By 2008, there should be 622,000 jobs. Find the percent of increase.

46. a. Business A seasonal store buys 5 doz T-shirts for $4.29 each. The store owner decides to sell the T-shirts for $6.59 each. What is the percent of increase in the price of the T-shirts?

b. After a month, the remaining 2 doz T-shirts go on sale for $4.59 each. What is the percent of decrease in the price of the T-shirts?

47. Writing in Math Describe how you can find the percent of change in the number of students in your school from last year to this year.

Challenge

48. a. Increase \$34.95 by 20%, then decrease the result by 30%.

b. Decrease \$34.95 by 30%, then increase the result by 20%.

c. Reasoning Is your answer to part (a) the same as your answer to part (b)? Why or why not?

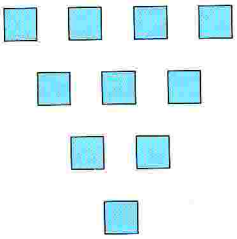
49. The cost of renting a movie increases 10% every year for three years. Find the percent of change at the end of the three-year period.

50. a. Stationery A storeowner buys a case of 144 pens for \$28.80. Tax and shipping costs him an additional \$8.64. He sells the pens for \$.59 each. How much will he collect if he sells all of the pens?

b. What is the amount of the markup per pen?

c. What is the percent of the markup?

51. Stretch Your Thinking Fill in the boxes with the numbers 1 through 10 so the number below any two numbers is the difference between those numbers. The order in which the numbers are subtracted does not have to be the same in each case.



Test Prep

Multiple Choice

52. Which of the following does NOT represent a 20% decrease?

A. 75 to 60 **B.** 2.5 to 2 **C.** 50 to 30 **D.** 150 to 120

53. Which equation can you use to find the percent of increase for a \$25 ticket to the ball game that is now \$32?

F. $\frac{25}{32} = \frac{n}{100}$ **G.** $\frac{32}{25} = \frac{n}{100}$ **H.** $\frac{7}{32} = \frac{n}{100}$ **I.** $\frac{7}{25} = \frac{n}{100}$

54. What is the percent of increase from 40 to 100?

A. 250% **B.** 150% **C.** 60% **D.** 40%

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www.PHSchool.com
Web Code aba-0608

Short Response

55. A \$79 CD player is discounted 30%. **(a)** Explain how to find the discounted price. **(b)** Find the discounted price.

Mixed Review

Lesson 6-7 **Algebra** **Find each payment.**

56. \$218 with a 6.25% sales tax **57.** \$451 with a 4.5% sales tax

Lesson 3-9 **Write each fraction as a decimal.**

58. $\frac{19}{25}$ **59.** $\frac{8}{12}$ **60.** $\frac{3}{18}$ **61.** $\frac{7}{9}$ **62.** $\frac{4}{6}$

Lesson 2-1 **Algebra** **Evaluate for $m = 8$ and $n = -2$.**

63. $6m + 8 + 5n$ **64.** $18 - 3(m + n)$ **65.** $-mn + 2$

6-9 Write an Equation

Problem Solving

What You'll Learn

OBJECTIVE 1 To solve problems by writing equations

. . . And Why

To solve a percent problem, as in Example 1

Check Skills You'll Need

For help, go to Lesson 6-4.

Find each answer.

1. 60% of 32
2. 120% of 250
3. 37% of 74
4. 26.5% of 95
5. 0.05% of 8
6. 345% of 1,226

OBJECTIVE 1

Solving Problems by Writing Equations

TEXT Interactive lesson includes instant self-check, tutorials, and activities.

Finding a discount or markup is not always a one-step process.

1 EXAMPLE Real-World Problem Solving

Clothing A coat was originally \$140, but then it was discounted 60%. At the register, a second discount was given for an unknown percent. The receipt says the final price is \$33.60. What was the second discount?

Reading Math
Discounts that are taken one after another are called "successive discounts."

Read and Understand The coat originally cost \$140 and was discounted by 60%. Given that the final cost of the coat was \$33.60, your goal is to find the second discount.

Plan and Solve First, find the price after the first discount. As a result of the 60% discount, the cost was 40% of the original price.

$$0.40 \cdot \$140 = \$56$$

The cost of the coat after the first discount was \$56. Subtracting \$33.60 from \$56 gives you \$22.40, the amount of the second discount.

Words Percent of second discount of \$56 is \$22.40.

