CHAPTER 6

Percents

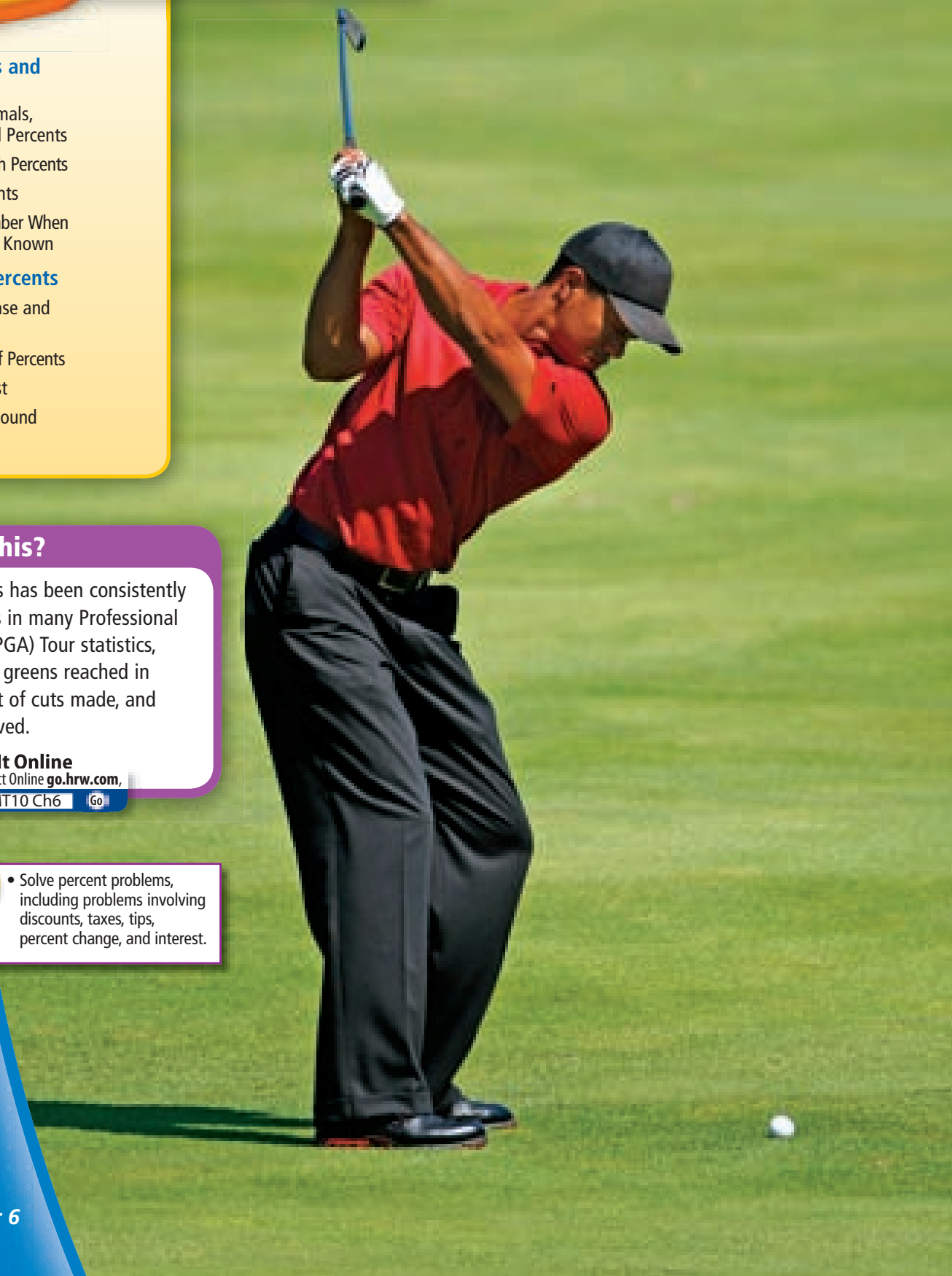
Why Learn This?

Golfer Tiger Woods has been consistently among the leaders in many Professional Golf Association (PGA) Tour statistics, such as percent of greens reached in regulation, percent of cuts made, and percent of pars saved.

Learn It Online
Chapter Project Online **go.hrw.com**, keyword MT10 Ch6 Go

Chapter Project

- Solve percent problems, including problems involving discounts, taxes, tips, percent change, and interest.



Are You Ready?

Learn It Online
Resources Online go.hrw.com,
keyword MT10 AYR6 Go

Vocabulary

Choose the best term from the list to complete each sentence.

1. A(n) __?__ is a comparison of two quantities by division.
2. Ratios that make the same comparison are __?__.
3. Two ratios that are equivalent are in __?__.
4. To solve a proportion, you can __?__.

cross multiply
equivalent ratios
proportion
ratio

Complete these exercises to review skills you will need for this chapter.

Write Fractions as Decimals

Write each fraction as a decimal.

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

Write Decimals as Fractions

Write each decimal as a fraction in simplest form.

9. 0.7
10. 0.6
11. 0.25
12. 0.375
13. 0.2
14. 0.9
15. 0.86
16. 0.99

Solve Proportions

Solve each proportion.

17. $\frac{x}{3} = \frac{9}{27}$
18. $\frac{7}{8} = \frac{h}{4}$
19. $\frac{9}{n} = \frac{2}{3}$
20. $\frac{3}{8} = \frac{12}{t}$
21. $\frac{4}{5} = \frac{28}{z}$
22. $\frac{100}{p} = \frac{90}{45}$

Multiply with Fractions and Decimals

Multiply.

23. $\frac{12}{13} \times 8$
24. 18×0.45
25. $20 \times \frac{9}{10}$
26. 2.75×11
27. $\frac{1}{5} \times 12$
28. 6×0.08
29. $13 \times \frac{25}{26}$
30. 15.32×9
31. $\frac{2}{9} \times 78$

CHAPTER 6

Study Guide: Preview

Where You've Been

Previously, you

- compared and ordered integers and positive rational numbers.
- found solutions to application problems involving proportional relationships.

In This Chapter

You will study

- comparing and ordering rational numbers, including integers, percents, and positive and negative fractions and decimals.
- estimating and solving application problems involving percents.

Where You're Going

You can use the skills learned in this chapter

- to estimate tips.
- to find sales tax.
- to calculate discounts or markups.
- to find the amount of interest earned over a given time.

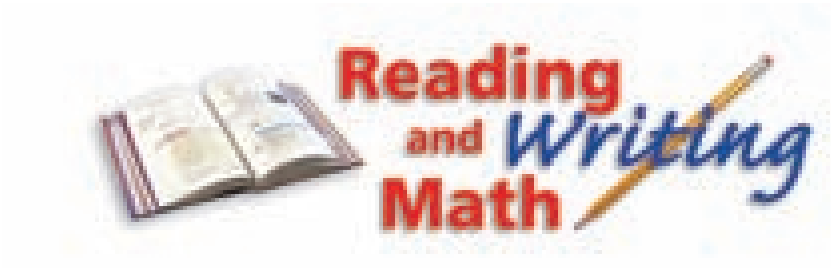
Key Vocabulary/Vocabulario

commission	comisión
compatible numbers	números compatibles
estimate	estimación
interest	interés
percent	porcentaje
percent decrease	porcentaje de disminución
percent increase	porcentaje de incremento
principal	capital
simple interest	interés simple

Vocabulary Connections

To become familiar with some of the vocabulary terms in the chapter, consider the following. You may refer to the chapter, the glossary, or a dictionary if you like.

1. The word *principal* means "first." What do you suppose **principal** means when referring to interest?
2. The word **commission** has the Latin prefix *com-,* which means "with," and the Latin root *mis,* which means "send." What do you think these Latin parts mean together when referring to money?
3. The word *percent* contains the root word *cent,* which means "one hundred." What do you think a **percent** is?



CHAPTER 6

Reading Strategy: Read Problems for Understanding

When solving a word problem, first read the problem to identify exactly what the problems asks you to do. Then read the problem again, slowly and carefully, to break the problem into parts. Highlight or underline the key information. Then make a plan to solve the problem.

From Lesson 5-5

13. **Art** Helen is copying a printed reproduction of the *Mona Lisa.* The print is 24 in. wide and 36 in. tall. If Helen's canvas is 12 in. wide, how tall should her canvas be?

Slowly read the exercise again.

Step 1	**Identify exactly what the problem asks you to do.**	• Find the height of the canvas Helen should use.
Step 2	**Break the problem into parts. Highlight or underline the key information.**	• The print is **24 in. wide** and **36 in. tall.** • The canvas is **12 in. wide** • The **height** of the canvas is **unknown.** • The print and the copy are **similar rectangles.**
Step 3	**Make a plan to solve the problem.**	• Set up a proportion using the corresponding sides of the similar rectangles. • Find the cross products, and solve for x. • Check the answer by making sure the cross products are equal.

Try This

For the problem below,

a. identify exactly what the problem asks you to do.
b. break the problem into parts. Highlight or underline the key information.
c. Make a plan to solve the problem.

1. A helicopter transporting a patient to a hospital travels 20 miles in 15 minutes. At this rate of speed, how long will it take the helicopter to reach the hospital, which is 50 miles away?

6-1 Relating Decimals, Fractions, and Percents

Learn to compare and order decimals, fractions, and percents.

In an average day, a typical newborn baby sleeps 16 out of 24 hours. The part of a day the baby sleeps can be shown in several ways.

$$\frac{16}{24} = 0.66\overline{6} = 66.\overline{6}\%$$

So newborns sleep over 60% of the time.

Vocabulary

percent

Percents are ratios that compare a number to 100.

Reading Math

Think of the % symbol as meaning per 100 or /100.
75% = 75/100 = 0.75

Ratio	Decimal	Percent
$\frac{3}{10} = \frac{30}{100}$	0.30	30%
$\frac{1}{2} = \frac{50}{100}$	0.50	50%
$\frac{3}{4} = \frac{75}{100}$	0.75	75%

Interactivities Online ▶

To convert a fraction to a decimal, divide the numerator by the denominator.

$$\frac{1}{8} = 1 \div 8 = 0.125$$

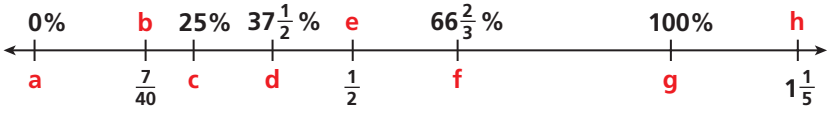
$$\begin{array}{r} 0.125 \\ 8\overline{)1.000} \\ \underline{8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

To convert a decimal to a percent, multiply by 100 and insert the percent symbol.

$$0.125 \cdot 100 \rightarrow 12.5\%$$

EXAMPLE 1 Finding Equivalent Ratios and Percents

Find the missing ratio or percent equivalent for each letter on the number line.



a: $0\% = \frac{0}{100} = 0$

b: $\frac{7}{40} = 0.175 = 17.5\% = 17\frac{1}{2}\%$

c: $25\% = \frac{25}{100} = \frac{5}{20} = \frac{1}{4}$

d: $37\frac{1}{2}\% = 0.375 = \frac{375}{1000} = \frac{3}{8}$

e: $\frac{1}{2} = 0.5 = 50\%$

f: $66\frac{2}{3}\% = 0.66\overline{6} = \frac{2}{3}$

g: $100\% = \frac{100}{100} = 1$

h: $1\frac{1}{5} = 1.2 = 120\%$

To compare and order fractions, decimals, and percents, write them in the same form first.

EXAMPLE 2 Comparing Fractions, Decimals, and Percents

Compare. Write <, >, or =.

A $\frac{1}{2}$ ▢ 37%

$\frac{1}{2} = 0.50 = 50\%$ *Write as a percent.*

$50\% > 37\%$ *Compare.*

$\frac{1}{2} > 37\%$

B 0.125 ▢ 19%

$0.125 = 12.5\%$ *Write as a percent.*

$12.5\% < 19\%$ *Compare.*

$0.125 < 19\%$

Remember!

You can use a number line to compare rational numbers.

EXAMPLE 3 Ordering Fractions, Decimals, and Percents

Write 0.25%, $\frac{13}{5}$, 0.57, and 300% in order from least to greatest.

$\frac{13}{5} = 2.6 = 260\%$ *Write as percents.*

$0.57 = 57\%$

$0.25\% < 57\% < 260\% < 300\%$ *Compare.*

$0.25\%, 0.57, \frac{13}{5}, 300\%$

EXAMPLE 4 *Physical Science Application*

The United States nickel was once made of 100% nickel. Today nickels are 3 parts copper and 1 part nickel. What percent of today's nickel is pure nickel?

$\frac{\text{parts pure nickel}}{\text{total parts}} \rightarrow \frac{1}{4}$ *Set up a ratio and simplify.*

$\frac{1}{4} = 1 \div 4 = 0.25 = 25\%$ *Find the percent.*

So today's nickel is 25% pure nickel.

