

Ratio, Proportion, and Percent

BEFORE

In previous chapters you've...

- Found equivalent fractions
- Rewritten fractions and decimals

Now

In Chapter 7 you'll study...

- Finding ratios and unit rates
- Writing and solving proportions
- Solving percent problems
- Rewriting fractions, decimals, and percents
- Finding probabilities of events

WHY?

So you can solve real-world problems about...

- lightning, p. 318
- crocodiles, p. 329
- guitars, p. 342
- beaches, p. 347



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Chapter Warm-Up Games

Review skills you need for this chapter in these quick games.

START **Video Maze**

$72 \div x = 8$	$x - 6 = 9$	$21 + x = 24$	$21 \div x = 3$
$x + 7 = 11$	$x \div 4 = 3$	$x - 1 = 3$	$7x = 7$
$8x = 24$	$x + 10 = 14$	$2 + x = 21$	$9 - x = 8$
$15 - x = 12$	$5x = 35$	$x + 14 = 18$	$64 \div x = 8$
$x \div 6 = 5$	$x - 9 = 17$	$3x = 27$	$x + 8 = 19$
$33 \div x = 3$	$11x = 55$	$10 - x = 6$	$2x = 14$
$5 + x = 13$	$42 \div x = 7$	$6x = 24$	$14 - x = 8$

FINISH

**BRAIN
GAME**

Key Skill:
Solving equations

Find a path through the maze from start to finish.

- Then find the sum of all the solutions of the equations to find your total number of points.
- Which path has the least number of points?

Bouncing Basketballs

How high a ball bounces is affected by how bouncy the ball is. For example, a fully inflated basketball bounces higher than a partially inflated one, if both balls hit the ground with the same energy. The fully inflated ball is more bouncy.

You can express the bounciness of a ball by finding the ratio of the bounce height to the drop height. Height is measured from the bottom of the ball to the ground. A standard basketball inflated for game play has a bounciness ratio of about 0.6.

$$\frac{\text{Bounce height (in meters)}}{\text{Drop height (in meters)}} \approx 0.6$$

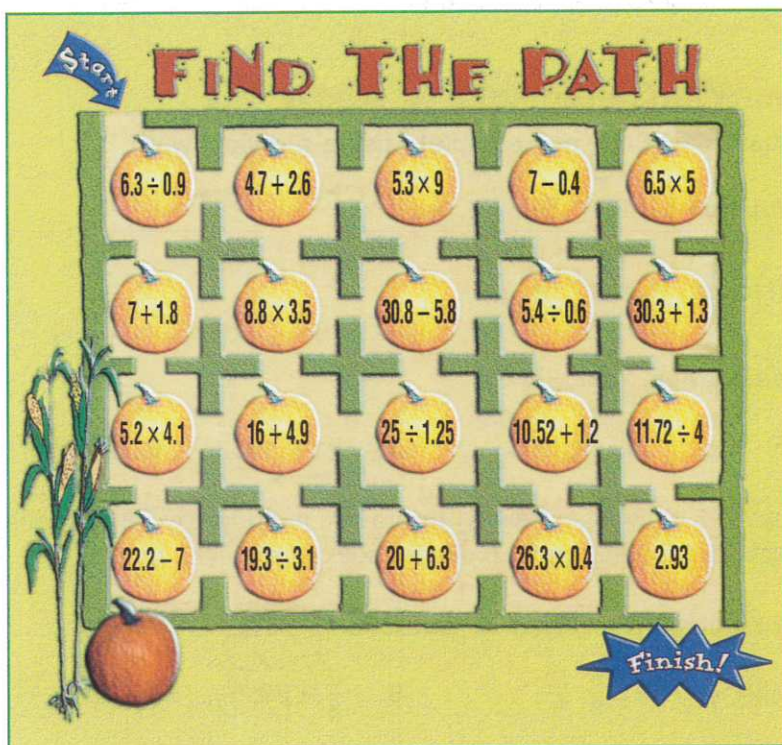
A ball's bounce height is the height of the first bounce.

6. You drop a standard basketball 3 meters. About how high will it bounce on its first bounce?
7. You drop a standard basketball. It bounces to a height of 2 meters on its first bounce. From about what height was it dropped?
8. **Critical Thinking** A ball drops 1.5 meters. It bounces 0.6 meters. Is this ball more or less bouncy than a standard basketball? Explain.
9. **Challenge** You drop a standard basketball 6 meters. Explain how to use the bounciness ratio to find how high the ball bounces on its second bounce. Then find the height of the second bounce.

Project IDEAS

- **Experiment** Design and carry out an experiment to compare the bounciness of several types of ball. Describe your experiment and present your results.
- **Report** A given ball may be designed to perform well during the play of the game in which it is commonly used. Choose a sport and find information on the design of the balls and other equipment used in the sport. Present your findings to the class.
- **Research** The unit of energy called the Joule was named after the scientist James Prescott Joule. Find out more about James Prescott Joule and his work. Present your findings to the class.
- **Career** A variety of professionals do scientific research to study how athletes can improve performance and avoid injury. Investigate some of these careers and present your findings to the class.





Key Skill:
Performing operations on
decimals

Find your way from start to finish in the maze above.

- Evaluate each expression. Then move to the nearest expression that begins with the number that is the value of the previous expression.
- For example, if you start from $5.3 + 4.2$ and your choices are $1.4 + 7.2$ and $9.5 - 8$, you would move to $9.5 - 8$ because $5.3 + 4.2 = 9.5$.