Let d = the second percent of discount.

Equation $d \cdot 56 = 22.40$

$$56d = 22.40$$

$$\frac{56d}{56} = \frac{22.4}{56} \quad \leftarrow \text{Divide each side by 56.}$$

$$d = 0.4 \quad \leftarrow \text{Simplify.}$$

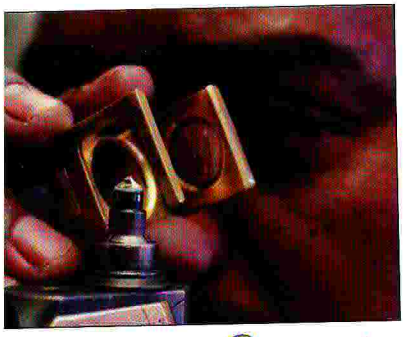
$$= 40\% \quad \leftarrow \text{Change to percent.}$$

The second discount was 40%.

Look Back and Check To check, confirm that the second discount of 40% does give the final price of \$33.60. Forty percent of \$56 is \$22.40 and \$56 − \$22.40 is \$33.60. So the answer checks.

Check Understanding 1 During a 25% off sale, a furniture store sells a couch for \$450. Another store sells the same couch for \$750. Find the percent of discount for the original price of the couch compared to the price of the couch at the second store.

2 EXAMPLE Real-World Problem Solving



Real-World Connection
A diamond cutter uses a lens to get the best view of the diamond.

Jewelry A jewelry store buys a pair of diamond earrings for \$90 and sells the pair for \$315. What is the maximum percent of discount the jewelry store can give and still make \$60 in profit from the earrings?

Read and Understand The store pays \$90 for earrings that are sold at \$315. Your goal is to find the maximum percent of discount the store can give and still make \$60 in profit.

Plan and Solve To make at least \$60, the store will have to sell the earrings for at least \$90 + \$60, or \$150. So the discount will be \$315 − \$150, or \$165.

Words Maximum percent of discount of \$315 is \$165.

Let d = maximum percent of discount.

Equation $d \cdot 315 = 165$

$$315d = 165$$

$$\frac{315d}{315} = \frac{165}{315} \quad \leftarrow \text{Divide each side by 315.}$$

$$d = 0.5238095238 \quad \leftarrow \text{Use a calculator.}$$

$$d \approx 52\% \quad \leftarrow \text{Change decimal to percent.}$$

The maximum percent of discount the store can offer is 52%.

Look Back and Check You can ***try, check, and revise*** different percents. The price of the earrings has to be at least \$150 for the store to earn \$60.

Percent Discount	Percent Paid by Customer	Cost of Earrings	Result
51%	49%	49% · \$315 = \$154.35	✔
52%	48%	48% · \$315 = \$151.20	✔
53%	47%	47% · \$315 = \$148.05	Too low
54%	46%	46% · \$315 = \$144.90	Too low

The answer checks.

Check Understanding 2 **a.** In Example 2, what is the percent of markup on the earrings?
b. What would be the maximum percent of discount the jewelry store could give and still make a \$75 profit on the earrings?

EXERCISES

For more practice, see *Extra Practice*.

A Practice by Example

Solve each problem by writing an equation. Check each answer in the original problem.

Example 1 (page 333)

Need Help?
- Reread the problem.
- Identify the key facts and details.
- Tell the problem in your own words.
- Try a different strategy.
- Check your work.

1. A store has a frequent shopper program. Depending on the number of items purchased in the previous month, you get an additional 10%, 20%, or 30% off. During a 15% off sale, you paid \$37.40 for a \$55 item. Which frequent shopper discount did you receive?

2. A comic book store gives a discount that depends on the number of comics you buy. If you buy from 1 to 5 books, your discount is 5%. If you buy from 6 to 10 books, your discount is 10%. If you buy more than 10 books, your discount is 20%. Your friend pays \$15.29 for comics originally priced at \$16.99. What is the least number of books that your friend bought?

Example 2 (page 334)

3. A candle maker pays \$1.35 for supplies to make each candle. The candle maker normally makes a profit of \$.85 on each one. What is the maximum percent of discount that the candle maker can offer while making a profit of \$.35 on each candle?

4. A bookstore pays \$12.75 for hardcover books and charges \$29.95. What is the maximum percent of discount that it can offer while still making a profit of \$5 on each book?

B Apply Your Skills

Use any strategy to solve each problem. Show your work.

