

Basic College Mathematics

AN APPLIED APPROACH



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Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

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Ratio and Proportion

4

OBJECTIVES

SECTION 4.1

- A** To write the ratio of two quantities in simplest form
- B** To solve application problems

SECTION 4.2

- A** To write rates
- B** To write unit rates
- C** To solve application problems

SECTION 4.3

- A** To determine whether a proportion is true
- B** To solve proportions
- C** To solve application problems

Focus on Success

Are you making attending class a priority? Remember that to be successful, you must attend class. You need to be in class to hear your instructor's explanations and instructions, as well as to ask questions when something is unclear. Most students who miss a class fall behind and then find it very difficult to catch up. (See Class Time, page AIM-5.)



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Prep Test

Are you ready to succeed in this chapter? Take the Prep Test below to find out if you are ready to learn the new material.

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

2. Simplify: $\frac{450}{650 + 250}$

3. Write $\frac{372}{15}$ as a terminating or repeating decimal.

4. Which is greater, 4×33 or 62×2 ?

5. Complete: $? \times 5 = 20$

SECTION

4.1

Ratio

OBJECTIVE A

To write the ratio of two quantities in simplest form

Quantities such as 3 feet, 12 cents, and 9 cars are number quantities written with units.

3 feet

12 cents

9 cars

↑

units

These are some examples of units. Shirts, dollars, trees, miles, and gallons are further examples.

A **ratio** is a comparison of two quantities that have the *same* units. This comparison can be written in three different ways:

1. As a fraction
2. As two numbers separated by a colon (:)
3. As two numbers separated by the word *to*

The ratio of the lengths of two boards, one 8 feet long and the other 10 feet long, can be written as

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

$$2. 8 \text{ feet} : 10 \text{ feet} = 8 : 10 = 4 : 5$$

$$3. 8 \text{ feet to } 10 \text{ feet} = 8 \text{ to } 10 = 4 \text{ to } 5$$

Writing the **simplest form of a ratio** means writing it so that the two numbers have no common factor other than 1.

This ratio means that the smaller board is $\frac{4}{5}$ the length of the longer board.

EXAMPLE 1

Write the comparison \$6 to \$8 as a ratio in simplest form using a fraction, a colon, and the word *to*.

Solution $\frac{\$6}{\$8} = \frac{6}{8} = \frac{3}{4}$

$$\$6 : \$8 = 6 : 8 = 3 : 4$$

$$\$6 \text{ to } \$8 = 6 \text{ to } 8 = 3 \text{ to } 4$$

YOU TRY IT 1

Write the comparison 20 pounds to 24 pounds as a ratio in simplest form using a fraction, a colon, and the word *to*.

Your solution

EXAMPLE 2

Write the comparison 18 quarts to 6 quarts as a ratio in simplest form using a fraction, a colon, and the word *to*.

Solution $\frac{18 \text{ quarts}}{6 \text{ quarts}} = \frac{18}{6} = \frac{3}{1}$

$$18 \text{ quarts} : 6 \text{ quarts} = 18 : 6 = 3 : 1$$

$$18 \text{ quarts to } 6 \text{ quarts} = 18 \text{ to } 6 \\ = 3 \text{ to } 1$$

YOU TRY IT 2

Write the comparison 64 miles to 8 miles as a ratio in simplest form using a fraction, a colon, and the word *to*.

Your solution

Solutions on p. S11

OBJECTIVE B*To solve application problems*

Christian Delbert/Shutterstock.com

The table below shows the number of board feet in stock at a lumber store for each of four types of wood. Use the table for Example 3 and You Try It 3.

Board Feet of Wood at a Lumber Store			
Pine	Ash	Oak	Cedar
20,000	18,000	10,000	12,000

EXAMPLE 3

Find, as a fraction in simplest form, the ratio of the number of board feet of pine to the number of board feet of oak.

Strategy

To find the ratio, write the ratio of board feet of pine (20,000) to board feet of oak (10,000) in simplest form.

Solution

$$\frac{20,000}{10,000} = \frac{2}{1}$$

The ratio is $\frac{2}{1}$.

YOU TRY IT 3

Find, as a fraction in simplest form, the ratio of the number of board feet of cedar to the number of board feet of ash.

Your strategy**Your solution****EXAMPLE 4**

The cost of building a patio cover was \$500 for labor and \$700 for materials. What, as a fraction in simplest form, is the ratio of the cost of materials to the total cost for labor and materials?

Strategy

To find the ratio, write the ratio of the cost of materials (\$700) to the total cost (\$500 + \$700) in simplest form.

Solution

$$\frac{\$700}{\$500 + \$700} = \frac{700}{1200} = \frac{7}{12}$$

The ratio is $\frac{7}{12}$.

YOU TRY IT 4

A company spends \$600,000 a month for television advertising and \$450,000 a month for radio advertising. What, as a fraction in simplest form, is the ratio of the cost of radio advertising to the total cost of radio and television advertising?

Your strategy**Your solution**

Solutions on p. S11



4.1 EXERCISES

 **Concept Check**

- How do you read $\frac{3}{8}$ as a ratio?
- How do you read $8 : 3$ as a ratio?

OBJECTIVE A*To write the ratio of two quantities in simplest form*


For Exercises 3 to 20, write the comparison as a ratio in simplest form using a fraction, a colon (:), and the word *to*.

- 3 pints to 15 pints
- 6 pounds to 8 pounds
- \$40 to \$20
- 10 feet to 2 feet
- 3 miles to 8 miles
- 2 hours to 3 hours
- 6 minutes to 6 minutes
- 8 days to 12 days
- 35 cents to 50 cents
- 28 inches to 36 inches
- 30 minutes to 60 minutes
- 25 cents to 100 cents
- 32 ounces to 16 ounces
- 12 quarts to 4 quarts
- 30 yards to 12 yards
- 12 quarts to 18 quarts
- 20 gallons to 28 gallons
- 14 days to 7 days
-  To write a ratio that compares 3 days to 3 weeks, change 3 weeks into an equivalent number of _____.
-  Is the ratio $3 : 4$ the same as the ratio $4 : 3$?

OBJECTIVE B*To solve application problems*

Budgets For Exercises 23 to 26, use the information in the table. Write ratios in simplest form using a fraction.

Family Budget						
Housing	Food	Transportation	Taxes	Utilities	Miscellaneous	Total
\$1600	\$800	\$600	\$700	\$300	\$800	\$4800

- Find the ratio of utilities costs to food costs.
- Find the ratio of food costs to total expenses.
- Find the ratio of housing costs to total expenses.
-  Write a verbal description of two ratios represented by $1 : 2$.

27. **Facial Hair** Using the data in the news clipping at the right and the figure 110 million for the number of adult males in the United States, write the ratio of the number of men who participated in Movember to the number of adult males in the U.S. Write the ratio as a fraction in simplest form.
28. **Real Estate** A house with an original value of \$180,000 increased in value to \$220,000 in 5 years. What is the ratio of the increase in value to the original value of the house?
29. **Energy Prices** The price per gallon of gasoline rose from \$2.70 to \$3.24 in one year. What is the ratio of the increase in price to the original price?
30. **Sports** National Collegiate Athletic Association (NCAA) statistics show that for every 75,000 high school seniors playing basketball, about 2250 play college basketball as first-year students. Write the ratio of the number of first-year students playing college basketball to the number of high school seniors playing basketball.
31. **Sports** NCAA statistics show that of about 3750 college seniors playing college basketball, about 45 will play as rookies in the National Basketball Association. Write the ratio of the number of National Basketball Association rookies to the number of college seniors playing basketball.
32. **Consumerism** In a recent year, women spent \$2 million on swimwear and purchased 92,000 swimsuits. During the same year, men spent \$500,000 on swimwear and purchased 37,000 swimsuits. (Source: NPD Group) **a.** Find the ratio of the amount men spent on swimwear to the amount women spent on swimwear. **b.** Find the ratio of the amount men spent on swimwear to the total amount men and women spent on swimwear. Write the ratios as fractions in simplest form.


In the NEWS!

Grow a Mustache, Save a Life

Movember, a month-long mustache-growing event during November, raises money for the Prostate Cancer Foundation. Last year, 65,000 U.S. men took part in Movember, raising \$7.5 million.

Source: *The Sacramento Bee*

Critical Thinking

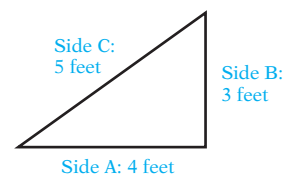
33.  Is the value of a ratio always less than 1? Explain.

Projects or Group Activities

34. Ratios can be extended to include more than two numbers. For instance, the ratio of the sides of the triangle at the right below can be written 3 : 4 : 5. The study of the ratios of the sides of a triangle is part of a branch of mathematics called **trigonometry**, which has important applications to science and engineering. The Canadarm2 uses trigonometry in the design of its robotic system on the international space station.
- Are the sides of a triangle whose sides measure 18 inches, 24 inches, and 30 inches in the ratio 3 : 4 : 5?
 - Are the sides of a triangle whose sides measure 9 inches, 16 inches, and 25 inches in the ratio 3 : 4 : 5?
 - For the triangle at the right, find the ratio of Side B to Side A.
 - For the triangle at the right, find the ratio of Side B to Side C.
 - For the triangle at the right, find the ratio of Side A to Side C.
35. Get a large bag of M&Ms and find the ratio of the number of red, blue, green, yellow, and orange candies.



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SECTION

4.2

Rates

OBJECTIVE A

To write rates



Point of Interest

Listed below are rates at which various crimes are committed in our nation.

Crime	Every
Larceny	4 seconds
Burglary	14 seconds
Robbery	60 seconds
Rape	6 minutes
Murder	31 minutes

A **rate** is a comparison of two quantities that have *different* units. A rate is written as a fraction.

A distance runner ran 26 miles in 4 hours. The distance-to-time rate is written

$$\frac{26 \text{ miles}}{4 \text{ hours}} = \frac{13 \text{ miles}}{2 \text{ hours}}$$

Notice that the above rate is written in simplest form. Writing the **simplest form of a rate** means writing it so that the two numbers that form the rate have no common factor other than 1.

EXAMPLE 1

Write “6 roof supports for every 9 feet” as a rate in simplest form.

Solution

$$\frac{6 \text{ supports}}{9 \text{ feet}} = \frac{2 \text{ supports}}{3 \text{ feet}}$$

YOU TRY IT 1

Write “15 pounds of fertilizer for 12 trees” as a rate in simplest form.

Your solution

Solution on p. S11

OBJECTIVE B

To write unit rates



Point of Interest

According to a Gallup Poll, women see doctors more often than men do. On average, men visit the doctor 3.8 times per year, whereas women go to the doctor 5.8 times per year.

A **unit rate** is a rate in which the number in the denominator is 1.

$$\frac{\$3.25}{1 \text{ pound}} \text{ or } \$3.25/\text{pound} \text{ is read “\$3.25 per pound.”}$$

To find a unit rate, divide the number in the numerator of the rate by the number in the denominator of the rate.

APPLY THE CONCEPT

A car was driven 344 miles on 16 gallons of gasoline. How many miles did the car travel on 1 gallon of gasoline?

$$\text{The rate that compares miles to gallons is } \frac{344 \text{ miles}}{16 \text{ gallons}}$$

To find the miles per gallon (the unit rate), divide the numerator (344 miles) by the denominator (16 gallons).

$$344 \text{ miles} \div 16 \text{ gallons} = 21.5 \text{ miles/gallon}$$

The car traveled 21.5 miles per gallon of gasoline.

EXAMPLE 2

Write “300 feet in 8 seconds” as a unit rate.

Solution

$$\frac{300 \text{ feet}}{8 \text{ seconds}} = \frac{37.5}{8} = 37.5$$

37.5 feet/second

YOU TRY IT 2

Write “260 miles in 8 hours” as a unit rate.

Your solution

Solution on p. S11

OBJECTIVE C*To solve application problems*

Denver Airport

Ambient Ideas/Shutterstock.com

HOW TO 1

The table at the right shows miles flown and air fares for some routes in the continental United States. Determine the most expensive route and the least expensive route per mile.

Long Routes	Miles	Fare
New York–Los Angeles	2475	\$683
San Francisco–Dallas	1464	\$536
Denver–Pittsburgh	1302	\$525
Minneapolis–Hartford	1050	\$483

Strategy

Find the cost per mile for each route by dividing the fare by the miles flown. Compare the costs per mile to determine the most and least expensive routes.

Solution

$$\text{New York–Los Angeles} \quad \frac{683}{2475} \approx 0.28$$

$$\text{San Francisco–Dallas} \quad \frac{536}{1464} \approx 0.37$$

$$\text{Denver–Pittsburgh} \quad \frac{525}{1302} \approx 0.40$$

$$\text{Minneapolis–Hartford} \quad \frac{483}{1050} = 0.46$$

$$0.28 < 0.37 < 0.40 < 0.46$$

The Minneapolis–Hartford route is the most expensive per mile, and the New York–Los Angeles route is the least expensive per mile.

Integrating Technology

To calculate the costs per mile using a calculator, perform four divisions:

$$683 \div 2475 =$$

$$536 \div 1464 =$$

$$525 \div 1302 =$$

$$483 \div 1050 =$$

In each case, round the number in the display to the nearest hundredth.

EXAMPLE 3

A motorcycle racer completed a 6-mile lap in 0.05 hour (3 minutes). Find the racer’s speed in miles per hour.

Strategy

To find the speed in miles per hour, divide the length of the lap (6 miles) by the time (0.05 hour).

Solution

$$\frac{6 \text{ miles}}{0.05 \text{ hour}} = 120 \text{ miles/hour}$$

The racer’s speed was 120 miles/hour.

YOU TRY IT 3



A landscape technician purchased 40 feet of $\frac{3}{4}$ -inch PVC pipe for \$22.40. What is the per-foot cost of the pipe?

Your strategy**Your solution**

Solution on p. S11


4.2 EXERCISES

 **Concept Check**

-  What is the difference between a ratio and a rate?
-  How is a unit rate calculated?

OBJECTIVE A *To write rates*

For Exercises 3 to 10, write each phrase as a rate in simplest form.

- 3 pounds of meat for 4 people
- 30 ounces in 24 glasses
- \$80 for 12 boards
- 84 cents for 3 candy bars
- 300 miles on 15 gallons
- 88 feet in 8 seconds
- 16 gallons in 2 hours
- 25 ounces in 5 minutes
-  If the rate at which water flows through a nozzle is given in gallons per minute, how do you find the rate in gallons per second?

OBJECTIVE B *To write unit rates*

 For Exercises 12 to 14, complete the unit rate.

- 5 miles in ___ hour
- 15 feet in ___ second
- 5 grams of fat in ___ serving

For Exercises 15 to 24, write each phrase as a unit rate.

- 10 feet in 4 seconds
- 816 miles in 6 days
- \$3900 earned in 4 weeks
- \$51,000 earned in 12 months

19. 1100 trees planted on 10 acres
20. 3750 words on 15 pages
21. \$131.88 earned in 7 hours
22. 628.8 miles in 12 hours
23. 409.4 miles on 11.5 gallons of gasoline
24. \$11.05 for 3.4 pounds
25. **Fuel Efficiency** A hybrid electric vehicle used 15 gallons of gasoline to travel 639 miles. How many miles per gallon did the car get?
26. **Audio Technology** An audio-visual technician spent 2 hours preparing a surround sound recommendation for a homeowner. If the technician charged \$99 for this service, what is the technician's hourly wage?

OBJECTIVE C *To solve application problems*

Miles per Dollar One measure of how expensive it is to drive your car is calculated as miles per dollar, which is the number of miles you drive on 1 dollar's worth of gasoline. Use this information for Exercises 27 and 28.

27. Suppose you get 26 miles per gallon of gasoline and gasoline costs \$3.49 per gallon. Calculate your miles per dollar. Round to the nearest tenth.
28. Suppose you get 23 miles per gallon of gasoline and gasoline costs \$3.15 per gallon. It costs you \$44.10 to fill the tank. Calculate your miles per dollar. Round to the nearest tenth.



iStockphoto.com/Aydim Mutlu

29. **Bike Sharing** Use the information in the news clipping at the right. Find the average number of rides per day during the Hubway program's first month. Round to the nearest whole number of rides per day.



© Clarence Holmes Photography/Alamy

30. **Construction** An architect designed a house that contains 1850 square feet. A home builder estimates that it will cost \$172,050 to build the house. What is the estimated cost per square foot to build the house?
31. **Advertising** The advertising fee for a 30-second spot for the 2011 Super Bowl was approximately \$3 million. If 106 million viewers watched the Super Bowl, what is the advertiser's cost per viewer for a 30-second ad? Round to the nearest cent. (Source: money.cnn.com)


In the NEWS!


Hubway's First Month a Success

In recent years, bike sharing programs have been rolled out in cities across the United States and around the world. In its first 30 days of operation, Boston's Hubway program saw its bicycles used for 36,612 rides.

Source: boston.com

- 32. Air Flow** A tire containing 732 cubic inches of air is punctured and begins a slow leak. After 4 hours, the tire is flat and there are 36 cubic inches of air remaining in the tire. What is the rate, in cubic feet per minute, at which air escaped from the tire?
- 33. Gas Pump** A quality control inspector needs to measure the flow rate of a gasoline pump. The inspector pumps 10 gallons of gas into a container in 50 seconds. What is the rate, in gallons per minute, at which the pump dispenses gas?

 **Exchange Rates** One application of rates is in the area of international trade. Suppose a company in Canada purchases a shipment of sneakers from an American company. The Canadian company must exchange Canadian dollars for U.S. dollars in order to pay for the order. The number of Canadian dollars that are equivalent to 1 U.S. dollar is called the **exchange rate**. The table at the right below shows the exchange rates per U.S. dollar for three foreign countries and for the euro at the time of this writing. Use this table for Exercises 34 to 36.

- 34.** How many euros would be paid for an order of American computer hardware costing \$120,000?
- 35.** Calculate the cost, in Japanese yen, of an American car costing \$34,000.
- 36.**  What does the quantity 1.9831×2500 represent?


<i>Exchange Rates per U.S. Dollar</i>	
Russian Ruble	30.4006
Brazilian Real	1.9831
Japanese Yen	79.8700
Euro	0.7788

- 37. Demography** The table below shows the population and area of three countries. The population density of a country is the number of people per square mile.

<i>Country</i>	<i>Population</i>	<i>Area (in square miles)</i>
Australia	21,767,000	2,968,000
India	1,189,173,000	1,269,000
United States	311,051,000	3,619,000


- a. Which country has the least population density?
- b. How many more people per square mile are there in India than in the United States? Round to the nearest whole number.

Critical Thinking

- 38. Compensation** You have a choice of receiving a wage of \$34,000 per year, \$2840 per month, \$650 per week, or \$18 per hour. Which pay choice would you take? Assume a 40-hour work week with 52 weeks of work per year.
- 39.**  The price–earnings ratio of a company’s stock is one measure used by stock market analysts to assess the financial well-being of the company. Explain the meaning of the price–earnings ratio.

Projects or Group Activities

Other Bases for Rates Some unit rates are so small that they are difficult to read, so a base other than 1 is used. Some common bases are 1000, 100,000, 1,000,000, and 1,000,000,000. For instance, a smog test on a car may be reported as 650 parts per million, abbreviated 650 ppm. This means that there are 650 smog molecules (such as nitrogen dioxide or carbon monoxide) per million molecules of exhaust. This rate is easier to understand than a unit rate of $\frac{650}{1,000,000} = 0.00065$ smog molecule per 1 molecule of exhaust.

40.  Infant mortality rates are reported in deaths per 1000 live births. Work through the following steps to find the infant mortality rate in the United States for a recent year, given that there were 4,316,000 live births and 29,000 deaths.
- Divide the number of deaths by the number of live births.
 - Multiply the answer by 1000. Round to the nearest tenth. This is the infant mortality rate per thousand.
41. The Environmental Protection Agency (EPA) has started using a new statistic on EPA fuel economy stickers—gallons of gas used per 100 miles driven. To find the number of gallons used per 100 miles, divide 100 by the car's miles-per-gallon (mpg) rating. What is the number of gallons per 100 miles for a car that has a rating of 28 mpg? Round to the nearest tenth.
42. The maximum amount of arsenic that is allowed in safe drinking water is 0.010 ppm. What is this amount in parts per billion (ppb)?
43. A safe level of beryllium in drinking water is set at 4 ppb. What is this amount in parts per million (ppm)?

CHECK YOUR PROGRESS: CHAPTER 4

For Exercises 1 to 3, write the ratio in simplest form using a fraction and a colon.

1. 12 minutes to 48 minutes 2. 24 pounds to 36 pounds 3. 25 miles to 60 miles

For Exercises 4 to 6, write the rate as a unit rate. Round to the nearest tenth.

4. \$96 in 4 hours 5. 100 yards in 9.6 seconds 6. 525 miles on 18 gallons of gasoline

7. **Lawn Care** A fertilizer manufacturer recommends using 10 gallons of liquid fertilizer for every 400 square feet of lawn. What is the recommended amount of fertilizer per square foot of lawn?
8. **Nutrition** There are 150 calories in an 8-ounce glass of whole milk. What is the number of calories per ounce in whole milk?
9. **Consumerism** One dozen long-stemmed roses cost \$51. What is the cost per rose?
10. **Consumerism** A certain cyan print cartridge will print 2000 pages before it needs to be replaced. If the cost of the cartridge is \$85, what is the cost per page for this cartridge?

SECTION

4.3

Proportions

OBJECTIVE A

To determine whether a proportion is true**Point of Interest**

Proportions were studied by the earliest mathematicians. Clay tablets uncovered by archaeologists show evidence of proportions in Egyptian and Babylonian cultures dating from 1800 B.C.

A **proportion** is an expression of the equality of two ratios or rates.

$$\frac{50 \text{ miles}}{4 \text{ gallons}} = \frac{25 \text{ miles}}{2 \text{ gallons}}$$

Note that the units of the numerators are the same and the units of the denominators are the same.

$$\frac{3}{6} = \frac{1}{2}$$

This is the equality of two ratios.

A proportion is **true** if the fractions are equal when written in simplest form.

In any true proportion, the **cross products** are equal.

HOW TO 1

Is $\frac{2}{3} = \frac{8}{12}$ a true proportion?

$$\begin{array}{l} \frac{2}{3} \quad \frac{8}{12} \rightarrow 3 \times 8 = 24 \\ \frac{2}{3} \quad \frac{8}{12} \rightarrow 2 \times 12 = 24 \end{array}$$

The cross products *are* equal.

$\frac{2}{3} = \frac{8}{12}$ is a true proportion.

A proportion is **not true** if the fractions are not equal when reduced to simplest form.

If the cross products are not equal, then the proportion is not true.

HOW TO 2

Is $\frac{4}{5} = \frac{8}{9}$ a true proportion?

$$\begin{array}{l} \frac{4}{5} \quad \frac{8}{9} \rightarrow 5 \times 8 = 40 \\ \frac{4}{5} \quad \frac{8}{9} \rightarrow 4 \times 9 = 36 \end{array}$$

The cross products *are not* equal.

$\frac{4}{5} = \frac{8}{9}$ is *not* a true proportion.

EXAMPLE 1

Is $\frac{5}{8} = \frac{10}{16}$ a true proportion?

Solution

$$\begin{array}{l} \frac{5}{8} \quad \frac{10}{16} \rightarrow 8 \times 10 = 80 \\ \frac{5}{8} \quad \frac{10}{16} \rightarrow 5 \times 16 = 80 \end{array}$$

The cross products are equal.

The proportion is true.

YOU TRY IT 1

Is $\frac{6}{10} = \frac{9}{15}$ a true proportion?

Your solution**EXAMPLE 2**

Is $\frac{62 \text{ miles}}{4 \text{ gallons}} = \frac{33 \text{ miles}}{2 \text{ gallons}}$ a true proportion?

Solution

$$\begin{array}{l} \frac{62}{4} \quad \frac{33}{2} \rightarrow 4 \times 33 = 132 \\ \frac{62}{4} \quad \frac{33}{2} \rightarrow 62 \times 2 = 124 \end{array}$$

The cross products are not equal.

The proportion is not true.

YOU TRY IT 2

Is $\frac{\$32}{6 \text{ hours}} = \frac{\$90}{8 \text{ hours}}$ a true proportion?

Your solution

Solutions on p. S11

OBJECTIVE B

To solve proportions

★ Tips for Success

An important element of success is practice. We cannot do anything well if we do not practice it repeatedly. Practice is crucial to success in mathematics. In this objective you are learning a new skill: how to solve a proportion. You will need to practice this skill over and over again in order to be successful at it.

Sometimes one of the numbers in a proportion is unknown. In this case, it is necessary to *solve* the proportion.

To **solve a proportion**, find a number to replace the unknown so that the proportion is true.

HOW TO 3

Solve: $\frac{9}{6} = \frac{3}{n}$

$$\frac{9}{6} = \frac{3}{n}$$

$$9 \times n = 6 \times 3$$

$$9 \times n = 18$$

$$n = 18 \div 9$$

$$n = 2$$

• Find the cross products.

• Think of $9 \times n = 18$ as $9 \overline{)18}$.

Check:

$$\begin{array}{l} \frac{9}{6} \quad \frac{3}{2} \rightarrow 6 \times 3 = 18 \\ \frac{9}{6} \quad \frac{3}{2} \rightarrow 9 \times 2 = 18 \end{array}$$

EXAMPLE 3

Solve $\frac{n}{12} = \frac{25}{60}$ and check.

Solution

$$n \times 60 = 12 \times 25$$

$$n \times 60 = 300$$

$$n = 300 \div 60$$

$$n = 5$$

• Find the cross products. Then solve for n .

Check:

$$\begin{array}{l} \frac{5}{12} \quad \frac{25}{60} \rightarrow 12 \times 25 = 300 \\ \frac{5}{12} \quad \frac{25}{60} \rightarrow 5 \times 60 = 300 \end{array}$$

YOU TRY IT 3

Solve $\frac{n}{14} = \frac{3}{7}$ and check.

Your solution

EXAMPLE 4

Solve $\frac{4}{9} = \frac{n}{16}$. Round to the nearest tenth.

Solution

$$4 \times 16 = 9 \times n$$

$$64 = 9 \times n$$

$$64 \div 9 = n$$

$$7.1 \approx n$$

• Find the cross products. Then solve for n .

Note: A rounded answer is an approximation. Therefore, the answer to a check will not be exact.

YOU TRY IT 4

Solve $\frac{5}{7} = \frac{n}{20}$. Round to the nearest tenth.

Your solution

Solutions on pp. S11–S12

EXAMPLE 5Solve $\frac{28}{52} = \frac{7}{n}$ and check.**Solution**

$$28 \times n = 52 \times 7$$

$$28 \times n = 364$$

$$n = 364 \div 28$$

$$n = 13$$

- Find the cross products. Then solve for n .

Check:

$$\frac{28}{52} \quad \frac{7}{13} \quad \begin{array}{l} \rightarrow 52 \times 7 = 364 \\ \rightarrow 28 \times 13 = 364 \end{array}$$

YOU TRY IT 5Solve $\frac{15}{20} = \frac{12}{n}$ and check.**Your solution****EXAMPLE 6**Solve $\frac{15}{n} = \frac{8}{3}$. Round to the nearest hundredth.**Solution**

$$15 \times 3 = n \times 8$$

$$45 = n \times 8$$

$$45 \div 8 = n$$

$$5.63 \approx n$$

YOU TRY IT 6Solve $\frac{12}{n} = \frac{7}{4}$. Round to the nearest hundredth.**Your solution****EXAMPLE 7**Solve $\frac{n}{9} = \frac{3}{1}$ and check.**Solution**

$$n \times 1 = 9 \times 3$$

$$n \times 1 = 27$$

$$n = 27 \div 1$$

$$n = 27$$

Check:

$$\frac{27}{9} \quad \frac{3}{1} \quad \begin{array}{l} \rightarrow 9 \times 3 = 27 \\ \rightarrow 27 \times 1 = 27 \end{array}$$

YOU TRY IT 7Solve $\frac{n}{12} = \frac{4}{1}$ and check.**Your solution**

Solutions on p. S12

OBJECTIVE C**To solve application problems**

The application problems in this objective require you to write and solve a proportion. When setting up a proportion, remember to keep the same units in the numerators and the same units in the denominators.

EXAMPLE 8

The dosage of a certain medication is 2 ounces for every 50 pounds of body weight. How many ounces of this medication are required for a person who weighs 175 pounds?

Strategy

To find the number of ounces of medication for a person weighing 175 pounds, write and solve a proportion using n to represent the number of ounces of medication for a 175-pound person.

Solution

$$\frac{2 \text{ ounces}}{50 \text{ pounds}} = \frac{n \text{ ounces}}{175 \text{ pounds}}$$

$$2 \times 175 = 50 \times n$$

$$350 = 50 \times n$$

$$350 \div 50 = n$$

$$7 = n$$

- The unit "ounces" is in the numerator. The unit "pounds" is in the denominator.

A 175-pound person requires 7 ounces of medication.

EXAMPLE 9

A mason determines that 9 cement blocks are required for a retaining wall that is 2 feet long. At this rate, how many cement blocks are required for a retaining wall that is 24 feet long?

Strategy

To find the number of cement blocks required for a retaining wall that is 24 feet long, write and solve a proportion using n to represent the number of blocks required.

Solution

$$\frac{9 \text{ cement blocks}}{2 \text{ feet}} = \frac{n \text{ cement blocks}}{24 \text{ feet}}$$

$$9 \times 24 = 2 \times n$$

$$216 = 2 \times n$$

$$216 \div 2 = n$$

$$108 = n$$

A 24-foot retaining wall requires 108 cement blocks.

YOU TRY IT 8

Three tablespoons of a liquid plant fertilizer are to be added to every 4 gallons of water. How many tablespoons of fertilizer are required for 10 gallons of water?

Your strategy**Your solution****YOU TRY IT 9**

Twenty-four jars can be packed in 6 identical boxes. At this rate, how many jars can be packed in 15 boxes?

Your strategy**Your solution**

Solutions on p. S12

4.3 EXERCISES

 **Concept Check**



Solving a proportion requires rewriting a multiplication problem as a division problem. For instance, the multiplication problem $7 \times 9 = 63$ has the related division problems $63 \div 9 = 7$ and $63 \div 7 = 9$. For Exercises 1 to 4, rewrite the given multiplication problem as a division problem whose quotient is n .

1. $n \times 15 = 45$ 2. $12 \times n = 60$ 3. $72 = n \times 9$ 4. $54 = 6 \times n$


OBJECTIVE A *To determine whether a proportion is true*

For Exercises 5 to 22, determine whether the proportion is true or not true.

5. $\frac{4}{8} = \frac{10}{20}$ 6. $\frac{39}{48} = \frac{13}{16}$ 7. $\frac{7}{8} = \frac{11}{12}$ 8. $\frac{15}{7} = \frac{17}{8}$
9. $\frac{27}{8} = \frac{9}{4}$ 10. $\frac{3}{18} = \frac{4}{19}$ 11. $\frac{45}{135} = \frac{3}{9}$ 12. $\frac{3}{4} = \frac{54}{72}$
13. $\frac{50 \text{ miles}}{2 \text{ gallons}} = \frac{25 \text{ miles}}{1 \text{ gallon}}$ 14. $\frac{16 \text{ feet}}{10 \text{ seconds}} = \frac{24 \text{ feet}}{15 \text{ seconds}}$
15. $\frac{6 \text{ minutes}}{5 \text{ cents}} = \frac{30 \text{ minutes}}{25 \text{ cents}}$ 16. $\frac{16 \text{ pounds}}{12 \text{ days}} = \frac{20 \text{ pounds}}{14 \text{ days}}$
17. $\frac{\$15}{4 \text{ pounds}} = \frac{\$45}{12 \text{ pounds}}$ 18. $\frac{270 \text{ trees}}{6 \text{ acres}} = \frac{90 \text{ trees}}{2 \text{ acres}}$
19. $\frac{300 \text{ feet}}{4 \text{ rolls}} = \frac{450 \text{ feet}}{7 \text{ rolls}}$ 20. $\frac{1 \text{ gallon}}{4 \text{ quarts}} = \frac{7 \text{ gallons}}{28 \text{ quarts}}$
21. $\frac{\$65}{5 \text{ days}} = \frac{\$26}{2 \text{ days}}$ 22. $\frac{80 \text{ miles}}{2 \text{ hours}} = \frac{110 \text{ miles}}{3 \text{ hours}}$

23.  Suppose in a true proportion you switch the numerator of the first fraction with the denominator of the second fraction. Must the result be another true proportion?
24.  Write a true proportion in which the cross products are equal to 36.

OBJECTIVE B*To solve proportions*

25.  Consider the proportion $\frac{n}{7} = \frac{9}{21}$ in Exercise 27. The simplest form of the ratio $\frac{9}{21}$ is $\frac{3}{7}$. Will solving the proportion $\frac{n}{7} = \frac{3}{7}$ give the same result for n as found in Exercise 27?

For Exercises 26 to 45, solve. Round to the nearest hundredth, if necessary.

26. $\frac{n}{4} = \frac{6}{8}$

27. $\frac{n}{7} = \frac{9}{21}$

28. $\frac{12}{18} = \frac{n}{9}$

29. $\frac{7}{21} = \frac{35}{n}$

30. $\frac{6}{n} = \frac{24}{36}$

31. $\frac{3}{n} = \frac{15}{10}$

32. $\frac{n}{6} = \frac{2}{3}$

33. $\frac{5}{12} = \frac{n}{144}$

34. $\frac{n}{5} = \frac{7}{8}$

35. $\frac{4}{n} = \frac{9}{5}$

36. $\frac{5}{12} = \frac{n}{8}$

37. $\frac{36}{20} = \frac{12}{n}$

38. $\frac{n}{15} = \frac{21}{12}$

39. $\frac{40}{n} = \frac{15}{8}$

40. $\frac{28}{8} = \frac{12}{n}$

41. $\frac{n}{30} = \frac{65}{120}$



42. $\frac{0.3}{5.6} = \frac{n}{25}$

43. $\frac{1.3}{16} = \frac{n}{30}$

44. $\frac{0.7}{9.8} = \frac{3.6}{n}$

45. $\frac{1.9}{7} = \frac{13}{n}$

OBJECTIVE C*To solve application problems*

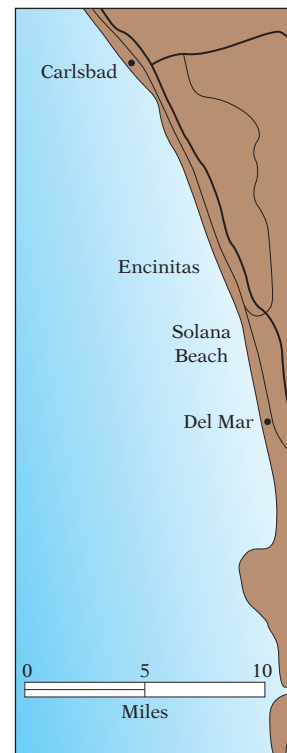
46.  Jesse walked 3 miles in 40 minutes. Let n be the number of miles Jesse can walk in 60 minutes at the same rate. To determine how many miles Jesse can walk in 60 minutes, a student used the proportion $\frac{40}{3} = \frac{60}{n}$. Is this a valid proportion to use in solving this problem?
47. **Nutrition** A 6-ounce package of Puffed Wheat contains 600 calories. How many calories are contained in a 0.5-ounce serving of the cereal?
48.  **Health** Using the information in the news clipping at the right and a figure of 309 million for the number of Americans, determine the number of **a.** overweight Americans and **b.** obese Americans.
49. **Fuel Efficiency** A car travels 70.5 miles on 3 gallons of gas. Find the distance the car can travel on 14 gallons of gas.