Stop and Think



1. **Writing** A student says that a decimal divided by a decimal is never a whole number. Explain the error in the student's reasoning.
2. **Critical Thinking** How many different paths are there through the Video Maze that do not cover the same ground more than once?

CHAPTER 7

Getting Ready to Learn

Word Watch

Review Words

data, p. 5
equation, p. 28
formula, p. 33
simplest form, p. 179
equivalent fractions, p. 179

Review What You Need to Know



Using Vocabulary Copy and complete using a review word.

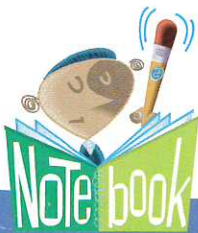
- The fraction $\frac{1}{2}$ is in ?, but $\frac{2}{4}$ is not.
- The fractions $\frac{2}{3}$ and $\frac{4}{6}$ are ?.

Solve the equation. (p. 113)

- $\frac{x}{7} = 3$
- $\frac{x}{-2} = 4$
- $-9x = 108$
- $8x = 56$
- You have 15 pairs of socks in your drawer, including exactly 6 pairs of black socks. What fraction of your socks are black? (p. 179)

Order the numbers from least to greatest. (p. 242)

- 0, -0.25, $\frac{1}{3}$, -1.11, $\frac{9}{8}$, $\frac{12}{9}$
- $-\frac{7}{8}$, 1.28, $\frac{1}{12}$, -0.02, 0.34, $\frac{10}{3}$



You should include material that appears on a notebook like this in your own notes.

Know How to Take Notes

Taking Notes in Class When your teacher answers your question in class, include the answer in your notes.

Writing Decimals as Fractions

$$0.007 = \frac{7}{1000}$$

0.007 has **3** decimal places.

1000 has **3** zeros.

$$0.13 = \frac{13}{100}$$

0.13 has **2** decimal places.

100 has **2** zeros.

Number of decimal places equals number of zeros!

As you work on solving proportions in Chapter 7, be sure to ask questions about things you don't understand and write the answers in your notes.

LESSON 7.1

Ratios and Rates

BEFORE

Now

WHY?

You found equivalent fractions.

You'll find ratios and unit rates.

So you can tell whether a TV has a wide screen, as in Ex. 22.

Word Watch

ratio, p. 317
equivalent ratios, p. 317
rate, p. 318
unit rate, p. 318

Activity

You can compare side lengths and perimeters of squares.

- Copy and complete the table using the squares shown. Write the relationship between the side length and the perimeter of each square as a fraction in simplest form.
- What do you notice about the fractions in the table?
- Describe the relationship between the side length and the perimeter of a square with side length s .



Side length	2	4	5
Perimeter	?	?	?
Side length Perimeter	?	?	?

In the activity, you used a *ratio* to reach a conclusion about the relationship between the side length and the perimeter of a square. A **ratio** uses division to compare two numbers. You can write the ratio of a to b ($b \neq 0$) in three ways.

$$\frac{a}{b} \quad a : b \quad a \text{ to } b$$

Ratios that have the same value are called **equivalent ratios**.

EXAMPLE 1 Writing a Ratio

Skiing A ski resort has 15 easy, 25 intermediate, 7 difficult, and 11 expert-only trails. Write the ratio intermediate trails : easy trails in three ways.

$$\frac{\text{intermediate trails}}{\text{easy trails}} = \frac{25}{15} = \frac{5}{3} \quad \text{Write as a fraction and simplify.}$$

ANSWER The ratio can be written as $\frac{5}{3}$, $5 : 3$, or 5 to 3 .

Your turn now

Use the information in Example 1 to write the ratio as a fraction in simplest form and two other ways.

- easy trails to difficult trails
- expert-only trails to easy trails



Rates A **rate** is a ratio of two quantities that have *different* units. Two rates are equivalent if they have the same value.



EXAMPLE 2 Finding an Equivalent Rate

Weather Lightning strikes about 100 times per second around the world. About how many times does lightning strike per minute around the world?

Solution

Use the fact that $60 \text{ sec} = 1 \text{ min}$. So, $\frac{60 \text{ sec}}{1 \text{ min}}$ is equivalent to 1.

$$\begin{aligned} \frac{100 \text{ times}}{1 \text{ sec}} &= \frac{100 \text{ times}}{1 \text{ sec}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \\ &= \frac{6000 \text{ times}}{1 \text{ min}} \end{aligned}$$

Multiply by a fraction that is equivalent to 1.

Simplify.

ANSWER Lightning strikes about 6000 times per minute around the world.

Unit Rates A **unit rate** is a rate that has a denominator of 1 unit. To write a unit rate, find an equivalent rate with a denominator of 1 unit.



For help with equivalent fractions, see p. 179.

EXAMPLE 3 Finding a Unit Rate

Write -24 feet per 5 seconds as a unit rate.

$$\begin{aligned} \frac{-24 \text{ ft}}{5 \text{ sec}} &= \frac{-24 \div 5}{5 \div 5} \\ &= \frac{-4.8}{1} \end{aligned}$$

Divide numerator and denominator by 5 to get a denominator of 1 unit.

Simplify.

ANSWER The unit rate is -4.8 feet per second.

✓ **Check** Round -4.8 ft/sec to -5 ft/sec . The product $-5 \cdot 5 = -25$, which is about -24 , so your answer is reasonable.

Your turn now Write your answer as a rate.

3. A water pump moves 2 gallons of water per second. How many gallons of water are pumped per minute?

Write the rate as a unit rate.