Think and Discuss

1. **Give an example** of a real-world situation in which you would use (1) decimals, (2) fractions, and (3) percents.
2. **Show** 25 cents as a part of a dollar in terms of (1) a reduced fraction, (2) a percent, and (3) a decimal. Which is most common?
3. **Explain** how you can find a fraction, decimal, or percent when you have only one form of a number.

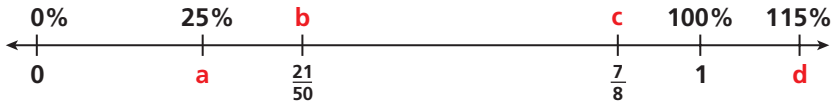
6-1 Exercises

Learn It Online
Homework Help Online go.hrw.com, keyword MT10 6-1 Go
Exercises 1–22, 23, 25

GUIDED PRACTICE

See Example 1

Find the missing ratio or percent equivalent for each letter on the number line.



1. a **2.** b **3.** c **4.** d

See Example 2

Compare. Write <, >, or =.

5. $\frac{3}{4}$ ▢ 70% **6.** 42% ▢ $\frac{2}{5}$ **7.** 87.5% ▢ 0.875 **8.** 0.99 ▢ 100%

See Example 3

Order the numbers from least to greatest.

9. 36%, 0.3, $33\frac{1}{3}$%, $\frac{3}{8}$ **10.** $\frac{4}{5}$, −0.5, 500%, $66\frac{2}{3}$%

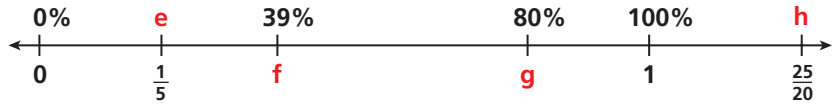
See Example 4

11. A molecule of water is made up of 2 atoms of hydrogen and 1 atom of oxygen. What percent of the atoms of a water molecule is oxygen?

INDEPENDENT PRACTICE

See Example 1

Find the missing ratio or percent equivalent for each letter on the number line.



12. e **13.** f **14.** g **15.** h

See Example 2

Compare. Write <, >, or =.

16. $\frac{2}{3}$ ▢ 66% **17.** 37% ▢ $\frac{3}{8}$ **18.** 6% ▢ 0.6 **19.** 0.09 ▢ 9%

See Example 3

Order the numbers from least to greatest.

20. −6%, 0.6, $66\frac{1}{3}$%, $\frac{3}{6}$ **21.** $\frac{2}{5}$, 0.04, 42%, 70%

See Example 4

22. Sterling silver is an alloy combining 925 parts pure silver and 75 parts of another metal, such as copper. What percent of sterling silver is not pure silver?

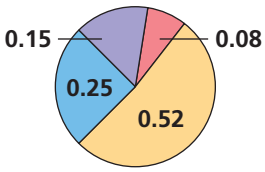
PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP12.

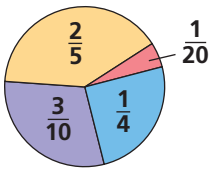
Write the labels from each circle graph as percents.

23.

24.



25.

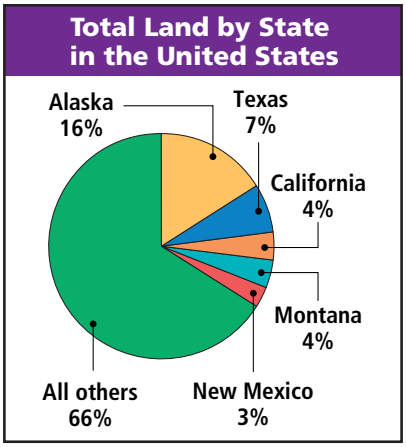


26. Patterns Find the next three numbers in this pattern. Then describe the pattern.

$\frac{1}{8}$, 25%, 0.375, $\frac{1}{2}$, 62.5%, 0.75

27. Critical Thinking Describe a situation when changing a fraction to a percent would be helpful.

28. Geography The graph shows the percents of the total U.S. land area taken up by the five largest states. The sixth section of the graph represents the area of the remaining 45 states.



a. Alaska is the largest state in total land area. Write Alaska's portion of the total U.S. land area as a fraction and as a decimal.

b. What percent of the total U.S. land area is taken up by Alaska and Texas? How might you describe this percent?

29. What's the Error? An analysis showed that 0.06% of the T-shirts made by one company were defective. A student says this is 6 out of every 100. What is the student's error?

30. Write About It Explain the steps you would take to order $\frac{1}{3}$, 0.33, and 30% from least to greatest.

31. Challenge Wyatt and Allyson were asked to solve a percent problem using the numbers 13 and 38. Wyatt found 13% of 38, and Allyson found 38% of 13. Explain why they both got the same answer. Would this work for other numbers as well? Why or why not?

Test Prep and Spiral Review

32. Multiple Choice Of the 32 students in Mr. Smith's class, 12 have jobs during the summer. What percent of the students have a summer job?

Ⓐ 12% Ⓑ 20% Ⓒ 37.5% Ⓓ 62.5%

33. Multiple Choice Claudia has 40 CDs. Of these, 14 are country music CDs. What percent of Claudia's CD collection is country music?

Ⓕ 40% Ⓖ 35% Ⓗ 14% Ⓙ 12%

Compare. Write <, >, or =. (Lesson 2-2)

34. $\frac{4}{9} \square \frac{21}{25}$ **35.** $\frac{3}{7} \square \frac{8}{9}$ **36.** $-\frac{1}{3} \square -\frac{2}{5}$ **37.** $-\frac{8}{14} \square -\frac{4}{7}$

Determine whether each ordered pair is a solution of $5x - 2y = 10$ (Lesson 3-1)

38. (–1.6, –9) **39.** $\left(\frac{13}{5}, \frac{3}{2}\right)$ **40.** (2.5, 3)

6-2 Estimating with Percents

© Cartoon Stock

Learn to estimate percents.

Vocabulary

estimate

compatible numbers

benchmark

Waiters, waitresses, and other restaurant employees depend upon tips for much of their income. Typically, a tip is 15% to 20% of the bill. Tips do not have to be calculated exactly, so estimation is often used. When the sales tax is about 8%, doubling the tax gives a good estimate for a tip.

An **estimate** is a useful answer that is close to the exact answer. Estimates involving percents and fractions can be found by using **compatible numbers**, numbers that go well together because they have common factors.

$\frac{13}{24}$ *13 and 24 are not compatible numbers.*

$\frac{12}{24}$ *12 and 24 are compatible numbers because 12 is a common factor of 12 and 24*

$\frac{12}{24} = \frac{1}{2}$ *Simplify.*

$\frac{13}{24} \approx \frac{1}{2}$ *$\frac{13}{24}$ is nearly equivalent to $\frac{12}{24}$*

Remember!

For a review of estimation by using compatible numbers, see Skills Bank page SB5.

When estimating with percents, it helps to know some *benchmarks*. **Benchmarks** are common numbers that serve as points of reference. Some common benchmarks for percents are shown in the table.

Percent	Decimal	Fraction	Percent	Decimal	Fraction
5%	0.05	$\frac{1}{20}$	50%	0.5	$\frac{1}{2}$
10%	0.1	$\frac{1}{10}$	$66.\overline{6}\%$	$0.\overline{6}$	$\frac{2}{3}$
25%	0.25	$\frac{1}{4}$	75%	0.75	$\frac{3}{4}$
$33.\overline{3}\%$	$0.\overline{3}$	$\frac{1}{3}$	100%	1	1

EXAMPLE 1 Estimating with Percents

Estimate.

A 24% of 44

$24\% \approx 25\%$ *Use a benchmark close to 24%.*

$\approx \frac{1}{4}$ *Write 25% as a fraction.*

$\frac{1}{4} \cdot 44 = 11$ *Use mental math: 44 ÷ 4.*

24% of 44 is about 11.

Estimate.

B **36% of 20**

$36\% \approx 35\%$ *Round.*

$\approx 25\% + 10\%$ *Break the percent into two benchmarks.*

$35\% \cdot 20 = (25\% + 10\%) \cdot 20$ *Set up an equation.*

$= 25\% \cdot 20 + 10\% \cdot 20$ *Use Distributive Property.*

$= 5 + 2$ *25% of 20 is 5, and 10% of 20 is 2.*

36% of 20 is about 7.

EXAMPLE 2 PROBLEM SOLVING APPLICATION

PROBLEM SOLVING

Angelica ate lunch with a group of friends. The restaurant would not issue separate checks, so each friend had to calculate what she owed. Angelica's entrée, drink, and dessert cost a total of $9.75. If the sales tax rate is 8.25% and Angelica wants to leave a 15% tip, about how much should she pay?

1 Understand the Problem

The **answer** is the total amount Angelica should pay for her lunch.

List the important information:

- Angelica's food and drink cost a total of $9.75.
- The sales tax rate is 8.25%.
- Angelica wants to leave a 15% tip.

2 Make a Plan

Think: Sales tax and tip together are 23.25% of Angelica's food and drink total (8.25% + 15% = 23.25%). The numbers $9.75 and 23.25% are difficult to work with. Use compatible numbers: $9.75 is close to $10.00; 23.25% is close to 25%.

3 Solve

$\$10.00 \cdot 25\% = \$10.00 \cdot 0.25$

$= \$2.50$

$\$9.75 + \$2.50 = \$12.25$

Angelica should pay $12.25.

4 Look Back

To determine whether $12.25 is a reasonable estimate of what Angelica should pay, use a calculator to find the tax and the tip for $9.75.

$\$9.75 \cdot 1.2325 = \$12.02$, so $12.25 is a reasonable estimate.

EXAMPLE 3 *Manufacturing Application*

A company has found that on average 9% of the radios it manufactures are defective. Out of a production run of 1523 radios, the plant manager assumes that 137 are defective. Estimate to see if the plant manager's number is reasonable. Explain.

$9\% \cdot 1523 \approx 10\% \cdot 1500$ *Use compatible numbers.*

$\approx 0.1 \cdot 1500$ *Write 10% as a decimal.*

≈ 150 *Multiply.*

Because 150 is close to 137, the plant manager's number is reasonable.

Think and Discuss

1. **Determine** the ratios that are nearly equivalent to each of the following percents: 23%, 53%, 65%, 12%, and 76%.
2. **Describe** how to find 35% of a number when you know 10% of the number.

6-2 Exercises

Learn It Online
Homework Help Online **go.hrw.com**,
keyword MT10 6-2 Go
Exercises 1–20, 21, 23, 29, 35, 37, 39, 41

GUIDED PRACTICE

See Example 1 **Estimate.**

1. 11% of 507
2. 26% of 99
3. 34% of 91
4. 48% of 124
5. 20% of 66
6. $12\frac{1}{2}\%$ of 87
7. $66\frac{2}{3}\%$ of 25
8. 47% of 80

See Example 2

9. Arnold ate breakfast at a restaurant. The total cost of his food, juice, and coffee was $6.45. If the sales tax rate is 8% and Arnold wants to leave a 20% tip, about how much should he pay?

See Example 3

10. Approximately 11% of each batch of yo-yos is defective. Mr. Andersen said that in a batch of 1500 yo-yos, 125 yo-yos would be defective. Estimate to determine if Mr. Andersen's number is reasonable. Explain.

INDEPENDENT PRACTICE

See Example 1 **Estimate.**

11. 48% of 202
12. 74% of 39
13. 101% of 6
14. 20% of 42
15. 40% of 81
16. $62\frac{1}{2}\%$ of 239
17. $33\frac{1}{3}\%$ of 26
18. 30% of 118

See Example 2

19. Inga wants to buy a new MP3 player that costs $119.99. If the sales tax is 6.35%, about how much should Inga expect to pay?

See Example 3

20. In a recent election, the leading candidate captured approximately 75% of the 24,082 total votes. The newspaper reported that the winner captured 18,039 votes. Estimate to determine if the newspaper report is reasonable. Explain.

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP12.

Choose the best estimate. Write A, B, or C.

21. 5% of 29.4
- (A) 0.15
- (B) 1.5
- (C) 15

22. 50% of 29.85
- (A) 3
- (B) 12
- (C) 15

23. 33.3% of 65
- (A) 2
- (B) 20
- (C) 30

24. 66% of $357.99
- (A) $120
- (B) $240
- (C) $360

25. 75% of $317.99
- (A) $24
- (B) $120
- (C) $240

26. 105% of $776.50
- (A) $80
- (B) $900
- (C) $800

Estimate.

27. 50% of 297 is about what number?

28. 75% of 76 is about what number?

29. 103% of 40 is about what number?

30. 103% of 885 is about what number?

31. 50% of 1611 is about what number?

32. 50% of 12.42 is about what number?

33. $33\frac{1}{3}$% of 87 is about what number?

34. 9.6% of 77 is about what number?

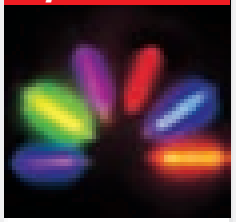
35. 24% of 402 is about what number?

36. 66% of 1.8 is about what number?