In the NEWS!**Small Gains in Obesity Battle**

A recent study shows a small but encouraging increase in the number of Americans of normal weight. Still, obesity remains a major health problem in the United States, with approximately 1 in 3 Americans falling in the overweight category, and 1 in 4 in the obese category.

Source: msnbc.com

50. **Landscaping** Ron Stokes uses 2 pounds of fertilizer for every 100 square feet of lawn for landscape maintenance. At this rate, how many pounds of fertilizer did he use on a lawn that measures 3500 square feet?
51. **Gardening** A nursery prepares a liquid plant food by adding 1 gallon of water for each 2 ounces of plant food. At this rate, how many gallons of water are required for 25 ounces of plant food?
52. **Masonry** A brick wall 20 feet in length contains 1040 bricks. At the same rate, how many bricks would it take to build a wall 48 feet in length?
53. **Cartography** The scale on the map at the right is “1.25 inches equals 10 miles.” Find the distance between Carlsbad and Del Mar, which are 2 inches apart on the map.
54. **Architecture** The scale on the plans for a new house is “1 inch equals 3 feet.” Find the width and the length of a room that measures 5 inches by 8 inches on the drawing.
55. **Medicine** The dosage for a medication is $\frac{1}{3}$ ounce for every 40 pounds of body weight. At this rate, how many ounces of medication should a physician prescribe for a patient who weighs 150 pounds? Write the answer as a decimal.
56. **Banking** A bank requires a monthly payment of \$33.45 on a \$2500 loan. At the same rate, find the monthly payment on a \$10,000 loan.
57. **Elections** A pre-election survey showed that 2 out of every 3 eligible voters would cast ballots in the county election. At this rate, how many people in a county of 240,000 eligible voters would vote in the election?
58. **Interior Design** A paint manufacturer suggests using 1 gallon of paint for every 400 square feet of wall. At this rate, how many gallons of paint would be required for a room that has 1400 square feet of wall?
59. **Insurance** A 60-year-old male can obtain \$10,000 of life insurance for \$35.35 per month. At this rate, what is the monthly cost for \$50,000 of life insurance?
60. **Food Waste** At the rate given in the news clipping, find the cost of food wasted yearly by **a.** the average family of three and **b.** the average family of five.
61. **Manufacturing** Suppose a computer chip manufacturer knows that in an average production run of 2000 circuit boards, 60 will be defective. How many defective circuit boards are expected in a run of 25,000 circuit boards?
62. **Investments** You own 240 shares of stock in a computer company. The company declares a stock split of 5 shares for every 3 owned. How many shares of stock will you own after the stock split?



In the NEWS!

How Much Food Do You Waste?

In the United States, the estimated cost of food wasted each year by the average family of four is \$590.

Source: University of Arizona

63. **Physics** The ratio of weight on the moon to weight on Earth is 1:6. If a bowling ball weighs 16 pounds on Earth, what would it weigh on the moon? Round to the nearest hundredth of a pound.
64. **Automobiles** When engineers designed a new car, they first built a model of the car. The ratio of the size of a part on the model to the actual size of the part is 2:5. If a door is 1.3 feet long on the model, what is the length of the door on the car?
65. **Investments** Carlos Capasso owns 50 shares of Texas Utilities that pay dividends of \$153. At this rate, what dividend would Carlos receive after buying 300 additional shares of Texas Utilities?



Michael Dunning/Getty Images

Critical Thinking

66. **Gaming** Use the information in the news clipping at the right. Explain how a proportion can be used to determine the number of Nintendo DS systems sold given the number of Nintendo 3DS systems sold.
67. **Social Security** According to the Social Security Administration, the numbers of workers per retiree in the future are expected to be as given in the table below.
Why is the shrinking number of workers per retiree of importance to the Social Security Administration?

Year	2020	2030	2040
Number of workers per retiree	2.5	2.1	2.0

68. **Elections** A survey of voters in a city claimed that 2 people of every 5 who voted cast a ballot in favor of city amendment A and that 3 people of every 4 who voted cast a ballot against amendment A. Is this possible? Explain your answer.

Projects or Group Activities

69. **Anatomy** The average circumference (the distance around an object) of a baby's head at birth is approximately 13.7 inches. The average length of a baby at birth is approximately 20 inches. Measure the circumference of your head and your height in inches. Is the ratio of a baby's head circumference at birth to your head circumference equal to the ratio of a baby's length at birth to your height? Based on your findings, does the circumference of a person's head grow more slowly or more quickly than the person's height?
70. **Biology** One way biologists measure a wildlife population is by capturing a certain species of animal, tagging it, and then releasing it back into the wild. Suppose a biologist captures 100 trout from a lake, tags them, and releases them back into the water. One month later, the biologist captures 50 trout from the same lake and finds that 3 trout have tags. Based on this information, approximate the number of trout in the lake.

In the NEWS!

Old DS Outsell New 3D System

Figures released for the month of June show that the Nintendo DS handheld game system outsold the newer Nintendo 3DS by 2.7 systems to 1.

Source: msnbc.com

CHAPTER

4

Summary

Key Words

A **ratio** is the comparison of two quantities with the same units. A ratio can be written in three ways: as a fraction, as two numbers separated by a colon (:), or as two numbers separated by the word *to*. A ratio is in **simplest form** when the two numbers do not have a common factor other than 1. [4.1A, p. 178]

A **rate** is the comparison of two quantities with different units. A rate is written as a fraction. A rate is in **simplest form** when the numbers that form the rate do not have a common factor other than 1. [4.2A, p. 182]

A **unit rate** is a rate in which the number in the denominator is 1. [4.2B, p. 182]

A **proportion** is an expression of the equality of two ratios or rates. A proportion is true if the fractions are equal when written in simplest form; in any true proportion, the **cross products** are equal. A proportion is not true if the fractions are not equal when written in simplest form; if the cross products are not equal, the proportion is not true. [4.3A, p. 188]

Essential Rules and Procedures

To find a unit rate, divide the number in the numerator of the rate by the number in the denominator of the rate. [4.2B, p. 182]

To solve a proportion, find a number to replace the unknown so that the proportion is true. [4.3B, p. 189]

To set up a proportion, keep the same units in the numerators and the same units in the denominators. [4.3C, p. 190]

Examples

The comparison 16 to 24 ounces can be written as a ratio in simplest form as $\frac{2}{3}$, 2 : 3, or 2 to 3.

You earned \$63 for working 6 hours. The rate is written in simplest form as $\frac{\$21}{2 \text{ hours}}$.

You traveled 144 miles in 3 hours. The unit rate is 48 miles per hour.

The proportion $\frac{3}{5} = \frac{12}{20}$ is true because the cross products are equal:

$$3 \times 20 = 5 \times 12.$$

The proportion $\frac{3}{4} = \frac{12}{20}$ is not true because the cross products are not equal:

$$3 \times 20 \neq 4 \times 12.$$

Examples

You earned \$41 for working 4 hours.

$$\frac{41}{4} = 41 \div 4 = 10.25$$

The unit rate is \$10.25/hour.

$$\frac{6}{24} = \frac{9}{n}$$

$$6 \times n = 24 \times 9$$

• **Find the cross products.**

$$6 \times n = 216$$

$$n = 216 \div 6$$

$$n = 36$$

Three machines fill 5 cereal boxes per minute. How many boxes can 8 machines fill per minute?

$$\frac{3 \text{ machines}}{5 \text{ cereal boxes}} = \frac{8 \text{ machines}}{n \text{ cereal boxes}}$$

CHAPTER

4

Review Exercises

1. Is $\frac{2}{9} = \frac{10}{45}$ a true proportion?
2. Write the comparison 32 dollars to 80 dollars as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
3. Write “250 miles in 4 hours” as a unit rate.
4. Is $\frac{8}{15} = \frac{32}{60}$ a true proportion?
5. Solve the proportion.
$$\frac{16}{n} = \frac{4}{17}$$
6. Write “\$500 earned in 40 hours” as a unit rate.
7. Write “\$8.75 for 5 pounds” as a unit rate.
8. Write the comparison 8 feet to 28 feet as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
9. Solve the proportion.
$$\frac{n}{8} = \frac{9}{2}$$
10. Solve the proportion. Round to the nearest hundredth.
$$\frac{18}{35} = \frac{10}{n}$$
11. Write the comparison 6 inches to 15 inches as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
12. Is $\frac{3}{8} = \frac{10}{24}$ a true proportion?
13. Write “\$35 in 4 hours” as a rate in simplest form.
14. Write “326.4 miles on 12 gallons” as a unit rate.
15. Write the comparison 12 days to 12 days as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
16. Is $\frac{5}{7} = \frac{25}{35}$ a true proportion?

17. Solve the proportion. Round to the nearest hundredth.

$$\frac{24}{11} = \frac{n}{30}$$

19. **Business** In 5 years, the price of a calculator went from \$80 to \$48. What is the ratio, as a fraction in simplest form, of the decrease in price to the original price?
20. **Taxes** The property tax on a \$245,000 home is \$4900. At the same rate, what is the property tax on a home valued at \$320,000?
21. **Consumerism** Rita Sterling bought a computer system for \$2400. Five years later, she sold the computer for \$900. Find the ratio of the amount she received for the computer to the cost of the computer.
22. **Manufacturing** The total cost of manufacturing 1000 camera phones was \$36,600. Of the phones made, 24 did not pass inspection. What is the cost per phone of the phones that *did* pass inspection?
23. **Masonry** A brick wall 40 feet in length contains 448 concrete blocks. At the same rate, how many blocks would it take to build a wall that is 120 feet in length?
24. **Advertising** A retail computer store spends \$30,000 a year on radio advertising and \$12,000 on newspaper advertising. Find the ratio, as a fraction in simplest form, of radio advertising to newspaper advertising.
25. **Consumerism** A 15-pound turkey costs \$13.95. What is the cost per pound?
26. **Travel** Mahesh drove 198.8 miles in 3.5 hours. Find the average number of miles he drove per hour.
27. **Insurance** An insurance policy costs \$9.87 for every \$1000 of insurance. At this rate, what is the cost of \$50,000 of insurance?
28. **Investments** Pascal Hollis purchased 80 shares of stock for \$3580. What was the cost per share?
29. **Landscaping** Monique uses 1.5 pounds of fertilizer for every 200 square feet of lawn. How many pounds of fertilizer will she have to use on a lawn that measures 3000 square feet?
30. **Real Estate** A house had an original value of \$160,000, but its value increased to \$240,000 in 2 years. Find the ratio, as a fraction in simplest form, of the increase to the original value.

CHAPTER

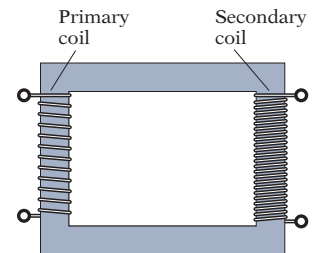
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TEST

1. Write “\$46,036.80 earned in 12 months” as a unit rate.
2. Write the comparison 40 miles to 240 miles as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
3. Write “18 supports for every 8 feet” as a rate in simplest form.
4. Is $\frac{40}{125} = \frac{5}{25}$ a true proportion?
5. Write the comparison 12 days to 4 days as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
6. Solve the proportion.
$$\frac{5}{12} = \frac{60}{n}$$
7. Write “256.2 miles on 8.4 gallons of gas” as a unit rate.
8. Write the comparison 27 dollars to 81 dollars as a ratio in simplest form using a fraction, a colon (:), and the word *to*.
9. Is $\frac{5}{14} = \frac{25}{70}$ a true proportion?
10. Solve the proportion.
$$\frac{n}{18} = \frac{9}{4}$$
11. Write “9 feet for 6 boards” as a rate in simplest form.
12. Write the comparison 18 feet to 30 feet as a ratio in simplest form using a fraction, a colon (:), and the word *to*.

13. **Investments** Fifty shares of a utility stock pay a dividend of \$62.50. At the same rate, what is the dividend paid on 500 shares of the utility stock?

14. **Electricity** A transformer has 40 turns in the primary coil and 480 turns in the secondary coil. State the ratio of the number of turns in the primary coil to the number of turns in the secondary coil.



15. **Travel** A plane travels 2421 miles in 4.5 hours. Find the plane's speed in miles per hour.

16. **Physiology** A research scientist estimates that the human body contains 88 pounds of water for every 100 pounds of body weight. At this rate, estimate the number of pounds of water in a college student who weighs 150 pounds.

17. **Business** If 40 feet of lumber costs \$69.20, what is the per-foot cost of the lumber?

18. **Medicine** The dosage of a certain medication is $\frac{1}{4}$ ounce for every 50 pounds of body weight. How many ounces of this medication are required for a person who weighs 175 pounds? Write the answer as a decimal.

19. **Sports** A basketball team won 20 games and lost 5 games during the season. Write, as a fraction in simplest form, the ratio of the number of games won to the total number of games played.

20. **Manufacturing** A computer manufacturer discovers through experience that an average of 3 defective hard drives are found in every 100 hard drives manufactured. How many defective hard drives are expected to be found in the production of 1200 hard drives?

Cumulative Review Exercises

1. Subtract:
$$\begin{array}{r} 20,095 \\ - 10,937 \\ \hline \end{array}$$
2. Write $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$ in exponential notation.
3. Simplify: $4 - (5 - 2)^2 \div 3 + 2$
4. Find the prime factorization of 160.
5. Find the LCM of 9, 12, and 18.
6. Find the GCF of 28 and 42.
7. Write $\frac{40}{64}$ in simplest form.
8. Find $4\frac{7}{15}$ more than $3\frac{5}{6}$.
9. What is $4\frac{5}{9}$ less than $10\frac{1}{6}$?
10. Multiply: $\frac{11}{12} \times 3\frac{1}{11}$
11. Find the quotient of $3\frac{1}{3}$ and $\frac{5}{7}$.
12. Simplify: $\left(\frac{2}{5} + \frac{3}{4}\right) \div \frac{3}{2}$
13. Write 4.0709 in words.
14. Round 2.09762 to the nearest hundredth.
15. Divide: $8.09 \overline{)16.0976}$
Round to the nearest thousandth.
16. Convert 0.06 to a fraction.

17. Write the comparison 25 miles to 200 miles as a ratio in simplest form using a fraction.
18. Write “87 cents for 6 pencils” as a rate in simplest form.
19. Write “250.5 miles on 7.5 gallons of gas” as a unit rate.
20. Solve $\frac{40}{n} = \frac{160}{17}$.
21. **Travel** A car traveled 457.6 miles in 8 hours. Find the car’s speed in miles per hour.
22. Solve the proportion.

$$\frac{12}{5} = \frac{n}{15}$$
23. **Banking** You had \$1024 in your checking account. You then wrote checks for \$192 and \$88. What is your new checking account balance?
24. **Finance** Malek Khatri buys a tractor for \$32,360. A down payment of \$5000 is required. The balance remaining is paid in 48 equal monthly installments. What is the monthly payment?
25. **Homework Assignments** Yuko is assigned to read a book containing 175 pages. She reads $\frac{2}{5}$ of the book during Thanksgiving vacation. How many pages of the assignment remain to be read?
26. **Real Estate** A building contractor bought $2\frac{1}{3}$ acres of land for \$84,000. What was the cost of each acre?
27. **Consumerism** Benjamin Eli bought a shirt for \$45.58 and a tie for \$19.18. He used a \$100 bill to pay for the purchases. Find the amount of change.
28. **Compensation** If you earn an annual salary of \$41,619, what is your monthly salary?
29. **Erosion** A soil conservationist estimates that a river bank is eroding at the rate of 3 inches every 6 months. At this rate, how many inches will be eroded in 50 months?
30. **Medicine** The dosage of a certain medication is $\frac{1}{2}$ ounce for every 50 pounds of body weight. How many ounces of this medication are required for a person who weighs 160 pounds? Write the answer as a decimal.



Iain Frazer/Shutterstock.com

OBJECTIVES

SECTION 5.1

- A** To write a percent as a decimal or a fraction
- B** To write a decimal or a fraction as a percent

SECTION 5.2

- A** To find the amount when the percent and the base are given
- B** To solve application problems

SECTION 5.3

- A** To find the percent when the base and the amount are given
- B** To solve application problems

SECTION 5.4

- A** To find the base when the percent and the amount are given
- B** To solve application problems

SECTION 5.5

- A** To solve percent problems using proportions
- B** To solve application problems

Focus on Success

Did you read Ask the Authors at the front of this text? If you did, then you know that the authors' advice is that you practice, practice, practice—and then practice some more. The more time you spend doing math outside of class, the more successful you will be in this course. (See Ask the Authors, page i, and Make the Commitment to Succeed, page AIM-3.)

Prep Test



© iStockphoto.com/Pete Saloutos

Are you ready to succeed in this chapter? Take the Prep Test below to find out if you are ready to learn the new material.

For Exercises 1 to 6, multiply or divide.

1. $19 \times \frac{1}{100}$

2. 23×0.01

3. 0.47×100

4. $0.06 \times 47,500$

5. $60 \div 0.015$

6. $8 \div \frac{1}{4}$

7. Multiply $\frac{5}{8} \times 100$. Write the answer as a decimal.

8. Write $\frac{200}{3}$ as a mixed number.

9. Divide $28 \div 16$. Write the answer as a decimal.

SECTION

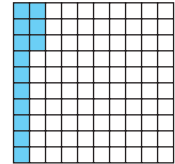
5.1

Introduction to Percents

OBJECTIVE A

To write a percent as a decimal or a fraction

Percent means “parts of 100.” In the figure at the right, there are 100 parts. Because 13 of the 100 parts are shaded, 13% of the figure is shaded. The symbol % is the **percent sign**.



In most applied problems involving percents, it is necessary either to rewrite a percent as a decimal or a fraction or to rewrite a fraction or a decimal as a percent.

To write a percent as a decimal, remove the percent sign and multiply by **0.01**.

$$13\% = 13 \times 0.01 = 0.13$$

Move the decimal point two places to the left. Then remove the percent sign.

To write a percent as a fraction, remove the percent sign and multiply by $\frac{1}{100}$.

$$13\% = 13 \times \frac{1}{100} = \frac{13}{100}$$

**Take Note**

Recall that division is defined as multiplication by the reciprocal. Therefore, multiplying by $\frac{1}{100}$ is equivalent to dividing by 100.

EXAMPLE 1

Write each percent as a decimal and as a fraction.

- a. 120% b. 4.3% c. 0.45%

Solution

a. $120\% = 120 \times 0.01 = 1.2$

$$120\% = 120 \times \frac{1}{100} = \frac{120}{100} = 1\frac{1}{5}$$

b. $4.3\% = 4.3 \times 0.01 = 0.043$

$$4.3\% = 4.3 \times \frac{1}{100}$$

$$= 4\frac{3}{10} \times \frac{1}{100}$$

$$= \frac{43}{10} \times \frac{1}{100} = \frac{43}{1000}$$

• $4.3 = 4\frac{3}{10}$

• Multiply the fractions.

c. $0.45\% = 0.45 \times 0.01 = 0.0045$

$$0.45\% = 0.45 \times \frac{1}{100}$$

$$= \frac{9}{20} \times \frac{1}{100}$$

$$= \frac{9}{2000}$$

• $0.45 = \frac{45}{100} = \frac{9}{20}$

• Multiply the fractions.

YOU TRY IT 1

Write each percent as a decimal and as a fraction.

- a. 125% b. 8.5% c. 0.25%

Your solution

Solution on p. S12

EXAMPLE 2Write $16\frac{2}{3}\%$ as a fraction.

$$\begin{aligned}\text{Solution} \quad 16\frac{2}{3}\% &= 16\frac{2}{3} \times \frac{1}{100} \\ &= \frac{50}{3} \times \frac{1}{100} = \frac{50}{300} = \frac{1}{6}\end{aligned}$$

YOU TRY IT 2Write $33\frac{1}{3}\%$ as a fraction.**Your solution***Solution on p. S12***OBJECTIVE B***To write a decimal or a fraction as a percent*A decimal or a fraction can be written as a percent by multiplying by **100%**.**HOW TO 1**

Write 0.37 as a percent.

$$0.37 = 0.37 \times 100\% = 37\%$$

Move the decimal point two places to the right. Then write the percent sign.

When changing a fraction to a percent, if the fraction can be written as a terminating decimal, the percent is written in decimal form. If the decimal representation of the fraction is a repeating decimal, the answer is written with a fraction.

**Take Note**The decimal form of $\frac{3}{8}$ terminates.

$$\begin{array}{r} 0.375 \\ 8 \overline{) 3.000} \\ \underline{-24} \\ 60 \\ \underline{-56} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

HOW TO 2Write $\frac{3}{8}$ as a percent.

$$\begin{aligned}\frac{3}{8} &= \frac{3}{8} \times \frac{100\%}{1} \\ &= \frac{300\%}{8} \\ &= 37.5\%\end{aligned}$$

$$\bullet \frac{3}{8} = 0.375 \text{ is a terminating decimal.}$$

• The answer is written in decimal form.

**Take Note**The decimal form of $\frac{1}{6}$ repeats.

$$\begin{array}{r} 0.1\overline{66} \\ 6 \overline{) 1.000} \\ \underline{-6} \\ 40 \\ \underline{-36} \\ 40 \\ \underline{-36} \\ 4 \end{array}$$

HOW TO 3Write $\frac{1}{6}$ as a percent.

$$\begin{aligned}\frac{1}{6} &= \frac{1}{6} \times \frac{100\%}{1} \\ &= \frac{100\%}{6} \\ &= 16\frac{2}{3}\%\end{aligned}$$

$$\bullet \frac{1}{6} = 0.1\overline{6} \text{ is a repeating decimal.}$$

• The answer is written with a fraction.

EXAMPLE 3

Write 0.015 and 2.3 as percents.

Solution

$$\begin{aligned} 0.015 &= 0.015 \times 100\% \\ &= 1.5\% \end{aligned}$$

$$\begin{aligned} 2.3 &= 2.3 \times 100\% \\ &= 230\% \end{aligned}$$

YOU TRY IT 3

Write 0.048 and 3.6 as percents.

Your solution**EXAMPLE 4**

Write $\frac{19}{80}$ as a percent.

Solution

$$\begin{aligned} \frac{19}{80} \times \frac{100\%}{1} &= \frac{1900\%}{80} \\ &= 23.75\% \end{aligned}$$

• Write the answer in decimal form.

YOU TRY IT 4

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

Your solution**EXAMPLE 5**

Write $\frac{2}{3}$ as a percent.

Solution

$$\begin{aligned} \frac{2}{3} &= \frac{2}{3} \times \frac{100\%}{1} \\ &= \frac{200\%}{3} \\ &= 66\frac{2}{3}\% \end{aligned}$$

• Write the answer with a fraction.

YOU TRY IT 5

Write $\frac{5}{6}$ as a percent.

Your solution

Solutions on p. S12

5.1 EXERCISES

 **Concept Check**

- Percent means “parts of ____.”
- If you answered correctly 85% of the questions on a 100-question exam, how many questions did you answer correctly?
- To change a percent to a decimal, remove the percent sign and move the decimal point two places to the ____.
- To change a fraction to a percent, multiply the fraction by ____.


OBJECTIVE A*To write a percent as a decimal or a fraction*

For Exercises 5 to 26, write the percent as a decimal and as a fraction.

- | | | | | |
|-----------|------------|-----------|-----------|---------|
| 5. 72% | 6. 65% | 7. 23% | 8. 79% | 9. 36% |
| 10. 69% | 11. 59% | 12. 24% | 13. 41% | 14. 25% |
| 15. 25.4% | 16. 34% | 17. 57.9% | 18. 73.6% | |
| 19. 6.2% | 20. 6.9% | 21. 6.4% | 22. 7.5% | |
| 23. 0.25% | 24. 0.875% | 25. 0.55% | 26. 0.74% | |

For Exercises 27 to 38, write as a fraction.

- | | | | | | |
|------------------------|-----------------------|-----------------------|----------------------|-----------------------|----------------------|
| 27. $66\frac{2}{3}\%$ | 28. $12\frac{1}{2}\%$ | 29. $83\frac{1}{3}\%$ | 30. $3\frac{1}{8}\%$ | 31. $11\frac{1}{9}\%$ | 32. $\frac{3}{8}\%$ |
| 33. $45\frac{5}{11}\%$ | 34. $15\frac{3}{8}\%$ | 35. $4\frac{2}{7}\%$ | 36. $5\frac{3}{4}\%$ | 37. $6\frac{2}{3}\%$ | 38. $8\frac{2}{3}\%$ |

39.  When a certain percent is written as a fraction, the result is an improper fraction. Is the percent less than, equal to, or greater than 100%?

OBJECTIVE B*To write a decimal or a fraction as a percent*

For Exercises 40 to 51, write as a percent.

- | | | | | | |
|-----------|-----------|-----------|-----------|----------|----------|
| 40. 0.16 | 41. 0.73 | 42. 0.05 | 43. 0.01 | 44. 1.07 | 45. 2.94 |
| 46. 0.004 | 47. 0.006 | 48. 1.012 | 49. 3.106 | 50. 0.8 | 51. 0.7 |

For Exercises 52 to 71, write as a percent.


52. $\frac{27}{50}$ 53. $\frac{17}{20}$ 54. $\frac{9}{16}$ 55. $\frac{2}{5}$ 56. $\frac{5}{8}$ 57. $\frac{1}{8}$

58. $\frac{3}{40}$ 59. $1\frac{1}{2}$ 60. $\frac{7}{40}$ 61. $\frac{9}{4}$ 62. $\frac{16}{5}$ 63. $\frac{7}{8}$

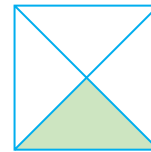
64. $\frac{15}{50}$ 65. $\frac{12}{25}$ 66. $\frac{7}{30}$ 67. $\frac{4}{9}$

68. $\frac{7}{12}$ 69. $1\frac{2}{3}$ 70. $2\frac{1}{6}$ 71. $\frac{7}{18}$


72.  Does a mixed number represent a percent greater than 100% or less than 100%?

73.  A decimal number less than 0 has zeros in the tenths and hundredths places. Does the decimal represent a percent greater than 1% or less than 1%?

74. Write the part of the square that is shaded as a fraction, as a decimal, and as a percent. Write the part of the square that is not shaded as a fraction, as a decimal, and as a percent.



Critical Thinking

75.  **The Food Industry** In a survey conducted by Opinion Research Corp. for Lloyd's Barbeque Co., people were asked to name their favorite barbeque side dishes. 38% named corn on the cob, 35% named cole slaw, 11% named corn bread, and 10% named fries. What percent of those surveyed named something other than corn on the cob, cole slaw, corn bread, or fries?



© iStockphoto.com/Jim Jurica

76. **Elections** If $\frac{2}{5}$ of the population voted in an election, what percent of the population did not vote?

Projects or Group Activities

There is a quantity similar to percent (“per hundred”) called *per mil*, which means *per thousand*. The symbol for per mil is ‰. Using this symbol, $7‰ = \frac{7}{1000} = 0.007$. For Exercises 77 to 80, write each per mil as a fraction in simplest form and as a decimal.

77. 53‰ 78. 25‰ 79. 150‰ 80. 600‰

For Exercises 81 to 84, write each per mil as a percent.

81. 5‰ 82. 45‰ 83. 625‰ 84. 1000‰

SECTION

5.2

Percent Equations: Part I

OBJECTIVE A

To find the amount when the percent and the base are given

Problems involving percents frequently are solved using the basic percent equation.

The Basic Percent Equation

$$\boxed{\text{Percent}} \times \boxed{\text{base}} = \boxed{\text{amount}}$$

APPLY THE CONCEPT

A real estate broker receives a commission that is 4% of a \$285,000 house sale. Find the amount the broker receives.

To find the amount the broker receives, we must answer the question, “4% of \$285,000 is what?” This sentence can be written using mathematical symbols and then solved for the unknown number.

4%	of	\$285,000	is	what?		<i>of</i>	is written as \times (times)
↓	↓	↓	↓	↓		<i>is</i>	is written as $=$ (equals)
↓	↓	↓	↓	↓		<i>what</i>	is written as n (the unknown number)

Percent 4%	\times	base 285,000	$=$	amount n		
0.04	\times	285,000	$=$	n		
		11,400	$=$	n		

Note that the percent is written as a decimal.

The broker receives a commission of \$11,400.

When solving the basic percent equation, the percent is usually written as a decimal, as in the problem above. However, some percents are more easily written as a fraction than as a decimal. For example,

$$33\frac{1}{3}\% = \frac{1}{3} \qquad 66\frac{2}{3}\% = \frac{2}{3} \qquad 16\frac{2}{3}\% = \frac{1}{6} \qquad 83\frac{1}{3}\% = \frac{5}{6}$$

EXAMPLE 1

Find 5.7% of 160.

Solution

$$\begin{aligned} \text{Percent} \times \text{base} &= \text{amount} \\ 0.057 \times 160 &= n \\ 9.12 &= n \end{aligned}$$

- The word *Find* is used instead of the words *what is*.

YOU TRY IT 1

Find 6.3% of 150.

Your solution

EXAMPLE 2

What is $33\frac{1}{3}\%$ of 90?

Solution

$$\begin{aligned} \text{Percent} \times \text{base} &= \text{amount} \\ \frac{1}{3} \times 90 &= n \\ 30 &= n \end{aligned}$$

- $33\frac{1}{3}\% = \frac{1}{3}$

YOU TRY IT 2

What is $16\frac{2}{3}\%$ of 66?

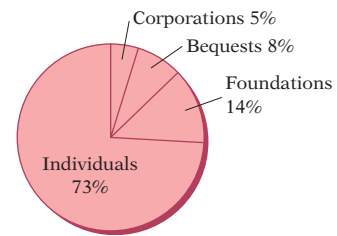
Your solution

Solutions on pp. S12–S13

OBJECTIVE B*To solve application problems*

Solving percent problems requires identifying the three elements of the basic percent equation. Recall that these three parts are the *percent*, the *base*, and the *amount*. Usually the base follows the phrase “percent of.”

During a recent year, Americans gave \$291 billion to charities. The circle graph at the right shows where that money came from. Use these data for Example 3 and You Try It 3.

**Charitable Giving**

Sources: American Association of Fundraising Counsel; www.nps.gov

EXAMPLE 3

How much of the amount given to charities came from individuals?

Strategy

To determine the amount that came from individuals, write and solve the basic percent equation using n to represent the amount. The percent is 73%. The base is \$291 billion.

Solution

Percent \times base = amount

$$73\% \times 291 = n$$

$$0.73 \times 291 = n$$

$$212.43 = n$$

Individuals gave \$212.43 billion to charities.

YOU TRY IT 3

How much of the amount given to charities was given by corporations?

Your strategy**Your solution****EXAMPLE 4**

A quality control inspector found that 1.2% of 2500 camera phones inspected were defective. How many camera phones inspected were not defective?

Strategy

To find the number of nondefective phones:

- Find the number of defective phones. Write and solve the basic percent equation, using n to represent the number of defective phones (amount). The percent is 1.2% and the base is 2500.
- Subtract the number of defective phones from the number of phones inspected (2500).

Solution

$$1.2\% \times 2500 = n$$

$$0.012 \times 2500 = n$$

$$30 = n \text{ defective phones}$$

$$2500 - 30 = 2470$$

2470 camera phones were not defective.

YOU TRY IT 4


An electrician's hourly wage was \$33.50 before an 8% raise. What is the new hourly wage?

Your strategy**Your solution**

Solutions on p. S13

5.2 EXERCISES **Concept Check**

1. What is the basic percent equation?

 For Exercises 2 to 4, without working the problem, determine whether the base is less than or greater than the amount.

2. What is 37% of 12?

3. 125.5% of 17 is what?

4. Find 0.5% of 33.

OBJECTIVE A

To find the amount when the percent and the base are given

For Exercises 5 to 22, solve.

5. 8% of 100 is what?

6. 16% of 50 is what?

7. 27% of 40 is what?

8. 52% of 95 is what?

9. 0.05% of 150 is what?

10. 0.075% of 625 is what?

11. 125% of 64 is what?

12. 210% of 12 is what?

13. Find 10.7% of 485.

14. Find 12.8% of 625.

15. What is 0.25% of 3000?

16. What is 0.06% of 250?

17. 80% of 16.25 is what?

18. 26% of 19.5 is what?

19. What is $1\frac{1}{2}\%$ of 250?

20. What is $5\frac{3}{4}\%$ of 65?

21. $16\frac{2}{3}\%$ of 120 is what?


22. What is $66\frac{2}{3}\%$ of 891?


23. Which is larger: 5% of 95, or 75% of 6?

24. Which is larger: 112% of 5, or 0.45% of 800?






25. Which is smaller: 79% of 16, or 20% of 65?

26. Which is smaller: 15% of 80, or 95% of 15?

27.  Is 15% of a number greater than or less than the number?

28.  Is 150% of a number greater than or less than the number?

OBJECTIVE B *To solve application problems*

29.  Read Exercise 30. Without doing any calculations, determine whether the number of people in the United States aged 18 to 24 who do not have health insurance is *less than*, *equal to*, or *greater than* 50 million.
30.  **Health Insurance** Approximately 16.2% of the 50 million people in the United States who do not have health insurance are between the ages of 18 and 24. (Source: U.S. Census Bureau) About how many people in the United States aged 18 to 24 do not have health insurance?
31.  **Aviation** Based on data from the Bureau of Transportation Statistics, there were 629.5 million domestic airline passengers in 2010. If it is forecasted that this number will increase by 22% by the year 2020, how many more domestic airline passengers will there be in 2020?
32. **Jewelry** An 18-carat, yellow-gold necklace contains 75% gold, 16% silver, and 9% copper. If the necklace weighs 25 grams, how many grams of copper are in the necklace?
33. **Jewelry** Fourteen-carat yellow gold contains 58.5% gold, 17.5% silver, and 24% copper. If a jeweler has a 50-gram piece of 14-carat yellow gold, how many grams each of gold, silver, and copper are in the piece?
34. **Car Lease Sales Tax** The base monthly payment for a car lease is \$324.76 per month. If a sales tax of 7.25% is added to the base monthly payment, what is the total monthly lease payment? Round to the nearest cent.
35.  **e-Filed Tax Returns** Use the information in the news clipping at the right. How many tax returns were filed electronically? Round to the nearest million.
36.  **Email Spam** Based on data from Symantec Corporation, Rustock was one of the largest spam-sending botnets. During one year, Rustock was responsible for 47.5 percent of the approximately 93 million spam emails sent each day. How many spam emails did Rustock send each day that year?
37. **Car Payment** A state sales tax of 6.75% is added to the purchase of a car. If the purchase price of a car is \$28,995, what is the total cost of the car, including sales tax? If that amount is repaid in 48 equal monthly payments, what is the monthly payment? Round to the nearest cent.