4. $\frac{114 \text{ points}}{6 \text{ games}}$

5. $\frac{365 \text{ people}}{5 \text{ months}}$

6. $\frac{329 \text{ miles}}{10 \text{ gallons}}$

7. $\frac{-49 \text{ m}}{14 \text{ sec}}$

HELP

with Homework

Example Exercises

- 1 10-17, 27-28
2 18-21
3 23-26

Online Resources
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Getting Ready to Practice

1. **Vocabulary** Copy and complete: Three gallons to \$4.50 and five gallons to \$7.50 are equivalent ?.

Write the ratio as a fraction in simplest form and two other ways.

2. $\frac{12}{36}$

3. $\frac{15}{10}$

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

Tell whether the ratios are equivalent.

5. $\frac{5}{2}$ and $\frac{20}{8}$

6. 12 to 3 and 6 to 2

7. 6 : 18 and 10 : 30

8. **Wages** You are paid \$47.25 for working 7 hours. How much are you paid per hour?

9. **Find the Error** Describe and correct the error in the solution.

Find an equivalent rate of 14 times a day.

$$\times \frac{14 \text{ times}}{\text{day}} \cdot \frac{1 \text{ week}}{7 \text{ days}} = \frac{2 \text{ times}}{\text{week}}$$

Practice and Problem Solving

Write the ratio as a fraction in simplest form and two other ways.

10. $\frac{33}{22}$

11. $\frac{20}{25}$

12. $-8 : 6$

13. 35 to 49

14. 51 to 17

15. 26 : 39

16. $\frac{27}{42}$

17. $\frac{-12}{4}$

Measurement Write the equivalent rate.

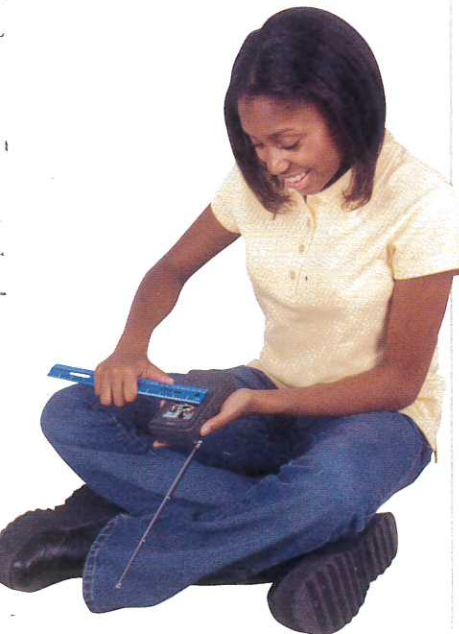
18. $\frac{60 \text{ miles}}{\text{hour}} = \frac{? \text{ miles}}{\text{minute}}$

19. $\frac{32 \text{ ounces}}{\text{serving}} = \frac{? \text{ pounds}}{\text{serving}}$

20. $\frac{105 \text{ min}}{\text{game}} = \frac{? \text{ h}}{\text{game}}$

21. $\frac{\$1.44}{\text{ft}} = \frac{\$?}{\text{yd}}$

22. **Television** The aspect ratio of a TV screen is the ratio of its length to its width. The aspect ratio of a *standard* TV screen is 4 : 3. The aspect ratio of a *wide screen* TV in the United States is 16 : 9. Describe how you would tell whether a TV has a standard or wide screen given the length and width of the screen.





Write the rate as a unit rate.

23. $\frac{24 \text{ adults}}{6 \text{ cars}}$

24. $\frac{-34 \text{ meters}}{8 \text{ seconds}}$

25. $\frac{3 \text{ pounds}}{\$2}$

26. $\frac{610 \text{ rotations}}{5 \text{ minutes}}$

Write the ratio of shaded to unshaded squares.



Find the value of the variable that makes the ratios equivalent.

29. $\frac{x}{8} = \frac{4}{16}$

30. $\frac{9}{c} = \frac{27}{30}$

31. $\frac{6}{10} = \frac{15}{n}$

32. $\frac{2}{12} = \frac{z}{18}$

33. **Writing** About one out of every ten people is left-handed. How many people in your math class would you predict to be left-handed? Explain.
34. **Running Speed** At top speed, a greyhound can run 330 feet in 5 seconds, a roadrunner can run 75 feet in 3 seconds, and a cheetah can run 198 feet in 2 seconds. Write each speed as a unit rate. Which animal is the fastest? Which animal is the slowest?
35. **Population Density** New Jersey's population in 2000 was about 8,414,000. New Jersey's area is 7417 square miles. What was the population per square mile, or *population density*, in New Jersey in 2000? Round to the nearest whole number.
36. **Challenge** You can buy your favorite crackers in a 10 ounce box or a 1 pound box. The 10 ounce box costs \$2.69 and the 1 pound box costs \$3.28. Which is the better buy? Explain.

Mixed Review

37. Find the radius of a circle with a circumference of 39.25 feet. Use 3.14 for π . (Lesson 6.4)
38. Solve the inequality $10y + 4 < 24$ and graph the solution. (Lesson 6.5)

Basic Skills Solve the equation.

39. $3c = 18$

40. $9x = -81$

41. $\frac{v}{4} = -2$

42. $\frac{n}{10} = 8$

Test-Taking Practice

43. **Multiple Choice** Which rate is equivalent to 232 miles per 4 hours?
- A. $\frac{58 \text{ mi}}{4 \text{ h}}$ B. $\frac{174 \text{ mi}}{3 \text{ h}}$ C. $\frac{232 \text{ mi}}{3 \text{ h}}$ D. $\frac{116 \text{ mi}}{1 \text{ h}}$
44. **Short Response** Emily runs 1600 meters in 5 minutes 30 seconds, and Megan runs 800 meters in 2 minutes 40 seconds. Who has the faster average speed? Explain your reasoning.