37. On a weekday, 911 cars passed through a city intersection. On Saturday, only 33% of that number passed through the intersection. Approximately how many cars passed through the intersection on the weekend?

38. A jury wants to give an award of about 9% of $695,531. What is a good estimate of the award?

LINK
Physical Science



Freezing a light stick may make it glow longer, but not as brightly.

39. **Business** The daily circulation for a city newspaper was 498,739. After a six-month period, the circulation dropped 5.1%. Approximately what was the daily circulation at the end of the six-month period?

40. **Finance** Brooke earns $320 a week. After taxes, her paycheck is only 78% of her earnings. Approximately how much is her paycheck each week?

41. **Physical Science** When you snap a light stick, you break a barrier between two chemical compounds. This causes a reaction that releases energy as light. An improvement allows an 8-hour light stick to glow for 50% more time. Approximately how long does the improved light stick glow?

42. A car originally priced at $19,995 will be discounted 20%. Estimate the amount of the discount.

43. Social Studies Alaska is the largest state in the United States in total land area, and Rhode Island is the smallest.

Area and Population: 2006		
	Total Land (mi^2)	Population
Alaska	571,951	670,053
Rhode Island	1045	1,067,610

Source: U.S. Census Bureau

a. *The area of Rhode Island is approximately 2% the area of Alaska.* Determine if this statement is reasonable. Explain.

b. Although Rhode Island is much smaller than Alaska, it has a larger population. *Alaska has approximately 65% the population of Rhode Island.* Determine if this statement is reasonable. Explain.

c. Estimate the number of people per square mile in Alaska and in Rhode Island.

44. Write a Problem Write a percent estimation problem using the following data: The equatorial circumference of Earth is approximately 40,075 km. The equatorial circumference of the moon is approximately 25% Earth's equatorial circumference.

45. Write About It Explain how you can estimate 1%, 10%, and 100% of 4027.

46. Challenge Explain two ways to estimate 20% of 82.

Test Prep and Spiral Review

47. Multiple Choice 328% of 82 is about what number?

Ⓐ 246 Ⓑ 264 Ⓒ 287 Ⓓ 298

48. Multiple Choice Regina receives a 5% commission on the merchandise she sells. Last week, Regina sold $11,976.57 worth of merchandise. Approximately how much commission does she earn?

Ⓕ $600 Ⓖ $11,400 Ⓗ $550 Ⓙ $10,450

49. Multiple Choice Which is the best estimate for 20% of 703?

Ⓐ 14 Ⓑ 140 Ⓒ 1400 Ⓓ 14,000

Evaluate. (Lesson 4-1)

50. 2^5 **51.** $(-3)^2$ **52.** $(-7)^3$ **53.** -4^3

54. $(-2)^7$ **55.** 5^3 **56.** $(-4)^4$ **57.** 8^1

Find the percent, fraction, or decimal equivalent for each of the following. (Lesson 6-1)

58. $\frac{9}{10}$ as a percent **59.** 46% as a fraction **60.** $\frac{3}{8}$ as a decimal

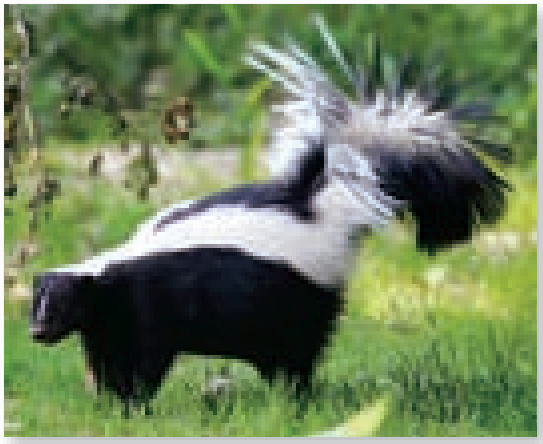
61. $\frac{7}{14}$ as a decimal **62.** 0.78 as a fraction **63.** 52.5% as a decimal

6-3 Finding Percents

Learn to find percents.

The odor of a skunk's spray may be detected more than a mile away, depending upon the direction and speed of the wind. You can use percents to find the distance that the skunk's spray actually travels.

You can use proportions and equations to solve percent problems.



EXAMPLE 1 Finding the Percent One Number Is of Another

What percent of 144 is 64?

Method 1: Set up a proportion to find the percent.

Think: What number is to 100 as 64 is to 144?

$\frac{\text{percent}}{100} = \frac{\text{part}}{\text{whole}}$ — *Set up a proportion.*

$\frac{n}{100} = \frac{64}{144}$ — *Let n represent the percent.*

$n \cdot 144 = 100 \cdot 64$ — *Find the cross products.*

$144n = 6400$ — *Simplify.*

$\frac{144n}{144} = \frac{6400}{144}$ — *Divide both sides by 144.*

$n \approx 44.4$ — *Simplify.*

64 is approximately 44.4% of 144.

Method 2: Set up an equation to find the percent.

$\text{percent} \cdot \text{whole} = \text{part}$ — *Set up an equation.*

$n \cdot 144 = 64$ — *Let n represent the percent.*

$\frac{144n}{144} = \frac{64}{144}$ — *Divide both sides by 144.*

$n = 0.\overline{4}$, or approximately 0.444. — *Simplify.*

64 is approximately 44.4% of 144. — *0.44 is 44%*

Check

$44.4\% \cdot 144 \stackrel{?}{=} 64$ — *Substitute 44.4% for n.*

$0.444 \cdot 144 \stackrel{?}{=} 64$ — *Write a decimal and multiply.*

$63.936 \approx 64$ ✔ — *44.4% of 144 is approximately 64.*

EXAMPLE 2 Recreation Application

A **A brother and three sisters built a treehouse in their backyard. Mary did $\frac{1}{4}$ of the work, Joshua did 0.28 of the work, Caroline did 30% of the work, and Laura did the rest. What percent of the work on the treehouse did Laura do?**

First, find what percent of the work Mary and Joshua did.

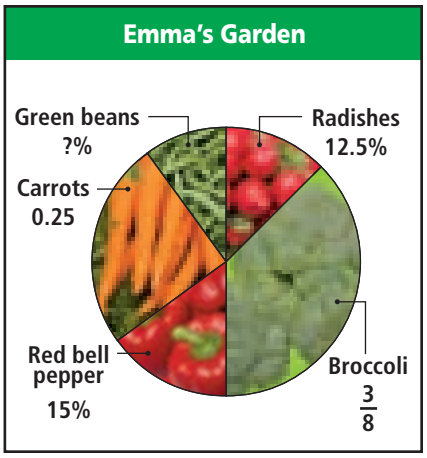
$\frac{1}{4} = 25\%$ and $0.28 = 28\%$

Next, subtract the percents you know from 100% to find the remaining percent.

$100\% - 25\% - 28\% - 30\% = 17\%$

Laura did 17% of the work.

B **Emma is planning a vegetable garden for her backyard. What percent of the garden will have green beans?**



First, find what percent of the garden will have broccoli: and carrots.

Broccoli: $\frac{3}{8} = 37.5\%$

Carrots: $0.25 = 25\%$

Next, subtract the percents you know from 100% to find the remaining percent.

$100\% - 37.5\% - 25\% - 12.5\% - 15\% = 10\%$

10% of the garden will have green beans.

EXAMPLE 3 Finding the Percent of a Number

A **The odor of a skunk's spray can travel 8000 feet downwind. The skunks spray only travels 0.075% of this distance. How far does the skunk's spray travel?**

Choose a method: Set up an equation.

Think: What distance is 0.075% of 8000 ft?

$d = 0.075\% \cdot 8000$ *Set up an equation.*

$d = 0.00075 \cdot 8000$ *Write the percent as a decimal.*

$d = 6$ *Simplify.*

The skunk's spray travels 6 feet.

Helpful Hint

Think about whether the answer should be less than or greater than the number given in the problem.

B **Mt. Churchill, in Alaska, is about 15,638 feet high. The height of Mt. McKinley is approximately 130% of the height of Mt. Churchill. To the nearest foot, find the height of Mt. McKinley.**

Choose a method: Set up a proportion.

Think: 130 is to 100 as **what height** is to 15,638 ft?

$$\frac{130}{100} = \frac{h}{15{,}638}$$ *Set up a proportion.*

$$130 \cdot 15{,}638 = 100 \cdot h$$ *Find the cross products.*

$$2{,}032{,}940 = 100h$$ *Simplify.*

$$\frac{2{,}032{,}940}{100} = \frac{100h}{100}$$ *Divide both sides by 100.*

$$20{,}329.4 = h$$ *Simplify.*

$$20{,}329 \approx h$$ *Round to the nearest whole number.*

Mt. McKinley is about 20,329 feet high.

Think and Discuss

1. **Show** why 0.5% of a number is less than $\frac{1}{100}$ of the number.
2. **Demonstrate** two ways to find 70% of a number.
3. **Name** fractions in simplest form that are the same as 40% and as 250%.

6-3 Exercises

Learn It Online
Homework Help Online **go.hrw.com**, keyword MT10 6-3 Go
Exercises 1–15, 17, 19, 21, 23, 25, 29, 31

GUIDED PRACTICE

See Example 1

1. What percent of 91 is 45?
2. What percent of 1270 is 375?
3. What percent of 240 is 180?
4. What percent of 186 is 75?

See Example 2

5. Four friends ordered a pizza. Christopher ate $\frac{1}{5}$, Emma ate 30%, Tanya ate 0.27, and Jamie ate the rest. What percent of the pizza did Jamie eat?

See Example 3

6. Elijah walks 2 miles to school. If Bailey's walk is 80% of the length of Elijah's walk, find the length of Bailey's walk.
7. Jay's term paper is 18 pages long. If Madison's paper is 175% of the length of Jay's paper, find the length of Madison's paper.
8. Of 109.6 million households, 19,508,800 watched the television show *CSI* during the week of October 3, 2005. What percent of American households watched *CSI* this week?

INDEPENDENT PRACTICE

See Example 1

9. What percent of 56 is 224?

10. What percent of 180 is 30?

11. 12.5 is what percent of 1250?

12. 115 is what percent of 40?

See Example 2

13. The Bishop family bought a case of water containing 24 bottles. During one week, Lydia drank $\frac{1}{8}$ of the bottles, Mitchell drank $33\frac{1}{3}\%$ of the bottles, Alexa drank 0.25 of the bottles, and Todd drank the rest. What percent of the case did Todd drink?

See Example 3

14. The tallest building in the United States is the Sears Tower in Chicago. The height of the Sears Tower is 1450 feet, which is 240% of the height of the Seattle Space Needle in Washington. Find the height of the Seattle Space Needle to the nearest foot.

15. In Arkansas, the highest elevation is Mount Magazine, and the lowest is the Ouachita River. Mount Magazine is 2753 ft above sea level, which is about 5098% of the elevation of the lowest portion of the state. Find the elevation of the Ouachita River area.

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP12.

Find each number to the nearest tenth.

16. What number is $33\frac{1}{3}\%$ of 30?

17. What number is $11\frac{1}{3}\%$ of 215?

18. What number is 0.77% of 900?

19. What number is $3\frac{1}{2}\%$ of 11,400?

20. What number is 166% of 300?

21. What number is $66\frac{2}{3}\%$ of 750?

Complete each statement.

22. Since 8 is 16% of 50,
- **a.** 16 is ____ % of 50.
- **b.** 24 is ____ % of 50.
- **c.** 80 is ____ % of 50.

23. Since 8 is 5% of 160,
- **a.** 8 is ____ % of 80.
- **b.** 8 is ____ % of 40.
- **c.** 8 is ____ % of 20.

24. Since 15 is 300% of 5,
- **a.** 15 is ____ % of 10.
- **b.** 15 is ____ % of 20.
- **c.** 15 is ____ % of 40.

Make a Conjecture Describe a possible rule for each pattern shown below.

25.
1% of 1200 = 12
2% of 600 = 12
4% of 300 = 12
8% of 150 =12
16% of 75 = 12

26.
400% of 320 = 1280
200% of 160 = 320
100% of 80 = 80
50% of 40 = 20
25% of 20 = 5

27.
400% of 5 = 20
200% of 15 = 30
100% of 45 = 45
50% of 135 = 67.5
25% of 405 = 101.25

28. Social Studies In 2005, 38% of the 50 largest U.S. cities were located east of the Mississippi River. How many of the 50 largest U.S. cities were located east of the Mississippi River in 2005?

29. Geography About 600 mi^2 of the 700 mi^2 of the Okefenokee Swamp is located in Georgia. If Georgia is 57,906 mi^2, estimate the percent of that area that is part of the Okefenokee Swamp.

30. **Language Arts** All of the letters of the Hawaiian alphabet are shown. The ` is actually a consonant!

   a. What percent of the Hawaiian alphabet are vowels?

   b. To the nearest tenth, what percent of the letters in the English alphabet are also in the Hawaiian alphabet?