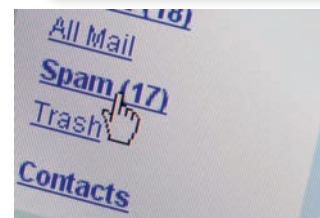


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In the NEWS!**E-Filing Still Rising**

The Internal Revenue Service reports that of 141.5 million federal tax returns filed in 2010, about 69.8% were filed electronically.

Source: www.efile.com



Pixel 4 Images/Shutterstock.com

Critical Thinking

38. **Jewelry** Eighteen-carat white gold contains 75% gold, 15% silver, and 10% platinum. A jeweler wants to make a 2-ounce, 18-carat, white-gold ring. If gold costs \$900 per ounce, silver costs \$17.20 per ounce, and platinum costs \$1900 per ounce, what is the cost of the metal used to make the ring?

Projects or Group Activities

The table at the right shows how to determine weekly federal withholding tax for a single person in 2011. Use this table for Exercises 39 to 43.

Income is between	Withholding amount
\$0 and \$40	\$0
\$40 and \$204	\$0 + 10% of amount over \$40
\$204 and \$704	\$16.40 + 15% of amount over \$204
\$704 and \$1648	\$91.40 + 25% of amount over \$704
\$1648 and \$3394	\$327.40 + 28% of amount over \$1648
\$3394 and \$7332	\$816.28 + 33% of amount over \$3394
More than \$7332	\$2115.82 + 35% of amount over \$7332

Source: Internal Revenue Service

39. What is the withholding tax for a person who earns \$38 in one week?
40. What is the withholding tax for a person who earns \$157 in one week?
41. What is the withholding tax for a person who earns \$2542 in one week?
42. What is the withholding tax for a person who earns \$8000 in one week?
43. Suppose a person earns \$1648 in one week. Would the amount of withholding tax be different if the person used the \$704 to \$1648 bracket instead of the \$1648 to \$3394 bracket?

✓ CHECK YOUR PROGRESS: CHAPTER 5

For Exercises 1 to 4, write each percent as a decimal and as a fraction.

1. 85% 2. 4% 3. 0.25% 4. 180%

For Exercises 5 to 8, write the decimal as a percent.

5. 0.15 6. 0.027 7. 1.45 8. 0.00125

For Exercises 9 to 12, write the fraction as a percent.

9. $\frac{3}{5}$ 10. $\frac{17}{40}$ 11. $\frac{25}{60}$ 12. $\frac{85}{50}$

13. 35% of 84 is what? 14. Find 5.5% of 250.
15. What is 33% of 120? 16. Find 0.2% of 78.

17. **Salary Increase** A police officer earned \$1445 per week before receiving a 5% increase in pay. What was the increase in the officer's weekly pay?

SECTION

5.3

Percent Equations: Part II

OBJECTIVE A

To find the percent when the base and the amount are given

The basic percent equation can be used to find an unknown percent.

APPLY THE CONCEPT

A student answered 68 questions correctly on an 80-question test. What percent of the questions did the student answer correctly?

To find the percent of questions that were answered correctly, we must answer the question, “What percent of 80 is 68?” This sentence can be written using mathematical symbols and then solved for the unknown percent.

What percent of 80 is 68?

$$\begin{array}{ccccccc}
 \text{Percent} & & \text{base} & & \text{amount} & & \\
 n & \times & 80 & = & 68 & & \\
 \hline
 n & \times & 80 & = & 68 & & \\
 & & n & = & 68 \div 80 & & \\
 & & n & = & 0.85 & & \\
 & & n & = & 85\% & &
 \end{array}$$

• The solution must be written as a percent in order to answer the question.

The student answered 85% of the questions correctly.



Integrating Technology

The percent key **%** on a scientific calculator moves the decimal point two places to the right when pressed after a multiplication or division computation. For the example at the right, enter

$$68 \div 80 \text{ \% } =$$

The display reads 85.

EXAMPLE 1

What percent of 40 is 27?

Solution Percent \times base = amount

$$\begin{aligned}
 n \times 40 &= 27 \\
 n &= 27 \div 40 \\
 n &= 0.675 \\
 n &= 67.5\%
 \end{aligned}$$

EXAMPLE 2

What percent of 12 is 27?

Solution Percent \times base = amount

$$\begin{aligned}
 n \times 12 &= 27 \\
 n &= 27 \div 12 \\
 n &= 2.25 \\
 n &= 225\%
 \end{aligned}$$

EXAMPLE 3

25 is what percent of 75?

Solution Percent \times base = amount

$$\begin{aligned}
 n \times 75 &= 25 \\
 n &= 25 \div 75 \\
 n &= \frac{1}{3} = 33\frac{1}{3}\%
 \end{aligned}$$

YOU TRY IT 1

What percent of 32 is 16?

Your solution

YOU TRY IT 2

What percent of 15 is 48?

Your solution

YOU TRY IT 3

30 is what percent of 45?

Your solution

Solutions on p. S13

OBJECTIVE B*To solve application problems*

To solve percent problems, remember that it is necessary to identify the percent, base, and amount. Usually the base follows the phrase “percent of.”

EXAMPLE 4

The monthly house payment for the Kaminski family is \$787.50. What percent of the Kaminskis' monthly income of \$3750 is the house payment?

Strategy

To find what percent of the income the house payment is, write and solve the basic percent equation using n to represent the percent. The base is \$3750 and the amount is \$787.50.

Solution

$$\begin{aligned}n \times 3750 &= 787.50 \\n &= 787.50 \div 3750 \\n &= 0.21 = 21\%\end{aligned}$$

The house payment is 21% of the monthly income.

EXAMPLE 5

Scientists recently released one of the most comprehensive estimates of the number of species on Earth. Earth supports an estimated 8.7 million species, of which 2.2 million live in the ocean. What percent of the species live on land? Round to the nearest tenth of a percent.

Strategy

To find the percent of the species living on land:

- Subtract the number of species living in the ocean from the total number of species (8.7 million $-$ 2.2 million). This gives the number of species living on land.
- Write and solve the basic percent equation, using n to represent the percent of species living on land. The base is 8.7 million, and the amount is the number of species living on land.

Solution

$$8.7 \text{ million} - 2.2 \text{ million} = 5.5 \text{ million}$$

There are 5.5 million species living on land.

$$\begin{aligned}n \times 8.7 &= 5.5 \\n &= 5.5 \div 8.7 \\n &\approx 0.632\end{aligned}$$

Approximately 63.2% of the species live on land.

YOU TRY IT 4

Tomo Nagata had an income of \$33,500 and paid \$5025 in income tax. What percent of the income is the income tax?

Your strategy**Your solution****YOU TRY IT 5**


In a recent year, there were approximately 302.9 million wireless subscriber connections in the United States. Of these, approximately 112.1 million were subscribers using a smartphone. What percent of wireless subscribers were not using a smartphone? Round to the nearest tenth of a percent.

Your strategy**Your solution**

Solutions on p. S13

5.3 EXERCISES

 **Concept Check**

 For Exercises 1 to 4, without working the problem, determine whether the answer is *less than* or *greater than* 100%.





1. What percent of 6 is 12?
2. 8 is what percent of 40?
3. 16 is what percent of 8?
4. What percent of 15 is 3?

OBJECTIVE A*To find the percent when the base and amount are given*

For Exercises 5 to 25, solve.

5. What percent of 75 is 24?
6. What percent of 80 is 20?
7. 15 is what percent of 90?
8. 24 is what percent of 60?
9. What percent of 12 is 24?
10. What percent of 6 is 9?
11. What percent of 16 is 6?
12. What percent of 24 is 18?
13. 18 is what percent of 100?
14. 54 is what percent of 100?
15. 5 is what percent of 2000?
16. 8 is what percent of 2500?
17. What percent of 6 is 1.2?
18. What percent of 2.4 is 0.6?
19. 16.4 is what percent of 4.1?
20. 5.3 is what percent of 50?
21. 1 is what percent of 40?
22. 0.3 is what percent of 20?
23. What percent of 48 is 18?
24. What percent of 400 is 12?
25. What percent of 2800 is 7?

OBJECTIVE B*To solve application problems*

26.  Read Exercise 28. Without doing any calculations, determine whether the percent of those surveyed who were irked by tailgaters is *less than* or *greater than* 25%.
27.  **Sociology** Seven in ten couples disagree about financial issues. (*Source*: Yankelovich Partners for Lutheran Brotherhood) What percent of couples disagree about financial matters?
28.  **Sociology** In a survey, 1236 adults nationwide were asked, “What irks you most about the actions of other motorists?” The response “tailgaters” was given by 293 people. (*Source*: Reuters/Zogby) What percent of those surveyed were most irked by tailgaters? Round to the nearest tenth of a percent.
29.  **Agriculture** According to data from the U.S. Department of Agriculture, of the 63 billion pounds of vegetables produced in the United States in one year, 16 billion pounds were wasted. What percent of the vegetables produced were wasted? Round to the nearest tenth of a percent.

30. **Wind Energy** In a recent year, wind machines in the United States generated 95 billion kilowatt-hours of electricity, enough to serve over 8.7 million households. The nation's total electricity production that year was 28,600 billion kilowatt-hours. (*Source:* Energy Information Administration) What percent of the total energy production was generated by wind machines? Round to the nearest tenth.
31. **Diabetes** Approximately 8.3% of the American population has diabetes. Within this group, 18.8 million are diagnosed, while 7.0 million are undiagnosed. (*Source:* Centers for Disease Control) What percent of Americans with diabetes have not been diagnosed? Round to the nearest tenth of a percent.
32. **Internal Revenue Service** See the news clipping at the right. What percent of Americans reporting an income of over \$1 million were audited by the IRS? Round to the nearest hundredth of a percent.
33. **Construction** In a test of the breaking strength of concrete slabs for freeway construction, 3 of the 200 slabs tested did not meet safety requirements. What percent of the slabs did meet safety requirements?



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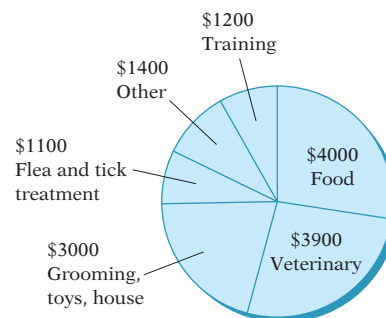
In the NEWS!

\$1 Million Audits
Of the 388,684 American taxpayers reporting an annual income of more than \$1 million, 32,494 were audited by the Internal Revenue Service.
Source: Internal Revenue Service; Bloomberg Businessweek

Critical Thinking

Pets The graph at the right shows several categories of average lifetime costs of dog ownership. Use this graph for Exercises 34 to 36. Round answers to the nearest tenth of a percent.

34. What percent of the total amount is spent on food?
35. What percent of the total is spent on veterinary care?
36. What percent of the total is spent on all categories except training?



Cost of Owning a Dog
Source: Based on data from the American Kennel Club, *USA Today* research

37. **Sports** The Fun in the Sun organization claims to have taken a survey of 350 people, asking them to give their favorite outdoor temperature for hiking. The results are given in the table at the right. Explain why these results are not possible.

<i>Favorite Temperature</i>	<i>Percent</i>
Greater than 90	5%
80–89	28%
70–79	35%
60–69	32%
Below 60	13%

Projects or Group Activities

38. Suppose the annual rainfall for a city in 2012 was 10 inches. In 2013, the annual rainfall increases by 10% from 2012. In 2014, the annual rainfall decreases by 10% from 2013. Is the annual rainfall in 2014 *less than*, *equal to*, or *greater than* the annual rainfall in 2012?
39. A stock decreased in value from \$25 per share to \$20 per share.
- What was the amount of the decrease?
 - What percent of the original value of a share is the decrease?
 - By what percent would the stock need to increase to return to its original value?
 - Are the answers to parts (b) and (c) the same?

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SECTION

5.4

Percent Equations: Part III

OBJECTIVE A

To find the base when the percent and the amount are given



Point of Interest

One gigawatt-hour of energy can supply approximately 165 homes with power for a period of one year.

APPLY THE CONCEPT

In one year, a utility company produced approximately 14,500 gigawatt-hours of energy using renewable energy resources. This was 19% of the total amount of energy produced by the company that year. To find the total amount of energy produced that year by the company, we must answer the question, “19% of what number is 14,500?”

19% of what is 14,500?
 ↓ ↓ ↓ ↓

Percent	×	base	=	amount
19%		n		14,500

$$0.19 \times n = 14,500$$

$$n = 14,500 \div 0.19$$

$$n \approx 76,316$$

The company produced approximately 76,316 gigawatt-hours of energy.

EXAMPLE 1

18% of what is 900?

Solution Percent \times base = amount

$$0.18 \times n = 900$$

$$n = 900 \div 0.18$$

$$n = 5000$$

YOU TRY IT 1

86% of what is 215?

Your solution

EXAMPLE 2

30 is 1.5% of what?

Solution Percent \times base = amount

$$0.015 \times n = 30$$

$$n = 30 \div 0.015$$

$$n = 2000$$

YOU TRY IT 2

15 is 2.5% of what?

Your solution

EXAMPLE 3

$33\frac{1}{3}\%$ of what is 7?

Solution Percent \times base = amount

$$\frac{1}{3} \times n = 7$$

• Note that the percent is written as a fraction.

$$n = 7 \div \frac{1}{3}$$

$$n = 21$$

YOU TRY IT 3

$16\frac{2}{3}\%$ of what is 5?

Your solution

Solutions on p. S13

OBJECTIVE B*To solve application problems*

To solve percent problems, it is necessary to identify the percent, the base, and the amount. Usually the base follows the phrase “percent of.”

EXAMPLE 4

A business office bought a used copy machine for \$900, which was 75% of the original cost. What was the original cost of the copier?

Strategy

To find the original cost of the copier, write and solve the basic percent equation, using n to represent the original cost (base). The percent is 75% and the amount is \$900.

Solution

$$\begin{aligned} 75\% \times n &= 900 \\ 0.75 \times n &= 900 \\ n &= 900 \div 0.75 \\ n &= 1200 \end{aligned}$$

The original cost of the copier was \$1200.

YOU TRY IT 4

A used car has a value of \$10,458, which is 42% of the car's original value. What was the car's original value?

Your strategy**Your solution****EXAMPLE 5**

A carpenter's wage this year is \$26.40 per hour, which is 110% of last year's wage. What was the increase in the hourly wage over last year?

Strategy

To find the increase in the hourly wage over last year:

- Find last year's wage. Write and solve the basic percent equation, using n to represent last year's wage (base). The percent is 110% and the amount is \$26.40.
- Subtract last year's wage from this year's wage (26.40).

Solution

$$\begin{aligned} 110\% \times n &= 26.40 \\ 1.10 \times n &= 26.40 \\ n &= 26.40 \div 1.10 \\ n &= 24.00 \end{aligned}$$

$$26.40 - 24.00 = 2.40$$

The increase in the hourly wage was \$2.40.

YOU TRY IT 5


Chang's Sporting Goods has a tennis racket on sale for \$89.60, which is 80% of the original price. What is the difference between the original price and the sale price?

Your strategy**Your solution**

Solutions on pp. S13–S14

5.4 EXERCISES

 **Concept Check**

 For Exercises 1 to 4, without working the problem, determine whether the base is *less than* or *greater than* the amount.

1. 15% of what is 12?
2. 30 is 0.5% of what?
3. 20 is 125% of what?
4. 110% of what is 200?

OBJECTIVE A




To find the base when the percent and amount are given

For Exercises 5 to 25, solve.

5. 12% of what is 9?
6. 38% of what is 171?
7. 8 is 16% of what?
8. 54 is 90% of what?
9. 10 is 10% of what?
10. 37 is 37% of what?
11. 30% of what is 25.5?
12. 25% of what is 21.5?
13. 2.5% of what is 30?
14. 10.4% of what is 52?
15. 125% of what is 24?
16. 180% of what is 21.6?
17. 18 is 240% of what?
18. 24 is 320% of what?
19. 4.8 is 15% of what?
20. 87.5 is 50% of what?
21. 25.6 is 12.8% of what?
22. 45.014 is 63.4% of what?
23. 30% of what is 2.7?
24. 120 is $33\frac{1}{3}\%$ of what?
25. 84 is $16\frac{2}{3}\%$ of what?

OBJECTIVE B

To solve application problems

26.  Read Exercise 27. Without doing any calculations, determine whether the number of travelers who allowed their children to miss school to go on a trip is *less than*, *equal to*, or *greater than* 1.738 million.
27.  **Travel** Of the travelers who, during a recent year, allowed their children to miss school to go on a trip, approximately 1.738 million allowed their children to miss school for more than a week. This represented 11% of the travelers who allowed their children to miss school. (*Source*: Travel Industry Association) About how many travelers allowed their children to miss school to go on a trip?
28.  **Tablet Shipments** Use the information in the news clipping at the right. Find the total number of media tablets shipped in 2010. Round to the nearest million.

In the NEWS!

Tablet Sales Surge

In their first year on the market, media tablets saw a surge in sales at the end of the year. The 10.1 million media tablets shipped worldwide in the fourth quarter represented 56.4% of all tablets shipped in 2010.

Source: International Data Corporation

29. **Marathons** In 2011, approximately 98.2% of the runners who started the Boston Marathon, or 23,913 people, crossed the finish line. (*Source*: Boston Athletic Association) How many runners started the Boston Marathon in 2011? Round to the nearest ten.
30. **Education** In the United States today, 29.6% of women and 30.3% of men have earned a bachelor's or graduate degree. (*Source*: Census Bureau) What additional information would you need in order to determine how many women in the United States have earned a bachelor's or graduate degree?
31. **Fuel Consumption** Use the information in the news clipping at the right. Sailing at full speed, how many tons of fuel per day does a large ship use?
32. **Taxes** A TurboTax online survey asked people how they planned to use their tax refunds. Seven hundred forty people, or 22% of the respondents, said they would save the money. How many people responded to the survey?
33. **Manufacturing** During a quality control test, Micronics found 24 defective computer boards. This amount was 0.8% of the computer boards tested.
- How many computer boards were tested?
 - How many of the computer boards tested were not defective?



HERO LANG/AFP/Getty Images

In the NEWS!

Reducing Cargo Ship Emissions

By using giant kites to power the ships and sailing at slower speeds, shipping companies are reducing the amount of fuel used by cargo ships, thus reducing the ships' CO₂ emissions. By reducing its speed by 20%, a large ship can lower its fuel use by 40%, saving 120 tons of fuel per day.

Source: www.guardian.uk.com

Critical Thinking

34. **Nutrition** The table at the right contains nutrition information about a breakfast cereal. The amount of thiamin in one serving of this cereal with skim milk is 0.45 milligram. Find the recommended daily allowance of thiamin for an adult.

NUTRITION INFORMATION

SERVING SIZE: 1.4 OZ WHEAT FLAKES WITH
0.4 OZ RAISINS: 39.4 g, ABOUT 1/2 CUP
SERVINGS PER PACKAGE:14

	CEREAL & RAISINS	WITH 1/2 CUP VITAMINS A & D SKIM MILK
PROTEIN	4	15
VITAMIN A	15	20
VITAMIN C	**	2
THIAMIN	25	30
RIBOFLAVIN	25	35
NIACIN	25	35
CALCIUM	**	15
IRON	100	100
VITAMIN D	10	25
VITAMIN B ₆	25	25
FOLIC ACID	25	25
VITAMIN B ₁₂	25	30
PHOSPHORUS	10	15
MAGNESIUM	10	20
ZINC	25	30
COPPER	2	4

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCES (U.S. RDA)

PROTEIN	4	15
VITAMIN A	15	20
VITAMIN C	**	2
THIAMIN	25	30
RIBOFLAVIN	25	35
NIACIN	25	35
CALCIUM	**	15
IRON	100	100
VITAMIN D	10	25
VITAMIN B ₆	25	25
FOLIC ACID	25	25
VITAMIN B ₁₂	25	30
PHOSPHORUS	10	15
MAGNESIUM	10	20
ZINC	25	30
COPPER	2	4

* 2% MILK SUPPLIES AN ADDITIONAL 20 CALORIES.
2 g FAT, AND 10 mg CHOLESTEROL.

** CONTAINS LESS THAN 2% OF THE U.S. RDA OF THIS NUTRIENT

Projects or Group Activities

35. a. Suppose you correctly answer 48 out of 60 questions on a test. What percent of the questions did you answer correctly?
- b. Suppose you correctly answer 56 out of 80 questions on a second test. What percent of the questions did you answer correctly?
- c. What is the average of the two percents in parts (a) and (b)?
- d. Consider the total number of questions on the two tests and the total number you answered correctly. What percent of the questions did you answer correctly? Is this the same number you calculated in part (c)?
- e. Your answers to parts (c) and (d) show that averaging the percent scores for two tests does not necessarily give the correct percent score for the combined tests. Under what conditions would the average of the percent scores give the true percent score for the combined tests? *Hint*: Consider the base of the basic percent equation.

SECTION

5.5

Percent Problems: Proportion Method

OBJECTIVE A

To solve percent problems using proportions

Problems that can be solved using the basic percent equation can also be solved using proportions.

The proportion method is based on writing two ratios. One ratio is the percent ratio, written as $\frac{\text{percent}}{100}$. The second ratio is the amount-to-base ratio, written as $\frac{\text{amount}}{\text{base}}$. These two ratios form the proportion

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$

To use the proportion method, first identify the percent, the amount, and the base (the base usually follows the phrase “percent of”).



Integrating Technology

To use a calculator to solve the proportions at the right for n , enter

$$\begin{array}{l} 23 \times 45 \div 100 = \\ 100 \times 4 \div 25 = \\ 100 \times 12 \div 60 = \end{array}$$

What is 23% of 45?

$$\frac{23}{100} = \frac{n}{45}$$

$$\begin{aligned} 23 \times 45 &= 100 \times n \\ 1035 &= 100 \times n \\ 1035 \div 100 &= n \\ 10.35 &= n \end{aligned}$$

What percent of 25 is 4?

$$\frac{n}{100} = \frac{4}{25}$$

$$\begin{aligned} n \times 25 &= 100 \times 4 \\ n \times 25 &= 400 \\ n &= 400 \div 25 \\ n &= 16 \end{aligned}$$

12 is 60% of what number?

$$\frac{60}{100} = \frac{12}{n}$$

$$\begin{aligned} 60 \times n &= 100 \times 12 \\ 60 \times n &= 1200 \\ n &= 1200 \div 60 \\ n &= 20 \end{aligned}$$

EXAMPLE 1

15% of what is 7? Round to the nearest hundredth.

Solution

$$\begin{aligned} \frac{15}{100} &= \frac{7}{n} \\ 15 \times n &= 100 \times 7 \\ 15 \times n &= 700 \\ n &= 700 \div 15 \\ n &\approx 46.67 \end{aligned}$$

EXAMPLE 2

30% of 63 is what?

Solution

$$\begin{aligned} \frac{30}{100} &= \frac{n}{63} \\ 30 \times 63 &= 100 \times n \\ 1890 &= 100 \times n \\ 1890 \div 100 &= n \\ 18.90 &= n \end{aligned}$$

YOU TRY IT 1

26% of what is 22? Round to the nearest hundredth.

Your solution

YOU TRY IT 2

16% of 132 is what?

Your solution

Solutions on p. S14

OBJECTIVE B*To solve application problems***EXAMPLE 3**

An antiques dealer found that 86% of the 250 items that were sold during one month sold for under \$1000. How many items sold for under \$1000?

Strategy

To find the number of items that sold for under \$1000, write and solve a proportion, using n to represent the number of items sold for less than \$1000 (amount). The percent is 86%, and the base is 250.

Solution

$$\begin{aligned}\frac{86}{100} &= \frac{n}{250} \\ 86 \times 250 &= 100 \times n \\ 21,500 &= 100 \times n \\ 21,500 \div 100 &= n \\ 215 &= n\end{aligned}$$

215 items sold for under \$1000.

EXAMPLE 4

In a test of the strength of nylon rope, 5 of the 25 pieces tested did not meet the test standards. What percent of the nylon ropes tested did meet the test standards?

Strategy

To find the percent of ropes tested that met the test standards:

- Find the number of ropes that met the test standards ($25 - 5$).
- Write and solve a proportion, using n to represent the percent of ropes that met the test standards. The base is 25, and the amount is the number of ropes that met the standards.

Solution

$$\begin{aligned}25 - 5 &= 20 \text{ ropes met test standards.} \\ \frac{n}{100} &= \frac{20}{25} \\ n \times 25 &= 100 \times 20 \\ n \times 25 &= 2000 \\ n &= 2000 \div 25 \\ n &= 80\end{aligned}$$

80% of the ropes tested did meet the test standards.

YOU TRY IT 3

Last year it snowed 64% of the 150 days of the ski season at a resort. How many days did it snow?

Your strategy**Your solution****YOU TRY IT 4**

The Rincon Fire Department received 24 false alarms out of a total of 200 alarms received. What percent of the alarms received were not false alarms?

Your strategy**Your solution**

Solutions on p. S14

5.5 EXERCISES

✓ Concept Check

1. Write a proportion that can be used to solve problems involving percent.

For Exercises 2 to 4, state whether the unknown n represents *percent*, *base*, or *amount*.


2. $\frac{45}{100} = \frac{28}{n}$

3. $\frac{n}{100} = \frac{30}{50}$

4. $\frac{n}{50} = \frac{30}{100}$




OBJECTIVE A

To solve percent problems using proportions

5. 26% of 250 is what? 6. What is 18% of 150? 7. 37 is what percent of 148?
8. What percent of 150 is 33? 9. 68% of what is 51? 10. 126 is 84% of what?
11. What percent of 344 is 43? 12. 750 is what percent of 50? 13. 82 is 20.5% of what?
14. 2.4% of what is 21? 15. What is 6.5% of 300? 16. 96% of 75 is what?
17. 7.4 is what percent of 50? 18. What percent of 1500 is 693? 19. 50.5% of 124 is what?
20. What is 87.4% of 255? 21. 33 is 220% of what? 22. 160% of what is 40?
23.  Which equation(s) below can be used to answer the question, **a.** “What is 12% of 75?” and **b.** to answer the question, “75 is 12% of what?”
- (i) $\frac{12}{100} = \frac{75}{n}$ (ii) $0.12 \times 75 = n$ (iii) $\frac{12}{100} = \frac{n}{75}$ (iv) $0.12 \times n = 75$

OBJECTIVE B

To solve application problems

24.  Read Exercise 25. Without doing any calculations, determine whether the length of time the drug will be effective is *less than* or *greater than* 6 hours.
25. **Medicine** A manufacturer of an anti-inflammatory drug claims that the drug will be effective for 6 hours. An independent testing service determined that the drug was effective for only 80% of the length of time claimed by the manufacturer. Find the length of time the drug will be effective as determined by the testing service.
26.  **Geography** The land area of North America is approximately 9,400,000 square miles. This represents approximately 16% of the total land area of the world. What is the approximate total land area of the world?
27.  **Girl Scout Cookies** Using the information in the news clipping at the right, calculate the cash generated annually **a.** from sales of Thin Mints and **b.** from sales of Trefoil shortbread cookies.



Jeff Greenberg/age fotostock

In the NEWS!

Thin Mints Biggest Seller

Every year, sales from the Girl Scout cookies sold by about 2.7 million girls total \$700 million. The most popular cookie, Thin Mints, earn 25% of total sales, while sales of Trefoil shortbread cookies represent only 9% of total sales.

Source: msnbc.com

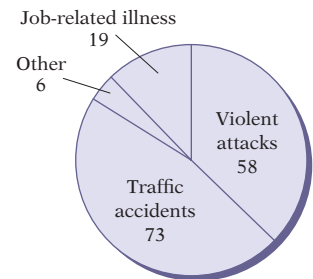
28. **Charities** In a recent year, the American Red Cross spent \$132,105,934 on administrative expenses. This amount was 3.68% of its total revenue. Find the American Red Cross's total revenue for that year. Round to the nearest ten million.
29. **Education** See the news clipping at the right. What percent of the baby boomers living in the United States have attended college? Round to the nearest tenth of a percent.
30. **Mining** During one year, approximately 2,240,000 ounces of gold went into the manufacturing of electronic equipment in the United States. This was 16% of all the gold mined in the United States that year. How many ounces of gold were mined in the United States that year?
31. **Poultry** In a recent year, North Carolina produced 963,000,000 pounds of turkey. This was 13.5% of the U.S. total in that year. Calculate the U.S. total turkey production for that year. Round to the nearest billion.
32. **Police Officers** The graph at the right shows causes of death for police officers killed in the line of duty during a recent year. What percent of the deaths were due to traffic accidents? Round to the nearest tenth of a percent.

In the NEWS!

Over Half of Baby Boomers Have College Experience

Of the 78 million baby boomers living in the United States, 45 million have attended college. Twenty-three million baby boomers are high school graduates with no college experience.

Source: USA Today



Numbers of Deaths for Police Officers Killed in the Line of Duty

Source: International Union of Police Associations

Critical Thinking

33. **The Federal Government** In the 110th Senate, there were 49 Republicans, 49 Democrats, and 2 Independents. In the 110th House of Representatives, there were 202 Republicans, 233 Democrats, and 0 Independents. Which had the larger percentage of Republicans, the 110th Senate or the 110th House of Representatives?

Projects or Group Activities

Gold jewelry comes in various colors. Three typical colors are yellow gold, rose gold, and white gold. The table at the right shows the percent breakdown of the elements used to make three colors of 18-carat gold. Use this table for Exercises 34 to 36.

34. How many grams of each element are needed for a yellow-gold ring that weighs 8 grams?
35. How many grams of each element are needed for a rose-gold ring that weighs 6 grams?
36. How many grams of each element are needed for a white-gold ring that weighs 8 grams?

Color	Composition
Yellow	Gold, 75% Copper, 25%
Rose	Gold, 75% Copper, 20% Silver, 5%
White	Gold, 75% Palladium, 10% Nickel, 10% Zinc, 5%

CHAPTER

5

Summary

Key Words

Percent means “parts of 100.” [5.1A, p. 204]

Examples

23% means 23 of 100 equal parts.

Essential Rules and Procedures

To write a percent as a decimal, drop the percent sign and multiply by 0.01. [5.1A, p. 204]

Examples

$$87\% = 87(0.01) = 0.87$$

To write a percent as a fraction, drop the percent sign and multiply by $\frac{1}{100}$. [5.1A, p. 204]

$$56\% = 56\left(\frac{1}{100}\right) = \frac{56}{100} = \frac{14}{25}$$

To write a decimal as a percent, multiply by 100%. [5.1B, p. 205]

$$0.325 = 0.325(100\%) = 32.5\%$$

To write a fraction as a percent, multiply by 100%. [5.1B, p. 205]

$$\frac{7}{20} = \frac{7}{20} \times \frac{100\%}{1} = \frac{700\%}{20} = 35\%$$

The Basic Percent Equation [5.2A, p. 209]

The basic percent equation is

$$\text{Percent} \times \text{base} = \text{amount}$$

Solving percent problems requires identifying the three elements of this equation. Usually the base follows the phrase “percent of.”

8% of 250 is what number?

Percent \times base = amount

$$0.08 \times 250 = n$$

$$20 = n$$

Proportion Method of Solving a Percent Problem

[5.5A, p. 222]

The following proportion can be used to solve percent problems.

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$

To use the proportion method, first identify the percent, the amount, and the base. The base usually follows the phrase “percent of.”

8% of 250 is what number?

$$\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$$

$$\frac{8}{100} = \frac{n}{250}$$

$$8 \times 250 = 100 \times n$$

$$2000 = 100 \times n$$

$$2000 \div 100 = n$$

$$20 = n$$

CHAPTER

5

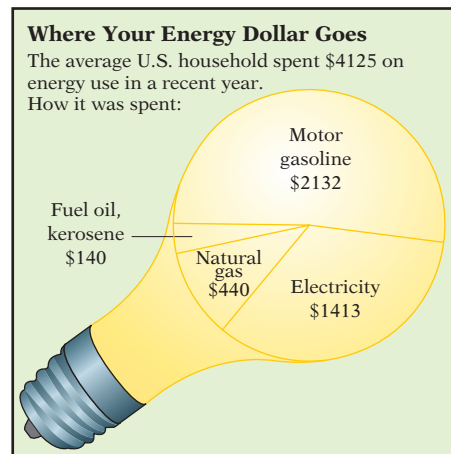
Review Exercises

1. What is 30% of 200?
2. 16 is what percent of 80?
3. Write $1\frac{3}{4}$ as a percent.
4. 20% of what is 15?
5. Write 12% as a fraction.
6. Find 22% of 88.
7. What percent of 20 is 30?
8. $16\frac{2}{3}\%$ of what is 84?
9. Write 42% as a decimal.
10. What is 7.5% of 72?
11. $66\frac{2}{3}\%$ of what is 105?
12. Write 7.6% as a decimal.
13. Find 125% of 62.
14. Write $16\frac{2}{3}\%$ as a fraction.
15. What percent of 25 is 40? Use the proportion method.
16. 20% of what number is 15? Use the proportion method.
17. Write 0.38 as a percent.
18. 78% of what is 8.5? Round to the nearest tenth.

19. What percent of 30 is 2.2? Round to the nearest tenth of a percent.
20. What percent of 15 is 92? Round to the nearest tenth of a percent.
21. **Education** Trent missed 9 out of 60 questions on a history exam. What percent of the questions did he answer correctly? Use the proportion method.

22. **Advertising** A company used 7.5% of its \$60,000 advertising budget for newspaper advertising. How much of the advertising budget was spent on newspaper advertising?

23. **Energy** The graph at the right shows the amounts spent by the average U.S. household for energy use. What percent of energy costs is spent on electricity? Round to the nearest tenth of a percent.