GOAL

Make scale drawings.

MATERIALS

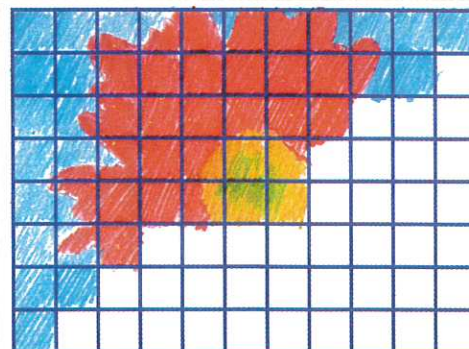
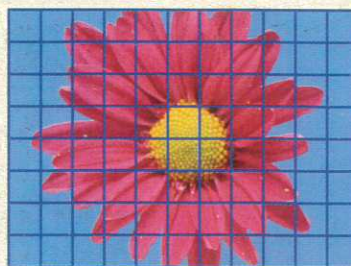
- ruler
- colored pencils
- grid paper
- magazine

Making a Scale Drawing

A *scale drawing* of an object preserves ratios of lengths but is either smaller or larger than the original object.

Explore**Make an enlarged drawing of the picture.**

- 1 Draw a grid on the original picture.
- 2 On your grid paper, draw a rectangle that is the same number of units long and wide as the picture you want to enlarge. These unit squares should be bigger than the grid squares on the original picture.
- 3 Starting in a corner, copy the image that appears in the corresponding corner of the original onto your grid paper. Continue copying the image one block at a time until you have drawn the entire picture.
- 4 The *scale* of the drawing is the ratio of corresponding measurements of the copy to the original. Measure the width of the copy and of the original. What is the scale of your drawing?

**Your turn now**

1. Cut out a picture from a magazine and create an enlarged scale drawing of it. Measure the original picture and the enlarged drawing to determine the scale.
2. Is the ratio of the area of a unit square in the copy to the area of a unit square in the original the same as the ratio of their sides? Explain.

Stop and Think

3. **Critical Thinking** What would happen if different scales were used in the same drawing?

LESSON 7.2

Writing and Solving Proportions

BEFORE

You wrote ratios.

Now

You'll write and solve proportions.

WHY?

So you can find the dimensions of a model car, as in Ex. 35.

Word Watch

proportion, p. 322
cross products, p. 323
scale model, p. 324
scale, p. 324

In the Real World

Rhinoceros Beetles An adult rhinoceros beetle weighs only 0.525 ounce but can carry about 446.25 ounces on its back. If a person were as strong as a rhinoceros beetle, how much weight could a 100 pound person carry?

A **proportion** is an equation that states that two ratios are equivalent.

$$\frac{a}{b} = \frac{c}{d}, b \neq 0, d \neq 0$$

The proportion above is read “ a is to b as c is to d .”



EXAMPLE 1 Writing and Solving a Proportion

To answer the question about strength above, write and solve a proportion.

	Beetle	Person
Carries	446.25	x
Weighs	0.525	100

Use a table to set up a proportion.

$$\frac{446.25}{0.525} = \frac{x}{100}$$

Write a proportion.

$$\frac{446.25}{0.525} \cdot 100 = \frac{x}{100} \cdot 100$$

Multiply each side by 100.

$$85,000 = x$$

Simplify.

ANSWER If human strength were proportional to that of a rhinoceros beetle, a 100 pound person could carry 85,000 pounds.

HELP with Solving

In Example 1, the ratios in the proportion use the following units:

$\frac{\text{ounces}}{\text{ounces}}$ and $\frac{\text{pounds}}{\text{pounds}}$

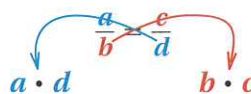
Your turn now Solve the proportion.

1. $\frac{n}{12} = \frac{3}{4}$

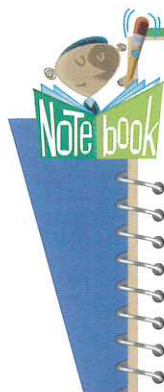
2. $\frac{50}{20} = \frac{z}{16}$

3. $\frac{250}{30} = \frac{t}{51}$

Cross Products The proportion $\frac{a}{b} = \frac{c}{d}$ has **cross products** ad and bc .



You can use cross products to solve a proportion. You can also use cross products to check whether two ratios form a proportion.



Cross Products Property

Words The cross products of a proportion are equal.

Algebra If $\frac{a}{b} = \frac{c}{d}$, where b and d are nonzero numbers, then $ad = bc$.

Numbers Because $\frac{3}{4} = \frac{9}{12}$, you know that $3 \cdot 12 = 4 \cdot 9$.

EXAMPLE 2 Using the Cross Products Property

$$\frac{6.8}{15.4} = \frac{40.8}{m}$$

Original proportion

$$6.8 \cdot m = 15.4 \cdot 40.8$$

Cross products property

$$6.8m = 628.32$$

Multiply.

$$\frac{6.8m}{6.8} = \frac{628.32}{6.8}$$

Divide each side by 6.8.

$$m = 92.4$$

Simplify.

✓ **Check** You can check your solution by finding the cross products of the proportion. If the cross products are equal, the solution is correct.

$$\frac{6.8}{15.4} \stackrel{?}{=} \frac{40.8}{92.4}$$

Substitute 92.4 for m in original proportion.

$$6.8 \cdot 92.4 \stackrel{?}{=} 15.4 \cdot 40.8$$

$$628.32 = 628.32 \quad \checkmark$$

Your turn now Solve the proportion. Then check your solution.