31. **Multi-Step** Joseph, Ana, Lena, and George chipped in money for a friend's gift. The gift cost $45.99 plus $3.45 sales tax. Joseph paid $12.50, Ana paid $\frac{1}{4}$ of the total cost, Lena paid 24% of the total cost, and George paid the rest. Order the people from least amount paid to greatest amount paid.

32. **Choose a Strategy** Masco Industries has 285,000 total employees. Of those employees, 85,500 telecommute. What percent of the company's total employees telecommute?

   (A) 3% (B) 15% (C) 30% (D) 150%

33. **Write About It** A question on a math quiz asks, "What is 175% of 72?" Petra calculates 12.6 as the answer. Is this a reasonable answer? Explain.

34. **Challenge** Molly cut 10 ft 6 in. from a pipe measuring 8 yd 1 ft. What percent of the pipe's original length did Molly remove, and what is the length of the pipe that remains?

Test Prep and Spiral Review

35. **Multiple Choice** Currently, 96 students are enrolled in the Grove City Dance Center. Of those students, 54 study tap dance. The remaining students study ballet. What percentage of the students study ballet?

   (F) 42% (G) 43.75% (H) 54% (J) 56.25%

36. **Gridded Response** According to the U.S. Census, approximately 129 million Americans spend 3.4% of a 24-hour day commuting. How many minutes a day does a person in this group spend commuting?

Solve each proportion. (Lesson 5-4)

37. $\frac{x}{3} = \frac{8}{12}$ 38. $\frac{7}{y} = \frac{49}{98}$ 39. $\frac{10}{12} = \frac{b}{6}$ 40. $\frac{12}{36} = \frac{4}{c}$

41. $\frac{b}{6} = \frac{42}{18}$ 42. $\frac{8}{c} = \frac{64}{24}$ 43. $\frac{11}{33} = \frac{3}{x}$ 44. $\frac{14}{9} = \frac{y}{18}$

Estimate. (Lesson 6-2)

45. 26% of 398 46. 48% of 746 47. 39% of 99

6-4 Finding a Number When the Percent Is Known

Learn to find a number when the percent is known.

Carcharocles megalodon, a giant shark that became extinct almost 3 million years ago, had teeth as large as 7.25 inches along an edge. This is 240% bigger than the largest teeth of a modern great white shark.

When one number is known, and its relationship to another number is given by a percent, the other number can be found.

Carcharocles megalodon's jaw may have been 6 feet wide.

EXAMPLE 1 Finding a Number When the Percent Is Known

42 is 5% of what number?

Choose a method: Set up an equation to find the number.

$42 = 5\% \cdot n$ *Set up an equation.*

$42 = 0.05n$ *5% = 0.05*

$\frac{42}{0.05} = \frac{0.05}{0.05}n$ *Divide both sides by 0.05.*

$840 = n$ *Simplify*

42 is 5% of 840.

EXAMPLE 2 *Physical Science Application*

In a science lab, a sample of a compound contains 14.5 grams of magnesium. If 72.5% of the sample is magnesium, find the number of grams the entire sample weighs.

Choose a method: Set up a proportion to find the number.

Think: 72.5 is to 100 as 14.5 g is to **what mass**?

$\frac{72.5}{100} = \frac{14.5}{m}$ *Set up a proportion.*

$72.5 \cdot m = 100 \cdot 14.5$ *Find the cross products.*

$72.5m = 1450$ *Simplify.*

$\frac{72.5m}{72.5} = \frac{1450}{72.5}$ *Divide both sides by 72.5*

$m = 20$ *Simplify.*

The entire sample weighs 20 grams.

EXAMPLE 3 Life Science Application

Reticulated means "net-like" or "forming a network." The reticulated python is named for the pattern on its skin.

A **The king cobra can reach a length of 18 feet. This is only about 60% of the length of the largest reticulated python. Find the length of the largest reticulated python.**

Choose a method: Set up a proportion.

Think: 60 is to 100 as 18 ft is to **what length**?

$\frac{60}{100} = \frac{18}{\ell}$ *Set up a proportion.*

$60 \cdot \ell = 100 \cdot 18$ *Find the cross products.*

$\frac{60\ell}{60} = \frac{1800}{60}$ *Divide both sides by 60.*

$\ell = 30$ *Simplify.*

The largest reticulated python is 30 feet long.

B ***Carcharocles megalodon*** **had teeth as large as 7.25 inches along an edge. This is about 240% of the maximum length of the teeth of a modern great white shark. To the nearest inch, find the maximum length of the teeth of a great white shark.**

Choose a method: Set up an equation.

Think: 7.25 in. is 240% of **what length**?

$7.25 = 240\% \cdot \ell$ *Set up an equation.*

$7.25 = 2.40 \cdot \ell$ *240% = 2.40*

$\frac{7.25}{2.40} = \frac{2.40\ell}{2.40}$ *Divide both sides by 2.40.*

$3 \approx \ell$ *Simplify.*

The maximum size is about 3 inches along an edge.

You have now seen all three types of percent problems.

Percent Problem	Equation	Proportion
Finding the percent of a number	15% of 120 = n	$\frac{15}{100} = \frac{n}{120}$
Finding the percent one number is of another	p% of 120 = 18	$\frac{p}{100} = \frac{18}{120}$
Finding a number when the percent is known	15% of n = 18	$\frac{15}{100} = \frac{18}{n}$

Think and Discuss

1. **Compare** finding a number when a percent is known to finding the percent one number is of another number.
2. **Explain** whether a number is greater than or less than 36 if 22% of the number is 36.

6-4 Exercises

Learn It Online
Homework Help Online go.hrw.com, keyword MT10 6-4 Go
Exercises 1–12, 13, 15, 17, 19, 21

GUIDED PRACTICE

See Example 1

Find each number to the nearest tenth.

1. 6.9 is $11\frac{1}{2}\%$ of what number?
2. 92 is $66\frac{2}{3}\%$ of what number?
3. 12% of what number is 20?
4. 30% of what number is 96?

See Example 2

5. How much water can a 7.4 oz piece of chalk absorb if it can absorb 32% of its weight?

See Example 3

6. At 2 P.M., a flag pole casts a shadow that is 155% of its actual height. If the shadow is 23.25 ft, what is the actual height of the pole?

INDEPENDENT PRACTICE

See Example 1

Find each number to the nearest tenth.

7. 90 is $66\frac{2}{3}\%$ of what number?
8. 63 is 15% of what number?
9. 0.75% of what number is 10?
10. 44% of what number is 37.4?

See Example 2

11. Isaac sold 58 of his baseball cards at a collectors' show. If this represented $14\frac{1}{2}\%$ of his total collection, how many baseball cards did Isaac have before he sold his cards?

See Example 3

12. When a tire is labeled "185/70/14," that means it is 185 mm wide, the sidewall height (from the rim to the road) is 70% of its width, and the wheel has a diameter of 14 in. What is the tire's sidewall height?

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP12.

Complete each statement.

13. Since 2% of 500 is 10,
    a. 4% of ▢ is 10.
    b. 8% of ▢ is 10.
    c. 16% of ▢ is 10.
14. Since 100% of 8 is 8,
    a. 50% of ▢ is 8.
    b. 25% of ▢ is 8.
    c. 10% of ▢ is 8.
15. Since 15% of 60 is 9,
    a. 30% of ▢ is 9.
    b. 45% of ▢ is 9.
    c. 60% of ▢ is 9.
16. In a survey of 175 students, 42 said that their favorite cookout food was hamburgers, and 61 said that their favorite was hot dogs. Give these numbers as percents.
17. **Life Science** The Congress Avenue bridge in Austin, Texas, is home to the largest urban bat colony in the world. Nearly 1.5 million Mexican free-tailed bats live under the bridge. This bat population is approximately 228.3% the population of Austin. What is the population of Austin to the nearest thousand people?

Social Studies LINK

The U.S. census collects information about state populations, economics, income and poverty levels, births and deaths, and so on. This information can be used to study trends and patterns. For Exercises 18–20, round answers to the nearest tenth.

2000 U.S. Census Data			
	Population	Male	Female
Alaska	626,932	324,112	302,820
New York	18,976,457	9,146,748	9,829,709
Age 34 and Under	139,328,990	71,053,554	68,275,436
Age 35 and Over	142,092,916	67,000,009	75,092,907
Total U.S.	281,421,906	138,053,563	143,368,343

18. What percent of New York's population is male?

19. What percent of the entire country's population, to the nearest tenth of a percent, is made up of people in New York?

20. Tell what percent of the U.S. population each represents.

a. people 34 and under **b.** people 35 and over **c.** male **d.** female

21. American Indians and Native Alaskans make up about 15.6% of Alaska's population. What is their population, to the nearest thousand?

22. **Challenge** About 71% of the U.S. population age 85 and over is female. Of the fractions that round to 71% when rounded to the nearest percent, which has the least denominator?

Test Prep and Spiral Review

23. **Multiple Choice** There are 72 boys in the eighth-grade class at Lincoln Middle School. The other 55% of the class are girls. How many girls are there?

Ⓐ 55 Ⓑ 72 Ⓒ 88 Ⓓ 127

24. **Gridded Response** 25% of what number is 9.6?

Each square root is between two integers. Name the integers. (Lesson 4-6)

25. $\sqrt{35}$ **26.** $\sqrt{45}$ **27.** $\sqrt{55}$ **28.** $\sqrt{65}$ **29.** $\sqrt{140}$

30. $\sqrt{27}$ **31.** $\sqrt{101}$ **32.** $\sqrt{42}$ **33.** $\sqrt{222}$ **34.** $\sqrt{1011}$

Find the decimal equivalent of each. (Lesson 6-1)

35. $\frac{5}{8}$ **36.** 212% **37.** 71% **38.** $4\frac{1}{12}$ **39.** $-\frac{3}{4}$

40. $\frac{4}{5}$ **41.** 123% **42.** 26% **43.** $3\frac{1}{2}$ **44.** $27\frac{1}{5}$

CHAPTER 6 SECTION 6A

Ready To Go On?

Learn It Online
Resources Online go.hrw.com,
keyword MT10 RTGO6A Go

Quiz for Lessons 6-1 Through 6-4

6-1 Relating Decimals, Fractions, and Percents

Compare. Write <, >, or =.

1. $\frac{5}{6}$ ▢ 83% **2.** $\frac{4}{9}$ ▢ 45% **3.** 0.03 ▢ 3% **4.** 6.5 ▢ 65%

Order the numbers from least to greatest.

5. $\frac{1}{4}$, 0.1, 3%, 28% **6.** 130%, $\frac{3}{2}$, 1.25, 10% **7.** $\frac{2}{3}$, 72%, 0.6, $\frac{3}{4}$

8. A molecule of ferric oxide is made up of 2 atoms of iron and 3 atoms of oxygen. What percent of the atoms of a ferric oxide molecule is oxygen?

6-2 Estimating with Percents

Estimate.

9. 48% of 52 **10.** 33% of 613 **11.** $12\frac{1}{2}$% of 57 **12.** 60% of 26

Estimate the tip for each bill.

13. tip: 10% bill: $28.20 **14.** tip: 15% bill: $41.80

15. Approximately 9.6% of all daily shipments are returned. Ms. Kui said that in a daily shipment of 12,034 packages, approximately 120 would be returned. Estimate to determine if Ms. Kui's number is reasonable. Explain.

6-3 Finding Percents

16. What number is 32% of 8? **17.** What number is 0.8% of 200?

18. What percent of 48 is 36? **19.** What percent of 35 is 42?

20. Of Canada's total area of 9,976,140 km^2, 755,170 km^2 is water. To the nearest tenth of a percent, what part of Canada is water?

6-4 Finding a Number When the Percent Is Known

21. 27 is 7.5% of what number? **22.** 336 is 375% of what number?

23. 4 is 0.25% of what number? **24.** $16\frac{2}{3}$% of what number is 90?

25. The speed of sound in air at sea level at 32 °F is 1088 ft/s. If that represents only 22.04% of the speed of sound in ice-cold water, what is the speed of sound in ice-cold water, to the nearest whole number?

Focus on Problem Solving

Make a Plan

• Do you need an estimate or an exact answer?

When you are solving a word problem, ask yourself whether you need an exact answer or whether an estimate is sufficient. For example, if the amounts given in the problem are approximate, only an approximate answer can be given. If an estimate is sufficient, you may wish to use estimation techniques to save time in your calculations.

For each problem below, explain whether an exact answer is needed or whether an estimate is sufficient. Then find the answer.

1. In a poll of 5000 registered voters in a certain district, 2800 favored a proposed new library. What percent favored the new library?

2. Albert needs to score 78% on his final exam to get a B in his math class. If the final is worth 300 points, how many points does he need?

3. Mai needs $500 for a trip to Hawaii. If she has saved 23% of what she needs for the trip, about how much money does Mai have?

4. Esteban makes $8.30 per hour at his job. If he receives a 3% raise, how much will he be making per hour?

5. Carmen is planning to tile her kitchen floor. The room is 215 square feet. It is recommended that she buy enough tiles for an area 25% greater than the actual kitchen floor space to account for breakage. How many square feet of tile should she buy?