Source: Bureau of Labor Statistics

24. **Consumerism** Joshua purchased a camcorder for \$980 and paid a sales tax of 6.25% of the cost. What was the total cost of the camcorder?

25. **Health** In a survey of 350 women and 420 men, 275 of the women and 300 of the men reported that they wore sunscreen often. To the nearest tenth of a percent, what percent of the women wore sunscreen often?



© iStockphoto.com/Troels Graugaard

26. **Demography** It is estimated that by the year 2050 the world's population will be 9,400,000,000. This is 155% of the population in 2000. (Source: U.S. Census Bureau) What was the world's population in 2000? Round to the nearest hundred million.

27. **Computers** A computer system can be purchased for \$1800. This is 60% of the cost 4 years ago. What was the cost of the computer system 4 years ago? Use the proportion method.

28. **Agriculture** In a recent year, Wisconsin growers produced 281.72 million pounds of cranberries. This represented 49.25% of the total cranberry crop in the United States that year. Find the total cranberry crop in the United States that year. Round to the nearest million.



Lijuan Guo/Shutterstock.com

CHAPTER

5

TEST

1. Write 97.3% as a decimal.
2. Write $83\frac{1}{3}\%$ as a fraction.
3. Write 0.3 as a percent.
4. Write 1.63 as a percent.
5. Write $\frac{3}{2}$ as a percent.
6. Write $\frac{37}{40}$ as a percent.
7. What is 77% of 65?
8. 47.2% of 130 is what?
9. Write $\frac{11}{18}$ as a percent.
10. Write 0.75% as a fraction.
11. 12 is 15% of what?
12. 42.5 is 150% of what? Round to the nearest tenth.
13. 123 is 86% of what number? Use the proportion method. Round to the nearest tenth.
14. What percent of 12 is 120? Use the proportion method.

15. **Advertising** A travel agency uses 6% of its \$750,000 budget for advertising. What amount of the budget is spent on advertising?
16. **Agriculture** During the packaging process for vegetables, spoiled vegetables are discarded by an inspector. In one day, an inspector found that 6.4% of the 1250 pounds of vegetables were spoiled. How many pounds of vegetables were not spoiled?

Nutrition The table at the right contains nutrition information about a breakfast cereal. Solve Exercises 17 and 18 with information taken from this table.

17. The recommended amount of potassium per day for an adult is 3000 milligrams (mg). What percent, to the nearest tenth of a percent, of the daily recommended amount of potassium is provided by one serving of this cereal with skim milk?
18. The daily recommended number of calories for a 190-pound man is 2200 calories. What percent, to the nearest tenth of a percent, of the daily recommended number of calories is provided by one serving of this cereal with 2% milk?
19. **Employment** The Urban Center Department Store has 125 permanent employees and must hire an additional 20 temporary employees for the holiday season. What percent of the number of permanent employees is the number hired as temporary employees for the holiday season?
20. **Education** Conchita missed 7 out of 80 questions on a math exam. What percent of the questions did she answer correctly? Round to the nearest tenth of a percent.
21. **Manufacturing** A manufacturer of digital cameras found 384 defective digital cameras during a quality control study. This amount was 1.2% of the digital cameras tested. Find the number of digital cameras tested.
22. **Real Estate** A new house was bought for \$285,000. Five years later, the house sold for \$456,000. What percent of the original price was the increase?
23. **Wages** An administrative assistant receives a wage of \$16.24 per hour. This amount is 112% of last year's wage. What is the dollar increase in the hourly wage over last year? Use the proportion method.
24. **Demography** A city has a population of 71,500. Ten years ago the population was 32,500. What percent of the population 10 years ago is the population now? Use the proportion method.
25. **Fees** The annual license fee on a car is 1.4% of the value of the car. If the annual license fee is \$350, what is the value of the car? Use the proportion method.

NUTRITION INFORMATION		
SERVING SIZE: 1.4 OZ WHEAT FLAKES WITH 0.4 OZ RAISINS: 39.4 g, ABOUT 1/2 CUP		
SERVINGS PER PACKAGE:14		
	CEREAL & RAISINS	WITH 1/2 CUP VITAMINS A & D SKIM MILK
CALORIES	120	180
PROTEIN, g	3	7
CARBOHYDRATE, g	28	34
FAT, TOTAL, g	1	1*
UNSATURATED, g	1	
SATURATED, g	0	
CHOLESTEROL, mg	0	0*
SODIUM, mg	125	190
POTASSIUM, mg	240	440
* 2% MILK SUPPLIES AN ADDITIONAL 20 CALORIES, 2 g FAT, AND 10 mg CHOLESTEROL. ** CONTAINS LESS THAN 2% OF THE U.S. RDA OF THIS NUTRIENT		

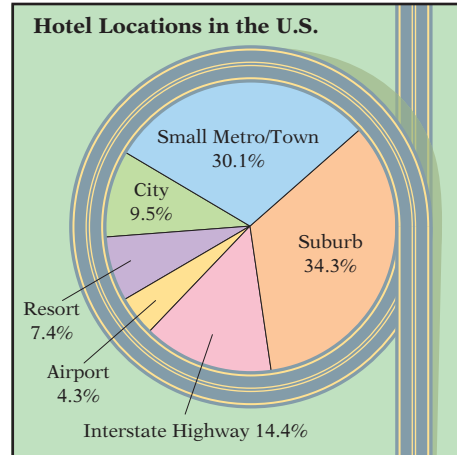
Cumulative Review Exercises

1. Simplify: $18 \div (7 - 4)^2 + 2$
2. Find the LCM of 16, 24, and 30.
3. Find the sum of $2\frac{1}{3}$, $3\frac{1}{2}$, and $4\frac{5}{8}$.
4. Subtract: $27\frac{5}{12} - 14\frac{9}{16}$
5. Multiply: $7\frac{1}{3} \times 1\frac{5}{7}$
6. What is $\frac{14}{27}$ divided by $1\frac{7}{9}$?
7. Simplify: $\left(\frac{3}{4}\right)^3 \cdot \left(\frac{8}{9}\right)^2 + \frac{1}{9}$
8. Simplify: $\left(\frac{2}{3}\right)^2 - \left(\frac{3}{8} - \frac{1}{3}\right) \div \frac{1}{2}$
9. Round 3.07973 to the nearest hundredth.
10. Subtract:
$$\begin{array}{r} 3.0902 \\ - 1.9706 \\ \hline \end{array}$$
11. Divide: $0.032 \overline{)1.097}$
Round to the nearest ten-thousandth.
12. Convert $3\frac{5}{8}$ to a terminating or repeating decimal.
13. Convert 1.75 to a fraction.
14. Place the correct symbol, $<$ or $>$, between the two numbers.
$$\frac{3}{8} \quad 0.87$$
15. Solve the proportion $\frac{3}{8} = \frac{20}{n}$.
Round to the nearest tenth.
16. Write “\$153.60 earned in 8 hours” as a unit rate.

17. Write $18\frac{1}{3}\%$ as a fraction.
18. Write $\frac{13}{18}$ as a percent.
19. 16.3% of 120 is what?
20. 24 is what percent of 18?
21. 12.4 is 125% of what?
22. What percent of 35 is 120?
Round to the nearest tenth.
23. **Taxes** Sergio has an income of \$740 per week. One-fifth of his income is deducted for income tax payments. Find his take-home pay.
24. **Finance** Eunice bought a used car for \$12,530, with a down payment of \$2000. The balance was paid in 36 equal monthly payments. Find the monthly payment.
25. **Taxes** The gasoline tax is \$.41 per gallon. Find the number of gallons of gasoline used during a month in which \$172.20 was paid in gasoline taxes.

26. **Taxes** The real estate tax on a \$344,000 home is \$6880. At the same rate, find the real estate tax on a home valued at \$500,000.

27. **Lodging** The graph at the right shows the breakdown of the locations of the 51,015 hotels throughout the United States. How many of these hotels are located along interstate highways? Round to the nearest whole number.



Source: American Hotel and Lodging Association

28. **Elections** A survey of 300 people showed that 165 people favored a certain candidate for mayor. What percent of the people surveyed did not favor this candidate?
29. **Television** According to the Cabletelevision Advertising Bureau, cable households watch television 36.5% of the time. On average, how many hours per week do cable households spend watching TV? Round to the nearest tenth.
30. **Health** The Environmental Protection Agency found that 990 out of 5500 children tested had levels of lead in their blood that exceeded federal guidelines. What percent of the children tested had levels of lead that exceeded federal standards?

Applications for Business and Consumers

6

OBJECTIVES

SECTION 6.1

- A** To find unit cost
- B** To find the most economical purchase
- C** To find total cost

SECTION 6.2

- A** To find percent increase
- B** To apply percent increase to business—markup
- C** To find percent decrease
- D** To apply percent decrease to business—discount

SECTION 6.3

- A** To calculate simple interest
- B** To calculate finance charges on a credit card bill
- C** To calculate compound interest

SECTION 6.4

- A** To calculate the initial expenses of buying a home
- B** To calculate the ongoing expenses of owning a home

SECTION 6.5

- A** To calculate the initial expenses of buying a car
- B** To calculate the ongoing expenses of owning a car

SECTION 6.6

- A** To calculate commissions, total hourly wages, and salaries

SECTION 6.7

- A** To calculate checkbook balances
- B** To balance a checkbook

Focus on Success

Are you using the features of this text to learn the concepts being presented? The HOW TO feature includes a step-by-step solution to the type of exercise you will be working in your homework assignments and on exams. A numbered Example provides you with a fully-worked-out solution. After studying the Example, try completing the You Try It to the right of the Example. A complete solution to the You Try It is given in the back of the text. (See Use the Interactive Method, page AIM-8).

Prep Test



Are you ready to succeed in this chapter? Take the Prep Test below to find out if you are ready to learn the new material.

1. Divide: $3.75 \div 5$
2. Multiply: 3.47×15
3. Subtract: $874.50 - 369.99$
4. Multiply: $0.065 \times 150,000$
5. Multiply: $1500 \times 0.06 \times 0.5$
6. Add: $1372.47 + 36.91 + 5.00 + 2.86$
7. Divide $10 \div 3$. Round to the nearest hundredth.
8. Divide $345 \div 570$. Round to the nearest thousandth.
9. Place the correct symbol, $<$ or $>$, between the two numbers.
 0.379 0.397

SECTION

6.1

Applications to Purchasing

OBJECTIVE A

To find unit cost

When items are packaged together, such as a six-pack of soda or a 10-pound bag of potatoes, we may want to find the cost of just one item—one can of soda or one pound of potatoes. The cost of one item, such as one can of soda or one pound of potatoes, is called the **unit cost**.

$$\text{Unit cost} = \frac{\text{cost of the package}}{\text{number of units in the package}}$$

APPLY THE CONCEPT

As a promotional sale, a store offers a case of 24 bottles of a sports drink for \$25.95. What is the cost of one bottle of the sports drink?

$$\begin{aligned} \text{Unit cost} &= \frac{\text{cost of the package}}{\text{number of units in the package}} \\ &= \frac{\$25.95}{24 \text{ bottles}} \\ &\approx \$1.08 \text{ per bottle} \end{aligned}$$

The unit cost is approximately \$1.08 per bottle.

APPLY THE CONCEPT

The cost of a 12-ounce package of salmon is \$6.72. What is the cost of one ounce of salmon?

$$\begin{aligned} \text{Unit cost} &= \frac{\text{cost of the package}}{\text{number of units in the package}} \\ &= \frac{\$6.72}{12 \text{ ounces}} \\ &= \$.56 \text{ per ounce} \end{aligned}$$

The unit cost is \$.56 per ounce.

EXAMPLE 1

Find the unit cost. Round to the nearest cent.

- An 8-can value pack of canned chicken for \$18.99.
- 4 ounces of toothpaste for \$2.59

Strategy

To find the unit cost, divide the cost of the package by the number of units in the package.

Solution

- Unit cost = $\frac{\text{cost of the package}}{\text{number of units in the package}}$
 $= \frac{\$18.99}{8 \text{ cans}} \approx \2.37 per can
- Unit cost = $\frac{\text{cost of the package}}{\text{number of units in the package}}$
 $= \frac{\$2.59}{4 \text{ ounces}} \approx \0.65 per ounce

YOU TRY IT 1

Find the unit cost. Round to the nearest cent.

- 12 Honey Crisp apples for \$14.49
- 15 pounds of potatoes for \$10.00

Your strategy**Your solution**

Solution on p. S14

OBJECTIVE B**To find the most economical purchase**

Comparison shoppers often find the most economical buy by comparing unit costs.

APPLY THE CONCEPT

One store is selling 6 twelve-ounce cans of ginger ale for \$2.99, and a second store is selling 24 twelve-ounce cans of ginger ale for \$11.79. To find the better buy, compare the unit costs. Round each unit cost to the nearest tenth of a cent.

$$2.99 \div 6 \approx 0.498$$

$$11.79 \div 24 \approx 0.491$$

Unit cost: **\$0.498** per can

Unit cost: **\$0.491** per can

Because **\$0.491 < \$0.498**, the better buy is 24 cans for \$11.79.

EXAMPLE 2

Find the more economical purchase: 5 pounds of nails for \$4.80, or 4 pounds of nails for \$3.78.

Strategy

To find the more economical purchase, compare the unit costs.

Solution

$$4.80 \div 5 = 0.96$$

$$3.78 \div 4 = 0.945$$

$$\$0.945 < \$0.96$$

The more economical purchase is 4 pounds for \$3.78.

YOU TRY IT 2

Find the more economical purchase: 6 cans of fruit for \$8.70, or 4 cans of fruit for \$6.96.

Your strategy**Your solution**

Solution on p. S14

OBJECTIVE C*To find total cost*

© iStockphoto.com/epicture

An installer of floor tile found the unit costs of identical floor tiles at three stores.

Store 1	Store 2	Store 3
\$1.22 per tile	\$1.18 per tile	\$1.28 per tile

By comparing the unit costs, the installer determined that store 2 would provide the most economical purchase.

The installer also uses the unit cost to find the total cost of purchasing 300 floor tiles at store 2. The **total cost** is found by multiplying the unit cost by the number of units purchased.

$$\begin{array}{r}
 \boxed{\text{Unit}} \\
 \boxed{\text{cost}}
 \end{array}
 \times
 \begin{array}{r}
 \boxed{\text{number}} \\
 \boxed{\text{of units}}
 \end{array}
 =
 \begin{array}{r}
 \boxed{\text{total}} \\
 \boxed{\text{cost}}
 \end{array}$$

$$1.18 \times 300 = 354$$

The total cost of 300 floor tiles is \$354.

EXAMPLE 3

One size of clear redwood lumber costs \$5.43 per foot. How much would 25 feet of this clear redwood lumber cost?

Strategy

To find the total cost, multiply the unit cost (5.43) by the number of units (25).

Solution

$$\begin{array}{r}
 \boxed{\text{Unit}} \\
 \boxed{\text{cost}}
 \end{array}
 \times
 \begin{array}{r}
 \boxed{\text{number}} \\
 \boxed{\text{of units}}
 \end{array}
 =
 \begin{array}{r}
 \boxed{\text{total}} \\
 \boxed{\text{cost}}
 \end{array}$$

$$5.43 \times 25 = 135.75$$

The total cost of 25 feet of clear redwood lumber is \$135.75.

YOU TRY IT 3

Pine saplings cost \$9.96 each. How much would 7 pine saplings cost?

Your strategy**Your solution**

Solution on p. S14

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6.1 EXERCISES


✓ Concept Check

1.  What is unit cost?
2.  How is total cost calculated?

OBJECTIVE A

To find unit cost

For Exercises 3 to 12, find the unit cost. Round to the nearest tenth of a cent.



3. Heinz B·B·Q sauce, 18 ounces for \$.99
4. Birds-eye maple, 6 feet for \$18.75
5. Diamond walnuts, \$2.99 for 8 ounces
6. A&W root beer, 6 cans for \$2.99
7. Ibuprofen, 50 tablets for \$3.99
8. Visine eye drops, 0.5 ounce for \$3.89
9. Adjustable wood clamps, 2 for \$13.95
10. Corn, 6 ears for \$2.85
11. Cheerios cereal, 15 ounces for \$2.99
12. Doritos Cool Ranch chips, 14.5 ounces for \$2.99
13.  A store advertises a “buy one, get one free” sale on pint containers of ice cream. How would you find the unit cost of one pint of ice cream?

OBJECTIVE B


To find the most economical purchase

For Exercises 14 to 23, suppose your local supermarket offers the following products at the given prices. Find the more economical purchase.


14. Sutter Home pasta sauce, 25.5 ounces for \$3.29, or Muir Glen Organic pasta sauce, 26 ounces for \$3.79
15. Kraft mayonnaise, 40 ounces for \$3.98, or Springfield mayonnaise, 32 ounces for \$3.39
16. Ortega salsa, 20 ounces for \$3.29 or 12 ounces for \$1.99
17. L'Oréal shampoo, 13 ounces for \$4.69, or Cortexx shampoo, 12 ounces for \$3.99
18. Golden Sun vitamin E, 200 tablets for \$12.99 or 400 tablets for \$18.69
19. Ultra Mr. Clean, 20 ounces for \$2.67, or Ultra Spic and Span, 14 ounces for \$2.19
20. 16 ounces of Kraft cheddar cheese for \$4.37, or 9 ounces of Land O'Lakes cheddar cheese for \$2.29
21. Bertolli olive oil, 34 ounces for \$9.49, or Pompeian olive oil, 8 ounces for \$2.39
22. Maxwell House coffee, 4 ounces for \$3.99, or Sanka coffee, 2 ounces for \$2.39
23. Wagner's vanilla extract, \$3.95 for 1.5 ounces, or Durkee vanilla extract, 1 ounce for \$2.84

24.  If the number of units of a product in a package increases but the cost remains the same, does the unit cost increase or decrease?
25.  If the total cost for the same number of units increases, does the unit cost increase or decrease?

OBJECTIVE C*To find total cost*

26. Sliced bacon costs \$4.59 per pound. Find the total cost of 3 pounds.
27. Used red brick costs \$.98 per brick. Find the total cost of 75 bricks.
28. Kiwi fruit cost \$.43 each. Find the total cost of 8 kiwi.
29. Boneless chicken filets cost \$4.69 per pound. Find the cost of 3.6 pounds. Round to the nearest cent.
30. Herbal tea costs \$.98 per ounce. Find the total cost of 6.5 ounces.
31. Swiss cheese costs \$5.99 per pound. Find the total cost of 0.65 pound. Round to the nearest cent.
32. Gala apples cost \$1.29 per pound. Find the total cost of 2.1 pounds. Round to the nearest cent.
33. Rib eye steak costs \$9.49 per pound. Find the total cost of 2.8 pounds. Round to the nearest cent.
34.  Suppose a store flyer advertises cantaloupes as “buy one, get one free.” True or false? The total cost of 6 cantaloupes at the sale price is the same as the total cost of 3 cantaloupes at the regular price.

Critical Thinking

 For Exercises 35 and 36, suppose a box of Tea A contains twice as many tea bags as a box of Tea B. Decide which box of tea is the more economical purchase.

35. The price of a box of Tea B is greater than half the price of a box of Tea A.
36. The price of a box of Tea A is less than twice the price of a box of Tea B.

37.  What is the UPC (Universal Product Code) and how is it used?

**Projects or Group Activities**

38. Some financial advisors recommend that long-term investors use dollar cost averaging. With this method, the same dollar amount is invested at regular intervals. The number of shares purchased for that amount varies depending on the cost per share. The table at the right shows the results for one investor. It is common when using this method to purchase a fraction of a share, rounded to the nearest thousandth. Complete the cost-per-share (unit cost) column. Round to the nearest cent. Then find the average unit cost of all shares purchased.

Investment Amount	Shares Purchased	Cost per Share
\$250	29.296	
\$250	26.743	
\$250	27.981	
\$250	25.522	
\$250	23.377	
\$250	22.187	

SECTION

6.2

Percent Increase and Percent Decrease

OBJECTIVE A

To find percent increase



Point of Interest

Precious metals such as gold or silver are measured in troy ounces. The ounce used to measure the weight of everyday items, such as coffee, beans, or meat, is called an avoirdupois ounce. 1 troy ounce \approx 1.097 (avoirdupois) ounces

Percent increase is used to show how much a quantity has increased over its original value. The statements “Food prices increased by 2.3% last year” and “City council members received a 4% pay increase” are examples of percent increase.

HOW TO 1

In a six-month period, the price of gold increased from \$1424.80 per ounce to \$1621.40 per ounce. What is the percent increase in the price of one ounce of gold for the six-month period? Round to the nearest tenth of a percent.

$$\begin{array}{|c|} \hline \text{New} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{original} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{increase} \\ \hline \end{array}$$

$$1621.40 - 1424.80 = 196.60$$

Now solve the basic percent equation for percent.

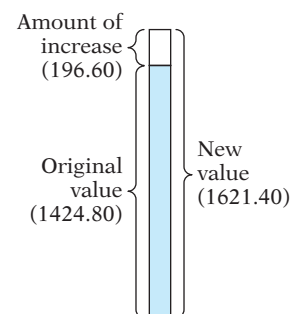
$$\text{Percent} \times \text{base} = \text{amount}$$

$$\begin{array}{|c|} \hline \text{Percent} \\ \hline \text{increase} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{original} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{increase} \\ \hline \end{array}$$

$$n \times 1424.80 = 196.60$$

$$n = 196.60 \div 1424.80$$

$$n \approx 0.138 = 13.8\%$$



The percent increase in the price of one ounce of gold is approximately 13.8%.

EXAMPLE 1

Based on data from Bloomberg New Energy Finance, it is estimated that there will be 1.6 million plug-in cars on the road by 2020, and 4 million by 2030. What percent increase in plug-in cars is predicted by this report?

Strategy

To find the percent increase:

- Find the amount of the increase.
- Solve the basic percent equation for *percent*.

Solution

$$\begin{array}{|c|} \hline \text{New} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{original} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{increase} \\ \hline \end{array}$$

$$4 \text{ million} - 1.6 \text{ million} = 2.4 \text{ million}$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$n \times 1.6 = 2.4$$

$$n = 2.4 \div 1.6$$

$$n = 1.5 = 150\%$$

The predicted percent increase is 150%.

YOU TRY IT 1

The average price of gasoline rose from \$3.46 to \$3.83 in 5 months. What was the percent increase in the price of gasoline? Round to the nearest percent.

Your strategy

Your solution

Solution on p. S15

EXAMPLE 2

Chris Carley was earning \$17.86 an hour as a paramedic assistant before receiving a 15% increase in pay. What is Chris's new hourly pay?

Strategy

To find the new hourly wage:

- Solve the basic percent equation for *amount*.
- Add the amount of the increase to the original wage.

Solution

Percent \times base = amount

$$0.15 \times 17.86 = n$$

$$2.68 \approx n$$

The amount of the increase was \$2.68.

$$17.86 + 2.68 = 20.54$$

The new hourly wage is \$20.54.

YOU TRY IT 2

Yolanda Liyama was making a wage of \$12.50 an hour as a baker before receiving a 14% increase in hourly pay. What is Yolanda's new hourly wage?

Your strategy**Your solution**

Solution on p. S15

OBJECTIVE B

To apply percent increase to business—markup

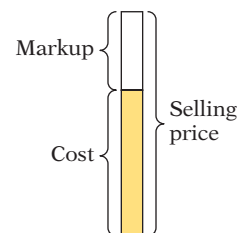
Some of the expenses involved in operating a business are salaries, rent, equipment, and utilities. To pay these expenses and earn a profit, a business must sell a product at a higher price than it paid for the product.

Cost is the price a business pays for a product, and **selling price** is the price at which a business sells a product to a customer. The difference between selling price and cost is called **markup**.

$$\boxed{\text{Selling price}} - \boxed{\text{cost}} = \boxed{\text{markup}}$$

or

$$\boxed{\text{Cost}} + \boxed{\text{Markup rate}} = \boxed{\text{selling price}}$$



Markup is frequently expressed as a percent of a product's cost. This percent is called the **markup rate**.

$$\boxed{\text{Markup rate}} \times \boxed{\text{cost}} = \boxed{\text{markup}}$$

HOW TO 2

Suppose Bicycles Galore purchases a Felt Z4 bicycle for \$2119.20 and sells it for \$2649. What markup rate does Bicycles Galore use?

$$\boxed{\text{Selling price}} - \boxed{\text{cost}} = \boxed{\text{markup}}$$

$$2649.00 - 2119.20 = 529.80$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Markup rate}} \times \boxed{\text{cost}} = \boxed{\text{markup}}$$

$$n \times 2119.20 = 529.80$$

$$n = 529.80 \div 2119.20 = 0.25$$

The markup rate is 25%.

- First find the markup.

- Then solve the basic percent equation for percent.

**Point of Interest**

According to *Managing a Small Business* from Liraz Publishing Company, goods in a store are often marked up 50% to 100% of the cost. This allows a business to make a profit of 5% to 10%.



©Gorilla/Shutterstock.com

EXAMPLE 3

The manager of a sporting goods store determines that a markup rate of 56% is necessary to make a profit. What is the markup on a pair of skis that costs the store \$225?

Strategy

To find the markup, solve the basic percent equation for *amount*.

Solution

Percent \times base = amount

$$\boxed{\text{Markup rate}} \times \boxed{\text{cost}} = \boxed{\text{markup}}$$

$$0.56 \times 225 = n$$

$$126 = n$$

The markup is \$126.

YOU TRY IT 3

A bookstore manager determines that a markup rate of 20% is necessary to make a profit. What is the markup on a book that costs the bookstore \$32?

Your strategy**Your solution****EXAMPLE 4**

A plant nursery bought a yellow twig dogwood for \$9.50 and used a markup rate of 65%. What is the selling price?

Strategy

To find the selling price:

- Find the markup by solving the basic percent equation for *amount*.
- Add the markup to the cost.

Solution

Percent \times base = amount

$$\boxed{\text{Markup rate}} \times \boxed{\text{cost}} = \boxed{\text{markup}}$$

$$0.65 \times 9.50 = n$$

$$6.18 \approx n$$

$$\boxed{\text{Cost}} + \boxed{\text{markup}} = \boxed{\text{selling price}}$$

$$9.50 + 6.18 = 15.68$$

The selling price is \$15.68.

YOU TRY IT 4

A clothing store bought a leather jacket for \$72 and used a markup rate of 55%. What is the selling price?

Your strategy**Your solution**

OBJECTIVE C*To find percent decrease*

Percent decrease is used to show how much a quantity has decreased from its original value. The statements “The number of family farms decreased by 2% last year” and “There has been a 50% decrease in the cost of a Pentium chip” are examples of percent decrease.

HOW TO 3

Data from the Internal Revenue Service show that between two recent years, the number of individuals with incomes over \$500,000 per year fell from 862,227 to 729,451. Find the percent decrease in the number of individuals with incomes over \$500,000. Round to the nearest tenth of a percent.

$$\begin{array}{|c|} \hline \text{Original} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{new} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{decrease} \\ \hline \end{array}$$

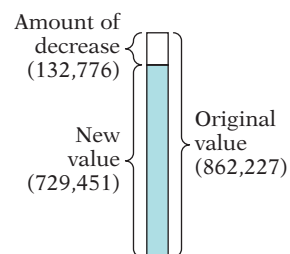
$$862,227 - 729,451 = 132,776$$

Now solve the basic percent equation for percent.

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\begin{array}{|c|} \hline \text{Percent} \\ \hline \text{decrease} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{original} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{decrease} \\ \hline \end{array}$$

$$\begin{array}{l} n \times 862,227 = 132,776 \\ n = 132,776 \div 862,227 \\ n \approx 0.154 = 15.4\% \end{array}$$



The percent decrease in the number of individuals with incomes over \$500,000 was approximately 15.4%.

★ Tips for Success

Note in the example below that solving a word problem involves stating a strategy and using the strategy to find a solution. If you have difficulty with a word problem, write down the known information. Be very specific. Write out a phrase or sentence that states what you are trying to find. See *AIM for Success* at the front of the book.

EXAMPLE 5

Between two recent years, annual attendance at New York Yankees baseball games decreased from approximately 3,766,000 people to approximately 3,654,000 people. (*Source: espn.go.com*) Find the percent decrease in attendance between these two years. Round to the nearest tenth of a percent.

Strategy

To find the percent decrease:

- Find the amount of the decrease.
- Solve the basic percent equation for *percent*.

Solution

$$\begin{array}{|c|} \hline \text{Original} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{new} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{decrease} \\ \hline \end{array}$$

$$3,766,000 - 3,654,000 = 112,000$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$n \times 3,766,000 = 112,000$$

$$n = 112,000 \div 3,766,000$$

$$n \approx 0.030 = 3.0\%$$

The percent decrease in attendance was approximately 3.0%.

YOU TRY IT 5

The annual team payroll of the Colorado Rockies decreased from approximately \$88,000,000 to approximately \$84,227,000 between two years. (*Source: Wikipedia; espn.go.com*) Find the percent decrease in the annual payroll between these two years. Round to the nearest tenth of a percent.

Your strategy**Your solution**

Solution on p. S15

EXAMPLE 6

The total sales for December at a stationery store were \$96,000. In January, total sales showed an 8% decrease from December's sales. What were the total sales for January?

Strategy

To find the total sales for January:

- Find the amount of decrease by solving the basic percent equation for *amount*.
- Subtract the amount of decrease from the December sales.

Solution

$$\begin{array}{rcl} \text{Percent} \times \text{base} & = & \text{amount} \\ 0.08 \times 96,000 & = & n \\ \quad \quad \quad 7680 & = & n \end{array}$$

The decrease in sales was \$7680.

$$96,000 - 7680 = 88,320$$

The total sales for January were \$88,320.

YOU TRY IT 6

Fog decreased the normal 5-mile visibility at an airport by 40%. What was the visibility in the fog?

Your strategy**Your solution**

Solution on p. S15

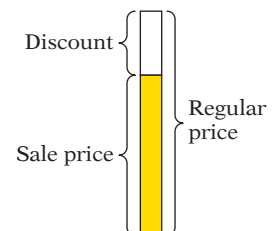
OBJECTIVE D**To apply percent decrease to business—discount**

To promote sales, a store may reduce the regular price of some of its products temporarily. The reduced price is called the **sale price**. The difference between the regular price and the sale price is called the **discount**.

$$\boxed{\text{Regular price}} - \boxed{\text{sale price}} = \boxed{\text{discount}}$$

or

$$\boxed{\text{Regular price}} - \boxed{\text{discount}} = \boxed{\text{sale price}}$$



Discount is frequently stated as a percent of a product's regular price. This percent is called the **discount rate**.

$$\boxed{\text{Discount rate}} \times \boxed{\text{regular price}} = \boxed{\text{discount}}$$

EXAMPLE 7

A Sanyo 42-inch LCD 1080p television that regularly sells for \$498 is on sale for \$449. Find the discount rate. Round to the nearest tenth of a percent.

Strategy

To find the discount rate:

- Find the discount.
- Solve the basic percent equation for *percent*.

Solution

Regular price	−	sale price	=	discount
498		449		49

Percent × base = amount

Discount rate	×	regular price	=	discount
n		498		49

$$n = 49 \div 498$$

$$n \approx 0.098$$

The discount rate is approximately 9.8%.

YOU TRY IT 7

A white azalea that regularly sells for \$12.50 is on sale for \$10.99. Find the discount rate. Round to the nearest tenth of a percent.

Your strategy**Your solution****EXAMPLE 8**

A 20-horsepower lawn mower is on sale for 25% off the regular price of \$1525. Find the sale price.

Strategy

To find the sale price:

- Find the discount by solving the basic percent equation for *amount*.
- Subtract to find the sale price.

Solution

Percent × base = amount

Discount rate	×	regular price	=	discount
0.25		1525		n
		381.25		n

Regular price	−	discount	=	sale price
1525		381.25		1143.75

The sale price is \$1143.75.

YOU TRY IT 8

A hardware store is selling a Newport security door for 15% off the regular price of \$225. Find the sale price.

Your strategy**Your solution**

Solutions on p. S15

6.2 EXERCISES

✓ Concept Check

- Which expression do you use when finding percent increase?
(i) Original value – new value (ii) New value – original value
- Which expression do you use when finding percent decrease?
(i) Original value – new value (ii) New value – original value
- ✎ What is the difference between markup and markup rate?
- ✎ What is the difference between discount and discount rate?

OBJECTIVE A *To find percent increase*

Solve. If necessary, round percents to the nearest tenth of a percent.

- Halloween** See the news clipping at the right. Find the percent increase in Halloween spending between the two years described.
- Fuel Efficiency** An automobile manufacturer increased the average mileage on a car from 17.5 miles per gallon to 18.2 miles per gallon. Find the percent increase in mileage.
- Bike Sharing** Montreal's bike-sharing program had about 29,750 members during its second year, up from 7900 members during its first year. (*Source*: bixisystem.com) What was the percent increase in the number of members between these years?
- Airfares** In 2010, the average airfare from Boston to Los Angeles over the Thanksgiving holiday was \$795. In 2011, the average airfare for the same trip was \$880. (*Source*: The Boston Globe) Find the percent increase in the average Boston-to-Los Angeles airfare between Thanksgiving 2010 and Thanksgiving 2011.
- Sports** The first Winter Olympics, held in 1924, included 14 competitive events. Plans for the 2014 Winter Olympics include 98 competitive events. (*Source*: Wikipedia) Find the percent increase in the number of competitive events in the Winter Olympics from 1924 to 2014.
- Television** Over a period of one year, the number of people subscribing to direct broadcasting satellite systems increased 87%. If the number of subscribers at the beginning of the year was 2.3 million, how many subscribers were there at the end of the year?
- Pets** In a recent year, Americans spent \$50.84 billion on their pets. This was up from \$28.5 billion a decade earlier. (*Source*: American Pet Products Association) Find the percent increase in the amount Americans spent on their pets during the 10-year period. Rounded to the nearest tenth.
- Demography** From 1970 to 2008, the average age of American mothers giving birth to their first child rose 17.3%. (*Source*: Centers for Disease Control and Prevention) If the average age in 1970 was 21.4 years, what was the average age in 2008? Round to the nearest tenth.
- Compensation** A welder earning \$12 per hour is given a 10% raise. To find the new wage, we can multiply \$12 by 0.10 and add the product to \$12. Can the new wage be found by multiplying \$12 by 1.10?

In the NEWS!

Spooky Increase in Spending

The holiday preferred by ghosts and goblins is more popular than ever this fall. Americans are predicted to spend a frightening \$6.9 billion on Halloween this year, as compared to \$5.8 billion last year.