4. $\frac{6}{c} = \frac{54}{99}$

5. $\frac{n}{14} = \frac{63}{98}$

6. $\frac{2.1}{0.9} = \frac{27.3}{y}$

What do you think?

Art



■ Sculpture

How many inches tall is the giant strawberry? Write the scale of the strawberry sculpture without units.

Scale The dimensions of a **scale model** are proportional to the dimensions of the actual object. The **scale** gives the relationship between the model's dimensions and the actual object's dimensions. A scale can be written as a ratio with or without units. For example, the scale 1 in. : 3 ft can also be written as 1 : 36.

EXAMPLE 3 Using a Scale

Sculpture Strawberry Point, Iowa, has a strawberry sculpture that is 15 feet tall. If the scale of this model is 10 feet to 1 inch, how tall was the original strawberry?

Solution

$$\text{Scale} = \frac{\text{Height of strawberry model}}{\text{Height of original strawberry}}$$

Write a verbal model.

$$\frac{10 \text{ ft}}{1 \text{ in.}} = \frac{15 \text{ ft}}{h \text{ in.}}$$

Write a proportion.

$$10h = 15$$

Cross products property

$$h = 1.5$$

Divide each side by 10.

ANSWER The height of the original strawberry was 1.5 inches.

7.2

Exercises

More Practice, p. 733

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Getting Ready to Practice

- Vocabulary** Describe how to use cross products to solve a proportion.

Solve the proportion. Then check your solution.

$$2. \frac{1}{2} = \frac{x}{6}$$

$$3. \frac{2}{3} = \frac{4}{z}$$

$$4. \frac{6}{a} = \frac{3}{1}$$

$$5. \frac{c}{10} = \frac{3}{5}$$

- Find the Error** Describe and correct the error in solving the proportion.

- Cars** A car moving at a constant speed travels 88 feet in 2 seconds. Use a proportion to find how many feet it travels in one minute.

$$\frac{3}{9} = \frac{12}{m}$$

✗

$$9m = 3 \cdot 12$$

$$9m = 36$$

$$m = 4$$

**Example Exercises**

- | | |
|---|-------------|
| 1 | 12-19 |
| 2 | 8-19, 25-27 |
| 3 | 20-23 |

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Practice and Problem Solving

Decide Tell whether the ratios form a proportion.

8. $\frac{3}{4} \stackrel{?}{=} \frac{6}{8}$

9. $\frac{1}{2} \stackrel{?}{=} \frac{2}{5}$

10. $\frac{14}{21} \stackrel{?}{=} \frac{21}{35}$

11. $\frac{15}{45} \stackrel{?}{=} \frac{45}{135}$

Solve the proportion.

12. $\frac{3}{8} = \frac{x}{32}$

13. $\frac{4}{c} = \frac{20}{45}$

14. $\frac{39}{13} = \frac{9}{d}$

15. $\frac{68}{12} = \frac{51}{p}$

16. $\frac{67.2}{g} = \frac{16.8}{3.3}$

17. $\frac{t}{29.4} = \frac{5.5}{4.2}$

18. $\frac{f}{5.4} = \frac{483}{18.9}$

19. $\frac{712}{8.8} = \frac{x}{18.7}$

Scale Models You use a scale of 1 inch to 20 feet to make scale models of buildings. A building's actual height is given. Find the model's height.

20. $h = 100$ ft

21. $h = 240$ ft

22. $h = 316$ ft

23. $h = 545$ ft

24. **Mental Math** Explain how you can use equivalent fractions and mental math to solve $\frac{5}{x} = \frac{10}{16}$.25. **Earnings** You earn \$54 mowing 3 lawns. You charge the same amount for each lawn. How much would you earn if you mowed 5 lawns?**Extended Problem Solving** To produce one pound of honey, the bees from a hive fly over 55,000 miles and visit about 2 million flowers.

26. About how many flowers are visited to make 10 ounces of honey?

27. About how many miles do the bees fly to make 10 ounces of honey?

28. **Explain** What is the mean number of flowers visited per mile traveled? Explain your reasoning.**EXAMPLE Finding the Value of x**

$$\frac{30}{2+x} = \frac{6}{7}$$

Original proportion

$$7 \cdot 30 = 6(2+x)$$

Cross products property

$$210 = 12 + 6x$$

Multiply and use distributive property.

$$33 = x$$

Solve the two-step equation for x.**In Exercises 29–31, find the value of x.**

29. $\frac{2}{x+2} = \frac{18}{27}$

30. $\frac{x-2}{8} = \frac{30}{40}$

31. $\frac{9}{5} = \frac{36}{x-3}$



Challenge Find the value of each variable.

32. $\frac{4}{12} = \frac{3}{x} = \frac{y}{21}$

33. $\frac{7}{12} = \frac{a}{72} = \frac{28}{b}$

34. $\frac{8}{5} = \frac{n}{7} = \frac{21}{p}$

35. **Model Car** A toy manufacturer plans to make a model version of a car using a scale of 1 inch to 43 inches. The actual vehicle is 215 inches long, 75.25 inches wide, and 53.75 inches high. Find the length, width, and height of the model car.