Strategies
- Draw a Diagram
- Look for a Pattern
- Make a Graph
- Make an Organized List
- Make a Table
- Simulate a Problem
- Solve a Simpler Problem
- Try, Check, and Revise
- Use Logical Reasoning
- Work Backward
- Write an Equation

5. **Writing in Math** Your brother finds that the bill for 18 sweatshirts ordered by his club has two digits blurred by water damage. He is sure that the first and last digits are the same. What do you think the total price is? Explain your reasoning.
   \$■69.9■

6. **Patterns** Examine the list at the right and look for a pattern.
   a. Write the sixth row.
   b. What is the last number in the 11th row? In the 23rd row?
   c. What is the sum of the numbers in the 4th row? In the 10th row?
   d. **Reasoning** How can you find the sum of any row when you know the row number?

Row 1	1
Row 2	1 3
Row 3	1 3 5
Row 4	1 3 5 7
Row 5	1 3 5 7 9
Row 6	■

7. **Geometry** The length of a rectangle is twice the width. The perimeter of the rectangle is 42 cm. Find the length and width.

8. Cooking A recipe that makes 2 doz raisin bars calls for $\frac{3}{4}$ c of flour. How much flour will be needed to make five dozen?

Challenge

9. Population Growth The population of a town increases at the rate of 1% each year. Today the town's population is 10,500. What will the population be in five years?

10. Stretch Your Thinking In the number array at the right, in which column will 1,000 appear?

	2 →	3 →	4 →	5
9 ←	8 ←	7 ←	6	
→	10	11	12	13
17	16	15	14	
	18	19	20	21
25	24	23	22	

Test Prep

Multiple Choice

11. Team A wins 70% of the 20 games it plays. Team B plays 15 games and wins 80% of them. What is the greatest number of games won by either team?

A. 16 B. 14 C. 12 D. 10

12. About 12% of an iceberg's mass is above water. If the mass above water is 9,000,000 kg, what is the mass of the entire iceberg?

F. 108,000 kg G. 1,080,000 kg
H. 75,000,000 kg I. 120,000,000 kg

13. The retail price of an item is \$6.99. What is the total cost of the item with 6.5% sales tax?

A. \$6.92 B. \$7.41 C. \$7.44 D. \$7.83

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14. The total cost of an item, including sales tax, is \$26.74. The percent of sales tax is 7%. What is the price of the item before sales tax?

F. \$26 G. \$25 H. \$23 I. \$21

Short Response

15. The retail price of an item is \$13.99, and with sales tax, the total cost is \$15.11. What is the percent of sales tax? Show your work.

Mixed Review

Lesson 6-8

Find each percent of change. Round to the nearest tenth of a percent. State whether the change is an increase or a decrease.

16. 125 to 251 **17.** 22 to 13 **18.** 21 to 63

19. 31 to 35 **20.** 5 to 11 **21.** 159 to 145

Lesson 6-4

Find each answer. Round to the nearest tenth of a percent.

22. 17% of 56 **23.** 22% of 3,000 **24.** 200% of 72

25. 175% of 120 **26.** 20% of 60 **27.** 3% of 47

Test-Taking Strategies

Work Backward

A useful problem-solving strategy for answering multiple-choice questions is to ***work backward.*** Check to see which choice results in a correct answer by substituting the answers into the problem.

EXAMPLE

In a pile of dimes and quarters, there are twice as many dimes as quarters. The total value of the coins is \$9.45. How many quarters are in the pile?

A. 11 **B.** 18 **C.** 21 **D.** 24

Check each answer to see whether it works.

A. 11 quarters = 2.75	22 dimes = 2.20	2.75 + 2.20 = 4.95	✘
B. 18 quarters = 4.50	36 dimes = 3.60	4.50 + 3.60 = 8.10	✘
C. 21 quarters = 5.25	42 dimes = 4.20	5.25 + 4.20 = 9.45	✔

Choice C is the only answer that works.

EXERCISES

Solve each problem by working backward.