6. There are about 1.5 million known species of animals on Earth. Of these, about 800,000 are insects. What percent of known species are insects?

6-5 Percent Increase and Decrease

Learn to find percent increase and decrease.

The number of home runs hit per game in Major League Baseball increased by more than 83% from 1981 to 2000, when a record 5693 home runs were hit. But the number hit per game decreased 13% from 2000 to 2007.

Vocabulary

percent change

percent increase

percent decrease

Percents can be used to describe a change. **Percent change** is the ratio of the *amount of change* to the *original amount*.

$$\text{percent change} = \frac{\text{amount of change}}{\text{original amount}}$$

Percent increase describes how much the original amount increases.
Percent decrease describes how much the original amount decreases.

EXAMPLE 1 Finding Percent Increase or Decrease

Find the percent increase or decrease from 36 to 45.

This is a percent increase.

$45 - 36 = 9$ *First find the amount of change.*

$\frac{\text{amount of increase}}{\text{original amount}} \rightarrow \frac{9}{36}$ *Set up the ratio.*

$\frac{9}{36} = 0.25 = 25\%$ *Find the decimal form. Write as a percent.*

From 36 to 45 is a 25% increase.

EXAMPLE 2 *Life Science Application*

A **The heart rate of a grizzly bear slows from 52 to 8 beats per minute during hibernation. What is the percent decrease to the nearest tenth of a percent?**

$52 - 8 = 44$ *First find the amount of change.*

$\frac{\text{amount of decrease}}{\text{original amount}} \rightarrow \frac{44}{52}$ *Set up the ratio.*

$\frac{44}{52} \approx 0.8462 \approx 84.6\%$ *Find the decimal form. Write as a percent.*

The grizzly bear's heart rate decreases by 84.6% during hibernation.

B **According to the U.S. Census Bureau, 72.3 million children (aged 17 years and younger) lived in the United States in 2004. It is estimated that there will be 80.3 million children in 2020. What is the percent increase, to the nearest percent?**

$80.3 - 72.3 = 8$ *First find the amount of change.*

$\frac{\text{amount of increase}}{\text{original amount}} = \frac{8}{72.3}$ *Set up the ratio.*

$\frac{8}{72.3} \approx 0.1107 \approx 11.07\%$ *Find the decimal form. Write as a percent.*

From 2004 to 2020, the number of children in the United States is estimated to increase 11%.

EXAMPLE 3 Using Percent Change to Find Discounts and Markups

Helpful Hint

A discount is percent decrease. A markup is percent increase.

A **Anthony bought an LCD monitor originally priced at $750 that was discounted by 35%. What was the reduced price?**

$\$750 \cdot 35\%$ *First find 35% of $750.*

$\$750 \cdot 0.35 = \$262.50$ *35% = 0.35*

The amount of the discount is $262.50.

Think: The reduced price is $262.50 *less than* $750.

$\$750 - \$262.50 = \$487.50$ *Subtract the discount.*

The reduced price of the monitor was $487.50.

B **Mr. Anzivino received a shipment of refrigerators that cost $966 each. To set the retail price, he marks the price of each refrigerator up $66\frac{2}{3}\%$. What is the retail price of each refrigerator?**

$\$966 \cdot 66\frac{2}{3}\%$ *First find $66\frac{2}{3}\%$ of $966.*

$\$966 \cdot \frac{2}{3} = \$644$ *$66\frac{2}{3}\% = \frac{2}{3}$*

The markup is $644.

Think: The retail price is $644 *more than* $966.

$\$966 + \$644 = \$1610$ *Add the markup.*

The retail price of each refrigerator is $1610.

Think and Discuss

1. **Explain** whether a 150% increase or a 150% decrease is possible.
2. **Compare** finding a 20% increase to finding 120% of a number.

6-5 Exercises

Learn It Online
Homework Help Online **go.hrw.com**, keyword MT10 6-5 Go
Exercises 1–10, 11, 13, 17, 19, 21, 23, 25

GUIDED PRACTICE

See Example 1

Find each percent increase or decrease to the nearest percent.

1. from 40 to 59 **2.** from 85 to 30 **3.** from 85 to 170

See Example 2

4. A population of squirrels rose from 338 to 520 over a period of 3 years. What is the percent increase, to the nearest tenth of a percent?

See Example 3

5. An automobile dealer agrees to discount the $10,288 sticker price of a new car by 5% for a customer. What is the price of the car for the customer?

INDEPENDENT PRACTICE

See Example 1

Find each percent increase or decrease to the nearest percent.

6. from 800 to 1500 **7.** from 0.76 to 0.59 **8.** from 35 to 19

See Example 2

9. The boiling point of water is lower at higher altitudes. Water boils at 212°F at sea level and 193.7°F at 10,000 ft. What is the percent decrease in the temperatures, to the nearest tenth of a percent?

See Example 3

10. Mr. Woodruff owns an automobile parts store and typically marks up merchandise 32% over warehouse cost. How much would he charge customers for a rotor that costs him $62.25?

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP12.

Find each percent increase or decrease to the nearest percent.

11. from $34.70 to $23.20 **12.** from $72 to $119 **13.** from $320 to $195

14. from $644 to $588 **15.** from $0.37 to $0.28 **16.** from $12.50 to $14.75

Find each missing number.

17. originally: $400
new price: ▢
25% increase

18. originally: 140
new amount ▢
50% increase

19. originally: ▢
new amount: 210
75% increase

20. originally: ▢
new price: $3.80
15% decrease

21. originally: 28
new amount: 42
▢ % increase

22. originally: $45
new price: $27
▢ % decrease

23. **Multi-Step** A pair of $195 boots are discounted 40%.

a. How much is the price decrease?

b. What is the sale price of the boots?

c. If the boots are reduced in price by an additional $66\frac{2}{3}$%, what will be the new sale price?

d. What percent decrease does this final sale price represent?

24. **Earth Science** After the Mount St. Helens volcano erupted in 1980, the elevation of the mountain decreased by about 13.6%. Its elevation had been 9677 ft. What was its elevation after the eruption?

25. **Literature** A signed hard-cover edition of Harper Lee's *To Kill a Mockingbird* is worth $1500. A paperback version of the novel sells for $6. What is the percent increase in price between the paperback version and the signed hard-cover version?

LINK

Literature

Harper Lee's *To Kill a Mockingbird* has sold over 10,000,000 copies worldwide and has been translated into more than 25 languages.

26. **Multi-Step** A video game console that is normally priced at $269.99 has been marked down to 70% of its original price. If sales tax is 8%, how much will Marcus pay for the discounted game console, to the nearest cent?

27. Last year, 12,932 people attended an annual convention. This year, 11,245 people are planning to attend. Does this represent a percent increase or a percent decrease? Find the percent change, to the nearest percent.

28. **Critical Thinking** Is the percent change the same when a DVD is marked up from $10 to $15 as when it is reduced from $15 to $10? Explain.

29. **Choose a Strategy** A digital camera originally sold for $249. Two months later, the price was reduced 40%. During a sale, the camera was discounted an additional 15% off the reduced price. What was the final price of the camera?

Ⓐ $14.94 Ⓑ $22.41 Ⓒ $126.99 Ⓓ $136.95

30. **Write About It** Describe how you can use mental math to find the percent increase from 75 to 100 and the percent decrease from 100 to 75.

31. **Challenge** During a sale, the price of a cell phone was decreased by 20%. By what percent must the sale price be increased to restore the original price?

Test Prep and Spiral Review

32. **Multiple Choice** A washing machine that usually sells for $459 is on sale for $379. What is the percent decrease, to the nearest tenth of a percent?

Ⓕ 17.4% Ⓖ 21.1% Ⓗ 32.8% Ⓙ 82.6%

33. **Extended Response** Puzzle Place has discounted its puzzles 20%. A puzzle of a giraffe is priced at $20.95, and a puzzle of a mountain is priced at $16.50. How much will Thomas save on both puzzles? If the sales tax rate is 6%, what is the final cost of the puzzles?

34. A square has a perimeter of 56 cm. If the square is dilated by a scale factor of 0.2, what is the length of each side of the new square? (Lesson 5-6)

Find each percent or number. (Lesson 6-3)

35. What percent of 122 is 61? **36.** What is 35% of 2340? **37.** What is 145% of 215?

6-6 Applications of Percents

Learn to find commission, sales tax, and percent of earnings.

Salespeople often work for *commission*. A **commission** is a fee paid to a person who makes a sale. It is usually a percent of the selling price. This percent is called the **commission rate**.

commission rate · sales = commission

Vocabulary
commission
commission rate

Often salespeople are paid a commission plus a regular salary. The total pay is a percent of the sales they make plus a salary.

EXAMPLE 1 Multiplying by Percents to Find Commission Amounts

Julie is paid a monthly salary of $2100 plus commissions. Last month she sold one car for $39,500, earning a 4% commission on the sale. How much was her commission? What was her total pay for the month?

First find her commission.

$4\% \cdot \$39{,}500 = c$ *commission rate · sales = commission*

$0.04 \cdot 39{,}500 = c$ *Change the percent to a decimal.*

$1580 = c$ *Solve for c.*

She earned a commission of $1580 on the sale.

Now find her total pay for last month.

$\$1580 + \$2100 = \$3680$ *commission + salary = total pay*

Her total pay for last month was $3680.

Sales tax is the tax on the sale of an item or service. It is a percent of the purchase price and is collected by the seller.

EXAMPLE 2 Multiplying by Percents to Find Sales Tax Amounts

If the sales tax rate is 7.75%, how much tax would Meka pay if she bought a portable DVD player for $145.80 and two DVDs for $15.99 each?

DVD player: 1 at $145.80 → $145.80

DVDs: 2 at $15.99 → $31.98

$177.78 *Total price*

$0.0775 \cdot 177.78 = 13.77795$ *Write the tax rate as a decimal and multiply by the total price.*

Meka would pay $13.78 in sales tax.

EXAMPLE 3 Using Proportions to Find the Percent of Earnings

Jorge earns $36,000 yearly. Of that, he pays $12,240 for rent. What percent of Jorge's earnings goes to rent?

Think: What percent of $36,000 is $12,240?

$$\frac{n}{100} = \frac{12{,}240}{36{,}000}$$ *Set up a proportion.*

$$n \cdot 36{,}000 = 100 \cdot 12{,}240$$ *Find the cross products.*

$$36{,}000n = 1{,}224{,}000$$ *Simplify.*

$$\frac{36{,}000n}{36{,}000} = \frac{1{,}224{,}000}{36{,}000}$$ *Divide both sides by 36,000.*

$$n = 34$$ *Simplify.*

So 34% of Jorges's earnings goes to rent.

The total amount of money brought in is *revenue*. After costs are subtracted from revenue, the amount remaining is *profit*.

EXAMPLE 4 Dividing by Percents to Find Total Revenue

Students wash cars to raise funds for class trips. The class made a profit of $326.60 from last Saturday's car wash, which was 92% of its revenue. How much was the revenue for the car wash?

Think: 326.60 is 92% of what number?

Let r = revenue for the car wash

$$326.6 = 0.92 \cdot r$$ *Set up an equation.*

$$\frac{326.6}{0.92} = \frac{0.92r}{0.92}$$ *Divide both sides by 0.92.*

$$355 = r$$ *Simplify.*

The revenue for the car wash was $355.

Think and Discuss

1. **Tell** how finding commission is similar to finding sales tax.
2. **Explain** whether adding 6% sales tax to a total gives the same result as finding 106% of the total.
3. **Explain** how to find the price of an item if you know the total cost after 5% sales tax.
4. **Explain** whether the sales tax on a $20 item would be double the sales tax on a $10 item. Justify your answer.

6-6 Exercises

Learn It Online
Homework Help Online go.hrw.com, keyword MT10 6-6 Go
Exercises 1–8, 9, 11, 13, 17

GUIDED PRACTICE

See Example 1
1. Aaron earns a weekly salary of $350 plus a 7% commission on sales. Last week, his sales totaled $3200. What was his total pay?

See Example 2
2. In a state with a sales tax rate of 7%, Hernando buys a radio for $59.99 and a CD for $13.99. How much is the sales tax?

See Example 3
3. Last year, Nadia earned $31,025. Of that amount, she spent $3612.59 on food. What percent of her income went to food, to the nearest tenth of a percent?

See Example 4
4. Shane works at a computer store. If he earns $20.93 from a 7% commission on the sale of a printer, what is the price of the printer?

INDEPENDENT PRACTICE

See Example 1
5. Kayla earns a weekly salary of $290 plus a 5.5% commission on sales at a gift shop. How much would she make in a week if she sold $5700 worth of merchandise?

See Example 2
6. The sales tax rate in Brad's town is 4.25%. If he buys 3 lamps for $22.49 each and a sofa for $829.99, how much sales tax does he owe?

See Example 3
7. Jada typically earns $1545 each month, of which $47.20 is spent on electricity. What percent of Jada's earnings are spent on electricity each month, to the nearest tenth of a percent?