Mixed Review

36. Write and solve an inequality for the sentence: *Four less than nine times a number is at most 95.* (Lesson 6.6)

Write the rate as a unit rate. (Lesson 7.1)

37. $\frac{42 \text{ people}}{14 \text{ taxis}}$

38. $\frac{258 \text{ miles}}{6 \text{ hours}}$

39. $\frac{36 \text{ dogs}}{18 \text{ households}}$

Test-Taking Practice

40. **Multiple Choice** Solve $\frac{12}{15} = \frac{x}{25}$.

A. 31

B. 21

C. 20

D. 4

41. **Multiple Choice** The scale on a map is $\frac{1}{4}$ inch : 20 miles. The distance from Montgomery, Alabama, to Atlanta, Georgia, is about 2 inches on the map. About how far is it from Montgomery to Atlanta?

F. 20 miles

G. 80 miles

H. 160 miles

I. 200 miles



Balancing Act

The middle person below is holding the same weight on both trays. What shapes do you need to add to the other people's trays to balance the weights they are holding?



LESSON 7.3

Solving Percent Problems

BEFORE

You solved proportions.

Now

You'll solve percent problems using proportions.

WHY?

So you can find the length of a crocodile, as in Ex. 19.

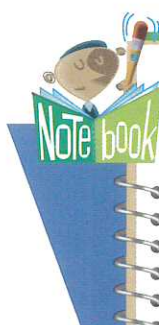
Word Watch

percent, p. 327

In the Real World

Environment A service club is planting seedlings as part of an erosion prevention project. Out of 240 newly planted seedlings, 15 are laurel sumac. What *percent* of the seedlings are laurel sumac?

The word *percent* means “per hundred.” A **percent** is a ratio whose denominator is 100. The symbol for percent is %.



Solving Percent Problems

To represent “ a is p percent of b ,” use the proportion

$$\frac{a}{b} = \frac{p}{100}$$

where a is part of the base b and $p\%$, or $\frac{p}{100}$, is the percent.

EXAMPLE 1 Finding a Percent

To find the percent of seedlings that are laurel sumac as described above, use a percent proportion.

$$\frac{a}{b} = \frac{p}{100}$$

Write a percent proportion.

$$\frac{15}{240} = \frac{p}{100}$$

Substitute 15 for a and 240 for b .

$$\frac{15}{240} \cdot 100 = \frac{p}{100} \cdot 100$$

Multiply each side by 100.

$$6.25 = p$$

Simplify.

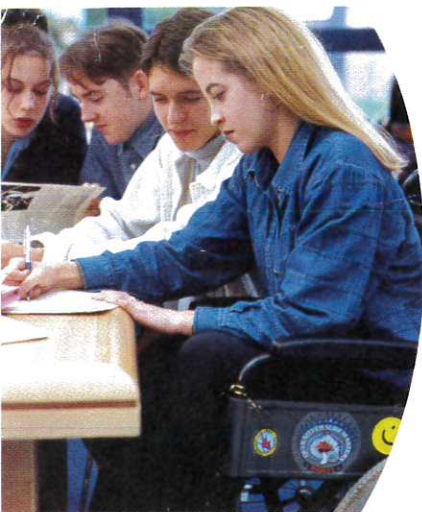
ANSWER Of the seedlings, 6.25% are laurel sumac.

Your turn now Use a percent proportion.

1. 126 is what percent of 150?

2. 84 is what percent of 70?





EXAMPLE 2 Finding Part of a Base

School Newspaper Your school newspaper's budget this year is 160% of last year's budget, which was \$2125. What is this year's budget?

Solution

$$\frac{a}{b} = \frac{p}{100}$$

Write a percent proportion.

$$\frac{a}{2125} = \frac{160}{100}$$

Substitute 2125 for b and 160 for p .

$$\frac{a}{2125} \cdot 2125 = \frac{160}{100} \cdot 2125$$

Multiply each side by 2125.

$$a = 3400$$

Simplify.

ANSWER This year's budget is \$3400.



HELP

with Notetaking

In your notes, you may want to include each step of the process of solving a percent proportion.

EXAMPLE 3 Finding a Base

Find the number of which 24 is 0.8%.

$$\frac{a}{b} = \frac{p}{100}$$

Write a percent proportion.

$$\frac{24}{b} = \frac{0.8}{100}$$

Substitute 24 for a and 0.8 for p .

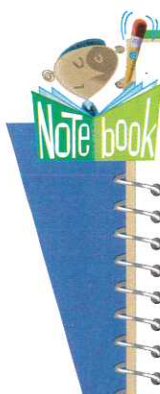
$$24 \cdot 100 = b \cdot 0.8$$

Cross products property

$$3000 = b$$

Divide each side by 0.8 and simplify.

ANSWER The number of which 24 is 0.8% is 3000.



Summary of Percent Problems

Question	Method	Proportion
a is what percent of b ?	Solve for p .	$\frac{a}{b} = \frac{p}{100}$
What number is $p\%$ of b ?	Solve for a .	$\frac{a}{b} = \frac{p}{100}$
a is $p\%$ of what number?	Solve for b .	$\frac{a}{b} = \frac{p}{100}$

Your turn now Use a percent proportion.

3. What number is 0.5% of 65?

4. 260 is 325% of what number?



Getting Ready to Practice

1. **Vocabulary** Copy and complete: Another way to say 25 songs of 100 is to say 25 $\frac{?}{?}$ of the songs.

Use a percent proportion.

2. 6 is what percent of 75? 3. 27 is what percent of 108?
 4. What number is 45% of 246? 5. 209 is 38% of what number?
 6. **Guided Problem Solving** You ask 356 people if they enjoy drawing. Of these people, 89 say they do like to draw. What percent of the people surveyed like to draw?

- (1) Write a percent proportion.
 (2) Substitute the known values for the variables.
 (3) Solve the proportion.