Source: The Boston Globe



© iStockphoto.com/Mariya Bibikova

OBJECTIVE B*To apply percent increase to business—markup*

 The three important markup equations are:



(1) Selling price $-$ cost = markup (2) Cost + markup = selling price (3) Markup rate \times cost = markup

For Exercises 14 and 15, list, in the order in which they will be used, the markup equations needed to solve each problem. Do not solve.

14. A book that cost the seller \$17 is sold for \$23. Find the markup rate.
15. A DVD that cost the seller \$12 has a markup rate of 55%. Find the selling price.
16. A window air conditioner cost AirRite Air Conditioning Systems \$285. Find the markup on the air conditioner if the markup rate is 25% of the cost.
17. The manager of Brass Antiques has determined that a markup rate of 38% is necessary for a profit to be made. What is the markup on a brass doorknob that costs \$45?
18. Computer Inc. uses a markup of \$975 on a computer system that costs \$3250. What is the markup rate on this system?
19. Saizon Pen & Office Supply uses a markup of \$12 on a calculator that costs \$20. What markup rate does this amount represent?
20. Giant Photo Service uses a markup rate of 48% on its Model ZA cameras, which cost the shop \$162. What is the selling price?
21. The Circle R golf pro shop uses a markup rate of 45% on a set of Tour Pro golf clubs that costs the shop \$210. What is the selling price?
22. Resner Builders' Hardware uses a markup rate of 42% for a table saw that costs \$225. What is the selling price of the table saw?
23. Brad Burt's Magic Shop uses a markup rate of 48%. What is the selling price of a telescoping sword that costs \$50?

OBJECTIVE C*To find percent decrease*

Solve. If necessary, round to the nearest tenth of a percent.

24.  **Law School** Use the news clipping at the right to find the percent decrease in the number of people who took the LSATs between the two years described.
25. **Travel** A new bridge reduced the normal 45-minute travel time between two cities by 18 minutes. What percent decrease does this represent?
26. **Energy** By installing energy-saving equipment, the Pala Rey Youth Camp reduced its normal \$800-per-month utility bill by \$320. What percent decrease does this amount represent?
27.  **Criminology** Data from the Federal Bureau of Investigation show that the number of hate crimes in the United States decreased between two recent years, from 7783 incidents to 6604 incidents. What was the percent decrease in hate crimes between these two years?

In the NEWS!**Fewer Students Take LSATs**

This year, 155,050 people took the Law School Admission Test (LSATs). Last year, the LSATs were administered to 171,514 people.

Source: Law School Admission Council

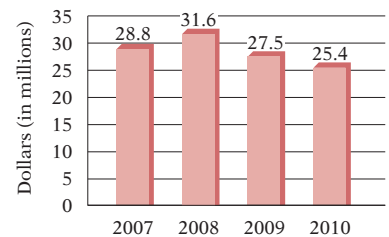
28. **Missing Persons** See the news clipping at the right. Find the percent decrease over the last 10 years in the number of people entered into the National Crime Information Center's Missing Person File.
29. **Depreciation** It is estimated that the value of a new car is reduced 30% after one year of ownership. Using this estimate, find how much value a \$28,200 new car loses after one year.
30. **Employment** A department store employs 1200 people during the holidays. At the end of the holiday season, the store reduces the number of employees by 45%. What is the decrease in the number of employees?
31. **Finance** Juanita's average monthly expense for gasoline was \$176. After joining a carpool, she was able to reduce the expense by 20%. What is her average monthly gasoline bill now?
32. **Investments** An oil company paid a dividend of \$1.60 per share. After a reorganization, the company reduced the dividend by 37.5%. What is the new dividend?
33. **Sports** The graph at the right shows the total earnings of the top 30 members of the Ladies Professional Golf Association (LPGA) golf tour. What was the percent decrease in total earnings between the years 2008 and 2010?
34. **Math** In a math class, the average grade on the second test was 5% lower than the average grade on the first test. By what number should you multiply the first test average to find the difference between the average grades on the two tests?

In the NEWS!

Missing-Person Cases Decrease

This year, 692,944 missing-person cases were entered into the National Crime Information Center's Missing Person File. Ten years ago, the number was 876,213.

Source: www.fbi.gov



Total Earnings of Top 30 LPGA Members

Source: www.lpga.com

OBJECTIVE D

To apply percent decrease to business—discount

The three important discount equations are:


- (1) Regular price $-$ sale price = discount
- (2) Regular price $-$ discount = sale price
- (3) Discount rate \times regular price = discount

For Exercises 35 and 36, list, in the order in which they will be used, the discount equations needed to solve each problem. Do not solve.


35. Shoes that regularly sell for \$65 are on sale for 15% off the regular price. Find the sale price.
36. A radio with a regular price of \$89 is on sale for \$59. Find the discount rate.

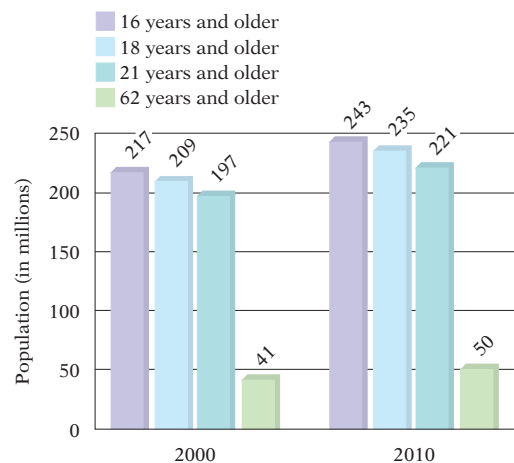
37. The Austin College Bookstore is giving a discount of \$8 on calculators that normally sell for \$24. What is the discount rate?
38. A discount clothing store is selling a \$72 sport jacket for \$24 off the regular price. What is the discount rate?
39. A Blu-ray disc player that regularly sells for \$400 is selling for 20% off the regular price. What is the discount?
40. Dacor Appliances is selling its \$450 washing machine for 15% off the regular price. What is the discount?
41. An electric grill that regularly sells for \$140 is selling for \$42 off the regular price. What is the discount rate?
42. Quick Service Gas Station has its regularly-priced \$125 tune-up on sale for 16% off the regular price. What is the sale price?
43. Tomatoes that regularly sell for \$1.25 per pound are on sale for 20% off the regular price. What is the sale price?
44. An outdoor supply store has its regularly priced \$160 sleeping bags on sale for \$120. What is the discount rate?
45. Standard Brands ceiling paint that regularly sells for \$20 per gallon is on sale for \$16 per gallon. What is the discount rate?

Critical Thinking

46.  **Business** A promotional sale at a department store offers 25% off the sale price. The sale price itself is 25% off the regular price. Is this the same as a sale that offers 50% off the regular price? If not, which sale gives the better price? Explain your answer.

Projects or Group Activities

47.  **Demographics** The graph at the right shows the numbers of people living in the United States for certain age groups, according to the 2000 and 2010 censuses. For the age groups shown, which age group had the greatest percent increase in population between the years 2000 and 2010?



U.S. Population by Age Group

Source: U.S. Census Bureau

SECTION

6.3

Interest

OBJECTIVE A

To calculate simple interest

When you deposit money in a bank—for example, in a savings account—you are permitting the bank to use your money. The bank may lend the deposited money to customers to buy cars or make renovations on their homes. The bank pays you for the privilege of using your money. The amount paid to you is called **interest**. If you are the one borrowing money from the bank, the amount you pay for the privilege of using that money is also called interest.

**Take Note**

If you deposit \$1000 in a savings account paying 5% interest, the \$1000 is the principal and 5% is the interest rate.

The original amount deposited or borrowed is called the **principal**. The amount of interest paid is usually given as a percent of the principal. The percent used to determine the amount of interest is the **interest rate**.

Interest paid on the original principal is called **simple interest**. To calculate simple interest, multiply the principal by the interest rate per time period by the number of time periods. In this objective, we are working with annual interest rates, so the time period is years. The simple interest formula for an annual interest rate is given below.

Simple Interest Formula for Annual Interest Rates

$$\text{Principal} \times \text{annual interest rate} \times \text{time (in years)} = \text{interest}$$

Interest rates generally are given as percents. Before performing calculations involving an interest rate, write the interest rate as a decimal.

HOW TO 1

Calculate the simple interest due on a 2-year loan of \$1500 that has an annual interest rate of 7.5%.

$$\begin{array}{ccccccc} \boxed{\text{Principal}} & \times & \boxed{\text{annual interest rate}} & \times & \boxed{\text{time (in years)}} & = & \boxed{\text{interest}} \\ 1500 & \times & 0.075 & \times & 2 & = & 225 \end{array}$$

The simple interest due is \$225.

When we borrow money, the total amount to be repaid to the lender is the sum of the principal and the interest. This amount is called the **maturity value of a loan**.

Maturity Value Formula for Simple Interest Loans

$$\text{Principal} + \text{interest} = \text{maturity value}$$

In HOW TO 1 above, the simple interest due on the loan of \$1500 was \$225. The maturity value of the loan is therefore $\$1500 + \$225 = \$1725$.

**Take Note**

The time of the loan must be in years. Eight months is

$\frac{8}{12}$ of a year.

See Example 1. The time of the loan must be in years.

180 days is $\frac{180}{365}$ of a year.

HOW TO 2

Calculate the maturity value of a simple interest, 8-month loan of \$8000 if the annual interest rate is 9.75%.

First find the interest due on the loan.

$$\begin{array}{ccccccc} \boxed{\text{Principal}} & \times & \boxed{\text{annual interest rate}} & \times & \boxed{\text{time (in years)}} & = & \boxed{\text{interest}} \\ 8000 & \times & 0.0975 & \times & \frac{8}{12} & = & 520 \end{array}$$

Find the maturity value.

$$\begin{array}{ccccccc} \boxed{\text{Principal}} & + & \boxed{\text{interest}} & = & \boxed{\text{maturity value}} \\ 8000 & + & 520 & = & 8520 \end{array}$$

The maturity value of the loan is \$8520.

The monthly payment on a loan can be calculated by dividing the maturity value by the length of the loan in months.

Monthly Payment on a Simple Interest Loan

$$\text{Maturity value} \div \text{length of the loan in months} = \text{monthly payment}$$

In HOW TO 2 above, the maturity value of the loan is \$8520. To find the monthly payment on the 8-month loan, divide 8520 by 8.

$$\begin{array}{ccccccc} \boxed{\text{Maturity value}} & \div & \boxed{\text{length of the loan in months}} & = & \boxed{\text{monthly payment}} \\ 8520 & \div & 8 & = & 1065 \end{array}$$

The monthly payment on the loan is \$1065.

EXAMPLE 1

Kamal borrowed \$500 from a savings and loan association for 180 days at an annual interest rate of 7%. What is the simple interest due on the loan?

Strategy

To find the simple interest due, multiply the principal (500) times the annual interest rate

(7% = 0.07) times the time in years

(180 days = $\frac{180}{365}$ year).

Solution

$$\begin{array}{ccccccc} \boxed{\text{Principal}} & \times & \boxed{\text{annual interest rate}} & \times & \boxed{\text{time (in years)}} & = & \boxed{\text{interest}} \\ 500 & \times & 0.07 & \times & \frac{180}{365} & \approx & 17.26 \end{array}$$

The simple interest due is \$17.26.

YOU TRY IT 1

A company borrowed \$15,000 from a bank for 18 months at an annual interest rate of 8%. What is the simple interest due on the loan?

Your strategy**Your solution**

Solution on p. S16

EXAMPLE 2

Calculate the maturity value of a simple interest, 9-month loan of \$4000 if the annual interest rate is 8.75%.

Strategy

To find the maturity value:

- Use the simple interest formula to find the simple interest due.
- Find the maturity value by adding the principal and the interest.

Solution

$$\begin{array}{|c|} \hline \text{Principal} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{annual} \\ \text{interest} \\ \text{rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{time} \\ \text{(in years)} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{interest} \\ \hline \end{array}$$

$$4000 \times 0.0875 \times \frac{9}{12} = 262.5$$

$$\begin{array}{|c|} \hline \text{Principal} \\ \hline \end{array} + \begin{array}{|c|} \hline \text{interest} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{maturity} \\ \text{value} \\ \hline \end{array}$$

$$4000 + 262.50 = 4262.50$$

The maturity value is \$4262.50.

EXAMPLE 3

The simple interest due on a 3-month loan of \$1400 is \$26.25. Find the monthly payment on the loan.

Strategy

To find the monthly payment:

- Find the maturity value by adding the principal and the interest.
- Divide the maturity value by the length of the loan in months (3).

Solution

$$\text{Principal} + \text{interest} = \text{maturity value}$$

$$1400 + 26.25 = 1426.25$$

$$\text{Maturity value} \div \text{length of the loan} = \text{payment}$$

$$1426.25 \div 3 \approx 475.42$$

The monthly payment is \$475.42.

YOU TRY IT 2

Calculate the maturity value of a simple interest, 90-day loan of \$3800. The annual interest rate is 6%.

Your strategy**Your solution****YOU TRY IT 3**

The simple interest due on a 1-year loan of \$1900 is \$152. Find the monthly payment on the loan.

Your strategy**Your solution**

Solutions on p. S16

OBJECTIVE B**To calculate finance charges on a credit card bill**

When a customer uses a credit card to make a purchase, the customer is actually receiving a loan. Therefore, there is frequently an added cost to the consumer who purchases on credit. This may be in the form of an annual fee and interest charges on purchases. The interest charges on purchases are called **finance charges**.

The finance charge on a credit card bill is calculated using the simple interest formula. In the last objective, the interest rates were annual interest rates. However, credit card companies generally issue *monthly* bills and express interest rates on credit card purchases as *monthly* interest rates. Therefore, when using the simple interest formula to calculate finance charges on credit card purchases, we use a monthly interest rate and express the time in months.

Note: In the simple interest formula, the time must be expressed in the same period as the rate. For an *annual* interest rate, the time must be expressed in years. For a *monthly* interest rate, the time must be expressed in months.

EXAMPLE 4

A credit card company charges a customer 1.5% per month on the unpaid balance of charges on the credit card. What is the finance charge for a month in which the customer has an unpaid balance of \$254?

Strategy

To find the finance charge, multiply the principal, or unpaid balance (254), times the monthly interest rate (1.5%) times the number of months (1).

Solution

$$\begin{array}{|c|} \hline \text{Principal} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{monthly} \\ \hline \text{interest} \\ \hline \text{rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{time} \\ \hline \text{(in months)} \\ \hline \end{array} \\ 254 \quad \times \quad 0.015 \quad \times \quad 1 \quad = \quad 3.81$$

The finance charge is \$3.81.

YOU TRY IT 4

The credit card that Francesca uses charges her 1.6% per month on her unpaid balance. Find the finance charge when her unpaid balance for the month is \$1250.

Your strategy**Your solution**

Solution on p. S16

OBJECTIVE C**To calculate compound interest**

Usually, the interest paid on money deposited or borrowed is compound interest. **Compound interest** is computed not only on the original principal but also on interest already earned. Here is an illustration.

Suppose \$1000 is invested for 3 years at an annual interest rate of 9% compounded annually. Because this is an *annual* interest rate, we will calculate the interest earned each year.

During the first year, the interest earned is calculated as follows:

$$\begin{array}{|c|} \hline \text{Principal} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{annual interest rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{time (in years)} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{interest} \\ \hline \end{array} \\ 1000 \quad \times \quad 0.09 \quad \times \quad 1 \quad = \quad 90$$

At the end of the first year, the total amount in the account is

$$1000 + 90 = 1090$$

During the second year, the interest earned is calculated on the amount in the account at the end of the first year.

Principal	×	annual interest rate	×	time (in years)	=	interest
1090	×	0.09	×	1	=	98.10

Note that the interest earned during the second year (\$98.10) is greater than the interest earned during the first year (\$90). This is because the interest earned during the first year was added to the original principal, and the interest for the second year was calculated using this sum. If the account earned *simple* interest, the interest earned would be the same every year (\$90).

At the end of the second year, the total amount in the account is the sum of the amount in the account at the end of the first year and the interest earned during the second year.

$$1090 + 98.10 = 1188.10$$

The interest earned during the third year is calculated using the amount in the account at the end of the second year (\$1188.10).

Principal	×	annual interest rate	×	time (in years)	=	interest
1188.10	×	0.09	×	1	≈	106.93

The amount in the account at the end of the third year is

$$1188.10 + 106.93 = 1295.03$$

To find the interest earned for the three years, subtract the original principal from the new principal.

New principal	−	original principal	=	interest earned
1295.03	−	1000	=	295.03

Note that the compound interest earned is \$295.03. The simple interest earned on the investment would have been only $\$1000 \times 0.09 \times 3 = \270 .

In this example, the interest was compounded annually. However, interest can be compounded over other time periods.

Compounding periods

- annually (once a year)
- semiannually (twice a year)
- quarterly (four times a year)
- monthly (12 times a year)
- daily (365 times a year)

The more frequent the compounding periods, the more interest the account earns. For example, if, in the above example, the interest had been compounded quarterly rather than annually, the interest earned would have been greater.



Take Note

The interest earned each year keeps increasing. This is the effect of compound interest.

Calculating compound interest can be very tedious, so there are tables that can be used to simplify these calculations. A portion of a Compound Interest Table is given in the Appendix.

HOW TO 3

What is the value after 5 years of \$1275 invested at 4.75% annual interest, compounded quarterly?

To find the interest earned, multiply the original principal (1275) by the factor found in the Compound Interest Table. To find the factor, first find the table headed “Compounded Quarterly” in the Compound Interest Table in the Appendix. Then look at the number where the 4.75% column and the 5-years row meet.

Compounded Quarterly								
	4%	4.25%	4.50%	4.75%	5.00%	5.25%	5.50%	5.75%
1 year	1.04060	1.04320	1.04580	1.04840	1.05090	1.05350	1.05610	1.05880
5 years	1.22020	1.23540	1.25080	1.26630	1.28200	1.29800	1.31410	1.33040
10 years	1.48890	1.52620	1.56440	1.60350	1.64360	1.68470	1.72680	1.76990
15 years	1.81670	1.88540	1.95660	2.03050	2.10720	2.18670	2.26910	2.35460
20 years	2.21670	2.32920	2.44730	2.57130	2.70150	2.83820	2.98170	3.13240

The factor is 1.26630.

$$1275 \times 1.26630 = 1614.53$$

The value of the investment after 5 years is \$1614.53.

EXAMPLE 5

An investment of \$650 pays 6.75% annual interest, compounded semiannually. What is the interest earned in 5 years?

Strategy

To find the interest earned:

- Find the new principal by multiplying the original principal (650) by the factor found in the Compound Interest Table (1.39365).
- Subtract the original principal from the new principal.

Solution

$$650 \times 1.39365 \approx 905.87$$

The new principal is \$905.87.

$$905.87 - 650 = 255.87$$

The interest earned is \$255.87.

YOU TRY IT 5


An investment of \$1000 pays 6% annual interest, compounded quarterly. What is the interest earned in 20 years?

Your strategy**Your solution**

Solution on p. S16

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6.3 EXERCISES**✓ Concept Check**


1. What is the Simple Interest Formula for Annual Interest Rates?
2. A contractor obtained a 9-month loan for \$80,000 at an annual simple interest rate of 9.75%. The simple interest due on the loan is \$5850. Identify **a.** the principal, **b.** the interest, **c.** the interest rate, and **d.** the time period of the loan.
3. A 2-year student loan of \$10,000 is made at an annual simple interest rate of 4.25%. The simple interest due on the loan is \$850. Identify **a.** the principal, **b.** the interest, **c.** the interest rate, and **d.** the time period of the loan.
4.  What is the difference between simple interest and compound interest?

OBJECTIVE A*To calculate simple interest*

5. Find the simple interest that Jacob Zucker owes on a 2-year student loan of \$8000 at an annual interest rate of 6%.
6. Find the simple interest that Kara Tanamachi owes on a $1\frac{1}{2}$ -year loan of \$1500 at an annual interest rate of 7.5%.
7. To finance the purchase of 15 new cars, the Tropical Car Rental Agency borrowed \$100,000 for 9 months at an annual interest rate of 4.5%. What is the simple interest due on the loan?
8. A home builder obtained a preconstruction loan of \$50,000 for 8 months at an annual interest rate of 9.5%. What is the simple interest due on the loan?
9. A bank lent Gloria Masters \$20,000 at an annual interest rate of 8.8%. The period of the loan was 9 months. Find the simple interest due on the loan.
10. Eugene Madison obtained an 8-month loan of \$4500 at an annual interest rate of 6.2%. Find the simple interest Eugene owes on the loan.
11. Jorge Elizondo took out a 75-day loan of \$7500 at an annual interest rate of 5.5%. Find the simple interest due on the loan.
12. Kristi Yang borrowed \$15,000. The term of the loan was 90 days, and the annual simple interest rate was 7.4%. Find the simple interest due on the loan.
13. The simple interest due on a 4-month loan of \$4800 is \$320. What is the maturity value of the loan?
14. The simple interest due on a 60-day loan of \$6500 is \$80.14. Find the maturity value of the loan.



Kenneth William Caleno/Shutterstock.com


15. William Carey borrowed \$12,500 for 8 months at an annual simple interest rate of 4.5%. Find the total amount due on the loan.
16. You arrange for a 9-month bank loan of \$9000 at an annual simple interest rate of 8.5%. Find the total amount you must repay to the bank.
17. Capital City Bank approves a home-improvement loan application for \$14,000 at an annual simple interest rate of 5.25% for 270 days. What is the maturity value of the loan?
18. A credit union lends a member \$5000 for college tuition. The loan is made for 18 months at an annual simple interest rate of 6.9%. What is the maturity value of the loan?
19. Action Machining Company purchased a robot-controlled lathe for \$225,000 and financed the full amount at 8% annual simple interest for 4 years. The simple interest due on the loan is \$72,000. Find the monthly payment.
20. For the purchase of a media center, a \$1900 loan is obtained for 2 years at an annual simple interest rate of 9.4%. The simple interest due on the loan is \$357.20. What is the monthly payment on the loan?
21. To attract new customers, Heller Ford is offering car loans at an annual simple interest rate of 4.5%.
- Find the interest charged to a customer who finances a car loan of \$12,000 for 2 years.
 - Find the monthly payment.
22. Cimarron Homes Inc. purchased a snow plow for \$57,000 and financed the full amount for 5 years at an annual simple interest rate of 9%.
- Find the interest due on the loan.
 - Find the monthly payment.
23. Dennis Pappas decided to build onto his present home instead of buying a new, larger house. He borrowed \$142,000 for $5\frac{1}{2}$ years at an annual simple interest rate of 7.5%. Find the monthly payment.
24. Rosalinda Johnson took out a 6-month, \$12,000 loan. The annual simple interest rate on the loan was 8.5%. Find the monthly payment.
25.  Student A and Student B borrow the same amount of money at the same annual interest rate. Student A has a 2-year loan and Student B has a 1-year loan. In each case, state whether the first quantity is *less than*, *equal to*, or *greater than* the second quantity.
- Student A's principal; Student B's principal
 - Student A's maturity value; Student B's maturity value
 - Student A's monthly payment; Student B's monthly payment



Sue Smith/Shutterstock.com

OBJECTIVE B*To calculate finance charges on a credit card bill*


26. A credit card company charges a customer 1.25% per month on the unpaid balance of charges on the credit card. What is the finance charge for a month in which the customer has an unpaid balance of \$118.72?
27. The credit card that Dee Brown uses charges her 1.75% per month on her unpaid balance. Find the finance charge when the unpaid balance for the month is \$391.64.
28. What is the finance charge on an unpaid balance of \$12,368.92 on a credit card that charges 1.5% per month on any unpaid balance?
29. Suppose you have an unpaid balance of \$995.04 on a credit card that charges 1.2% per month on any unpaid balance. What finance charge do you owe the company?
30. A credit card customer has an unpaid balance of \$1438.20. What is the difference between monthly finance charges of 1.15% per month on the unpaid balance and monthly finance charges of 1.85% per month?
31. One credit card company charges 1.25% per month on any unpaid balance, and a second company charges 1.75%. What is the difference between the finance charges that these two companies assess on an unpaid balance of \$687.45?

 Your credit card company requires a minimum monthly payment of \$10. You plan to pay off the balance on your credit card by paying the minimum amount each month and making no further purchases using this credit card. For Exercises 32 and 33, state whether the finance charge for the second month will be *less than*, *equal to*, or *greater than* the finance charge for the first month, and state whether you will eventually be able to pay off the balance.


32. The finance charge for the first month was less than \$10.
33. The finance charge for the first month was exactly \$10.

OBJECTIVE C*To calculate compound interest*

34. North Island Federal Credit Union pays 4% annual interest, compounded daily, on time savings deposits. Find the value after one year of \$750 deposited in this account.
35. Tanya invested \$2500 in a tax-sheltered annuity that pays 5.25% annual interest, compounded daily. Find the value of her investment after 20 years.
36. Sal Travato invested \$3000 in a corporate retirement account that pays 7.5% annual interest, compounded semiannually. Find the value of his investment after 15 years.
37. To replace equipment, a farmer invested \$20,000 in an account that pays 7% annual interest, compounded monthly. What is the value of the investment after 5 years?

38. Green River Lodge invests \$75,000 in a trust account that pays 7.25% interest, compounded quarterly.
- What will the value of the investment be in 5 years?
 - How much interest will be earned in the 5 years?
39. To save for retirement, a couple deposited \$3000 in an account that pays 7% annual interest, compounded daily.
- What will be the value of the investment after 10 years?
 - How much interest will be earned in the 10 years?
40. To save for a child's education, the Petersens deposited \$2500 into an account that pays 8.25% annual interest, compounded daily. Find the amount of interest earned on this account over a 20-year period.
41. How much interest is earned in 2 years on \$4000 deposited in an account that pays 6% interest, compounded quarterly?
42.  The compound interest factor for a 5-year investment at an annual interest rate of 6%, compounded semiannually, is 1.34392. What does the expression $(3500 \times 1.34392) - 3500$ represent?

Critical Thinking

43.  **Banking** At 4 P.M. on July 31, you open a savings account that pays 5% annual interest, compounded daily, and you deposit \$500 in the account. Your deposit is credited as of August 1. At the beginning of September, you receive a statement from the bank that shows that during the month of August, you received \$2.12 in interest. The interest has been added to your account, bringing the total on deposit to \$502.12. At the beginning of October, you receive a statement from the bank that shows that during the month of September, you received \$2.06 in interest on the \$502.12 on deposit. Explain why you received less interest during the second month when there was more money on deposit.

Projects or Group Activities

44. **Banking** Suppose you have a savings account that earns interest at the rate of 6% per year, compounded monthly. On January 1, you open this account with a deposit of \$100.
- On February 1, you deposit an additional \$100 into the account. What is the value of the account after the deposit?
 - On March 1, you deposit an additional \$100 into the account. What is the value of the account after the deposit?
 - You continue to deposit an additional \$100 into the account on the first day of each month. What is the value of the account on December 31? *Note:* This type of savings plan, wherein equal amounts (\$100) are saved at equal time intervals (every month), is called an annuity.

SECTION

6.4

Real Estate Expenses

OBJECTIVE A

To calculate the initial expenses of buying a home

One of the largest investments that most people ever make is the purchase of a home. The major initial expense in the purchase is the **down payment**, which is normally a percent of the purchase price. This percent varies among banks, but it usually ranges from 5% to 25%.

The **mortgage** is the amount that is borrowed to buy real estate. The mortgage amount is the difference between the purchase price and the down payment.

HOW TO 1

A home is purchased for \$140,000, and a down payment of \$21,000 is made. Find the mortgage.

Purchase price	–	down payment	=	mortgage
140,000	–	21,000	=	119,000

The mortgage is \$119,000.



Take Note

Because *points* means “percent,” a loan origination fee of $2\frac{1}{2}$ points is equal to $2\frac{1}{2}\%$ = 2.5% = 0.025.

Another initial expense in buying a home is the **loan origination fee**, which is a fee that the bank charges for processing the mortgage papers. The loan origination fee is usually a percent of the mortgage and is expressed in **points**, which is the term banks use to mean “percent.” For example, “5 points” means “5 percent.”

Points	×	mortgage	=	loan origination fee
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EXAMPLE 1

A house is purchased for \$250,000, and a down payment that is 20% of the purchase price is made. Find the mortgage.

Strategy

To find the mortgage:

- Find the down payment by solving the basic percent equation for *amount*.
- Subtract the down payment from the purchase price.

Solution

Percent	×	base	=	amount
Percent	×	purchase price	=	down payment
0.20	×	250,000	=	<i>n</i>
		50,000	=	<i>n</i>
Purchase price	–	down payment	=	mortgage
250,000	–	50,000	=	200,000

The mortgage is \$200,000.

YOU TRY IT 1

An office building is purchased for \$1,500,000, and a down payment that is 25% of the purchase price is made. Find the mortgage.

Your strategy

Your solution

Solution on p. S16

EXAMPLE 2

A home is purchased with a mortgage of \$165,000. The buyer pays a loan origination fee of $3\frac{1}{2}$ points. How much is the loan origination fee?

Strategy

To find the loan origination fee, solve the basic percent equation for *amount*.

Solution

$$\begin{array}{rcl} \text{Percent} & \times & \text{base} & = & \text{amount} \\ \boxed{\text{Points}} & \times & \boxed{\text{mortgage}} & = & \boxed{\text{fee}} \\ 0.035 & \times & 165,000 & = & n \\ & & 5775 & = & n \end{array}$$

The loan origination fee is \$5775.

YOU TRY IT 2

The mortgage on a real estate investment is \$180,000. The buyer paid a loan origination fee of $4\frac{1}{2}$ points. How much was the loan origination fee?

Your strategy**Your solution**

Solution on p. S16

OBJECTIVE B**To calculate the ongoing expenses of owning a home**

In addition to the initial expenses of buying a house, there are continuing monthly expenses involved in owning a home. The **monthly mortgage payment**, utilities, insurance, and **property tax** are some of these ongoing expenses. Of these expenses, the largest one is normally the monthly mortgage payment.

For a **fixed-rate mortgage**, the monthly mortgage payment remains the same throughout the life of the loan. The calculation of the monthly mortgage payment is based on the amount of the loan, the interest rate on the loan, and the number of years required to repay the loan. Calculation of the monthly mortgage payment is simplified by using a table such as the Monthly Payment Table in the Appendix, by using a calculator, or by using a spreadsheet program. We will use the table in the Appendix.

**Integrating Technology**

In general, when the answer to a problem involves money, the answer is rounded to the nearest cent. For HOW TO 2 at the right, enter

$$160000 \times 0.0080462 =$$

The display reads 1287.392. Round this number to the nearest hundredth: 1287.39. The answer is \$1287.39.

HOW TO 2

Find the monthly mortgage payment on a 30-year, \$160,000 mortgage at an annual interest rate of 9%. Use the Monthly Payment Table in the Appendix.

$$160,000 \times 0.0080462 \approx 1287.39$$

- Use the Monthly Payment Table to find the monthly payment factor, **0.0080462**.

The monthly mortgage payment is \$1287.39.

The monthly mortgage payment includes the payment of both principal and interest on the mortgage. The interest charged during any one month is charged on the unpaid balance of the loan. By completing the Project on pages 264 to 265, you will see that as payments are made, the amount of the monthly payment that goes toward interest decreases, and the amount that goes toward the principal increases.

HOW TO 3

A chef obtained a 30-year mortgage of \$245,000 at an annual interest rate of 5.75%. The chef's monthly mortgage payment is \$1429.75. How much of the first month's mortgage payment is interest?

At the end of the first month, the chef owes simple interest on the amount borrowed (\$245,000). The monthly simple interest rate is the annual interest rate, expressed as a decimal, divided by 12. Round this rate to six decimal places.

$$\text{Monthly simple interest rate} = \frac{\text{annual interest rate}}{12} = \frac{0.0575}{12} \approx 0.004792$$

To find the interest owed, solve the basic percent equation for amount. The base is the amount of the mortgage (\$245,000).

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.004792 \times 245,000 = 1174.04$$

The interest owed for the first month of the loan is \$1174.04.

If the interest owed the first month is subtracted from the monthly payment, the result is the amount of that month's payment that goes toward repaying the principal.

$$1429.75 - 1174.04 = 255.71$$

\$255.71 of the payment went toward paying off the original loan. The remaining mortgage is \$245,000.00 - \$255.71 = \$244,744.29.

**Take Note**

Reread the paragraph that precedes HOW TO 3. The reason for the change in the amount of interest owed each month is based on the calculation shown at the right. For the second month of the loan, the amount of interest owed is based on the remaining loan amount of \$244,744.29.

EXAMPLE 3

A home was purchased for \$239,000, with a down payment of 20% of the purchase price. The homeowner obtained a 30-year loan on the balance of the purchase price at an annual interest rate of 6.25%. What is the homeowner's monthly mortgage payment?

Strategy

To find the mortgage payment:

- Find the down payment.
- Subtract the down payment from the purchase price to find the mortgage.
- Multiply the mortgage by the factor in the Monthly Payment Table for a 30-year loan at 6.25%.

Solution

$$\text{Percent} \times \text{purchase price} = \text{down payment}$$

$$0.20 \times 239,000 = 47,800$$

The down payment is \$47,800.

$$\text{Purchase price} - \text{down payment} = \text{mortgage}$$

$$239,000 - 47,800 = 191,200$$

The mortgage is \$191,200.

The factor from the Monthly Payment Table is

0.0061572.

$$191,200 \times 0.0061572 = 1177.26$$

The monthly mortgage payment is \$1177.26.

YOU TRY IT 3

A hair salon was purchased for \$185,000, with a down payment of 30% of the purchase price.

The salon owner obtained a 20-year loan on the balance of the purchase price at an annual interest rate of 6%. What is the salon owner's monthly mortgage payment?

Your strategy**Your solution**

Solution on p. S17

EXAMPLE 4

A plumbing contractor obtained a 20-year mortgage of \$370,000 at an annual interest rate of 4.75%. The contractor's monthly mortgage payment is \$2391.01. How much of the first month's mortgage payment is interest? How much of the first month's mortgage payment goes to paying off the principal?

Strategy

To find the amount of the first month's payment that is interest and the amount that goes to paying off the principal:

- Find the monthly simple interest rate.
- Use the basic percent equation to find the interest owed for the first month.
- Subtract the interest owed for the first month from the monthly payment to find the amount of the payment that goes to paying off the principal.

Solution

$$\begin{aligned} \text{Monthly simple interest rate} &= \frac{\text{annual interest rate}}{12} \\ &= \frac{0.0475}{12} \approx 0.003958 \end{aligned}$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.003958 \times 370,000 \approx 1464.46$$

The interest owed for the first month is \$1464.46.