See Example 4
8. Heather works in a clothes shop, where she earns a commission of 5% and no weekly salary. What will Heather's weekly sales have to be for her to earn $375 in one week?

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP13.

Find each sales tax to the nearest cent.

9. total sales: $210.13
sales tax rate: 7.25%

10. total sales: $42.99
sales tax rate: 9%

11. total sales: $895.75
sales tax rate: 4.25%

Find the total sales to the nearest cent.

12. commission: $63.06
commission rate: 5%

13. commission: $2842
commission rate: 3.5%

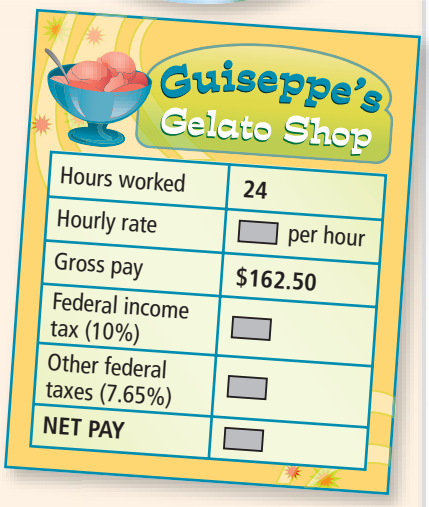
14. **Consumer Economics** Roz takes home $1600 each month. She budgets 30% of her paycheck for rent, 20% for food, and 10% for utilities. The remainder is divided evenly among entertainment, clothes, transportation, savings, and charity. How much money does Roz budget each month for each category?

15. **Critical Thinking** Deborah can choose between a monthly salary of $1800 plus 6.5% of sales or $2100 plus 4% of sales. She expects sales between $5,000 and $10,000 a month. Which salary option should she choose? Explain.

Economics LINK

Tax brackets are used to determine how much income tax people pay. Depending upon a person's taxable income, tax is given by the formula base tax + tax rate (amount over). "Amount over" refers only to the income above the amount listed. Refer to the table for Exercises 16–18.

2005 IRS Income Tax Brackets (Single)			
Taxable Income Range	**Base Tax**	**Tax Rate**	**Amount Over**
$0–$7,300	$0	10%	$0
$7,300–$29,700	$730	15%	$7,300
$29,700–$71,950	$4,090	25%	$29,700
$71,950–$150,150	$14,652.50	28%	$71,950
$150,150–$326,450	$36,548.50	33%	$150,150
$326,450 and up	$94,727.50	35%	$326,450



16. Tina's pay stub is shown at right. Find the missing numbers.

17. Anna earned $71,458 total in 2005. She was able to deduct $7250 for job-related expenses. This amount is subtracted from her total income to determine her taxable income.

- **a.** What was Anna's taxable income in 2005?
- **b.** How much income tax did she owe?
- **c.** What percent of Anna's total income did the tax represent?
- **d.** What percent of her taxable income did the tax represent?

18. **Challenge** Charlena paid $10,050 in taxes in 2005. How much taxable income did she earn that year?

Test Prep and Spiral Review

19. **Short Answer** Gabrielle earned a weekly salary of $235 plus 8% commission on sales over $500. What was her weekly pay if she had $6,250 in sales?

20. **Gridded Response** Rafael buys a video game for $49.95. The sales tax rate is 6.5%. What is the total cost, including tax, to the nearest dollar?

Simplify to tell whether the ratios form a proportion. (Lesson 5-1)

21. $\frac{3}{7}$ and $\frac{6}{14}$ **22.** $\frac{5}{8}$ and $\frac{10}{4}$ **23.** $\frac{13}{4}$ and $\frac{52}{16}$ **24.** $\frac{22}{7}$ and $\frac{11}{3}$

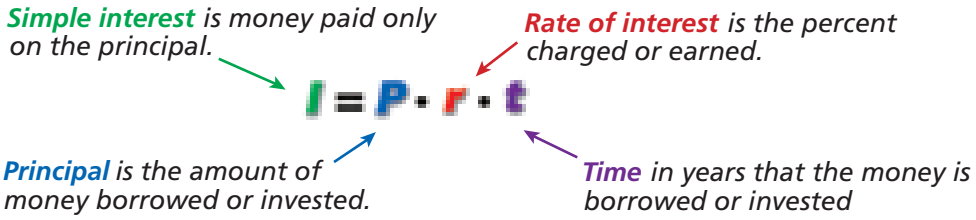
Find each percent increase or decrease to the nearest percent. (Lesson 6-5)

25. from 600 to 300 **26.** from $109.99 to $94.99

6-7 Simple Interest

Learn to compute simple interest.

Interest is the amount of money charged for borrowing or using money. When you deposit money into a savings account, you are paid interest. **Simple interest** is one type of fee paid for the use of money.



EXAMPLE 1 Finding Interest and Total Payment on a Loan

Vocabulary
- interest
- simple interest
- principal
- rate of interest

Tristan borrowed $14,500 from his brother and promised to pay him back over 5 years at an annual simple interest rate of 7%. How much interest will he pay if he pays off the entire loan at the end of the fifth year? What is the total amount he will repay?

First, find the interest he will pay.

$I = P \cdot r \cdot t$ *Use the formula.*

$I = 14{,}500 \cdot 0.07 \cdot 5$ *Substitute. Use 0.07 for 7%.*

$I = 5075$ *Solve for I.*

Tristan will pay $5075 in interest.

You can find the total amount A to be repaid on a loan by adding the principal P to the interest I.

$P + I = A$ *principal + interest = amount*

$14{,}500 + 5075 = A$ *Substitute.*

$19{,}575 = A$ *Solve for A.*

Tristan will repay a total of $19,575 on his loan.

EXAMPLE 2 Determining the Amount of Investment Time

Isaiah invested $3500 in a mutual fund at a yearly rate of 6%. He earned $945 in interest. For how long was the money invested?

$I = P \cdot r \cdot t$ *Use the formula.*

$945 = 3500 \cdot 0.06 \cdot t$ *Substitute.*

$945 = 210t$ *Simplify.*

$4.5 = t$ *Solve for t.*

The money was invested for 4.5 years, or 4 years and 6 months.

EXAMPLE 3 Computing Total Savings

Nadia's aunt deposited $3000 into a savings account as a college fund for Nadia. How much will be in this account after 5 years if the account earns a yearly simple interest rate of 3.5%?

$I = P \cdot r \cdot t$ *Use the formula.*

$I = 3000 \cdot 0.035 \cdot 5$ *Substitute. Use 0.035 for 3.5%.*

$I = 525$ *Solve for I.*

Now you can find the total.

$P + I = A$ *Use the formula.*

$3000 + 525 = A$ *Substitute.*

$3525 = A$ *Solve for A.*

Nadia will have $3525 in her savings account after 5 years.

EXAMPLE 4 Finding the Rate of Interest

To pay for her college expenses, Hannah borrows $7000. She plans to repay the loan in 5 years at simple interest. If Hannah repays a total of $9187.50, what is the interest rate?

$P + I = A$ *Use the formula.*

$7000 + I = 9187.5$ *Substitute.*

$-7000 \quad -7000$ *Subtract 7000 from both sides.*

$I = 2187.5$ *Simplify.*

She paid $2187.50 in interest. Use the amount of interest to find the interest rate.

$I = P \cdot r \cdot t$ *Use the formula.*

$2187.5 = 7000 \cdot r \cdot 5$ *Substitute.*

$2187.5 = 35{,}000r$ *Simplify.*

$\frac{2187.5}{35{,}000} = \frac{35{,}000r}{35{,}000}$ *Divide both sides by 35,000.*

$0.0625 = r$ *Simplify.*

The simple annual rate is 6.25%, or $6\frac{1}{4}\%$.

Think and Discuss

1. **Explain** the meaning of each variable in the interest formula.
2. **Tell** what value should be used for t when referring to 6 months.
3. **Name** the variables in the simple interest formula that represent dollar amounts.
4. **Demonstrate** that doubling the time while halving the interest rate results in the same amount of simple interest.

6-7 Exercises

Learn It Online
Homework Help Online go.hrw.com, keyword MT10 6-7 Go
Exercises 1–8, 9, 11, 13, 15, 17

GUIDED PRACTICE

See Example 1
1. Nick borrowed $7150, to be repaid after 5 years at an annual simple interest rate of 6.25%. How much interest will be due after 5 years? How much will Nick have to repay?

See Example 2
2. Mr. Williams invested $4000 in a bond with a yearly interest rate of 4%. His total interest on the investment was $800. What was the length of the investment?

See Example 3
3. Paige deposited $1277 in a savings account. How much would she have in the account after 3 years at an annual simple interest rate of 4%?

See Example 4
4. Tom borrowed $35,000 to remodel his house. At the end of the 5-year loan, he had repaid a total of $46,375. At what simple interest rate did he borrow the money?

INDEPENDENT PRACTICE

See Example 1
5. A bank offers an annual simple interest rate of 7% on home improvement loans. How much would Billy owe if he borrowed $18,500 over a period of 3.5 years?

See Example 2
6. Eliza deposits $8500 in a college fund. If the fund earns an annual simple interest rate of 6.5%, how long must the money be in the fund to earn $9392.50 in interest?

See Example 3
7. Jessika gave a security deposit of $1200 to her landlord, Mr. Allen, 8 years ago. Mr. Allen now intends to give her the deposit back with simple interest of 2.85%. How much will he return to her?

See Example 4
8. Premier Bank loaned a construction company $275,000 at an annual simple interest rate. After 5 years, the company repaid the bank $350,625. What was the interest rate on the loan?

PRACTICE AND PROBLEM SOLVING

Extra Practice
See page EP13.

Find the interest and the total amount to the nearest cent.

9. $315 at 6% per year for 5 years
10. $800 at 9% per year for 1 year
11. $4250 at 7% per year for 1.5 years
12. $550 at 5.5% per year for 3 years
13. $617 at 6% per year for 3 months
14. $2975 at 6% per year for 5 years
15. $900 at 7.25% per year for 3 years
16. $200 at 7% per year for 9 months
17. Jabari borrowed $1700 for 15 months at 16% annual simple interest rate. How much interest will he have to pay? What is the total amount he will repay?
18. Selena borrowed $9500 to buy a used car. The credit union charged 7% simple interest per year. She paid $3325 in interest. For what period of time did she borrow money?

Many bank ATMs in Bangkok, Thailand, are located in sculptures to attract customers.

19. Critical Thinking Meghan and Sabrina compared the amount of interest they each earned on their savings accounts. Each had deposited $1000, but Meghan earned $140 interest and Sabrina earned $157.50. Whose savings account had a higher interest rate? Explain.

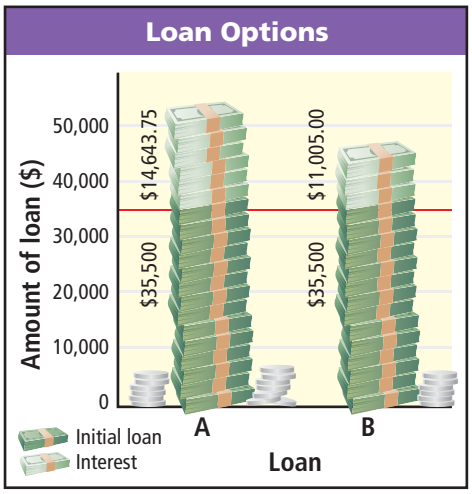
20. Money The Smiths will borrow $35,500 from a bank to start a business. They have two loan options. Option A is a 5-year loan; option B is a 4-year loan. Use the graph to answer the following questions.

a. What is the total amount the Smiths would pay under each loan option?

b. What would be the interest rate under each loan option?

c. What would be the monthly payment under each loan option?

d. How much interest will the Smiths save by choosing loan option B?



21. What's the Question? Alice places $700 in a savings account with a simple annual interest rate of 4%. When Alice withdraws the money, she has $840. What is the question?

22. Write About It Which loan would cost a borrower less: $3000 at 6% for 4 years or $3000 at 7.5% for 3 years? How much interest would the borrower save by taking the cheaper loan?

23. Challenge How would the total payment on a 5-year loan at 3% annual simple interest compare with the total payment on a 5-year loan where one-twelfth of that simple interest, 0.25%, is calculated monthly? Give an example.

Test Prep and Spiral Review

24. Multiple Choice Sam invested $2500 for 2 years in a savings account. The savings account paid an annual simple interest rate of 2.5% How much interest did Sam earn during the 2 years?

Ⓐ $62.50 Ⓑ $125 Ⓒ $1250 Ⓓ $2625

25. Multiple Choice Toni invested $250 in a savings account for 4 years. The total interest earned on the investment was $125. What was the interest rate on the account?

Ⓕ 3.125% Ⓖ 12.5% Ⓗ 125% Ⓙ 1125%

Find the appropriate factor for each conversion. (Lesson 5-3)

26. meters to millimeters **27.** quarts to gallons **28.** gallons to pints

Find each number. (Lesson 6-4)

29. 19 is 20% of what number? **30.** 74% of what number is 481?