1. You have some stamps worth 4¢ and 5¢. The total value of the stamps is \$1. There are 22 stamps in all. How many 5¢ stamps do you have?
   A. 3 **B.** 6 **C.** 9 **D.** 12

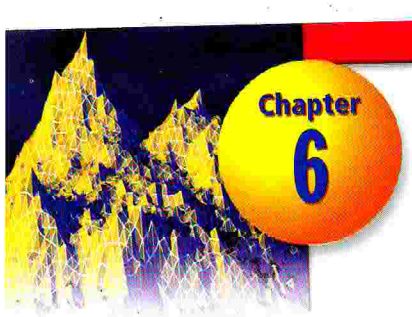
2. If $3x - 14 = 127$, what is the value of x?
   F. 47 **G.** 43 **H.** 41 **I.** 37

3. What is the greatest number of movie tickets you can buy if you have \$33.48 and each movie ticket costs \$6.75?
   A. 3 **B.** 4 **C.** 5 **D.** 6

4. Your grades on four math tests are 97, 88, 79, and 92. What grade do you need on the fifth test to reach an average of 90?
   F. 90 **G.** 92 **H.** 94 **I.** 96

5. If you start with a number, add 5, and then multiply by 7, the result is 133. What is the number?
   A. 12 **B.** 14 **C.** 15 **D.** 21

6. For your birthday, you receive \$48 and a \$15 gift certificate to a department store. The store is having a sale that takes 40% off the price of all items. What is the total value of the merchandise you can buy and still have \$7.50 left for lunch?
   F. \$70.50 **G.** \$88.20 **H.** \$92.50 **I.** \$100



Chapter 6

Chapter Review

Vocabulary

commission (p. 324)
discount (p. 329)
markup (p. 328)
percent (p. 291)
percent of change (p. 327)

Reading Math: Understanding Vocabulary

Choose the vocabulary term from the column on the right that best completes each sentence.

1. The difference between the selling price and the store's cost is the __?__.
2. A __?__ can be either an increase or a decrease.
3. To write a __?__ as a decimal, divide it by 100.
4. The difference between the original price and the sale price is the __?__.
5. A __?__ is a percent of the sales made by a salesperson.

A. commission
B. discount
C. markup
D. percent
E. percent of change

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Online vocabulary quiz at **www.PHSchool.com**
Web Code abj-0651

Skills and Concepts

6-1 and 6-2 Objectives

- To model percents
- To write percents using equal ratios
- To connect percents and decimals
- To connect percents and fractions

A **percent** is a ratio that compares a number to 100.

To write a decimal as a percent, multiply the decimal by 100, or move the decimal point two places to the right. To write a percent as a decimal, divide by 100, or move the decimal point two places to the left.

To write a fraction as a percent, convert the fraction into a decimal first. To write a percent as a fraction, write the percent with a denominator of 100 and simplify.

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

6. 65%
7. 2%
8. 1.8%
9. $62\frac{1}{2}\%$

Write each number as a percent.

10. $\frac{3}{8}$
11. 0.16
12. 0.03
13. $\frac{17}{40}$

6-3 and 6-4 Objectives

- To use percents greater than 100% or less than 1%
- To use a percent to find part of a whole
- To use mental math and estimation with percents

A mixed number represents a percent greater than 100%.

To find a percent of a whole, write the percent as a decimal or a fraction and then multiply.

Write each number as a percent.

14. 1.43
15. $\frac{7}{500}$
16. $2\frac{3}{4}$
17. 0.008

Find each answer.

18. Find 82% of 54. **19.** What is 41% of 16? **20.** Find 135% of 72.

6-5 and 6-6 Objectives

- To find the percent using proportions
- To find the whole using proportions
- To write and solve percent equations

Percent problems are solved by using a proportion or an equation.

Use a proportion or an equation to solve.

21. What percent of 40 is 28?

22. 38 is 80% of what number?

23. What is 60% of 420?

24. 80% of 15 is what number?

25.

26.

27. Technology The price of a new version of a computer game is 120% of the price of the original version. The original version cost $48. What is the cost of the new version?

6-7 Objectives

- To find tax and tips
- To find commissions

A tip is a percent of a bill that you give to the person providing a service. A **commission** is a percent of a sale.

28. Restaurants You go to dinner at a restaurant with four other people. The total for the food you ordered is $43.85. There is a 5% food tax. You want to give a 15% tip. You decide to share the bill equally. Estimate how much you will pay.

29. Find the commission on a $6,700 sale when commission is paid at 4%.

30. Insurance An insurance company pays its agents 40% commission on the first-year's premium and 5% on the second-year's premium for life insurance policies. If the premiums are $500 per year, what is the total commission that will be paid during the two years?