Monthly payment	−	amount toward interest	=	amount toward principal
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$$2391.01 - 1464.46 = 926.55$$

The amount paid toward the principal is \$926.55.

YOU TRY IT 4

A facilities manager purchased a home and secured a 30-year mortgage of \$296,000 at an annual interest rate of 4.5%. The manager's monthly mortgage payment is \$1413.15. How much of the first month's mortgage payment is interest? How much of the first month's mortgage payment goes to paying off the principal?

Your strategy**Your solution**


Solution on p. S17

6.4 EXERCISES

 **Concept Check**

1. When purchasing real estate, what is the difference between the purchase price and the down payment called?
2. What does the term “3 points” mean when used by a banker?

OBJECTIVE A*To calculate the initial expenses of buying a home*

3. A condominium at Mt. Baldy Ski Resort was purchased for \$197,000, with a down payment of \$24,550. Find the mortgage.
4. An insurance business was purchased for \$173,000, with a down payment of \$34,600. Find the mortgage.
5. Brian Stedman made a down payment of 25% of the \$850,000 purchase price of an apartment building. How much was the down payment?
6. A clothing store was purchased for \$625,000, and a down payment that was 30% of the purchase price was made. Find the down payment.
7. A loan of \$150,000 is obtained to purchase a home. The loan origination fee is $2\frac{1}{2}$ points. Find the amount of the loan origination fee.
8. Security Savings & Loan requires a borrower to pay $3\frac{1}{2}$ points for a loan. Find the amount of the loan origination fee for a loan of \$90,000.
9. Baja Construction Inc. is selling homes for \$350,000. A down payment of 10% is required. Find the mortgage.
10. A cattle rancher purchased some land for \$240,000. The bank requires a down payment of 15% of the purchase price. Find the mortgage.
11. Vivian Tom purchased a home for \$210,000. Find the mortgage if the down payment Vivian made is 10% of the purchase price.
12. A mortgage lender requires a down payment of 5% of the \$180,000 purchase price of a condominium. How much is the mortgage?
13.  A home is purchased for \$435,000. The mortgage lender requires a 10% down payment. Which expression below represents the mortgage?

(i) $0.10 \times 435,000$	(ii) $0.10 \times 435,000 - 435,000$
(iii) $435,000 - 0.10 \times 435,000$	(iv) $435,000 + 0.10 \times 435,000$




Rodolfo Arpiza/Alamy

OBJECTIVE B*To calculate the ongoing expenses of owning a home*

For Exercises 14 to 23, solve. Use the Monthly Payment Table in the Appendix. Round to the nearest cent.

14. An investor obtained a loan of \$850,000 to buy a car wash business. The monthly mortgage payment was based on 25 years at 5.75%. Find the monthly mortgage payment.
15. A beautician obtained a 20-year mortgage of \$90,000 to expand the business. The credit union charges an annual interest rate of 6%. Find the monthly mortgage payment.

16. A couple interested in buying a home determines that they can afford a monthly mortgage payment of \$800. Can they afford to buy a home with a 30-year, \$110,000 mortgage at 7.25% interest?
17. A lawyer is considering purchasing a new office building with a 15-year, \$525,000 mortgage at 5% interest. The lawyer can afford a monthly mortgage payment of \$4000. Can the lawyer afford the monthly mortgage payment on the new office building?
18. Maria Hernandez purchased a home for \$210,000 and made a down payment of 15% of the purchase price. The balance was financed for 15 years at an annual interest rate of 6%.
- Find the mortgage.
 - Find the monthly mortgage payment.
19. Richard Chin purchased a patio home for \$312,500 and made a down payment of 20% of the purchase price. The balance was financed for 30 years at an annual interest rate of 4.75%.
- Find the mortgage.
 - Find the monthly mortgage payment.
20. The retail sales manager of a computer company purchased a large house for \$799,000 and made a down payment of 30% of the purchase price. The balance was financed for 20 years at an annual interest rate of 4.25%. Find the monthly mortgage payment.
21. A copper mine worker purchased a home for \$299,000 and made a down payment of 25% of the purchase price. The balance was financed for 30 years at an annual interest rate of 5.5%. Find the monthly mortgage payment.
22. Abacus Imports Inc. purchased a warehouse and secured a 20-year mortgage of \$500,000 at an annual interest rate of 6%. The monthly mortgage payment is \$3582.15. Find the amount of the first month's payment that is interest and the amount that goes toward paying off the principal.
23. A dentist purchased an existing dental practice and obtained a 30-year loan of \$720,000 at an annual interest rate of 5%. The monthly mortgage payment is \$3865.10. Find the amount of the first month's payment that is interest and the amount that goes toward the principal.
24.  The monthly payment on a \$300,000 mortgage is \$1610. The mortgage is a 30-year loan at an annual interest rate of 5%. Which expression represents the amount of the first month's payment that goes toward the principal?
- $300,000 - \frac{0.05}{12} \times 1610$
 - $\frac{0.05(300,000 - 1610)}{12}$
 - $1610 - \frac{0.05}{12} \times 300,000$

Critical Thinking

25. **Mortgages** A couple considering a mortgage of \$100,000 have a choice of loans. One loan is an 8% loan for 20 years, and the other loan is at 8% for 30 years. Find the amount of interest that the couple can save by choosing the 20-year loan.

Projects or Group Activities

26. In HOW TO 3 on page 261, we calculated the amount of the first monthly payment of a loan that was interest and the amount that was principal. In this project, you

will continue these calculations for the next three months of that 30-year loan by completing the table below. This table, if completed for all 360 months of the loan, is called an *amortization schedule*. Remember that the amount of interest paid each month is based on the new principal amount at the beginning of that month.

Month	Principal	Monthly payment	Amount to interest	Amount to principal	New principal
1	245,000.00	1429.75	1174.04	255.71	244,744.29
2	244,744.29	1429.75			
3		1429.75			
4		1429.75			

✓ CHECK YOUR PROGRESS: CHAPTER 6

- Sports** Twelve golf balls cost \$45.99. Find the unit cost. Round to the nearest cent.
- Commerce** Find the more economical purchase: 20 ounces of dark chocolate for \$18.49 or 16 ounces of dark chocolate for \$12.99.
- Agriculture** The cost of bluegrass sod is \$2.97 per square yard. What is the cost of 15 square yards of bluegrass sod?
- Demographics** Between 1998 and 2011, the world's population increased from 7 billion to 8 billion people. What was the percent increase in the world's population between the given years? Round to the nearest tenth of a percent.
- Commerce** A tire store purchased a high performance automobile tire for \$225 and used a markup rate of 40%. What is the selling price of the tire?
- Sports** At the beginning of a training program, a sports agent weighed 185 pounds. Six months later, the agent weighed 168 pounds. What was the percent decrease in the agent's weight? Round to the nearest tenth of a percent.
- Commerce** A graphing calculator is on sale for 20% off the regular price of \$89.95. Find the sale price.
- Loans** The owner of a flower shop borrowed \$1500 for 18 months at an annual simple interest rate of 8%. Find the interest the borrower will pay on the loan.
- Credit Cards** A credit card company charges a customer 1.8% per month on the unpaid balance of charges on the credit card. What is the finance charge for a month in which the customer had an unpaid balance of \$365?
- Investing** What is the value after 10 years of a \$2500 investment at 5.25% annual interest, compounded daily?
- Real Estate** A plumber purchases a home for \$236,000 and makes a down payment of 20% of the purchase price. What is the plumber's mortgage?
- Real Estate** A couple buys a cabin and obtains a 15-year mortgage of \$175,000 at an annual interest rate of 5.5%. What is the monthly mortgage payment?

SECTION

6.5

Car Expenses

OBJECTIVE A

To calculate the initial expenses of buying a car

The initial expenses involved in the purchase of a car usually include the down payment, the **license fees** (fees charged for authorization to operate a vehicle), and the **sales tax** (a tax levied by a state or municipality on purchases). The down payment may be very small or as much as 25% or 30% of the purchase price of the car, depending on the lending institution. License fees and sales tax are regulated by each state, so these expenses vary from state to state.

EXAMPLE 1

A car is purchased for \$38,500, and the lender requires a down payment of 15% of the purchase price. Find the amount financed.

Strategy

To find the amount financed:

- Find the down payment by solving the basic percent equation for *amount*.
- Subtract the down payment from the purchase price.

Solution

$$\begin{array}{rcl} \text{Percent} & \times & \text{base} & = & \text{amount} \\ \hline \text{Percent} & \times & \text{purchase price} & = & \text{down payment} \\ 0.15 & \times & 38,500 & = & n \\ & & & & 5775 = n \end{array}$$

$$38,500 - 5775 = 32,725$$

The amount financed is \$32,725.

EXAMPLE 2

A sales clerk purchases a used car for \$16,500 and pays a sales tax that is 5% of the purchase price. How much is the sales tax?

Strategy

To find the sales tax, solve the basic percent equation for *amount*.

Solution

$$\begin{array}{rcl} \text{Percent} & \times & \text{base} & = & \text{amount} \\ \hline \text{Percent} & \times & \text{purchase price} & = & \text{sales tax} \\ 0.05 & \times & 16,500 & = & n \\ & & & & 825 = n \end{array}$$

The sales tax is \$825.

YOU TRY IT 1

A down payment of 20% of the \$19,200 purchase price of a new car is made. Find the amount financed.

Your strategy

Your solution

YOU TRY IT 2

A car is purchased for \$27,350. The car license fee is 1.5% of the purchase price. How much is the license fee?

Your strategy

Your solution

Solutions on p. S17

OBJECTIVE B*To calculate the ongoing expenses of owning a car***Take Note**

The same formula that is used to calculate a monthly mortgage payment is used to calculate a monthly car payment.

In addition to the initial expenses of buying a car, there are continuing expenses involved in owning a car. These ongoing expenses include car insurance, gas and oil, general maintenance, and the monthly car payment. The monthly car payment is calculated using the Monthly Payment Table in the Appendix.

EXAMPLE 3

At a cost of \$.38 per mile, how much does it cost to operate a car during a year in which the car is driven 15,000 miles?

Strategy

To find the cost, multiply the cost per mile (0.38) by the number of miles driven (15,000).

Solution

$$15,000 \times 0.38 = 5700$$

The cost is \$5700.

YOU TRY IT 3

At a cost of \$.41 per mile, how much does it cost to operate a car during a year in which the car is driven 23,000 miles?

Your strategy**Your solution****EXAMPLE 4**

During one month, your total gasoline bill was \$252 and the car was driven 1200 miles. What was the cost per mile for gasoline?

Strategy

To find the cost per mile, divide the cost for gasoline (252) by the number of miles driven (1200).

Solution

$$252 \div 1200 = 0.21$$

The cost per mile was \$.21.

YOU TRY IT 4

For a year in which your total car insurance bill was \$360 and the car was driven 15,000 miles, what was the cost per mile for car insurance?

Your strategy**Your solution****EXAMPLE 5**

A car is purchased for \$18,500 with a down payment of \$3700. The balance is financed for 3 years at an annual interest rate of 6%. Find the monthly car payment.

Strategy

To find the monthly payment:

- Subtract the down payment from the purchase price to find the amount financed.
- Multiply the amount financed by the factor found in the Monthly Payment Table in the Appendix.

Solution

$$18,500 - 3700 = 14,800$$

$$14,800 \times 0.0304219 \approx 450.24$$

The monthly payment is \$450.24.

YOU TRY IT 5


A truck is purchased for \$25,900 with a down payment of \$6475. The balance is financed for 4 years at an annual interest rate of 8%. Find the monthly payment.

Your strategy**Your solution**


Solutions on p. S17

6.5 EXERCISES



 **Concept Check**

-  If a car dealer requires a down payment of 20% of the purchase price of a car, how would you determine the amount of the down payment?
- Which table in the Appendix is used to calculate a monthly car payment?


OBJECTIVE A*To calculate the initial expenses of buying a car*

- Amanda has saved \$780 to make a down payment on a used minivan that costs \$7100. The car dealer requires a down payment of 12% of the purchase price. Has she saved enough money to make the down payment?
- A sedan was purchased for \$23,500. A down payment of 15% of the purchase price was required. How much was the down payment?
- A drapery installer bought a van to carry drapery samples. The purchase price of the van was \$26,500, and a 4.5% sales tax was paid. How much was the sales tax?
- A & L Lumber Company purchased a delivery truck for \$28,500. A sales tax of 4% of the purchase price was paid. Find the sales tax.
- A license fee of 2% of the purchase price is paid on a pickup truck costing \$32,500. Find the license fee for the truck.
- Your state charges a license fee of 1.5% on the purchase price of a car. How much is the license fee for a car that costs \$16,998?
- An electrician bought a \$32,000 flatbed truck. A state license fee of \$275 and a sales tax of 3.5% of the purchase price are required.
 - Find the sales tax.
 - Find the total cost of the sales tax and the license fee.
- A physical therapist bought a used car for \$9375 and made a down payment of \$1875. The sales tax is 5% of the purchase price.
 - Find the sales tax.
 - Find the total cost of the sales tax and the down payment.
- Martin bought a motorcycle for \$16,200 and made a down payment of 25% of the purchase price. Find the amount financed.
- A carpenter bought a utility van for \$24,900 and made a down payment of 15% of the purchase price. Find the amount financed.
- An author bought a sports car for \$45,000 and made a down payment of 20% of the purchase price. Find the amount financed.
- Tania purchased a used car for \$13,500 and made a down payment of 25% of the cost. Find the amount financed.
-  The purchase price of a car is \$25,700. The car dealer requires a down payment of 15% of the purchase price. There is a license fee of 2.5% of the purchase price and sales tax of 6% of the purchase price. What does the following expression represent? $25,700 + 0.025 \times 25,700 + 0.06 \times 25,700$

OBJECTIVE B*To calculate the ongoing expenses of owning a car*

16.  A driver had \$1100 in car expenses and drove the car 8500 miles. Would you use *multiplication* or *division* to find the driver's cost per mile to operate the car?
17.  A car costs \$.62 per mile to operate. Would you use *multiplication* or *division* to find the cost of driving the car 23,000 miles?

For Exercises 18 to 25, solve. When necessary, use the Monthly Payment Table in the Appendix. Round to the nearest cent.

18. A rancher financed \$24,000 for the purchase of a truck through a credit union at 5% interest for 4 years. Find the monthly truck payment.
19. A car loan of \$18,000 is financed for 3 years at an annual interest rate of 6.75%. Find the monthly car payment.
20.  Based on information from the American Automobile Association (AAA), the cost of owning a compact car is \$.586 per mile driven. Using this estimate, find how much it costs to operate a car during a year in which the car is driven 16,000 miles.
21. The table at the right shows some of the estimated expenses of owning a midsize car for 5 years. If the car is driven 75,000 miles over the 5-year period, what is the cost per mile for these expenses?
22. A farmer purchased a tractor for \$28,850 and made a 20% down payment. The balance was financed for 5 years at an annual interest rate of 5.25%.
 a. What was the amount of the down payment?
 b. How much was financed?
 c. What is the monthly payment?
23. An escrow officer purchased a Buick crossover vehicle for \$36,995 and made a down payment of 20% of the purchase price. The balance was financed for 4 years at an annual interest rate of 4.5%. What is the monthly payment?
24. A tennis coach purchased a new Chevrolet Corvette for \$56,500 and made a down payment of 25% of the purchase price. The balance was financed for 5 years at an annual interest rate of 5.5%. Find the monthly payment.
25. Last year you spent \$2685 on gasoline for your car. The car was driven 15,000 miles. What was your cost per mile for gasoline?

Expense	5-year cost
Taxes	\$2573
Financing	\$3650
Fuel	\$14,764
Insurance	\$11,457
Maintenance	\$5685

Critical Thinking

26. **Car Loans** How much interest is paid on a 5-year car loan of \$19,000 if the interest rate is 6.25%? Round to the nearest dollar.

Projects or Group Activities

27. One of the greatest costs of owning a car is depreciation. A conservative estimate is that a car will depreciate in value by 17% of the purchase price by the end of the first year. During the second year, the car will depreciate by approximately 12% of the depreciated value. For the next 3 years, the car will depreciate by 10% of its current value each year. If a new car is purchased for \$30,000, what will be its value after 5 years? If the car is driven 75,000 miles during the five years, what is the cost per mile for depreciation?

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SECTION

6.6

Wages

OBJECTIVE A

To calculate commissions, total hourly wages, and salaries

Commission, hourly wage, and salary are three ways to receive payment for doing work.

Commissions are usually paid to salespersons and are calculated as a percent of sales.

APPLY THE CONCEPT

As a real estate broker, Emma Smith receives a commission of 4.5% of the selling price of a house. Find the commission she earned for selling a home for \$275,000.

To find the commission Emma earned, solve the basic percent equation for *amount*.

Percent × base = amount

$$\begin{array}{rcccl} \boxed{\text{Commission rate}} & \times & \boxed{\text{total sales}} & = & \boxed{\text{commission}} \\ 0.045 & \times & 275,000 & = & 12,375 \end{array}$$

The commission is \$12,375.

An employee who receives an **hourly wage** is paid a certain amount for each hour worked.

APPLY THE CONCEPT

A plumber receives an hourly wage of \$28.25. Find the plumber's total wages for working 37 hours.

To find the plumber's total wages, multiply the hourly wage by the number of hours worked.

$$\begin{array}{rcccl} \boxed{\text{Hourly wage}} & \times & \boxed{\text{number of hours worked}} & = & \boxed{\text{total wages}} \\ 28.25 & \times & 37 & = & 1045.25 \end{array}$$

The plumber's total wages for working 37 hours are \$1045.25.

An employee who is paid a **salary** receives payment based on a weekly, biweekly (every other week), monthly, or annual time schedule. Unlike an employee who receives an hourly wage, a salaried worker does not receive additional pay for working more than the regularly scheduled workday.

APPLY THE CONCEPT

Ravi Basar is a computer operator who receives a weekly salary of \$895. Find his salary for one month (4 weeks).

To find Ravi's salary for one month, multiply the salary per pay period by the number of pay periods.

$$\begin{array}{rcccl} \boxed{\text{Salary per pay period}} & \times & \boxed{\text{number of pay periods}} & = & \boxed{\text{total salary}} \\ 895 & \times & 4 & = & 3580 \end{array}$$

Ravi's total salary for one month is \$3580.

EXAMPLE 1

A pharmacist's hourly wage is \$54.46. On Saturday, the pharmacist earns time and a half (1.5 times the regular hourly wage). How much does the pharmacist earn for working 6 hours on Saturday?

Strategy

To find the pharmacist's earnings:

- Find the hourly wage for working on Saturday by multiplying the regular hourly wage by 1.5.
- Multiply the Saturday hourly wage by the number of hours worked.

Solution

$$54.46 \times 1.5 = 81.69 \quad 81.69 \times 6 = 490.14$$

The pharmacist earns \$490.14.

EXAMPLE 2

An efficiency expert received a contract for \$3000. The expert spent 75 hours on the project. Find the expert's hourly wage.

Strategy

To find the hourly wage, divide the total earnings by the number of hours worked.

Solution

$$3000 \div 75 = 40$$

The hourly wage was \$40.

EXAMPLE 3

Dani Greene earns \$38,500 per year plus a 5.5% commission on sales over \$100,000. During one year, Dani sold \$150,000 worth of computers. Find Dani's total earnings for the year.

Strategy

To find the total earnings:

- Find the sales over \$100,000.
- Multiply the commission rate by the sales over \$100,000.
- Add the commission to the annual pay.

Solution

$$150,000 - 100,000 = 50,000$$

$$50,000 \times 0.055 = 2750 \quad \bullet \text{ Commission}$$

$$38,500 + 2750 = 41,250$$

Dani earned \$41,250.

YOU TRY IT 1

A construction worker, whose hourly wage is \$28.50, earns double time (2 times the regular hourly wage) for working overtime. Find the worker's wages for working 8 hours of overtime.

Your strategy**Your solution****YOU TRY IT 2**

A contractor for a bridge project receives an annual salary of \$70,980. What is the contractor's monthly salary?



Your strategy**Your solution****YOU TRY IT 3**

An insurance agent earns \$37,000 per year plus a 9.5% commission on sales over \$50,000. During one year, the agent's sales totaled \$175,000. Find the agent's total earnings for the year.

Your strategy**Your solution**

Solutions on pp. S17–S18

6.6 EXERCISES**✓ Concept Check**

1.  How are a salesperson's commissions determined?
2.  How do you determine the weekly wage of an employee who receives an hourly wage?

OBJECTIVE A*To calculate commissions, total hourly wages, and salaries*

3. Lewis works in a clothing store and earns \$11.50 per hour. How much does he earn for a 40-hour work week?
4. Sasha pays a gardener an hourly wage of \$11. How much does she pay the gardener for working 25 hours?
5. A real estate agent receives a 3% commission for selling a house. Find the commission the agent earned for selling a house for \$131,000.
6. Ron Caruso works as an insurance agent and receives a commission of 40% of the first year's premium. Find Ron's commission for selling a life insurance policy with a first-year premium of \$1050.
7. A stockbroker receives a commission of 1.5% of the price of stock that is bought or sold. Find the commission on 100 shares of stock that were bought for \$5600.
8. The owner of the Carousel Art Gallery receives a commission of 20% on paintings that are sold on consignment. Find the commission on a painting that sold for \$22,500.
9. Keisha Brown receives an annual salary of \$38,928 as a teacher of Italian. How much does Keisha receive each month?
10. An apprentice plumber receives an annual salary of \$27,900. How much does the plumber receive per month?



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11. Carlos receives a commission of 12% of his weekly sales as a sales representative for a medical supply company. Find the commission he earned during a week in which sales were \$4500.
12. A golf pro receives a commission of 25% for selling a golf set. Find the commission the pro earned for selling a golf set costing \$450.
13. Steven receives \$5.75 per square yard to install carpet. How much does he receive for installing 160 square yards of carpet?
14. An indexer charges \$3.75 per page for indexing technical material. How much does the indexer earn for indexing a 225-page book?
15. A nuclear chemist received \$15,000 in consulting fees while working on a nuclear power plant. The chemist worked 120 hours on the project. Find the chemist's hourly wage.
16. Maxine received \$3400 for working on a project as a computer consultant for 40 hours. Find her hourly wage.
17. Gil Stratton's hourly wage is \$10.78. For working overtime, he receives double time.
 - a. What is Gil's hourly wage for working overtime?
 - b. How much does he earn for working 16 hours of overtime?
18. A lathe operator receives an hourly wage of \$21.84. When working on Saturday, he receives time and a half.
 - a. What is the lathe operator's hourly wage on Saturday?
 - b. How much does he earn for working 8 hours on Saturday?
19. A stock clerk at a supermarket earns \$12.68 an hour. For working the night shift, the clerk's wage increases by 15%.
 - a. What is the increase in hourly pay for working the night shift?
 - b. What is the clerk's hourly wage for working the night shift?
20. A nurse earns \$31.50 an hour. For working the night shift, the nurse receives a 10% increase in pay.
 - a. What is the increase in hourly pay for working the night shift?
 - b. What is the hourly pay for working the night shift?

SECTION

6.7

Bank Statements

OBJECTIVE A

To calculate checkbook balances



Take Note

A **checking account** is a bank account that enables you to withdraw money or make payments to other people using checks. A **check** is a printed form that, when filled out and signed, instructs a bank to pay a specified sum of money to the person named on it. A **deposit slip** is a form for depositing money in a checking account.

A checking account can be opened at most banks and savings and loan associations by depositing an amount of money in the bank. A checkbook contains checks and deposit slips, as well as a checkbook register in which to record checks written and amounts deposited in the checking account. A sample check is shown below.

The check is from East Phoenix Rental Equipment (3011 N.W. Ventura Street, Phoenix, AZ 85280) to Tellas Manufacturing Co. for \$827.00. The date is October 11, 2013. The check number is 68-461-1052. It is signed by Eugene L. Madison at Meyers' National Bank (11 N.W. Nova Street, Phoenix, AZ 85215). The amount is written as 'Eight Hundred Twenty-Seven and 00/100 DOLLARS'.

Each time a check is written, the amount of the check is subtracted from the amount in the account. When a deposit is made, the amount deposited is added to the amount in the account.

A portion of a checkbook register is shown below. The account holder had a balance of \$587.93 before writing two checks, one for \$286.87 and the other for \$202.38, and making one deposit of \$345.00.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									587	93
108	8/14	Plumber	\$286	87		\$			301	06
109	8/10	Car Payment	202	38					98	68
	8/14	Deposit					345	00	443	68

To find the current checking account balance, subtract the amount of each check from the previous balance. Then add the amount of the deposit.

The current checking account balance is \$443.68.

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EXAMPLE 1

A mail carrier had a checking account balance of \$485.93 before writing two checks, one for \$18.98 and another for \$35.72, and making a deposit of \$250. Find the current checking account balance.

Strategy

To find the current balance:

- Subtract the amount of each check from the old balance.
- Add the amount of the deposit.

Solution

$$\begin{array}{r}
 485.93 \\
 - 18.98 \quad \text{first check} \\
 \hline
 466.95 \\
 - 35.72 \quad \text{second check} \\
 \hline
 431.23 \\
 + 250.00 \quad \text{deposit} \\
 \hline
 681.23
 \end{array}$$

The current checking account balance is \$681.23.

YOU TRY IT 1

A cement mason had a checking account balance of \$302.46 before writing a check for \$20.59 and making two deposits, one in the amount of \$176.86 and another in the amount of \$94.73. Find the current checking account balance.

Your strategy**Your solution**

Solution on p. S18

OBJECTIVE B**To balance a checkbook**

Each month a bank statement is sent to the account holder. A **bank statement** is a document, either paper or electronic, showing all the transactions made to a bank account during the month. It shows the checks the bank has paid, the deposits received, and the current bank balance.

A bank statement and checkbook register are shown on the next page.

Balancing a checkbook, or determining whether the checking account balance is accurate, requires a number of steps.

1. In the checkbook register, put a check mark (✓) by each check paid by the bank and by each deposit recorded by the bank.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT		BALANCE	
			(-)				(+)		\$	
									840	27
263	5/20	Dentist	\$ 75	00	✓	\$			765	27
264	5/22	Post Office	33	61	✓				731	66
265	5/22	Gas Company	67	14					664	52
	5/29	Deposit			✓		192	00	856	52
266	5/29	Pharmacy	38	95	✓				817	57
267	5/30	Telephone	63	85					753	72
268	6/2	Groceries	73	19	✓				680	53
	6/3	Deposit			✓		215	00	895	53
269	6/7	Insurance	103	00	✓				792	53
	6/10	Deposit					225	00	1017	53
270	6/15	Photo Shop	16	63	✓				1000	90
271	6/18	Newspaper	27	00					973	90

CHECKING ACCOUNT Monthly Statement			Account Number: 924-297-8	
Date	Transaction	Amount	Balance	
5/20	OPENING BALANCE		840.27	
5/21	CHECK	75.00	765.27	
5/23	CHECK	33.61	731.66	
5/29	DEPOSIT	192.00	923.66	
6/1	CHECK	38.95	884.71	
6/1	INTEREST	4.47	889.18	
6/3	CHECK	73.19	815.99	
6/3	DEPOSIT	215.00	1030.99	
6/9	CHECK	103.00	927.99	
6/16	CHECK	16.63	911.36	
6/20	SERVICE CHARGE	3.00	908.36	
6/20	CLOSING BALANCE		908.36	

- Add to the current checkbook balance all checks that have been written but have not yet been paid by the bank and any interest paid on the account.
- Subtract any service charges and any deposits not yet recorded by the bank. This is the checkbook balance.
- Compare the balance with the bank balance listed on the bank statement. If the two numbers are equal, the bank statement and the checkbook balance.

Current checkbook balance:	973.90
Checks: 265	67.14
267	63.85
271	27.00
Interest:	+ 4.47
	<u>1136.36</u>
Service charge:	- 3.00
	<u>1133.36</u>
Deposit:	- 225.00
Checkbook balance:	<u>908.36</u>
Closing bank balance	Checkbook
from bank statement	balance
\$908.36	= \$908.36

The bank statement and the checkbook balance.



Take Note

A **service charge** is an amount of money charged by a bank for handling a transaction.

HOW TO 1

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
									\$	
									1620	42
413	3/2	Car Payment	\$232	15	✓	\$			1388	27
414	3/2	Utilities	67	14	✓				1321	13
415	3/5	Restaurant	78	14					1242	99
	3/8	Deposit			✓		1842	66	3085	65
416	3/10	House Payment	672	14	✓				2413	51
417	3/14	Insurance	177	10					2236	41

CHECKING ACCOUNT Monthly Statement			Account Number: 924-297-8	
Date	Transaction	Amount	Balance	
3/1	OPENING BALANCE		1620.42	
3/4	CHECK	232.15	1388.27	
3/5	CHECK	67.14	1321.13	
3/8	DEPOSIT	1842.66	3163.79	
3/10	INTEREST	6.77	3170.56	
3/12	CHECK	672.14	2498.42	
3/25	SERVICE CHARGE	2.00	2496.42	
3/30	CLOSING BALANCE		2496.42	

Balance the checkbook shown above.

- In the checkbook register, put a check mark (✓) by each check paid by the bank and by each deposit recorded by the bank.
- Add to the current checkbook balance all checks that have been written but have not yet been paid by the bank and any interest paid on the account.
- Subtract any service charges and any deposits not yet recorded by the bank. This is the checkbook balance.
- Compare the balance with the bank balance listed on the bank statement. If the two numbers are equal, the bank statement and the checkbook balance.

Current checkbook balance:	2236.41
Checks: 415	78.14
417	177.10
Interest:	+ 6.77
	<u>2498.42</u>

Service charge:	- 2.00
Checkbook balance:	<u>2496.42</u>

Closing bank balance from bank statement	\$2496.42	Checkbook balance	= \$2496.42
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The bank statement and the checkbook balance.

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EXAMPLE 2

Balance the checkbook shown below.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									\$ 412	64
345	1/14	Phone Bill	\$ 54	75	✓	\$			357	89
346	1/19	News Shop	18	98	✓				338	91
347	1/23	Theater Tickets	95	00					243	91
	1/31	Deposit			✓		947	00	1190	91
348	2/5	Cash	250	00	✓				940	91
349	2/12	Rent	840	00					100	91

CHECKING ACCOUNT Monthly Statement			Account Number: 924-297-8	
Date	Transaction	Amount	Balance	
1/10	OPENING BALANCE		412.64	
1/18	CHECK	54.75	357.89	
1/23	CHECK	18.98	338.91	
1/31	DEPOSIT	947.00	1285.91	
2/1	INTEREST	4.52	1290.43	
2/10	CHECK	250.00	1040.43	
2/10	CLOSING BALANCE		1040.43	

Solution

Current checkbook balance:	100.91
Checks: 347	95.00
349	840.00
Interest:	+ 4.52
	<u>1040.43</u>
Service charge:	- 0.00
	<u>1040.43</u>
Deposit:	- 0.00
Checkbook balance:	<u>1040.43</u>

Closing bank balance from bank statement: \$1040.43

Checkbook balance: \$1040.43

The bank statement and the checkbook balance.

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YOU TRY IT 2

Balance the checkbook shown below.


RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									903	17
	2/15	Deposit	\$			\$	523	84	1427	01
234	2/20	Mortgage	773	21					653	80
235	2/27	Cash	200	00					453	80
	3/1	Deposit					523	84	977	64
236	3/12	Insurance	275	50					702	14
237	3/12	Telephone	78	73					623	41

CHECKING ACCOUNT Monthly Statement			Account Number: 314-271-4	
Date	Transaction	Amount	Balance	
2/14	OPENING BALANCE		903.17	
2/15	DEPOSIT	523.84	1427.01	
2/21	CHECK	773.21	653.80	
2/28	CHECK	200.00	453.80	
3/1	INTEREST	2.11	455.91	
3/14	CHECK	275.50	180.41	
3/14	CLOSING BALANCE		180.41	

Your solution


Solution on p. S18

6.7 EXERCISES **Concept Check**

1.  When a check is written, who is the payee?
2. If the money in a checking account earns interest, is the earned interest a deposit or a withdrawal?

OBJECTIVE A*To calculate checkbook balances*

3. You had a checking account balance of \$342.51 before making a deposit of \$143.81. What is your new checking account balance?
4. The business checking account for R and R Tires showed a balance of \$1536.97. What is the balance in this account after a deposit of \$439.21 is made?
5. A nutritionist had a checking account balance of \$1204.63 before writing one check for \$119.27 and then another check for \$260.09. Find the current checkbook balance.
6. Sam had a checking account balance of \$3046.93 before writing a check for \$1027.33 and then making a deposit of \$150.00. Find the current checkbook balance.
7. The business checking account for a dry cleaner had a balance of \$3476.85 before a deposit of \$1048.53 was made. The store manager then wrote two checks, one for \$848.37 and another for \$676.19. Find the current checkbook balance.
8. Joel had a checking account balance of \$427.38 before a deposit of \$127.29 was made. Joel then wrote two checks, one for \$43.52 and one for \$249.78. Find the current checkbook balance.
9. A carpenter had a checkbook balance of \$404.96 before making a deposit of \$350 and writing a check for \$71.29. Is there enough money in the account to purchase a refrigerator for \$675?
10. A taxi driver had a checkbook balance of \$149.85 before making a deposit of \$245 and writing a check for \$387.68. Is there enough money in the account for the bank to pay the check?
11. A sporting goods store has the opportunity to buy downhill skis and cross-country skis at a manufacturer's closeout sale. The downhill skis will cost \$3500, and the cross-country skis will cost \$2050. There is currently \$5625.42 in the store's checking account. Is there enough money in the account to make both purchases?
12. A lathe operator's current checkbook balance is \$1143.42. The operator wants to purchase a utility trailer for \$525 and a used piano for \$650. Is there enough money in the account to make the two purchases?

 For Exercises 13 and 14, suppose the given account transactions take place in one day. State whether the account's ending balance on that day *must be less than*, *might be less than*, or *cannot be less than* its starting balance on that day.