Technology LAB 6-7

Explore Compound Interest

Use with Lesson 6-7

Learn It Online
Lab Resources Online **go.hrw.com**,
keyword MT10 Lab6 Go

Compound interest is interest paid not only on the principal but also on any interest that has already been earned. Every time interest is calculated, the interest is added to the principal for future interest calculations.

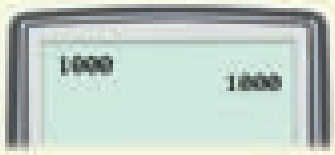
Suppose $1000 is deposited into an account paying 5% interest compounded annually for four years. The table shows the amount A in the account at the end of each year, rounded to the nearest cent.

Year	Beginning Balance	Interest = Prt	Amount = $P + I$
1	$1000	$I = 1000(0.05) = \$50$	$A = 1000 + 50 = \$1050$
2	$1050	$I = 1050(0.05) = \$52.50$	$A = 1050 + 52.50 = \$1102.50$
3	$1102.50	$I = 1102.50(0.05) = \$55.13$	$A = 1102.50 + 55.13 = \$1157.63$
4	$1157.63	$I = 1157.63(0.05) = \$57.88$	$A = 1157.63 + 57.88 = \$1215.51$

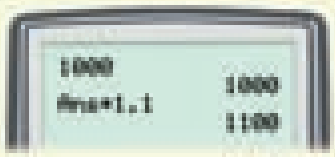
Activity 1

Suppose $1000 were deposited into an account paying 10% interest compounded annually. Find the amount A in the account at the end of each year for 5 years. How much interest is added after the first year? How much interest is added after the fifth year?

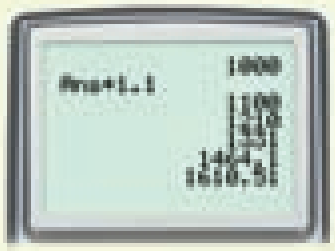
1. Press 1000 ENTER



2. Then press 2nd (−) ANS × 1.1 ENTER.



3. Then press ENTER 4 more times to repeat multiplication by 1.1.



The amounts in the account after each year are $1100, $1210, $1331, $1464.10, and $1610.51.

Interest added after the first year is $1100 − $1000 = $100.

Interest added after the fifth year is $1610.51 − $1464.10 = $146.41.

Think and Discuss

1. Suppose Activity 1 was done using simple interest. How would the interest added after the first year and the interest added after the fifth year compare? Why?
2. Suppose the interest was compounded *biannually* (2 times a year) at 5% interest each time interest compounds. Would the amount after one year be less, more, or equal to $1100? Justify your reasoning.

The formula for compound interest is $A = P(1 + r)^n$, where A is the final dollar value, P is the initial dollar investment, r is the rate for each interest period, and n is the number of interest periods.

Activity 2

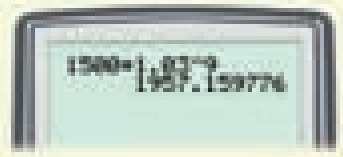
Use a calculator to find the value after 9 years of $1500 invested in a savings bank that pays 3% interest compounded annually.

The initial investment P is $1500. The rate r is 3% = 0.03. The interest period is one year. The number of interest periods n is 9.

$$A = 1500(1.03)^9$$

1. On your graphing calculator, press

   1500 [×] 1.03 [^] 9 [ENTER].



After 9 years, the initial investment of $1500 will be worth $1957.16 (rounded to the nearest cent).

Think and Discuss

1. Compare the value of an initial deposit of $1000 at 6% simple interest for 10 years with the same initial deposit at 6% annual compound interest for 10 years. Which is greater? Why?

Try This

Find the value of an initial investment of $2500 for the specified term and interest rate.

1. 8 years, 5% compounded annually
2. 20 years, 3% compounded annually
3. 6 years, 12% compounded annually
4. 12 years, 6% compounded annually

Ready To Go On?

Quiz for Lessons 6-5 Through 6-7

6-5 Percent Increase and Decrease

Find each percent increase or decrease to the nearest percent.

1. from 40 to 55

2. from 75 to 150

3. from 110 to 82

4. from 87 to 25

5. A population of geese rose from 234 to 460 over a period of two years. What is the percent increase, to the nearest tenth of a percent?

6. Mr. Simmons owns a hardware store and typically marks up merchandise by 28% over warehouse cost. How much would he charge a customer for a hammer that costs him $13.50?

7. A blouse and skirt that normally sell for $39.55 are on sale for 30% off the normal price. What is the sales price?

6-6 Applications of Percents

Find each commission or sales tax to the nearest cent.

8. total sales: $12,500
commission rate: 3.25%

9. total sales: $14.23
sales tax rate: 8.25%

10. total sales: $25,000
commission rate: 2.75%

11. total sales: $251.50
sales tax rate: 7.5%

12. total sales: $10,500
commission rate: 4%

13. total sales: $75.99
sales tax rate: 6.125%

14. Josh earns a weekly salary of $300 plus a 6% commission on sales. Last week, his sales totaled $3500. What was his total pay?

6-7 Simple Interest

Find the interest and the total amount to the nearest cent.

15. $225 at 5% per year for 3 years

16. $775 at 8% per year for 1 year

17. Leroy borrowed $8250 to be repaid after 3 years at an annual simple interest rate of 7.25%. How much interest will be due after 3 years? How much will Leroy have to repay?

18. Kim deposited $1422 in a savings account. How much would she have in the account after 5 years at an annual simple interest rate of 3%?

19. Hank borrowed $25,000 to remodel his house. At the end of 3 years, he had repaid a total of $29,125. At what simple interest rate did he borrow the money?

20. Akule borrowed $1500 at an annual simple interest rate of 12%. He paid $270 in interest. For what period of time did Akule borrow the money?

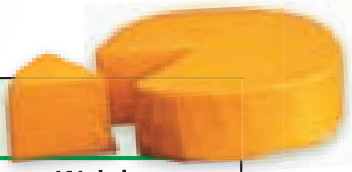
Real-World CONNECTIONS

CHAPTER 6

America's Dairyland

Wisconsin has long been known for its dairy industry. In 2007, the state had 1.25 million dairy cows, which produced an incredible 1.9 billion pounds of milk per month. Not surprisingly, Wisconsin is the nation's top-ranked state in cheese production.

WISCONSIN



1. The table gives data on the number of pounds of cheese produced in Wisconsin in 2006.

   a. Find the total weight of cheese produced in the state.

   b. What percent of the total weight was cheddar cheese? Round to the nearest percent.

Wisconsin Cheese Production (2006)

Variety	Weight (Millions of Pounds)
Cheddar	644
Mozzarella	846
Provolone	141
American	176
Parmesan	67
Other Varieties	594

2. In 2006, about 1.6% of all of the cheese produced in Wisconsin was Muenster cheese. To the nearest million, how many pounds of Muenster cheese were produced in Wisconsin?

3. In 2006, Wisconsin had 14,900 dairy farms. This number represents 19% of all dairy farms in the United States during that year. To the nearest hundred, how many dairy farms were there in the United States in 2006?

4. The value of Wisconsin dairy exports was $59 million during the first nine months of 2006. For the same months in 2007, the value of Wisconsin dairy exports was $127 million. What was the percent increase in the value of Wisconsin's dairy exports during this period? Round to the nearest percent.

5. In 2007, there were 154 dairy manufacturing plants in the state. This was a 10% increase from the number of dairy plants in 2006. How many dairy plants were there in Wisconsin in 2006?

Game Time

Percent Puzzlers

Prove your precision with these perplexing percent puzzlers!

1. A farmer is dividing his sheep among four pens. He puts 20% of the sheep in the first pen, 30% in the second pen, 37.5% in the third pen, and the rest in the fourth pen. What is the smallest number of sheep he could have?

2. Karen and Tina are on the same baseball team. Karen has hit in 35% of her 200 times at bat. Tina has hit in 30% of her 20 times at bat. If Karen hits in 100% of her next five times at bat and Tina hits in 80% of her next five times at bat, who will have the higher percentage of hits?

3. Joe was doing such a great job at work that his boss gave him a 10% raise! Then he made such a huge mistake that his boss gave him a 10% pay cut. What percent of his original salary does Joe make now?

4. Suppose you have 100 pounds of saltwater that is 99% water (by weight) and 1% salt. Some of the water evaporates so that the remaining liquid is 98% water and 2% salt. How much does the remaining liquid weigh?

Percent Tiles

Use cardboard or heavy paper to make 100 tiles with a digit from 0 through 9 (10 of each) on each tile, and print out a set of cards. Each player draws seven tiles. Lay four cards out on the table as shown. The object of the game is to collect as many cards as possible. To collect a card, use numbered tiles to correctly complete the statement on the card.

A complete set of the rules and game cards are available online.

Learn It Online
Game Time Extra **go.hrw.com**, keyword MT10 Games Go

It's in the Bag!

Materials

- 4-8 in. colored squares of paper
- 2-4$\frac{1}{2}$ in. squares of card stock
- about 12 in. of ribbon
- tape
- glue
- markers

PROJECT Origami Percents

Make this spectacular fold-and-hold origami notebook to record facts about percents.

Directions

1. Fold one of the colored squares of paper in half vertically and then horizontally. Unfold the paper. Then fold the square diagonally and unfold the paper. **Figure A**

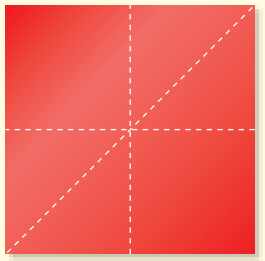
2. Fold the diagonal crease back and forth so that it is easy to work with. Then bring the two ends of the diagonal together as shown in the figure. **Figure B**

3. Repeat steps 1 and 2 for all of the squares of paper, and set them aside.

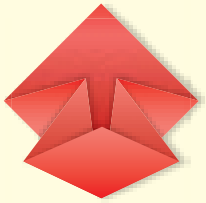
4. Lay the squares of card stock in front of you so that they are about $\frac{1}{4}$ inch apart. Lay the ribbon across the squares as shown, and tape it down. **Figure C**

5. Glue one of the folded squares onto the piece of card stock on the left. Glue the next folded square onto the first one so that their sides match up and they open in the same direction. Continue with the remaining squares, gluing the last one onto the piece of card stock on the right.

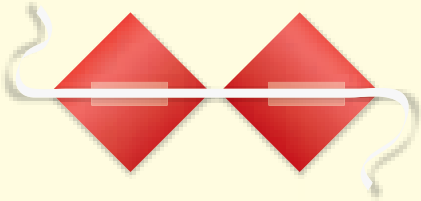
A



B



C



Taking Note of the Math

Write notes from the chapter on the various faces of the folded squares.

CHAPTER 6

Study Guide: Review

Vocabulary

Complete the sentences below with vocabulary words from the list above. Words may be used more than once.

1. A ratio that compares a number to 100 is called a(n) ___?___.
2. The ratio $\frac{\text{amount of change}}{\text{original amount}}$ is called the ___?___.
3. Percent is used to calculate ___?___, a fee paid to a person who makes a sale.

EXAMPLES

EXERCISES

6-1 Relating Decimals, Fractions, and Percents (pp. 282–285)

■ **Complete the table.**

Fraction	Decimal	Percent
$\frac{3}{4}$	0.75	0.75(100) = 75%
$\frac{625}{1000} = \frac{5}{8}$	0.625	0.625(100) = 62.5%
$\frac{80}{100} = \frac{4}{5}$	0.80	80%

Complete the table.

Fraction	Decimal	Percent
$\frac{7}{16}$	**4.**	**5.**
6.	1.125	**7.**
8.	**9.**	70%

6-2 Estimating with Percents (pp. 286–290)

■ **Estimate 6% of 17.**

$6\% \cdot 17 \approx 5\% \cdot 20$ *Use compatible numbers.*

$\approx 0.05 \cdot 20$ *Write 5% as a decimal.*

≈ 1 *Multiply.*

6% of 17 is about 1.

Estimate.

10. 11% of 303

11. 102% of 62

12. $33\frac{1}{3}\%$ of 10

13. 60% of 34

14. a 15% tip for $48.90

15. a 20% tip for $82.75

6-3 Finding Percents (pp. 291–295)

■ **A raw apple weighing 5.3 oz contains about 4.45 oz of water. What percent of an apple is water?**

$$\frac{\text{percent}}{100} = \frac{\text{part}}{\text{whole}}$$ *Set up a proportion.*

$$\frac{n}{100} = \frac{4.45}{5.3}$$ *Substitute.*

$$5.3n = 445$$ *Cross multiply.*

$$n = \frac{445}{5.3} \approx 83.96$$
$$\approx 84\%$$

An apple is about 84% water.

16. Find 27% of 1.4.

17. The length of a year on Mars is about 687 Earth days. The length of a year on Venus is about 225 Earth days. About what percent of the length of Mars's year is Venus's year?

18. The main span of the Brooklyn Bridge is 1595 feet long. The Golden Gate Bridge is about 263% of the length of the Brooklyn Bridge. To the nearest hundred feet, how long is the Golden Gate Bridge?