6-8 and 6-9 Objectives

- To find percent of increase
- To find percent of decrease
- To solve problems by writing equations

A **percent of change** is the percent a quantity increases or decreases from its original amount. Use the proportion $\frac{\text{amount of change}}{\text{original amount}} = \frac{\text{percent of change}}{100}$.

Markup is an example of a percent of increase. **Discount** is an example of a percent of decrease.

Find each percent of change. Round to the nearest percent. State whether the change is an increase or a decrease.

31. $90 to $75

32. 3.5 ft to 4.2 ft

33. 120 lb to 138 lb

34. Shopping The sale price of a game is $24.95. Its original price was $36. Find the percent of change. Round to the nearest percent.

35. Writing in Math When you find a percent of change, how do you know whether the percent of change is an increase or a decrease?

Chapter 6

Chapter Test

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1. Write each decimal as a percent and write each percent as a decimal.
   a. 5% **b.** 0.3 **c.** 125%
   d. 0.0045 **e.** 0.39% **f.** 3.4

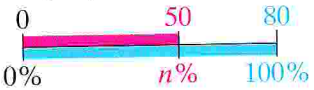
2. Write each fraction as a percent and each percent as a fraction.
   a. 35% **b.** $\frac{3}{4}$ **c.** 2%
   d. $\frac{7}{8}$ **e.** 125% **f.** $\frac{6}{5}$

3. According to the census, 0.98% of females in the United States in 1990 were named Barbara. Express this percent as a fraction.

4. Model each percent on 10×10 grids.
   a. 34% **b.** 285% **c.** $12\frac{1}{2}\%$

5. During the summer, you work 20 h per week at a grocery. Sixty percent of your job is restocking the shelves. How many hours per week do you spend restocking the shelves?

6. Use a proportion to find the answer to "25% of what number is 30?"

7. Use a proportion to solve.
   a.
   

   b.
   

   c. What is 225% of 15?
   d. 6 is 0.15% of what number?

8. Write an equation for each question. Then solve the equation.
   a. What percent of 82 is 10.25?
   b. 108% of 47 is what number?
   c. 99 is 72% of what number?
   d. 12 is what percent of 1,920?
   e. What is 62% of 128?
   f. 168% of what number is 714?

9. There are 6 sets of twins among 250 students. What percent of the students have a twin?

10. **Shopping** You buy a sweater for $18.75, which is 25% off the original price. What was the original price?

11. Your swimming coach requires you to swim 8 lengths. You swim 10 lengths. What percent of the required practice did you swim?

Find each percent of change. Round to the nearest tenth of a percent. State whether the change is an increase or a decrease.

12. 4.15 to 4.55 **13.** 379 to 302 **14.** 72 to 102

15. **Jobs** According to the U.S. Department of Labor, total employment is expected to increase from 146 million in 2000 to 168 million in 2010. Find the percent of increase.

16. **Recreation** A summer camp has 15 cabins that sleep 8 campers each and 5 cabins that sleep 6 campers each. Due to renovations within the camp, two of the smaller cabins will not be used this summer. Find the percent of decrease in the number of campers who can attend the camp this summer.

17. **a. Restaurants** You order items from a menu that total $7.85. Your bill comes to $8.30, including the tax. What is the percent of the tax? Round to the nearest tenth.
    b. Estimate a 15% tip for this order before the tax.

18. A salesperson receives a salary of $300 per week and a 6% commission on all sales. How much does this salesperson earn in a week with $2,540 in sales?

19. A bicycle helmet costs a store $29.62. The store sells the helmet for $39.99. Find the percent of markup.

20. **Writing in Math** Explain how to determine whether you are finding a percent of increase or a percent of decrease between two values.

Test Prep

CUMULATIVE REVIEW
CHAPTERS 1–6

Multiple Choice

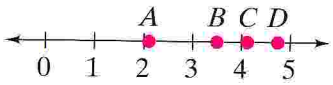
1. Which number is closest to 35% of 1,291?
   A. 400 **B.** 450 **C.** 500 **D.** 550

2. Which equation is NOT equivalent to $2x - 3 = 5$?
   F. $2x = 8$ **G.** $4x - 3 = 10$
   H. $2x - 4 = 4$ **I.** $x - 1.5 = 2.5$

3. Which expression equals $3 \times 3 \times 3 \times 3$?
   A. 3^4 **B.** 4^3 **C.** 4×3 **D.** 3^3

4. In which set of numbers is 9 a factor of all the numbers?
   F. 36, 18, 21 **G.** 108, 252, 45
   H. 98, 81, 450 **I.** 120, 180, 267