Practice and Problem Solving

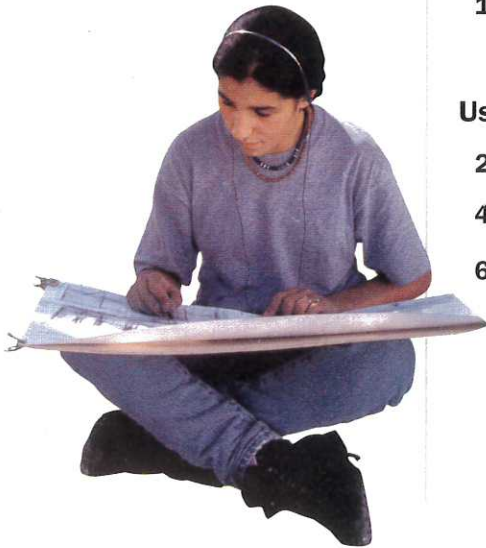
In Exercises 7–18, use a percent proportion.

7. 5 is what percent of 125? 8. 39 is what percent of 50?
 9. 756 is what percent of 840? 10. 111 is what percent of 740?
 11. What number is 45% of 245? 12. What number is 30% of 120?
 13. What number is 76% of 775? 14. What number is 66% of 95?
 15. 179.2 is 32% of what number? 16. 16.1 is 35% of what number?
 17. 481 is 52% of what number? 18. 351 is 78% of what number?

19. **Reptiles** The largest crocodiles alive today are 24 feet in length. Recently, researchers discovered bones of an ancient crocodile. It was 167% as long as today's crocodiles. How long was the ancient crocodile?
 20. **Water** A child's body is approximately 75% water. About how many pounds of a 60 pound child's weight is water?

In Exercises 21–26, use a percent proportion.

21. 567 is what percent of 420? 22. 1.26 is what percent of 42?
 23. What number is 520% of 550? 24. What number is 0.36% of 675?
 25. 918 is 170% of what number? 26. 79 is 0.01% of what number?



HELP

with Homework

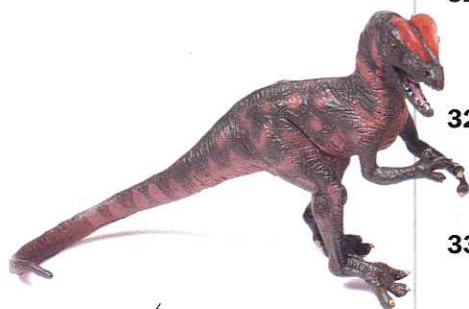
Example Exercises

- 1 7-18, 21-26
 2 7-26
 3 7-18, 21-26



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27. **Number Sense** One day, 32 of 80 people wear a red shirt to school. What percent of the 80 people did *not* wear a red shirt to school?
28. **Critical Thinking** Explain how to find 10% of 400 without writing a proportion.

Write and solve the percent problem in terms of y .

29. What number is 50% of $8y$? 30. $3y$ is 60% of what number?
31. **Weekends** There are about 52 weeks in a year and two weekend days each week. About what percent of the year falls on a weekend? Round your answer to the nearest tenth of a percent.
32. **Dilophosaurus** You buy your little brother a scale model of a Dilophosaurus. The scale of the model is 1 inch to 3 feet 4 inches. Use the scale to find what percent the model's height is of the actual height.
33. **Challenge** You use a photocopier to reduce an 8 inch by 10 inch photograph. When you press the reduction button, it reduces the length and width by the same percent. What is the new area if you reduce the photograph to 64% of its original size and then reduce the result to 78% of its size? What is the new area if you reduce to 78% first and then to 64%? Compare the two values.
34. **Marathon** Of the 23,513 people who entered the Honolulu Marathon one year, 19,236 finished. What percent of the runners finished? Round your answer to the nearest tenth of a percent.

Mixed Review

Write the decimal as a fraction or mixed number. (Lesson 5.5)

35. 1.86 36. 8.714 37. 0.624

Find the product or quotient. (Lesson 5.7)

38. 0.023×8.45 39. 47.1×0.96 40. $11.48 \div 8.2$

Test-Taking Practice

41. **Multiple Choice** You decide to save 20% of all the money that you earn. One month you earn \$90. How much do you save?
- A. \$18 B. \$20 C. \$22 D. \$70
42. **Short Response** You read in your school newspaper that 560 of the students at your school belong to a school club, and 875 students attend your school. Write a proportion to determine the percent of students in your school who belong to a club. Solve the proportion.

LESSON 7.4

Fractions, Decimals, and Percents

BEFORE

You wrote fractions as decimals and decimals as fractions.

Now

You'll rewrite fractions, decimals, and percents.

WHY?

So you can express circle graph sectors as percents, as in Ex. 46.

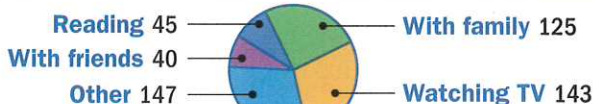
Word Watch

circle graph, p. 331

In the Real World

Survey The *circle graph* below shows the results of a survey of how 500 students prefer to spend time. What percent of students prefer to spend time with friends?

How Do You Prefer To Spend Your Time?



A **circle graph** represents data as parts of a circle. Each part is a percent of the data. The sum of the percents must equal 100% because the circle graph represents all of the data. Each part is also a fraction of the data. The sum of the fractions must equal 1.