6-4 Finding a Number When the Percent Is Known (pp. 296–299)

■ **In 2003 the population of Fairbanks, Alaska, was 30,970. This was about 491% of the population of Kodiak, Alaska. To the nearest ten people, find the population of Kodiak in 2003.**

$$\frac{491}{100} = \frac{30{,}970}{n}$$ *Set up a proportion.*

$$491n = 3{,}097{,}000$$ *Cross multiply.*

$$n = \frac{3{,}097{,}000}{491} \approx 6307.5356$$
$$\approx 6310$$

The population of Kodiak was about 6310.

19. 0.4% of what number is 10?

20. The diameter at the equator of Saturn is 74,897 miles. This is about 945% of the diameter of Earth at its equator. To the nearest ten miles, find the diameter of Earth at its equator.

21. At the age of 20 weeks, Zoe weighed 16 lb 4 oz. Her birth weight was about $33\frac{1}{3}\%$ of her 20-week weight. To the nearest ounce, what was her birth weight?

6-5 Percent Increase and Decrease (pp. 302–305)

■ **In 1990 there were 639,270 robberies reported in the United States. This number decreased in 2002 to 420,637. What was the percent decrease?**

$639{,}270 - 420{,}637 = 218{,}633$ *Amount of decrease*

$$\frac{\text{amount of decrease}}{\text{original amount}} = \frac{218{,}633}{639{,}270}$$

$$\approx 0.3420$$
$$\approx 34.2\%$$

The number of reported robberies decreased by 34.2%.

22. On sale, a skirt was reduced from \$25 to \$21. Find the percent decrease.

23. In 1900 the U.S. public debt was \$1.2 billion dollars. This number increased to \$5674.2 billion dollars in 2000. Find the percent increase.

24. At the beginning of a 40-week medically supervised diet, Arnie weighed 276 lb. After the diet, Arnie weighed 181 lb. Find the percent decrease.

EXAMPLES

EXERCISES

6-6 Applications of Percents (pp. 306–309)

■ **As an appliance salesman, Gavin earns a base pay of $525 per week plus a 6% commission on his weekly sales. Last week, his sales totaled $3250. How much did he earn for the week?**

Find the amount of commission.

$6\% \cdot \$3250 = c$

$0.06 \cdot 3250 = c$ *Write 6% as a decimal.*

$195 = c$ *Multiply.*

Add the commission amount to his base pay.

$\$195 + \$525 = \$720$

Last week Gavin earned $720.

25. As a real estate agent, Kensho earns $4\frac{1}{2}\%$ commission on the houses he sells. In the first quarter of this year, he sold two houses, one for $175,000 and the other for $199,000. How much was Kensho's commission for this quarter?

26. If the sales tax is $8\frac{1}{4}\%$, how much tax would Luisa pay for a picture frame that costs $17.99 and a desk calendar that costs $24.99?

6-7 Simple Interest (pp. 310–313)

■ **For home improvements, the Walters borrowed $10,000 for 3 years at simple interest. They repaid a total of $11,050. What was the interest rate of the loan?**

Find the amount of interest.

$P + I = A$ *Use the formula.*

$10{,}000 + I = 11{,}050$ *Substitute.*

$-10{,}000 \quad -10{,}000$ *Subtract 10,000 from both sides.*

$I = 1050$ *Simplify.*

The amount of interest was $1050. Substitute into the simple interest formula.

$I = P \cdot r \cdot t$ *Use the formula.*

$1050 = 10{,}000 \cdot r \cdot 3$ *Substitute.*

$1050 = 30{,}000r$ *Simplify.*

$\frac{1050}{30{,}000} = \frac{30{,}000r}{30{,}000}$ *Divide both sides by 30,000.*

$0.035 = r$ *Simplify.*

The interest rate of the loan was 3.5%.

Using the simple interest formula, find the missing number.

27. interest = ▢; principal = $14,500; rate = $6\frac{1}{4}\%$ per year; time = $3\frac{1}{2}$ years

28. interest = $32; principal = ▢; rate = 2% per year; time = 4 years

29. interest = $367.50; principal = $1500; rate per year = ▢; time = $3\frac{1}{2}$ years

30. interest = $1787.50; principal = $55,000; rate = $6\frac{1}{2}\%$ per year; time = ▢

31. Which simple-interest loan would cost the borrower less? How much less?
$1000 at 3% for 4 years or
$1000 at 3.75% for 3 years

32. Wade borrowed $12,500 from his uncle at 4.5% simple interest to use for travel and repaid the loan in 4 years. How much did he pay back?

Chapter Test

CHAPTER 6

Order the numbers from least to greatest.

1. $\frac{4}{5}$, 75%, 0.82, $\frac{17}{20}$ **2.** $\frac{8}{20}$, 0.35, 15%, 0.2 **3.** 75%, $\frac{7}{9}$, 0.8, $\frac{5}{6}$ **4.** 58%, $\frac{33}{60}$, 0.45, 49%

Estimate.

5. 17% of 42 **6.** 79% of 122 **7.** 32% of 511

8. 83% of 197 **9.** 4% of 1900 **10.** 27% of 80

11. a 15% tip on a $37 bill **12.** a 19% tip on a $53 bill **13.** a 17% tip on a $23 bill

14. What percent of 53 is 53? **15.** What percent of 0.5 is 0.03?

16. What percent of 2000 is 8? **17.** What percent of 24 is 96?

18. Of the 50 states in the Union, 32% have names that begin with either *M* or *N*. How many states have names beginning with either *M* or *N*?

19. 30 is 12.5% of what number? **20.** 244 is 250% of what number?

21. $7\frac{1}{2}$ is 5% of what number? **22.** 5.6 is 56% of what number

23. At 3 P.M., a chimney casts a shadow that is 135% its actual height. If the shadow is 37.8 ft, what is the actual height of the chimney?

Find each percent increase or decrease to the nearest percent.

24. from 125 to 75 **25.** from 20 to 62 **26.** from 236 to 125 **27.** from 11 to 98

28. from 0.5 to 2 **29.** from 12.2 to 6.1 **30.** from 18.4 to 18.3 **31.** from 0.2 to 6

32. The price for a share of XYZ stock went from $32 to $37 in one month. What was the percent increase to the nearest tenth of a percent?

Find each commission or sales tax to the nearest cent.

33. total sales: $13,600
commission rate: 2.75%

34. total sales: $135.50
sales tax rate: 8.25%

35. total sales: $20,250
commission rate: 3.9%

36. Ms. Tan earns $350 per week plus an 8% commission on her shoe sales. She sold $560 last week. What was her total pay for the week?

37. George earns an annual salary of $36,000. In addition to this, he earns a 3% commission on all sales he makes. If George had $264,000 in sales last year, what was his total pay?

38. Dena borrowed $7500 to buy a used car. The credit union charged 9% simple interest per year. She paid $2025 in interest. For what period of time did she borrow the money?

39. At Thrift Bank, if you keep $675 in a savings account for 12 years, your money will earn $486 in interest. What annual simple interest rate does the bank offer?

CHAPTER 6

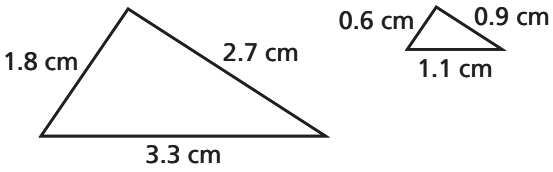
Standardized Test Prep

Learn It Online
State Test Practice go.hrw.com,
keyword MT10 TestPrep Go

Cumulative Assessment, Chapters 1–6

Multiple Choice

1. If the figures are similar, what is the scale factor?



Ⓐ 1:3 Ⓒ 2:9

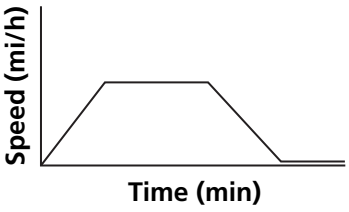
Ⓑ 2:3 Ⓓ 1:9

2. If the base of a right triangle is 24 centimeters and the hypotenuse is 40 centimeters, what is the area of the triangle?

Ⓕ 384 cm^2 Ⓗ 768 cm^2

Ⓖ 480 cm^2 Ⓙ 960 cm^2

3. Which situation corresponds to the graph?



Ⓐ Jill's dog chases a cat, stops and waits, and then runs down a hill.

Ⓑ Joe's dog sits at his feet, sees a cat and darts off, and then comes back.

Ⓒ Abe's dog chases a squirrel to a tree, runs circles around the tree, and then runs back to Abe and sits down.

Ⓓ Amy's dog walks around the block, then runs to the house, and then sits.

4. Which equation is equivalent to the equation $\frac{1}{2}x + 8 = -10$?

Ⓕ $\frac{1}{2}x = -2$ Ⓗ $x + 8 = -20$

Ⓖ $x + 8 = -5$ Ⓙ $\frac{1}{2}x = -18$

5. Which situation corresponds to the inequality $x < 90$?

Ⓐ Jerry has at least $90 in his bank account.

Ⓑ Jerry owes his mom no more than $90 for his car insurance.

Ⓒ Jerry rented more than 90 videos last year.

Ⓓ Jerry works fewer than 90 hours each month at the newspaper.

6. A refrigerator that usually sells for $879 goes on sale for $649. What is the percent decrease, to the nearest tenth of a percent?

Ⓕ 12.2% Ⓗ 35.4%

Ⓖ 26.2% Ⓙ 173.8%

7. The human body is 65% water. Which is NOT an equivalent number?

Ⓐ 0.65 Ⓒ 6.5×10^{-1}

Ⓑ $\frac{13}{20}$ Ⓓ 6.50

8. One in every 3 girls plays a varsity sport in high school. In 1970, 1 in every 27 girls played a varsity sport. What is the percent increase, rounded to the nearest percent?

Ⓕ 8% Ⓗ 800%

Ⓖ 88% Ⓙ 888%

9. Gloria invests $158 in a simple interest account for 4 years at 2% interest. How many dollars did she earn in interest?

Ⓐ $170.64 Ⓒ $12.64

Ⓑ $126.40 Ⓓ $1.26

HOT TIP! **Underline key words, such as *at least, rounded to,* and *equivalent,* to help you focus on what is being asked.**

Gridded Response

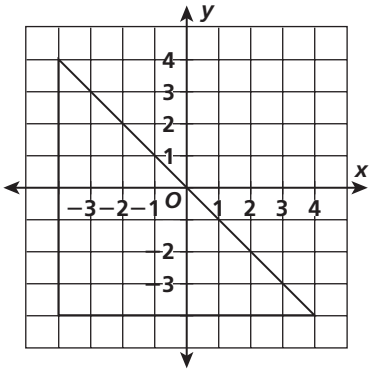
10. Heidi, Mike, Brenda, and Luis won 120 tokens in all at a fair. Heidi won $\frac{1}{5}$ of the tokens, Mike won 0.4 of the tokens, Brenda won 25% of the tokens, and Luis won the rest. How many tokens did Luis win?

11. Yesenia, a real estate agent, has 32 houses on the market. If she sells 5 of the houses this month, what percent of the houses on the market will she sell? Grid your response as a decimal rounded to the nearest thousandth.

12. A recipe calls for 4 cups of strawberries for every 6 cups of whipped topping. If Gino uses 54 cups of whipped topping, how many cups of strawberries does he need?

13. Six more than $\frac{1}{4}$ of a number is $\frac{1}{3}$ of the number. What is the number?

14. What is the length of the hypotenuse after a dilation with a scale factor of $\frac{1}{2}$? Round your answer to the nearest hundredth.



Short Response

S1. If 10 kg of acid is added to 15 kg of water, what percent of the resulting solution is acid? Show your work.

S2. In the chemistry laboratory, Jim is working with six large jars of capacities 5 L, 4 L, 3 L, 2 L, 1 L, and 10 L. The 5 L jar is filled with an acid mix, and the rest of the jars are empty. Jim uses the 5 L jar to fill the 4 L jar and pours the excess into the 10 L jar. Then he uses the 4 L jar to fill the 3 L jar and pours the excess into the 10 L jar. He repeats the process until all but the 1 L and 10 L jars are empty. What percent of the 10 L jar is now filled? Show your work.

S3. Mr. Coluzzi bought a 5-pound bag of Granny Smith apples for $3.99. Individual apples cost $0.82 per pound. Justify whether Mr. Coluzzi made the better buy.

S4. Four friends equally shared the cost of a $48.80 gift. They got a 20% discount and paid 7.25% sales tax. How much money did each person pay? Explain.

Extended Response

E1. Amanda and Sergio each have $3000 to invest. Amanda invests with her local banker, while Sergio invests his money using an online service. They both invest at a 3% interest rate.

a. Amanda's banker invests the money using a simple interest plan. If Amanda keeps her money in this plan for 5 years, how much interest will she earn?

b. What is the value of Sergio's investment if he invests for 5 years compounded annually?

c. What is the difference in the amount of money earned? Explain your reasoning.

d. Who earns more money after 5 years?