5. Which point on the number line shows the product $\left(1\frac{7}{8}\right)\left(2\frac{1}{5}\right)$?



6. Which fraction is closest in value to 0.46?
   F. $\frac{19}{50}$ **G.** $\frac{22}{50}$ **H.** $\frac{25}{50}$ **I.** $\frac{28}{50}$

7. You buy a sandwich for \$3.45, a salad for \$2.25, and a drink for \$.89. How much change do you receive from a \$10 bill?
   A. \$16.59 **B.** \$4.30 **C.** \$3.41 **D.** \$2.59

8. Which statement is NOT true?
   F. $\frac{12}{16} = \frac{9}{12}$ **G.** $\frac{12 + 16}{16} = \frac{9 + 12}{12}$
   H. $\frac{12}{9} = \frac{16}{12}$ **I.** $\frac{12 + 1}{16} = \frac{9 + 1}{12}$

9. What is $\frac{5}{8}$ written as a percent?
   A. 625% **B.** 160% **C.** $62\frac{1}{2}\%$ **D.** 16%

10. Write the numbers 0.361×10^7, 4.22×10^7, and 13.5×10^6 in order from least to greatest.
    F. 13.5×10^6, 0.361×10^7, 4.22×10^7
    G. 4.22×10^7, 13.5×10^6, 0.361×10^7
    H. 0.361×10^7, 13.5×10^6, 4.22×10^7
    I. 13.5×10^6, 4.22×10^7, 0.361×10^7

11. Find the value of $\frac{2m}{m + 2n}$ when $m = -4$ and $n = 3$.
    A. -8 **B.** -4 **C.** 0 **D.** 4

12. Which is the best estimate of $92.56 \cdot 37.1$?
    F. 2,700 **G.** 3,600 **H.** 4,000 **I.** 4,500

13. Which expression has the greatest value?
    A. $32 - (-12)$ **B.** $32 - |-12|$
    C. $-32 - (-12)$ **D.** $|-32 - (-12)|$

14. The mean of six numbers is 9. Five of the numbers are 4, 7, 9, 10, and 11. What is the sixth number?
    F. 6 **G.** 9 **H.** 12 **I.** 13

Gridded Response

15. A map's scale is 1 in. : 15 mi. Two towns are 3.5 in. apart on the map. How many miles apart are the two towns?

16. A video store charges \$.75 per day for overdue videos. Your friend has a video that was due on Sunday. She returns it on the following Friday. How much does she owe?

Short Response

17. Eighteen students in a class of 25 students plan to go on a hiking trip. What percent of the students plan to go on the trip? Show your work.

18. A blue shark swims about 2.26 mi in 10 min. What is the speed of the shark in **(a)** miles per minute **(b)** miles per hour?