13. Two deposits made and one check written
14. Three checks written

OBJECTIVE B*To balance a checkbook***15. Balance the checkbook.**

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									2466	79
223	3/2	Groceries	\$ 167	32		\$			2299	47
	3/5	Deposit					960	70	3260	17
224	3/5	Rent	860	00					2400	17
225	3/7	Gas & Electric	142	35					2257	82
226	3/7	Cash	300	00					1957	82
227	3/7	Insurance	218	44					1739	38
228	3/7	Credit Card	419	32					1320	06
229	3/12	Dentist	92	00					1228	06
230	3/13	Drug Store	47	03					1181	03
	3/19	Deposit					960	70	2141	73
231	3/22	Car Payment	241	35					1900	38
232	3/25	Cash	300	00					1600	38
233	3/25	Oil Company	166	40					1433	98
234	3/28	Plumber	155	73					1278	25
235	3/29	Department Store	288	39					989	86

CHECKING ACCOUNT Monthly Statement			Account Number: 122-345-1	
Date	Transaction	Amount	Balance	
3/1	OPENING BALANCE		2466.79	
3/5	DEPOSIT	960.70	3427.49	
3/7	CHECK	167.32	3260.17	
3/8	CHECK	860.00	2400.17	
3/8	CHECK	300.00	2100.17	
3/9	CHECK	142.35	1957.82	
3/12	CHECK	218.44	1739.38	
3/14	CHECK	92.00	1647.38	
3/18	CHECK	47.03	1600.35	
3/19	DEPOSIT	960.70	2561.05	
3/25	CHECK	241.35	2319.70	
3/27	CHECK	300.00	2019.70	
3/29	CHECK	155.73	1863.97	
3/30	INTEREST	13.22	1877.19	
4/1	CLOSING BALANCE		1877.19	

16. Balance the checkbook.


RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									1219	43
	5/1	Deposit	\$			\$	619	14	1838	57
515	5/2	Electric Bill	42	35					1796	22
516	5/2	Groceries	95	14					1701	08
517	5/4	Insurance	122	17					1578	91
518	5/5	Theatre Tickets	84	50					1494	41
	5/8	Deposit					619	14	2113	55
519	5/10	Telephone	37	39					2076	16
520	5/12	Newspaper	22	50					2053	66
	5/15	Deposit					619	14	2672	80
521	5/20	Computer Store	172	90					2499	90
522	5/21	Credit Card	313	44					2186	46
523	5/22	Eye Exam	82	00					2104	46
524	5/24	Groceries	107	14					1997	32
525	5/24	Deposit					619	14	2616	46
526	5/25	Oil Company	144	16					2472	30
527	5/30	Car Payment	288	62					2183	68
528	5/30	Mortgage Payment	877	42					1306	26

CHECKING ACCOUNT Monthly Statement			Account Number: 122-345-1	
Date	Transaction	Amount	Balance	
5/1	OPENING BALANCE		1219.43	
5/1	DEPOSIT	619.14	1838.57	
5/3	CHECK	95.14	1743.43	
5/4	CHECK	42.35	1701.08	
5/6	CHECK	84.50	1616.58	
5/8	CHECK	122.17	1494.41	
5/8	DEPOSIT	619.14	2113.55	
5/15	INTEREST	7.82	2121.37	
5/15	CHECK	37.39	2083.98	
5/15	DEPOSIT	619.14	2703.12	
5/23	CHECK	82.00	2621.12	
5/23	CHECK	172.90	2448.22	
5/24	CHECK	107.14	2341.08	
5/24	DEPOSIT	619.14	2960.22	
5/30	CHECK	288.62	2671.60	
6/1	CLOSING BALANCE		2671.60	

17. Balance the checkbook.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									2035	18
218	7/2	Mortgage	\$ 984	40		\$	\$		1050	58
219	7/4	Telephone	63	36					987	22
220	7/7	Cash	200	00					787	22
	7/12	Deposit					79.2	60	1579	82
221	7/15	Insurance	292	30					1287	52
222	7/18	Investment	500	00					787	52
223	7/20	Credit Card	414	83					372	69
	7/26	Deposit					79.2	60	1165	29
224	7/27	Department Store	113	37					1051	92

CHECKING ACCOUNT Monthly Statement			Account Number: 122-345-1	
Date	Transaction	Amount	Balance	
7/1	OPENING BALANCE		2035.18	
7/1	INTEREST	5.15	2040.33	
7/4	CHECK	984.60	1055.73	
7/6	CHECK	63.36	992.37	
7/12	DEPOSIT	792.60	1784.97	
7/20	CHECK	292.30	1492.67	
7/24	CHECK	500.00	992.67	
7/26	DEPOSIT	792.60	1785.27	
7/28	CHECK	200.00	1585.27	
7/30	CLOSING BALANCE		1585.27	

18.  When balancing your checkbook, you find that all the deposits in your checkbook register have been recorded by the bank, four checks in the register have not yet been paid by the bank, and the bank did not include a service charge. Is the ending balance on the monthly bank statement *less than* or *greater than* the ending balance on the check register?

Critical Thinking

19.  Define the words *credit* and *debit* as they apply to checkbooks.

Projects or Group Activities

20.  Look at the numbers along the bottom of a check. What are those numbers and how are they used?

CHAPTER

6

Summary

Key Words

The **unit cost** is the cost of one item. [6.1A, p. 234]

Percent increase is used to show how much a quantity has increased over its original value. [6.2A, p. 239]

Cost is the price a business pays for a product. **Selling price** is the price at which a business sells a product to a customer. **Markup** is the difference between selling price and cost. **Markup rate** is the markup expressed as a percent of the product's cost. [6.2B, p. 240]

Percent decrease is used to show how much a quantity has decreased from its original value. [6.2C, p. 242]

Sale price is the price after a reduction from the regular price. **Discount** is the difference between the regular price and the sale price. **Discount rate** is the discount expressed as a percent of the product's regular price. [6.2D, p. 243]

Interest is the amount paid for the privilege of using someone else's money. **Principal** is the amount of money originally deposited or borrowed. The percent used to determine the amount of interest is the **interest rate**. Interest computed on the original amount is called **simple interest**. The principal plus the interest owed on a loan is called the **maturity value**. [6.3A, p. 249]

The interest charged on purchases made with a credit card is called a **finance charge**. [6.3B, p. 251]

Compound interest is computed not only on the original principal but also on the interest already earned. [6.3C, p. 252]

A **mortgage** is an amount that is borrowed to buy real estate. The **loan origination fee** is usually a percent of the mortgage and is expressed as **points**. [6.4A, p. 259]

A **commission** is usually paid to a salesperson and is calculated as a percent of sales. [6.6A, p. 270]

Examples

Three paperback books cost \$36. The unit cost is the cost of one paperback book, \$12.

The city's population increased 5%, from 10,000 people to 10,500 people.

A business pays \$90 for a pair of cross trainers; the cost is \$90. The business sells the cross trainers for \$135; the selling price is \$135. The markup is $\$135 - \$90 = \$45$.

Sales decreased 10%, from 10,000 units in the third quarter to 9000 units in the fourth quarter.

A skateboard deck that regularly sells for \$50 is on sale for \$40. The regular price is \$50. The sale price is \$40. The discount is $\$50 - \$40 = \$10$.

Consider a 1-year loan of \$5000 at an annual simple interest rate of 8%. The principal is \$5000. The interest rate is 8%. The interest paid on the loan is $\$5000 \times 0.08 = \400 . The maturity value is $\$5000 + \$400 = \$5400$.

A credit card company charges 1.5% per month on any unpaid balance. The finance charge on an unpaid balance of \$1000 is $\$1000 \times 0.015 \times 1 = \15 .

\$10,000 is invested at 5% annual interest, compounded monthly. The value of the investment after 5 years can be found by multiplying 10,000 by the factor found in the Compound Interest Table in the Appendix.
 $\$10,000 \times 1.283359 = \$12,833.59$

The loan origination fee of 3 points paid on a mortgage of \$200,000 is $0.03 \times \$200,000 = \6000 .

A commission of 5% on sales of \$50,000 is $0.05 \times \$50,000 = \2500 .

An employee who receives an **hourly wage** is paid a certain amount for each hour worked. [6.6A, p. 270]

An employee is paid an hourly wage of \$15. The employee's wages for working 10 hours are $\$15 \times 10 = \150 .

An employee who is paid a **salary** receives payment based on a weekly, biweekly, monthly, or annual time schedule. [6.6A, p. 270]

An employee who earns an annual salary of \$60,000 is paid $\$60,000 \div 12 = \5000 per month.

Balancing a checkbook is a method of determining whether a checkbook balance is accurate. [6.7B, pp. 276–280]

To balance a checkbook:

- (1) Put a check mark in the checkbook register by each check paid by the bank and by each deposit recorded by the bank.
- (2) Add to the current checkbook balance all checks that have been written but have not yet been paid by the bank and any interest paid on the account.
- (3) Subtract any service charges and any deposits not yet recorded by the bank. This is the checkbook balance.
- (4) Compare the balance with the bank balance listed on the bank statement. If the two numbers are equal, the bank statement and the checkbook balance.

Essential Rules and Procedures

To find unit cost, divide the total cost by the number of units. [6.1A, p. 234]

To find total cost, multiply the unit cost by the number of units purchased. [6.1C, p. 236]

Basic Markup Equations [6.2B, p. 240]

Selling price – cost = markup

Cost + markup = selling price

Markup rate \times cost = markup

Basic Discount Equations [6.2D, p. 243]

Regular price – sale price = discount

Regular price – discount = sale price

Discount rate \times regular price = discount

Simple Interest Formula for Annual Interest Rates

[6.3A, p. 249]

Principal \times annual interest rate \times time (in years) = interest

Maturity Value Formula for a Simple Interest Loan

[6.3A, p. 249]

Principal + interest = maturity value

Monthly Payment on a Simple Interest Loan [6.3A, p. 250]

Maturity value \div length of the loan in months = monthly payment

Examples

Three paperback books cost \$36. The unit cost is $\$36 \div 3 = \12 per book.

One melon costs \$3. The total cost for 5 melons is $\$3 \times 5 = \15 .

A pair of cross trainers that cost a business \$90 has a 50% markup rate. The markup is $0.50 \times \$90 = \45 . The selling price is $\$90 + \$45 = \$135$.

A DVD box set is on sale for 20% off the regular price of \$50. The discount is $0.20 \times \$50 = \10 . The sale price is $\$50 - \$10 = \$40$.

The simple interest due on a 2-year loan of \$5000 that has an annual interest rate of 5% is $\$5000 \times 0.05 \times 2 = \500 .

The interest to be paid on a 2-year loan of \$5000 is \$500. The maturity value of the loan is $\$5000 + \$500 = \$5500$.

The maturity value of a simple interest 8-month loan is \$8000. The monthly payment is $\$8000 \div 8 = \1000 .

CHAPTER

6

Review Exercises

- Consumerism** A 20-ounce box of cereal costs \$3.90. Find the unit cost.
- Car Expenses** An account executive had car expenses of \$1025.58 for insurance, \$1805.82 for gas, \$37.92 for oil, and \$288.27 for maintenance during a year in which 11,320 miles were driven. Find the cost per mile for these four items taken as a group. Round to the nearest tenth of a cent.
- Investments** An oil stock was bought for \$42.375 per share. Six months later, the stock was selling for \$55.25 per share. Find the percent increase in the price of the stock over the 6 months. Round to the nearest tenth of a percent.
- Markup** A sporting goods store uses a markup rate of 40%. What is the markup on a ski suit that costs the store \$180?
- Simple Interest** A contractor borrowed \$100,000 from a credit union for 9 months at an annual interest rate of 4%. What is the simple interest due on the loan?
- Compound Interest** A computer programmer invested \$25,000 in a retirement account that pays 6% interest, compounded daily. What is the value of the investment in 10 years? Use the Compound Interest Table in the Appendix. Round to the nearest cent.
- Investments** Last year an oil company had earnings of \$4.12 per share. This year the earnings are \$4.73 per share. What is the percent increase in earnings per share? Round to the nearest percent.
- Real Estate** The monthly payment on a \$350,000 mortgage is \$2120.93. The mortgage is a 20-year loan at an annual interest rate of 4%. Find the amount of the first month's payment that goes to interest and the amount that goes to the principal.
- Car Expenses** A used pickup truck is purchased for \$24,450. A down payment of 8% is made, and the remaining cost is financed for 4 years at an annual interest rate of 5%. Find the monthly payment. Use the Monthly Payment Table in the Appendix. Round to the nearest cent.
- Compound Interest** A fast-food restaurant invests \$50,000 in an account that pays 7% annual interest, compounded quarterly. What is the value of the investment after one year? Use the Compound Interest Table in the Appendix.
- Real Estate** Paula Mason purchased a home for \$195,000. The lender requires a down payment of 15%. Find the amount of the down payment.
- Car Expenses** A plumber bought a truck for \$28,500. A state license fee of \$315 and a sales tax of 6.25% of the purchase price are required. Find the total cost of the sales tax and the license fee.



Spike Maiford/Getty Images

13. **Markup** Techno-Center uses a markup rate of 35% on all computer systems. Find the selling price of a computer system that costs the store \$1540.
14. **Car Expenses** Mien pays a monthly car payment of \$222.78. For a month in which \$65.45 is principal, how much of the payment is interest?
15. **Compensation** The manager of the retail store at a ski resort receives a commission of 3% on all sales at the alpine shop. Find the total commission received for a month in which the shop had \$108,000 in sales.
16. **Discount** A suit that regularly costs \$235 is on sale for 40% off the regular price. Find the sale price.
17. **Banking** Luke had a checking account balance of \$1568.45 before writing checks for \$123.76, \$756.45, and \$88.77. He then deposited a check for \$344.21. Find Luke's current checkbook balance.
18. **Simple Interest** Pros' Sporting Goods borrowed \$30,000 for 6 months at an annual interest rate of 8%. Find the maturity value of the loan.
19. **Real Estate** A credit union requires a borrower to pay $2\frac{1}{2}$ points for a loan. Find the origination fee for a \$75,000 loan.
20. **Consumerism** Sixteen ounces of mouthwash cost \$3.49. A 33-ounce container of the same brand of mouthwash costs \$6.99. Which is the better buy?
21. **Real Estate** The Sweeneys bought a home for \$356,000. The family made a 10% down payment and financed the remainder with a 30-year loan at an annual interest rate of 7%. Find the monthly mortgage payment. Use the Monthly Payment Table in the Appendix. Round to the nearest cent.
22. **Compensation** Richard Valdez receives \$12.60 per hour for working 40 hours a week, and time and a half for working over 40 hours. Find his total income for a week in which he worked 48 hours.
23. **Banking** The business checking account of a donut shop showed a balance of \$9567.44 before checks of \$1023.55, \$345.44, and \$23.67 were written, and checks of \$555.89 and \$135.91 were deposited. Find the current checkbook balance.
24. **Simple Interest** The simple interest due on a 4-month loan of \$55,000 is \$1375. Find the monthly payment on the loan.
25. **Simple Interest** A credit card company charges a customer 1.25% per month on the unpaid balance of charges on the card. What is the finance charge for a month in which the customer has an unpaid balance of \$576?

CHAPTER

6

TEST

1. **Consumerism** Twenty feet of lumber cost \$138.40. What is the cost per foot?
2. **Consumerism** Which is the more economical purchase: 3 pounds of tomatoes for \$7.49 or 5 pounds of tomatoes for \$12.59?
3. **Consumerism** Red snapper costs \$4.15 per pound. Find the cost of $3\frac{1}{2}$ pounds. Round to the nearest cent.
4. **Business** An exercise bicycle increased in price from \$415 to \$498. Find the percent increase in the cost of the exercise bicycle.
5. **Markup** A department store uses a 40% markup rate. Find the selling price of a Blu-ray disc player that the store purchased for \$315.
6. **Investments** The price of gold rose from \$1498 per ounce to \$1684 per ounce. What percent increase does this amount represent? Round to the nearest tenth of a percent.
7. **Consumerism** The price of a video camera dropped from \$1120 to \$896. What percent decrease does this price drop represent?
8. **Discount** A corner hutch with a regular price of \$299 is on sale for 30% off the regular price. Find the sale price.
9. **Discount** A box of stationery that regularly sells for \$9.50 is on sale for \$5.70. Find the discount rate.
10. **Simple Interest** A construction company borrowed \$75,000 for 4 months at an annual interest rate of 8%. Find the simple interest due on the loan.
11. **Simple Interest** Craig Allen borrowed \$25,000 for 9 months at an annual interest rate of 9.2%. Find the maturity value of the loan.
12. **Simple Interest** A credit card company charges a customer 1.2% per month on the unpaid balance of charges on the card. What is the finance charge for a month in which the customer has an unpaid balance of \$374.95?
13. **Compound Interest** Jorge, who is self-employed, placed \$30,000 in an account that pays 6% annual interest, compounded quarterly. How much interest was earned in 10 years? Use the Compound Interest Table in the Appendix.
14. **Real Estate** A savings and loan institution is offering mortgage loans that have a loan origination fee of $2\frac{1}{2}$ points. Find the loan origination fee when a home is purchased with a loan of \$134,000.



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- 15. Real Estate** A new housing development offers homes with a mortgage of \$222,000 for 25 years at an annual interest rate of 8%. Find the monthly mortgage payment. Use the Monthly Payment Table in the Appendix.
- 16. Car Expenses** A Chevrolet was purchased for \$23,750, and a 20% down payment was made. Find the amount financed.
- 17. Car Expenses** A rancher purchased an SUV for \$33,714 and made a down payment of 15% of the cost. The balance was financed for 4 years at an annual interest rate of 7%. Find the monthly payment. Use the Monthly Payment Table in the Appendix.
- 18. Compensation** Shaney receives an hourly wage of \$30.40 an hour as an emergency room nurse. When called in at night, she receives time and a half. How much does Shaney earn for a week in which she works 30 hours at normal rates and 15 hours during the night?
- 19. Banking** The business checking account for a pottery store had a balance of \$7349.44 before checks for \$1349.67 and \$344.12 were written. The store manager then made a deposit of \$956.60. Find the current checkbook balance.
- 20. Banking** Balance the checkbook shown.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT										
NUMBER	DATE	DESCRIPTION OF TRANSACTION	PAYMENT/DEBIT (-)		✓ T	FEE (IF ANY) (-)	DEPOSIT/CREDIT (+)		BALANCE	
			\$				\$		\$	
									1422	13
843	8/1	House Payment	\$ 713	72		\$	\$		708	41
	8/4	Deposit					852	60	1561	01
844	8/5	Loan Payment	162	40					1398	61
845	8/6	Groceries	166	44					1232	17
846	8/10	Car Payment	322	37					909	80
	8/15	Deposit					852	60	1762	40
847	8/16	Credit Card	413	45					1348	95
848	8/18	Pharmacy	92	14					1256	81
849	8/22	Utilities	72	30					1184	51
850	8/28	Telephone	78	20					1106	31

CHECKING ACCOUNT Monthly Statement			Account Number: 122-345-1	
Date	Transaction	Amount	Balance	
8/1	OPENING BALANCE		1422.13	
8/3	CHECK	713.72	708.41	
8/4	DEPOSIT	852.60	1561.01	
8/8	CHECK	166.44	1394.57	
8/8	CHECK	162.40	1232.17	
8/15	DEPOSIT	852.60	2084.77	
8/23	CHECK	72.30	2012.47	
8/24	CHECK	92.14	1920.33	
9/1	CLOSING BALANCE		1920.33	

Cumulative Review Exercises

1. Simplify: $12 - (10 - 8)^2 \div 2 + 3$
2. Add: $3\frac{1}{3} + 4\frac{1}{8} + 1\frac{1}{12}$
3. Find the difference between $12\frac{3}{16}$ and $9\frac{5}{12}$.
4. Find the product of $5\frac{5}{8}$ and $1\frac{9}{15}$.
5. Divide: $3\frac{1}{2} \div 1\frac{3}{4}$
6. Simplify: $\left(\frac{3}{4}\right)^2 \div \left(\frac{3}{8} - \frac{1}{4}\right) + \frac{1}{2}$
7. Divide: $0.059 \overline{)3.0792}$
Round to the nearest tenth.
8. Convert $\frac{17}{12}$ to a terminating or a repeating decimal.
Place a bar over any repeating digits.
9. Write “\$410 in 8 hours” as a unit rate.
10. Solve the proportion $\frac{5}{n} = \frac{16}{35}$.
Round to the nearest hundredth.
11. Write $\frac{5}{8}$ as a percent.
12. Find 6.5% of 420.
13. Write 18.2% as a decimal.
14. What percent of 20 is 8.4?
15. 30 is 12% of what?
16. 65 is 42% of what? Round to the nearest hundredth.

17. **Meteorology** A series of late-summer storms produced rainfall amounts of $3\frac{3}{4}$, $8\frac{1}{2}$, and $1\frac{2}{3}$ inches during a 3-week period. Find the total rainfall during the 3 weeks.
18. **Taxes** The Homer family pays $\frac{1}{5}$ of their total monthly income for taxes. The family has a total monthly income of \$4850. Find the amount of the monthly income that is paid for taxes.
19. **Consumerism** In 5 years, the cost of a scientific calculator went from \$75 to \$30. What is the ratio of the decrease in price to the original price?
20. **Fuel Efficiency** A compact car was driven 417.5 miles on 12.5 gallons of gasoline. Find the number of miles driven per gallon of gasoline.
21. **Consumerism** A 14-pound turkey costs \$15.40. Find the unit cost. Round to the nearest cent.
22. **Investments** Eighty shares of a stock paid a dividend of \$112. At the same rate, find the dividend on 200 shares of the stock.
23. **Discount** A laptop computer that regularly sells for \$900 is on sale for 20% off the regular price. What is the sale price?
24. **Markup** A pro skate shop bought a grinding rail for \$85 and used a markup rate of 40%. Find the selling price of the grinding rail.
25. **Compensation** Sook Kim, an elementary school teacher, received an increase in salary from \$2800 per month to \$3024 per month. Find the percent increase in her salary.
26. **Simple Interest** A contractor borrowed \$120,000 for 6 months at an annual interest rate of 4.5%. How much simple interest is due on the loan?
27. **Car Expenses** A red Ford Mustang was purchased for \$26,900, and a down payment of \$2000 was made. The balance was financed for 3 years at an annual interest rate of 9%. Find the monthly payment. Use the Monthly Payment Table in the Appendix. Round to the nearest cent.
28. **Banking** A family had a checking account balance of \$1846.78. A check for \$568.30 was deposited into the account, and checks for \$123.98 and \$47.33 were written. Find the new checking account balance.
29. **Car Expenses** During one year, Anna Gonzalez spent \$1840 on gasoline and oil, \$820 on insurance, \$185 on tires, and \$432 on repairs for her car. Find the cost per mile to drive the car 10,000 miles during the year. Round to the nearest cent.
30. **Real Estate** A house has a mortgage of \$172,000 for 20 years at an annual interest rate of 6%. Find the monthly mortgage payment. Use the Monthly Payment Table in the Appendix. Round to the nearest cent.



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You Try It 4

$$\frac{5}{7} = \frac{n}{20}$$

$$5 \times 20 = 7 \times n$$

$$100 = 7 \times n$$

$$100 \div 7 = n$$

$$14.3 \approx n$$

- Find the cross products. Then solve for n .

You Try It 5

$$\frac{15}{20} = \frac{12}{n}$$

$$15 \times n = 20 \times 12$$

$$15 \times n = 240$$

$$n = 240 \div 15$$

$$n = 16$$

- Find the cross products. Then solve for n .

Check: $\frac{15}{20} \times \frac{12}{16} \rightarrow 20 \times 12 = 240$
 $\frac{15}{20} \times \frac{12}{16} \rightarrow 15 \times 16 = 240$

You Try It 6

$$\frac{12}{n} = \frac{7}{4}$$

$$12 \times 4 = n \times 7$$

$$48 = n \times 7$$

$$48 \div 7 = n$$

$$6.86 \approx n$$

You Try It 7

$$\frac{n}{12} = \frac{4}{1}$$

$$n \times 1 = 12 \times 4$$

$$n \times 1 = 48$$

$$n = 48 \div 1$$

$$n = 48$$

Check: $\frac{48}{12} \times \frac{4}{1} \rightarrow 12 \times 4 = 48$
 $\frac{48}{12} \times \frac{4}{1} \rightarrow 48 \times 1 = 48$

You Try It 8**Strategy**

To find the number of tablespoons of fertilizer needed, write and solve a proportion using n to represent the number of tablespoons of fertilizer.

Solution

$$\frac{3 \text{ tablespoons}}{4 \text{ gallons}} = \frac{n \text{ tablespoons}}{10 \text{ gallons}}$$

$$3 \times 10 = 4 \times n$$

$$30 = 4 \times n$$

$$30 \div 4 = n$$

$$7.5 = n$$

- The unit “tablespoons” is in the numerator. The unit “gallons” is in the denominator.

For 10 gallons of water, 7.5 tablespoons of fertilizer are required.

You Try It 9**Strategy**

To find the number of jars that can be packed in 15 boxes, write and solve a proportion using n to represent the number of jars.

Solution

$$\frac{24 \text{ jars}}{6 \text{ boxes}} = \frac{n \text{ jars}}{15 \text{ boxes}}$$

$$24 \times 15 = 6 \times n$$

$$360 = 6 \times n$$

$$360 \div 6 = n$$

$$60 = n$$

60 jars can be packed in 15 boxes.

Solutions to Chapter 5 “You Try It”**SECTION 5.1****You Try It 1**

a. $125\% = 125 \times 0.01 = 1.25$

$$125\% = 125 \times \frac{1}{100}$$

$$= \frac{125}{100} = \frac{5}{4} = 1\frac{1}{4}$$

b. $8.5\% = 8.5 \times 0.01 = 0.085$

$$8.5\% = 8.5 \times \frac{1}{100}$$

$$= 8\frac{1}{2} \times \frac{1}{100} \quad \bullet \quad 8.5 = 8\frac{5}{10} = 8\frac{1}{2}$$

$$= \frac{17}{2} \times \frac{1}{100}$$

$$= \frac{17}{200}$$

- Multiply the fractions.

c. $0.25\% = 0.25 \times 0.01 = 0.0025$

$$0.25\% = 0.25 \times \frac{1}{100}$$

$$= \frac{1}{4} \times \frac{1}{100} \quad \bullet \quad 0.25 = \frac{25}{100} = \frac{1}{4}$$

$$= \frac{1}{400}$$

- Multiply the fractions.

You Try It 2

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

$$= \frac{100}{3} \times \frac{1}{100}$$

$$= \frac{100}{300} = \frac{1}{3}$$

You Try It 3

$$0.048 = 0.048 \times 100\% = 4.8\%$$

$$3.6 = 3.6 \times 100\% = 360\%$$

You Try It 4

$$\frac{5}{16} \times \frac{100\%}{1}$$

$$= \frac{500\%}{16} = 31.25\% \quad \bullet \quad \text{Write in decimal form.}$$

You Try It 5

$$\frac{5}{6} = \frac{5}{6} \times \frac{100\%}{1} = \frac{500\%}{6} = 83\frac{1}{3}\%$$

SECTION 5.2**You Try It 1**

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.063 \times 150 = n$$

$$9.45 = n$$

You Try It 2Percent \times base = amount

$$\frac{1}{6} \times 66 = n \quad \bullet \quad 16\frac{2}{3}\% = \frac{1}{6}$$

$$11 = n$$

You Try It 3**Strategy**

To determine the amount that came from corporations, write and solve the basic percent equation, using n to represent the amount. The percent is 5%. The base is \$291 billion.

SolutionPercent \times base = amount

$$5\% \times 291 = n$$

$$0.05 \times 291 = n$$

$$14.55 = n$$

Corporations gave \$14.55 billion to charities.

You Try It 4**Strategy**

To find the new hourly wage:

- ▶ Find the amount of the raise. Write and solve the basic percent equation, using n to represent the amount of the raise (amount). The percent is 8%. The base is \$33.50.
- ▶ Add the amount of the raise to the old wage (33.50).

Solution

$$8\% \times 33.50 = n \qquad 33.50$$

$$0.08 \times 33.50 = n \qquad + 2.68$$

$$2.68 = n \qquad \hline 36.18$$

The new hourly wage is \$36.18.

SECTION 5.3**You Try It 1**Percent \times base = amount

$$n \times 32 = 16$$

$$n = 16 \div 32$$

$$n = 0.50$$

$$n = 50\%$$

You Try It 2Percent \times base = amount

$$n \times 15 = 48$$

$$n = 48 \div 15$$

$$n = 3.2$$

$$n = 320\%$$

You Try It 3Percent \times base = amount

$$n \times 45 = 30$$

$$n = 30 \div 45$$

$$n = \frac{2}{3} = 66\frac{2}{3}\%$$

You Try It 4**Strategy**

To find what percent of the income the income tax is, write and solve the basic percent equation, using n to represent the percent. The base is \$33,500, and the amount is \$5025.

Solution

$$n \times 33,500 = 5025$$

$$n = 5025 \div 33,500$$

$$n = 0.15 = 15\%$$

The income tax is 15% of the income.

You Try It 5**Strategy**

To find the percent of wireless subscribers not using a smartphone:

- ▶ Subtract to find the number of subscribers not using a smartphone (302.9 million $-$ 112.1 million).
- ▶ Write and solve the basic percent equation, using n to represent the percent. The base is 302.9 million, and the amount is the number of wireless subscribers not using a smartphone.

Solution

$$302.9 \text{ million} - 112.1 \text{ million} = 190.8 \text{ million}$$

There were 190.8 million wireless subscribers not using a smartphone.

$$n \times 302.9 = 190.8$$

$$n = 190.8 \div 302.9$$

$$n \approx 0.6299$$

Approximately 63.0% of the wireless subscribers were not using a smartphone.

SECTION 5.4**You Try It 1**Percent \times base = amount

$$0.86 \times n = 215$$

$$n = 215 \div 0.86$$

$$n = 250$$

You Try It 2Percent \times base = amount

$$0.025 \times n = 15$$

$$n = 15 \div 0.025$$

$$n = 600$$

You Try It 3Percent \times base = amount

$$\frac{1}{6} \times n = 5 \quad \bullet \quad 16\frac{2}{3}\% = \frac{1}{6}$$

$$n = 5 \div \frac{1}{6}$$

$$n = 30$$

You Try It 4**Strategy**

To find the original value of the car, write and solve the basic percent equation, using n to represent the original value (base). The percent is 42%, and the amount is \$10,458.

Solution

$$42\% \times n = 10,458$$

$$0.42 \times n = 10,458$$

$$n = 10,458 \div 0.42$$

$$n = 24,900$$

The original value of the car was \$24,900.

You Try It 5

Strategy To find the difference between the original price and the sale price:

- ▶ Find the original price. Write and solve the basic percent equation, using n to represent the original price (base). The percent is 80%, and the amount is \$89.60.
- ▶ Subtract the sale price (89.60) from the original price.

Solution

$$\begin{aligned} 80\% \times n &= 89.60 \\ 0.80 \times n &= 89.60 \\ n &= 89.60 \div 0.80 \\ n &= 112.00 \quad (\text{original price}) \\ 112.00 - 89.60 &= 22.40 \end{aligned}$$

The difference between the original price and the sale price is \$22.40.

SECTION 5.5**You Try It 1**

$$\begin{aligned} \frac{26}{100} &= \frac{22}{n} \\ 26 \times n &= 100 \times 22 \\ 26 \times n &= 2200 \\ n &= 2200 \div 26 \\ n &\approx 84.62 \end{aligned}$$

You Try It 2

$$\begin{aligned} \frac{16}{100} &= \frac{n}{132} \\ 16 \times 132 &= 100 \times n \\ 2112 &= 100 \times n \\ 2112 \div 100 &= n \\ 21.12 &= n \end{aligned}$$

You Try It 3

Strategy To find the number of days it snowed, write and solve a proportion, using n to represent the number of days it snowed (amount). The percent is 64%, and the base is 150.

Solution

$$\begin{aligned} \frac{64}{100} &= \frac{n}{150} \\ 64 \times 150 &= 100 \times n \\ 9600 &= 100 \times n \\ 9600 \div 100 &= n \\ 96 &= n \end{aligned}$$

It snowed 96 days.

You Try It 4

Strategy To find the percent of alarms that were not false alarms:

- ▶ Subtract to find the number of alarms that were not false alarms ($200 - 24$).

- ▶ Write and solve a proportion, using n to represent the percent of alarms that were not false. The base is 200, and the amount is the number of alarms that were not false alarms.

Solution

$$\begin{aligned} 200 - 24 &= 176 \\ \frac{n}{100} &= \frac{176}{200} \\ n \times 200 &= 100 \times 176 \\ n \times 200 &= 17,600 \\ n &= 17,600 \div 200 \\ n &= 88 \end{aligned}$$

88% of the alarms were not false alarms.

Solutions to Chapter 6 “You Try It”**SECTION 6.1****You Try It 1**

Strategy To find the unit cost, divide the cost of the package by the number of units in the package.

Solution

- Unit cost = $\frac{\text{cost of the package}}{\text{number of units in the package}}$
 $= \frac{\$14.99}{12 \text{ apples}} \approx \1.208 per apple
- Unit cost = $\frac{\text{cost of the package}}{\text{number of units in the package}}$
 $= \frac{\$10.00}{15 \text{ pounds}} \approx \0.667 per pound

You Try It 2

Strategy To find the more economical purchase, compare the unit costs.

Solution

$$\begin{aligned} 8.70 \div 6 &= 1.45 \\ 6.96 \div 4 &= 1.74 \\ \$1.45 &< \$1.74 \end{aligned}$$

The more economical purchase is 6 cans for \$8.70.

You Try It 3

Strategy To find the total cost, multiply the unit cost (9.96) by the number of units (7).

Solution

Unit cost	×	number of units	=	total cost
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$$9.96 \times 7 = 69.72$$

The total cost is \$69.72.

SECTION 6.2

**You Try It 1
Strategy**

To find the percent increase:

- ▶ Find the amount of the increase.
- ▶ Solve the basic percent equation for *percent*.

Solution

$$\begin{array}{|c|} \hline \text{New} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{original} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{increase} \\ \hline \end{array}$$

$$3.83 - 3.46 = 0.37$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$n \times 3.46 = 0.37$$

$$n = 0.37 \div 3.46$$

$$n \approx 0.11 = 11\%$$

The percent increase was 11%.

**You Try It 2
Strategy**

To find the new hourly wage:

- ▶ Solve the basic percent equation for *amount*.
- ▶ Add the amount of the increase to the original wage.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.14 \times 12.50 = n$$

$$1.75 = n$$

$$12.50 + 1.75 = 14.25$$

The new hourly wage is \$14.25.

**You Try It 3
Strategy**

To find the markup, solve the basic percent equation for *amount*.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\begin{array}{|c|} \hline \text{Markup} \\ \hline \text{rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{cost} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{markup} \\ \hline \end{array}$$

$$0.20 \times 32 = n$$

$$6.4 = n$$

The markup is \$6.40.

**You Try It 4
Strategy**

To find the selling price:

- ▶ Find the markup by solving the basic percent equation for *amount*.
- ▶ Add the markup to the cost.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\begin{array}{|c|} \hline \text{Markup} \\ \hline \text{rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{cost} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{markup} \\ \hline \end{array}$$

$$0.55 \times 72 = n$$

$$39.60 = n$$

$$\begin{array}{|c|} \hline \text{Cost} \\ \hline \end{array} + \begin{array}{|c|} \hline \text{markup} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{selling} \\ \hline \text{price} \\ \hline \end{array}$$

$$72 + 39.60 = 111.60$$

The selling price is \$111.60.