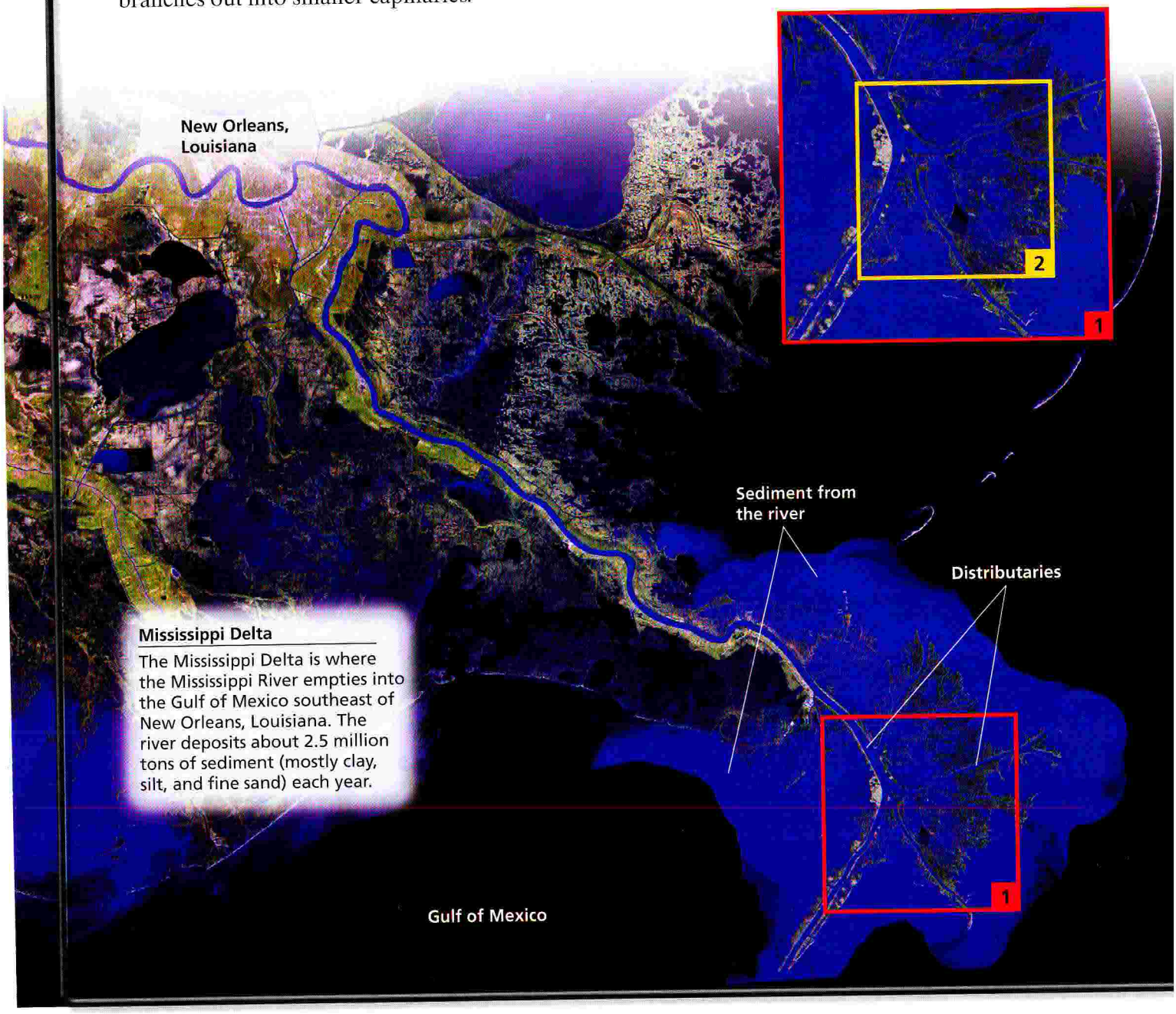
Extended Response

19. A movie theater charges \$6 for admission and \$4.50 for a bucket of popcorn. Write an expression for the total cost for a group of friends to see a movie and split one bucket of popcorn. Then evaluate your expression for five friends.

Fractal Facts

Applying Percents A fractal is a design that repeats itself at smaller and smaller levels. Fractals give us beautiful, intricate pictures of things like ferns and rivers. They also provide a practical way to increase surface area. For example, the circulatory system branches from arteries into smaller and smaller blood vessels called capillaries. Because there are so many of them, capillaries have a much greater surface area than arteries and can absorb nutrients more effectively.

The activity models how the length of a "blood vessel" increases as it branches out into smaller capillaries.