**You Try It 5
Strategy**

To find the percent decrease:

- ▶ Find the amount of the decrease.
- ▶ Solve the basic percent equation for *percent*.

Solution

$$\begin{array}{|c|} \hline \text{Original} \\ \hline \text{value} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{new} \\ \hline \text{value} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{amount of} \\ \hline \text{decrease} \\ \hline \end{array}$$

$$88,000,000 - 84,227,000 = 3,773,000$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$n \times 88,000,000 = 3,773,000$$

$$n = 3,773,000 \div 88,000,000$$

$$n \approx 0.043$$

The percent decrease is 4.3%.

**You Try It 6
Strategy**

To find the visibility in the fog:

- ▶ Find the amount of decrease by solving the basic percent equation for *amount*.
- ▶ Subtract the amount of decrease from the original visibility.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.40 \times 5 = n$$

$$2 = n$$

$$5 - 2 = 3$$

The visibility in the fog was 3 miles.

**You Try It 7
Strategy**

To find the discount rate:

- ▶ Find the discount.
- ▶ Solve the basic percent equation for *percent*.

Solution

$$\begin{array}{|c|} \hline \text{Regular} \\ \hline \text{price} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{sale} \\ \hline \text{price} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{discount} \\ \hline \end{array}$$

$$12.50 - 10.99 = 1.51$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\begin{array}{|c|} \hline \text{Discount} \\ \hline \text{rate} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{regular} \\ \hline \text{price} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{discount} \\ \hline \end{array}$$

$$n \times 12.50 = 1.51$$

$$n = 1.51 \div 12.50$$

$$n = 0.1208$$

The discount rate is 12.1%.

**You Try It 8
Strategy**

To find the sale price:

- ▶ Find the discount by solving the basic percent equation for *amount*.
- ▶ Subtract to find the sale price.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Discount rate}} \times \boxed{\text{regular price}} = \boxed{\text{discount}}$$

$$0.15 \times 225 = n$$

$$33.75 = n$$

$$\boxed{\text{Regular price}} - \boxed{\text{discount}} = \boxed{\text{sale price}}$$

$$225 - 33.75 = 191.25$$

The sale price is \$191.25.

SECTION 6.3**You Try It 1****Strategy**

To find the simple interest due, multiply the principal (15,000) times the annual interest rate (8% = 0.08) times the time in years (18 months = $\frac{18}{12}$ years = 1.5 years).

Solution

$$\boxed{\text{Principal}} \times \boxed{\text{annual interest rate}} \times \boxed{\text{time (in years)}} = \boxed{\text{interest}}$$

$$15,000 \times 0.08 \times 1.5 = 1800$$

The interest due is \$1800.

You Try It 2**Strategy**

To find the maturity value:

- ▶ Use the simple interest formula to find the simple interest due.
- ▶ Find the maturity value by adding the principal and the interest.

Solution

$$\boxed{\text{Principal}} \times \boxed{\text{annual interest rate}} \times \boxed{\text{time (in years)}} = \boxed{\text{interest}}$$

$$3800 \times 0.06 \times \frac{90}{365} \approx 56.22$$

$$\boxed{\text{Principal}} + \boxed{\text{interest}} = \boxed{\text{maturity value}}$$

$$3800 + 56.22 = 3856.22$$

The maturity value is \$3856.22.

You Try It 3**Strategy**

To find the monthly payment:

- ▶ Find the maturity value by adding the principal and the interest.
- ▶ Divide the maturity value by the length of the loan in months (12).

Solution

Principal + interest = maturity value

$$1900 + 152 = 2052$$

Maturity value \div length of the loan = payment

$$2052 \div 12 = 171$$

The monthly payment is \$171.

You Try It 4**Strategy**

To find the finance charge, multiply the principal, or unpaid balance (1250), times the monthly interest rate (1.6%) times the number of months (1).

Solution

$$\boxed{\text{Principal}} \times \boxed{\text{monthly interest rate}} \times \boxed{\text{time (in months)}}$$

$$1250 \times 0.016 \times 1 = 20$$

The finance charge is \$20.

You Try It 5**Strategy**

To find the interest earned:

- ▶ Find the new principal by multiplying the original principal (1000) by the factor found in the Compound Interest Table (3.29066).
- ▶ Subtract the original principal from the new principal.

Solution

$$1000 \times 3.29066 = 3290.66$$

The new principal is \$3290.66.

$$3290.66 - 1000 = 2290.66$$

The interest earned is \$2290.66.

SECTION 6.4**You Try It 1****Strategy**

To find the mortgage:

- ▶ Find the down payment by solving the basic percent equation for *amount*.
- ▶ Subtract the down payment from the purchase price.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Percent}} \times \boxed{\text{purchase price}} = \boxed{\text{down payment}}$$

$$0.25 \times 1,500,000 = n$$

$$375,000 = n$$

$$\boxed{\text{Purchase price}} - \boxed{\text{down payment}} = \boxed{\text{mortgage}}$$

$$1,500,000 - 375,000 = 1,125,000$$

The mortgage is \$1,125,000.

You Try It 2**Strategy**

To find the loan origination fee, solve the basic percent equation for *amount*.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Points}} \times \boxed{\text{mortgage}} = \boxed{\text{fee}}$$

$$0.045 \times 180,000 = n$$

$$8100 = n$$

The loan origination fee was \$8100.

You Try It 3**Strategy**

To find the mortgage payment:

- ▶ Find the down payment.
- ▶ Subtract the down payment from the purchase price to find the mortgage.
- ▶ Multiply the mortgage by the factor in the Monthly Payment Table for a 20-year loan at 6%.

Solution

Percent \times purchase price = down payment
 $0.30 \times 185,000 = 55,000$
 The down payment is \$55,500.

$$\boxed{\text{Purchase price}} - \boxed{\text{down payment}} = \boxed{\text{mortgage}}$$

$$185,000 - 55,500 = 129,500$$

The mortgage is \$129,500.

The factor from the Monthly Payment Table is 0.0071643.

$$129,500 \times 0.0071643 \approx 927.78$$

The monthly mortgage payment is \$927.78.

You Try It 4**Strategy**

To find the amount of the first month's payment that is interest and the amount that is principal:

- ▶ Find the monthly simple interest rate.
- ▶ Use the basic percent equation to find the interest owed for the first month.
- ▶ Subtract the interest owed for the first month from the monthly payment to find the amount of the payment that is principal.

Solution

$$\begin{aligned} \text{Monthly simple interest rate} &= \frac{\text{annual interest rate}}{12} \\ &= \frac{0.045}{12} = 0.00375 \end{aligned}$$

$$\text{Percent} \times \text{base} = \text{amount}$$

$$0.00375 \times 296,000 = 1110$$

The interest owed for the first month is \$1110.

$$\boxed{\text{Monthly payment}} - \boxed{\text{amount to interest}} = \boxed{\text{amount to principal}}$$

$$1413.15 - 1110.00 = 303.15$$

The amount of the payment that goes to the principal is \$303.15.

SECTION 6.5**You Try It 1****Strategy**

To find the amount financed:

- ▶ Find the down payment by solving the basic percent equation for *amount*.
- ▶ Subtract the down payment from the purchase price.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Percent}} \times \boxed{\text{purchase price}} = \boxed{\text{down payment}}$$

$$0.20 \times 19,200 = n$$

$$3840 = n$$

The down payment is \$3840.

$$19,200 - 3840 = 15,360$$

The amount financed is \$15,360.

You Try It 2**Strategy**

To find the license fee, solve the basic percent equation for *amount*.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$

$$\boxed{\text{Percent}} \times \boxed{\text{purchase price}} = \boxed{\text{license fee}}$$

$$0.015 \times 27,350 = n$$

$$410.25 = n$$

The license fee is \$410.25.

You Try It 3**Strategy**

To find the cost, multiply the cost per mile (0.41) by the number of miles driven (23,000).

Solution

$$23,000 \times 0.41 = 9430$$

The cost is \$9430.

You Try It 4**Strategy**

To find the cost per mile for car insurance, divide the cost for insurance (360) by the number of miles driven (15,000).

Solution

$$360 \div 15,000 = 0.024$$

The cost per mile for insurance is \$.024.

You Try It 5**Strategy**

To find the monthly payment:

- ▶ Subtract the down payment from the purchase price to find the amount financed.
- ▶ Multiply the amount financed by the factor found in the Monthly Payment Table.

Solution

$$25,900 - 6475 = 19,425$$

$$19,425 \times 0.0244129 \approx 474.22$$

The monthly payment is \$474.22.

SECTION 6.6**You Try It 1****Strategy**

To find the worker's earnings:

- ▶ Find the worker's overtime wage by multiplying the hourly wage by 2.
- ▶ Multiply the number of overtime hours worked by the overtime wage.

CHAPTER 3 TEST

1. $0.0068 > 0.000963$ [3.1C; Example 7] 2. 4.087 [3.3A; Example 1] 3. Forty-five and three hundred two ten-thousandths [3.1A; Example 2] 4. 209.07086 [3.1A; Example 3] 5. $\frac{33}{40}$ [3.6B; HOW TO 3] 6. $\frac{13}{8} > 0.72$ [3.6C; You Try It 5]
7. 1.538 [3.5A; Example 3] 8. 27.76626 [3.3A; Example 2] 9. 25.8808 [3.3A; Example 3] 10. 0.325 [3.6A; HOW TO 1]
11. 7.095 [3.1B; Example 4] 12. 23.2 [3.5A; Example 1] 13. 458.581 [3.2A; Example 2] 14. $0.\overline{681}$ [3.6A; Example 1]
15. 0.00548 [3.4A; You Try It 3] 16. 255.957 [3.2A; You Try It 1] 17. 17,149.6 [3.4A; You Try It 5] 18. 0.0015923 [3.5A; Example 5] 19. The cost is \$21.60. [3.4B; Example 7] 20. The monthly payment is \$395.40. [3.5B; Example 7]
21. Your total income is \$3087.14. [3.2B; You Try It 4] 22. The cost of the call is \$4.63. [3.4B; Example 8]

CUMULATIVE REVIEW EXERCISES

1. 235 r17 [1.5C] 2. 128 [1.6A] 3. 3 [1.6B] 4. 72 [2.1A] 5. $4\frac{2}{5}$ [2.2B] 6. $\frac{37}{8}$ [2.2B] 7. $\frac{25}{60}$ [2.3A]
8. $1\frac{17}{48}$ [2.4B] 9. $8\frac{35}{36}$ [2.4C] 10. $5\frac{23}{36}$ [2.5C] 11. $\frac{1}{12}$ [2.6A] 12. $9\frac{1}{8}$ [2.6B] 13. $1\frac{2}{9}$ [2.7A] 14. $\frac{19}{20}$ [2.7B]
15. $\frac{3}{16}$ [2.8B] 16. $2\frac{5}{18}$ [2.8B] 17. Sixty-five and three hundred nine ten-thousandths [3.1A] 18. 504.6991 [3.2A]
19. 21.0764 [3.3A] 20. 55.26066 [3.4A] 21. 2.154 [3.5A] 22. $0.7\overline{3}$ [3.6A] 23. $\frac{17}{40}$ [3.6B] 24. $\frac{8}{9} < 0.98$ [3.6C]
25. Sweden mandates 14 more vacation days than Germany. [1.3C] 26. The patient must lose $7\frac{3}{4}$ pounds during the third month to achieve the goal. [2.5D] 27. Your checking account balance is \$617.38. [3.3B] 28. The resulting thickness is 1.395 inches. [3.3B]
29. You paid \$6008.80 in income tax last year. [3.4B] 30. The amount of each payment is \$46.37. [3.5B]

Answers to Chapter 4 Selected Exercises

PREP TEST

1. $\frac{4}{5}$ [2.3B] 2. $\frac{1}{2}$ [2.3B] 3. 24.8 [3.6A] 4. 4×33 [1.4A] 5. 4 [1.5A]

SECTION 4.1

1. 3 to 8 3. $\frac{1}{5}$ 1:5 1 to 5 5. $\frac{2}{1}$ 2:1 2 to 1 7. $\frac{3}{8}$ 3:8 3 to 8 9. $\frac{1}{1}$ 1:1 1 to 1 11. $\frac{7}{10}$ 7:10 7 to 10 13. $\frac{1}{2}$ 1:2 1 to 2
15. $\frac{2}{1}$ 2:1 2 to 1 17. $\frac{5}{2}$ 5:2 5 to 2 19. $\frac{5}{7}$ 5:7 5 to 7 21. days 23. The ratio is $\frac{3}{8}$. 25. The ratio is $\frac{1}{3}$.
27. The ratio is $\frac{13}{22,000}$. 29. The ratio is $\frac{1}{5}$. 31. The ratio is $\frac{3}{250}$. 35. Answers will vary.

SECTION 4.2

3. $\frac{3 \text{ pounds}}{4 \text{ people}}$ 5. $\frac{\$20}{3 \text{ boards}}$ 7. $\frac{20 \text{ miles}}{1 \text{ gallon}}$ 9. $\frac{8 \text{ gallons}}{1 \text{ hour}}$ 11. Divide the number of gallons per minute by 60. 13. 1 15. 2.5 feet/second
17. \$975/week 19. 110 trees/acre 21. \$18.84/hour 23. 35.6 miles/gallon 25. The car got 42.6 miles/gallon.
27. The rate is 7.4 miles per dollar. 29. The average number of rides per day was 1220. 31. The cost per viewer is \$.03.
33. The rate is 12 gallons/minute. 35. The cost is 2,715,580 yen. 37. a. Australia has the least population density.
- b. There are 851 more people per square mile in India than in the United States. 41. The car gets about 3.6 gallons per 100 miles.
43. 0.004 ppm

CHECK YOUR PROGRESS: CHAPTER 4

1. $\frac{1}{4}$, 1:4 [4.1A] 2. $\frac{2}{3}$, 2:3 [4.1A] 3. $\frac{5}{12}$, 5:12 [4.1A] 4. \$24/hour [4.2B] 5. 10.4 yards/second [4.2B]
6. 29.2 miles/gallon [4.2B] 7. The recommended amount of fertilizer is 0.025 gallon/square foot. [4.2C]
8. Whole milk has 18.75 calories/ounce. [4.2C] 9. The cost per rose is \$4.25. [4.2C] 10. The cost per page is \$.0425. [4.2C]

SECTION 4.3

1. $n = 45 \div 15$ 3. $72 \div 9 = n$ 5. True 7. Not true 9. Not true 11. True 13. True 15. True 17. True
19. Not true 21. True 23. Yes 25. Yes 27. 3 29. 105 31. 2 33. 60 35. 2.22 37. 6.67 39. 21.33
41. 16.25 43. 2.44 45. 47.89 47. A 0.5-ounce serving contains 50 calories. 49. The car can travel 329 miles. 51. 12.5 gallons of water are required. 53. The distance is 16 miles. 55. 1.25 ounces are required. 57. 160,000 people would vote.
59. The monthly payment is \$176.75. 61. 750 defective circuit boards are expected in a run of 25,000. 63. A bowling ball would weigh about 2.67 pounds on the moon. 65. The dividend would be \$1071.

CHAPTER 4 REVIEW EXERCISES

1. True [4.3A] 2. $\frac{2}{5}$ 2:5 2 to 5 [4.1A] 3. 62.5 miles/hour [4.2B] 4. True [4.3A] 5. 68 [4.3B]
 6. \$12.50/hour [4.2B] 7. \$1.75/pound [4.2B] 8. $\frac{2}{7}$ 2:7 2 to 7 [4.1A] 9. 36 [4.3B] 10. 19.44 [4.3B]
 11. $\frac{2}{5}$ 2:5 2 to 5 [4.1A] 12. Not true [4.3A] 13. $\frac{\$35}{4 \text{ hours}}$ [4.2A] 14. 27.2 miles/gallon [4.2B]
 15. $\frac{1}{1}$ 1:1 1 to 1 [4.1A] 16. True [4.3A] 17. 65.45 [4.3B] 18. $\frac{100 \text{ miles}}{3 \text{ hours}}$ [4.2A] 19. The ratio is $\frac{2}{5}$. [4.1B]
 20. The property tax is \$6400. [4.3C] 21. The ratio is $\frac{3}{8}$. [4.1B] 22. The cost per phone is \$37.50. [4.2C]
 23. 1344 blocks would be needed. [4.3C] 24. The ratio is $\frac{5}{2}$. [4.1B] 25. The turkey costs \$.93/pound. [4.2C]
 26. The average was 56.8 miles/hour. [4.2C] 27. The cost is \$493.50. [4.3C] 28. The cost is \$44.75/share. [4.2C]
 29. 22.5 pounds of fertilizer will be used. [4.3C] 30. The ratio is $\frac{1}{2}$. [4.1B]

CHAPTER 4 TEST

1. \$3836.40/month [4.2B; Example 2] 2. $\frac{1}{6}$ 1:6 1 to 6 [4.1A; You Try It 1] 3. $\frac{9 \text{ supports}}{4 \text{ feet}}$ [4.2A; Example 1]
 4. Not true [4.3A; Example 2] 5. $\frac{3}{1}$ 3:1 3 to 1 [4.1A; Example 2] 6. 144 [4.3B; HOW TO 3]
 7. 30.5 miles/gallon [4.2B; Apply the Concept] 8. $\frac{1}{3}$ 1:3 1 to 3 [4.1A; You Try It 1] 9. True [4.3A; Example 1]
 10. 40.5 [4.3B; Example 3] 11. $\frac{3 \text{ feet}}{2 \text{ boards}}$ [4.2A; Example 1] 12. $\frac{3}{5}$ 3:5 3 to 5 [4.1A; You Try It 1]
 13. The dividend is \$625. [4.3C; Example 9] 14. The ratio is $\frac{1}{12}$. [4.1B; Example 3] 15. The plane's speed is
 538 miles/hour. [4.2C; Example 3] 16. The college student's body contains 132 pounds of water. [4.3C; Example 8]
 17. The cost of the lumber is \$1.73/foot. [4.2C; You Try It 3] 18. The amount of medication required is 0.875 ounce.
 [4.3C; Example 8] 19. The ratio is $\frac{4}{5}$. [4.1B; Example 4] 20. 36 defective hard drives are expected to be found in the
 production of 1200 hard drives. [4.3C; You Try It 9]

CUMULATIVE REVIEW EXERCISES

1. 9158 [1.3B] 2. $2^4 \cdot 3^3$ [1.6A] 3. 3 [1.6B] 4. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$ [1.7B] 5. 36 [2.1A] 6. 14 [2.1B]
 7. $\frac{5}{8}$ [2.3B] 8. $8\frac{3}{10}$ [2.4C] 9. $5\frac{11}{18}$ [2.5C] 10. $2\frac{5}{6}$ [2.6B] 11. $4\frac{2}{3}$ [2.7B] 12. $\frac{23}{30}$ [2.8B]
 13. Four and seven hundred nine ten-thousandths [3.1A] 14. 2.10 [3.1B] 15. 1.990 [3.5A] 16. $\frac{3}{50}$ [3.6B]
 17. $\frac{1}{8}$ [4.1A] 18. $\frac{29¢}{2 \text{ pencils}}$ [4.2A] 19. 33.4 miles/gallon [4.2B] 20. 4.25 [4.3B] 21. The car's speed is
 57.2 miles/hour. [4.2C] 22. 36 [4.3B] 23. Your new balance is \$744. [1.3C] 24. The monthly payment is \$570. [1.5D]
 25. 105 pages remain to be read. [2.6C] 26. The cost per acre was \$36,000. [2.7C] 27. The change was \$35.24. [3.3B]
 28. Your monthly salary is \$3468.25. [3.5B] 29. 25 inches will erode in 50 months. [4.3C] 30. 1.6 ounces are required. [4.3C]

Answers to Chapter 5 Selected Exercises**PREP TEST**

1. $\frac{19}{100}$ [2.6B] 2. 0.23 [3.4A] 3. 47 [3.4A] 4. 2850 [3.4A] 5. 4000 [3.5A] 6. 32 [2.7B] 7. 62.5 [3.6A]
 8. $66\frac{2}{3}$ [2.2B] 9. 1.75 [3.5A]

SECTION 5.1

1. 100 3. left 5. 0.72, $\frac{18}{25}$ 7. 0.23, $\frac{23}{100}$ 9. 0.36, $\frac{9}{25}$ 11. 0.59, $\frac{59}{100}$ 13. 0.41, $\frac{41}{100}$ 15. 0.254, $\frac{127}{500}$ 17. 0.579, $\frac{579}{1000}$
 19. 0.062, $\frac{31}{500}$ 21. 0.064, $\frac{8}{125}$ 23. 0.0025, $\frac{1}{400}$ 25. 0.0055, $\frac{11}{2000}$ 27. $\frac{2}{3}$ 29. $\frac{5}{6}$ 31. $\frac{1}{9}$ 33. $\frac{5}{11}$ 35. $\frac{3}{70}$ 37. $\frac{1}{15}$
 39. Greater than 41. 73% 43. 1% 45. 294% 47. 0.6% 49. 310.6% 51. 70% 53. 85% 55. 40% 57. 12.5%
 59. 150% 61. 225% 63. 87.5% 65. 48% 67. $44\frac{4}{9}\%$ 69. $166\frac{2}{3}\%$ 71. $38\frac{8}{9}\%$ 73. Less than 75. 6% of those surveyed named
 something other than corn on the cob, cole slaw, corn bread, or fries. 77. $\frac{53}{1000}$, 0.053 79. $\frac{3}{20}$, 0.15 81. 0.5% 83. 62.5%

SECTION 5.2

1. Percent \times base = amount 3. Greater than 5. 8 7. 10.8 9. 0.075 11. 80 13. 51.895 15. 7.5 17. 13 19. 3.75
 21. 20 23. 5% of 95 25. 79% of 16 27. Less than 29. The number of people in the United States aged 18 to 24 without life insurance is
 less than 50 million. 31. There will be 138.49 million more passengers. 33. The piece contains 29.25 grams of gold, 8.75 grams of silver, and
 12 grams of copper. 35. 99 million returns were filed electronically. 37. The total cost is \$30,952.16. The monthly payment is \$644.84.
 39. The withholding tax is \$0. 41. The withholding tax is \$577.72. 43. No

CHECK YOUR PROGRESS: CHAPTER 5

1. $0.85, \frac{17}{20}$ [5.1A] 2. $0.04, \frac{1}{25}$ [5.1A] 3. $0.0025, \frac{1}{400}$ [5.1A] 4. $1.80, 1\frac{4}{5}$ [5.1A] 5. 15% [5.1B] 6. 2.7% [5.1B]
 7. 145% [5.1B] 8. 0.125% [5.1B] 9. 60% [5.1B] 10. 42.5% [5.1B] 11. $41\frac{2}{3}\%$ [5.1B] 12. 170% [5.1B]
 13. 29.4 [5.2A] 14. 13.75 [5.2A] 15. 39.6 [5.2A] 16. 0.156 [5.2A] 17. The weekly pay increase was \$72.25. [5.2B]

SECTION 5.3

1. Greater than 3. Greater than 5. 32% 7. $16\frac{2}{3}\%$ 9. 200% 11. 37.5% 13. 18% 15. 0.25% 17. 20% 19. 400%
 21. 2.5% 23. 37.5% 25. 0.25% 27. 70% of couples disagree about financial matters. 29. Approximately 25.4% of the vegetables were wasted. 31. 27.1% of Americans with diabetes have not been diagnosed. 33. 98.5% of the slabs did meet safety requirements.
 35. 26.7% of the total is spent on veterinary care. 39. a. \$5 per share b. 20% c. 25% d. No

SECTION 5.4

1. Greater than 3. Less than 5. 75 7. 50 9. 100 11. 85 13. 1200 15. 19.2 17. 7.5 19. 32 21. 200 23. 9
 25. 504 27. 15.8 million travelers allowed their children to miss school to go on a trip. 29. 24,350 runners started the Boston Marathon in 2011. 31. A large cargo ship uses 300 tons of fuel per day. 33. a. 3000 boards were tested. b. 2976 of the boards tested were not defective.
 35. a. 80% b. 70% c. 75% d. 74%; no e. When both tests have the same number of points

SECTION 5.5

1. $\frac{\text{percent}}{100} = \frac{\text{amount}}{\text{base}}$ 3. percent 5. 65 7. 25% 9. 75 11. 12.5% 13. 400 15. 19.5 17. 14.8% 19. 62.62 21. 15
 23. a. ii and iii b. i and iv 25. The drug will be effective for 4.8 hours. 27. a. \$175 million is generated annually from sales of Thin Mints.
 b. \$63 million is generated annually from sales of Trefoil shortbread cookies. 29. 57.7% of baby boomers have attended college.
 31. The U.S. total turkey production was 7 billion pounds. 33. The 110th Senate had the larger percentage of Republicans. 35. The rose-gold ring contains 4.5 grams of gold, 1.2 grams of copper, and 0.3 gram of silver.

CHAPTER 5 REVIEW EXERCISES

1. 60 [5.2A] 2. 20% [5.3A] 3. 175% [5.1B] 4. 75 [5.4A] 5. $\frac{3}{25}$ [5.1A] 6. 19.36 [5.2A] 7. 150% [5.3A]
 8. 504 [5.4A] 9. 0.42 [5.1A] 10. 5.4 [5.2A] 11. 157.5 [5.4A] 12. 0.076 [5.1A] 13. 77.5 [5.2A] 14. $\frac{1}{6}$ [5.1A]
 15. 160% [5.5A] 16. 75 [5.5A] 17. 38% [5.1B] 18. 10.9 [5.4A] 19. 7.3% [5.3A] 20. 613.3% [5.3A]
 21. The student answered 85% of the questions correctly. [5.5B] 22. The company spent \$4500 on newspaper advertising. [5.2B]
 23. 34.3% of energy costs is spent on electricity. [5.3B] 24. The total cost of the camcorder was \$1041.25. [5.2B]
 25. Approximately 78.6% of the women wore sunscreen often. [5.3B] 26. The world's population in 2000 was approximately 6,100,000,000 people. [5.4B] 27. The cost of the computer system 4 years ago was \$3000. [5.5B] 28. The total cranberry crop that year was 572 million pounds. [5.3B/5.5B]

CHAPTER 5 TEST

1. 0.973 [5.1A; Example 1] 2. $\frac{5}{6}$ [5.1A; Example 2] 3. 30% [5.1B; Example 3] 4. 163% [5.1B; Example 3]
 5. 150% [5.1B; HOW TO 2] 6. 92.5% [5.1B; Example 4] 7. 50.05 [5.2A; Example 1] 8. 61.36 [5.2A; Example 1]
 9. $61\frac{1}{9}\%$ [5.1B; HOW TO 3] 10. $\frac{3}{400}$ [5.1A; Example 1C] 11. 80 [5.4A; Example 2] 12. 28.3 [5.4A; Example 2]
 13. 143.0 [5.5A; Example 1] 14. 1000% [5.5A; Example 1] 15. The amount spent for advertising is \$45,000. [5.2B; Example 3]
 16. 1170 pounds of vegetables were not spoiled. [5.2B; Example 4] 17. 14.7% of the daily recommended amount of potassium is provided. [5.3B; Example 4] 18. 9.1% of the daily recommended number of calories is provided. [5.3B; Example 4] 19. The number of temporary employees is 16% of the number of permanent employees. [5.3B; Example 4] 20. The student answered approximately 91.3% of the questions correctly. [5.3B; Example 5] 21. 32,000 digital cameras were tested. [5.4B; Example 4] 22. The increase was 60% of the original price. [5.3B; Example 5] 23. The dollar increase in the hourly wage is \$1.74. [5.5B; Example 3] 24. The population now is 220% of the population 10 years ago. [5.3B; Example 5/5.5B; Example 4] 25. The value of the car is \$25,000. [5.5B; Example 3]

CUMULATIVE REVIEW EXERCISES

1. 4 [1.6B] 2. 240 [2.1A] 3. $10\frac{11}{24}$ [2.4C] 4. $12\frac{41}{48}$ [2.5C] 5. $12\frac{4}{7}$ [2.6B] 6. $\frac{7}{24}$ [2.7B] 7. $\frac{4}{9}$ [2.8B] 8. $\frac{13}{36}$ [2.8B]
 9. 3.08 [3.1B] 10. 1.1196 [3.3A] 11. 34.2813 [3.5A] 12. 3.625 [3.6A] 13. $1\frac{3}{4}$ [3.6B] 14. $\frac{3}{8} < 0.87$ [3.6C]
 15. 53.3 [4.3B] 16. \$19.20/hour [4.2B] 17. $\frac{11}{60}$ [5.1A] 18. $72\frac{2}{9}\%$ [5.1B] 19. 19.56 [5.2A/5.5A] 20. $133\frac{1}{3}\%$ [5.3A/5.5A]
 21. 9.92 [5.4A/5.5A] 22. 342.9% [5.3A/5.5A] 23. Sergio's take-home pay is \$592. [2.6C] 24. The monthly payment is \$292.50. [3.5B] 25. 420 gallons were used during the month. [3.5B] 26. The real estate tax is \$10,000. [4.3C] 27. 7346 hotels are located along interstate highways. [5.2B/5.5B] 28. 45% of the people did not favor the candidate. [5.3B/5.5B] 29. The approximate average number of hours spent watching TV in a week is 61.3 hours. [5.2B/5.5B] 30. 18% of the children tested had levels of lead that exceeded federal standards. [5.3B/5.5B]

Answers to Chapter 6 Selected Exercises

PREP TEST

1. 0.75 [3.5A] 2. 52.05 [3.4A] 3. 504.51 [3.3A] 4. 9750 [3.4A] 5. 45 [3.4A] 6. 1417.24 [3.2A]
 7. 3.33 [3.5A] 8. 0.605 [3.5A] 9. $0.379 < 0.397$ [3.1C]

SECTION 6.1

3. The unit cost is \$.055 per ounce. 5. The unit cost is \$.374 per ounce. 7. The unit cost is \$.080 per tablet.
 9. The unit cost is \$6.975 per clamp. 11. The unit cost is \$.199 per ounce. 13. Divide the price of one pint by 2.
 15. The Kraft mayonnaise is the more economical purchase. 17. The Cortexx shampoo is the more economical purchase.
 19. The Ultra Mr. Clean is the more economical purchase. 21. The Bertolli olive oil is the more economical purchase.
 23. The Wagner's vanilla extract is the more economical purchase. 25. Increase 27. The total cost is \$73.50.
 29. The total cost is \$16.88. 31. The total cost is \$3.89. 33. The total cost is \$26.57. 35. Tea A is the more economical purchase.

SECTION 6.2

1. ii 5. The percent increase is 19.0%. 7. The percent increase was 276.6%. 9. The percent increase is 600%.
 11. The percent increase is 78.4%. 13. Yes 15. Use equation (3) and then equation (2). 17. The markup is \$17.10.
 19. The markup rate is 60%. 21. The selling price is \$304.50. 23. The selling price is \$74. 25. The percent decrease is 40%.
 27. The percent decrease was 15.1%. 29. The car loses \$8460 in value. 31. The new average monthly gasoline bill is \$140.80.
 33. The percent decrease was 19.6%. 35. Use equation (3) and then (2). 37. The discount rate is $33\frac{1}{3}\%$.
 39. The discount is \$80. 41. The discount rate is 30%. 43. The sale price is \$1.00 per pound. 45. The discount rate is 20%.
 47. The age group with the greatest percent increase was 62 years and older.

SECTION 6.3

1. Principal \times annual interest rate \times time (in years) = interest 3. a. \$10,000 b. \$850 c. 4.25% d. 2 years
 5. The simple interest owed is \$960. 7. The simple interest due is \$3375. 9. The simple interest due is \$1320.
 11. The simple interest due is \$84.76. 13. The maturity value is \$5120. 15. The total amount due on the loan is \$12,875.
 17. The maturity value is \$14,543.70. 19. The monthly payment is \$6187.50. 21. a. The interest charged is \$1080.
 b. The monthly payment is \$545. 23. The monthly payment is \$3039.02. 25. a. Student A's principal is equal to student B's principal.
 b. Student A's maturity value is greater than student B's maturity value. c. Student A's monthly payment is less than student B's monthly payment.
 27. The finance charge is \$6.85. 29. The finance charge is \$11.94. 31. The difference between the finance charges is \$3.44.
 33. The finance charges for the first and second months are the same. No, you will not be able to pay off the balance.
 35. The value of the investment after 20 years is \$7143.60. 37. The value of the investment after 5 years is \$28,352.60.
 39. a. The value of the investment after 10 years will be \$6040.86. b. The amount of interest earned will be \$3040.86.
 41. The amount of interest earned is \$505.94.

SECTION 6.4

1. Mortgage 3. The mortgage is \$172,450. 5. The down payment is \$212,500. 7. The loan origination fee is \$3750.
 9. The mortgage is \$315,000. 11. The mortgage is \$189,000. 13. iii 15. The monthly mortgage payment is \$644.79.
 17. No, the lawyer cannot afford the monthly mortgage payment. 19. a. The mortgage is \$250,000. b. The monthly mortgage payment is \$1304.13. 21. The monthly mortgage payment is \$1273.27. 23. The amount that goes to interest is \$3000. The amount that goes to the principal is \$865.10. 25. The couple can save \$63,408 in interest.

CHECK YOUR PROGRESS: CHAPTER 6

1. The unit cost is \$3.83. [6.1A] 2. The more economical purchase is 16 ounces for \$12.99. [6.1B] 3. The cost is \$44.55. [6.1C]
 4. The percent increase was 14.3%. [6.2A] 5. The selling price of the tire is \$315. [6.2B] 6. The percent decrease was 9.2%. [6.2C]
 7. The sale price is \$71.96. [6.2D] 8. The borrower will pay \$180 in interest. [6.3A] 9. The finance charge is \$6.57. [6.3B]
 10. The value after 10 years is \$4225.99. [6.3C] 11. The mortgage is \$188,800. [6.4A] 12. The monthly mortgage payment is \$1429.89. [6.4B]

SECTION 6.5

3. No, Amanda does not have enough money for the down payment. 5. The sales tax was \$1192.50. 7. The license fee is \$650.
 9. a. The sales tax is \$1120. b. The total cost of the sales tax and the license fee is \$1395. 11. The amount financed is \$12,150.
 13. The amount financed is \$36,000. 15. The expression represents the total cost of buying the car. 17. Use multiplication to find the cost.
 19. The monthly car payment is \$553.73. 21. The cost per mile is \$.51. 23. The monthly payment is \$674.89.
 25. Your cost per mile for gasoline was \$.18. 27. The car's value after 5 years will be \$15,973.85. The cost per mile for depreciation is \$.187.