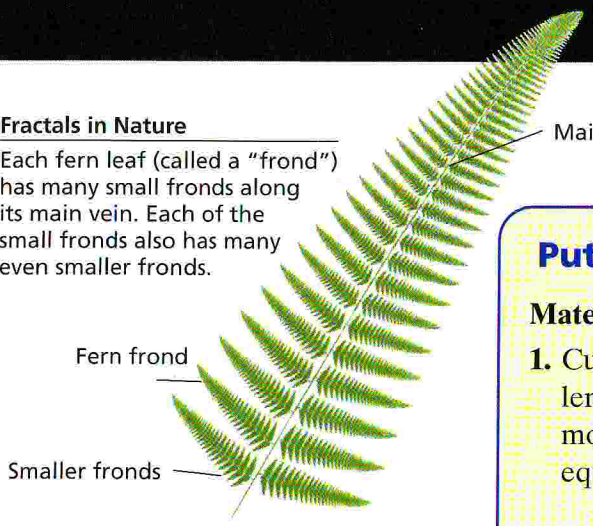


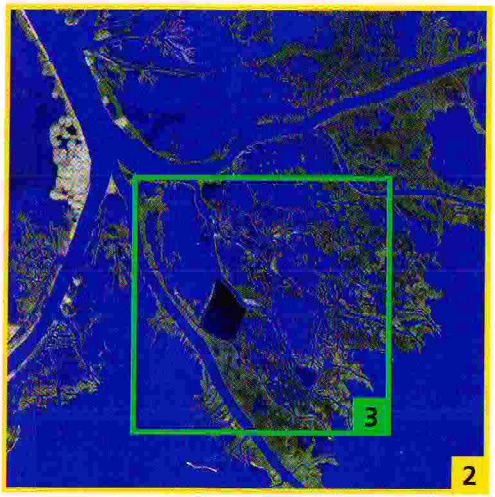
Mississippi Delta

The Mississippi Delta is where the Mississippi River empties into the Gulf of Mexico southeast of New Orleans, Louisiana. The river deposits about 2.5 million tons of sediment (mostly clay, silt, and fine sand) each year.

Fractals in Nature

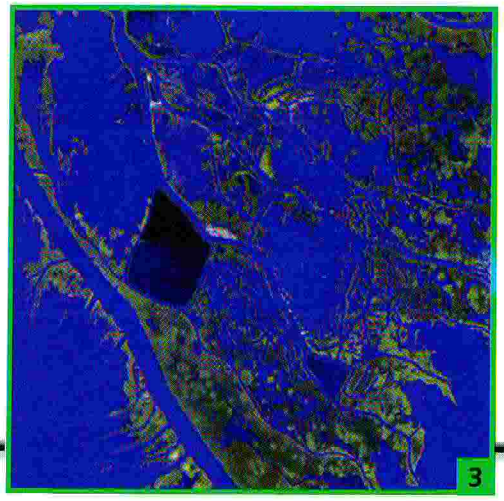
Each fern leaf (called a "frond") has many small fronds along its main vein. Each of the small fronds also has many even smaller fronds.





Fractal Structure

At the delta, the Mississippi River splits into distributaries, or branches. Many of the distributaries split into smaller branches. The smallest branches of the river look the same as the larger ones.



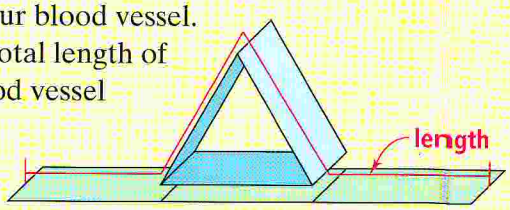
Put It All Together

Materials ruler, scissors, tape

1. Cut four thin strips of paper of equal length. Choose a length that is easy to divide into thirds. Use one strip to model a simple blood vessel. Mark it to show three equal segments.

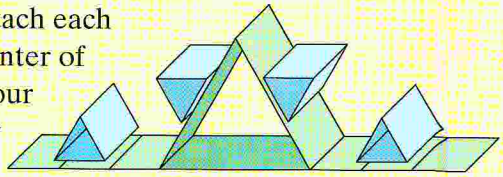
a. How long is your blood vessel?

b. Fold an unmarked strip into thirds and tape it to form a triangle. Attach this triangle to the center segment of your blood vessel. Measure the total length of the paper blood vessel after you add the triangle. How much did the length increase?



c. Use your answers to parts (a) and (b). Find the percent of increase.

2. Use the last two strips to make four new triangles with sides that are $\frac{1}{9}$ the length of the marked strip. Attach each triangle to the center of each of the the four segments of your blood vessel.



a. How long is the blood vessel after you add the four smaller triangles? How much did the length increase?

b. What is the percent increase?

3. Patterns Describe the pattern as a percent increase from one step to the next. Predict the total length if you repeat the pattern one more time.

4. Find the percent increase in length of the blood vessel from the first step to the last step.

Take It to the NET For more information about fractals, go to **www.PHSchool.com**.
Web Code: abe-0653

CHAPTER 7

Geometry

Lessons

Key Vocabulary

- acute angle (p. 352)
- adjacent angles (p. 353)
- angle bisector (p. 358)
- central angle (p. 383)
- chord (p. 383)
- equilateral triangle (p. 363)
- isosceles triangle (p. 363)
- obtuse angle (p. 352)
- perpendicular bisector (p. 357)
- polygon (p. 369)
- regular polygon (p. 370)
- right angle (p. 352)
- scalene triangle (p. 363)
- skew lines (p. 348)
- straight angle (p. 352)
- vertical angles (p. 353)