EXAMPLE 1 Writing a Fraction as a Percent

The fraction of students who prefer to spend time with friends is $\frac{40}{500}$. To write this fraction as a percent, write a percent proportion and solve for p .

$$\frac{40}{500} = \frac{p}{100}$$

Write a percent proportion.

$$\frac{40}{500} \cdot 100 = \frac{p}{100} \cdot 100$$

Multiply each side by 100.

$$8 = p$$

Simplify.

ANSWER 8% of the students prefer to spend time with friends.

Your turn now Write the fraction as a percent.

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

2. $\frac{27}{50}$

3. $\frac{1}{20}$

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

To write a decimal as a percent, write the decimal as a fraction with a denominator of 100. The numerator is the percent. For example:

$$0.89 = \frac{89}{100} = 89\%$$

So, $0.89 = 89\%$. Notice that 0.89 can be written as a percent by moving the decimal point two places to the right and adding a percent sign.

HELP with Solving

Make sure you move the decimal point two places to the right. Add a zero on the right if necessary, as in part (b) of Example 2.

EXAMPLE 2 Writing Decimals as Percents

Write the decimal as a percent.

$$\begin{aligned} \text{a. } 0.63 &= 0.63 \\ &= 63\% \end{aligned}$$

$$\begin{aligned} \text{b. } 2.7 &= 2.70 \\ &= 270\% \end{aligned}$$

$$\begin{aligned} \text{c. } 0.007 &= 0.007 \\ &= 0.7\% \end{aligned}$$

To write a percent as a decimal, remove the % sign and move the decimal point two places to the left. To write a percent as a fraction, write $n\%$ as $\frac{n}{100}$ and simplify.

EXAMPLE 3 Writing Percents as Decimals and Fractions

Write the percent as a decimal and as a fraction.

$$\begin{aligned} \text{As a decimal} \\ \text{a. } 0.32\% &= 00.32\% \\ &= 0.0032 \end{aligned}$$

$$\begin{aligned} \text{b. } 120\% &= 120\% \\ &= 1.2 \end{aligned}$$

$$\begin{aligned} \text{c. } 2.5\% &= 02.5\% \\ &= 0.025 \end{aligned}$$

$$\begin{aligned} \text{As a fraction} \\ 0.32\% &= \frac{0.32}{100} \\ &= \frac{32}{10,000} = \frac{2}{625} \end{aligned}$$

$$\begin{aligned} 120\% &= \frac{120}{100} \\ &= \frac{6}{5} = 1\frac{1}{5} \end{aligned}$$

$$\begin{aligned} 2.5\% &= \frac{2.5}{100} \\ &= \frac{25}{1000} = \frac{1}{40} \end{aligned}$$

Your turn now Write the decimal as a percent.

5. 0.62

6. 0.9

7. 0.248

8. 5.09

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

9. 45%

10. 214%

11. 77.5%

12. 0.5%

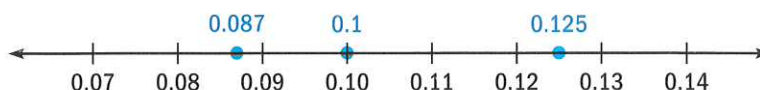
EXAMPLE 4 Ordering Fractions, Decimals, and Percents

Order the numbers from least to greatest: 8.7% , $\frac{1}{8}$, and 0.1 .

Write 8.7% as a decimal: $8.7\% = 0.087$

Write $\frac{1}{8}$ as a decimal: $\frac{1}{8} = 0.125$

Use a number line to order the decimals.



ANSWER The numbers ordered from least to greatest are 8.7% , 0.1 , and $\frac{1}{8}$.

Your turn now Order the numbers from least to greatest.

13. 41% , $\frac{9}{20}$, 0.389

14. $\frac{9}{10}$, 0.099 , 95%

15. 1.5 , 145% , $\frac{7}{5}$

7.4 Exercises

More Practice, p. 733

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Getting Ready to Practice

1. **Vocabulary** In a circle graph, what is the sum of the percents?
What is the sum of the fractions?

Write the decimal or fraction as a percent.

2. 0.1

3. 0.09

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

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

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

6. 80%


7. 12.5%

8. 7.5%

9. 110%

10. **Sleeping** You survey 48 people and find that 18 of them sleep eight hours a night. What percent sleep eight hours a night?

11. **Find the Error** Describe and correct the error in writing 0.001 as a percent.

 $0.001 = \frac{1}{100} = 1\%$



HELP with Homework

Example	Exercises
1	12-27, 45-48
2	12-27
3	28-39
4	40-43



Online Resources
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- More Examples
- eTutorial Plus

Practice and Problem Solving

Write the decimal or fraction as a percent.

- | | | | |
|--------------------|-----------------------|---------------------|-----------------------|
| 12. 1.27 | 13. 0.057 | 14. 0.039 | 15. 0.004 |
| 16. $\frac{1}{80}$ | 17. $\frac{3}{20}$ | 18. $\frac{31}{10}$ | 19. $\frac{4}{800}$ |
| 20. 47.3 | 21. 1.056 | 22. $\frac{1}{125}$ | 23. $\frac{105}{200}$ |
| 24. $\frac{5}{9}$ | 25. $\frac{128}{150}$ | 26. 0.0028 | 27. 0.7 |

Write the percent as a decimal and as a fraction.

- | | | | |
|-------------|----------|------------|------------|
| 28. 40% | 29. 87% | 30. 32.5% | 31. 101% |
| 32. 1% | 33. 4.2% | 34. 200.2% | 35. 124% |
| 36. 187.09% | 37. 0.4% | 38. 0.78% | 39. 44.55% |

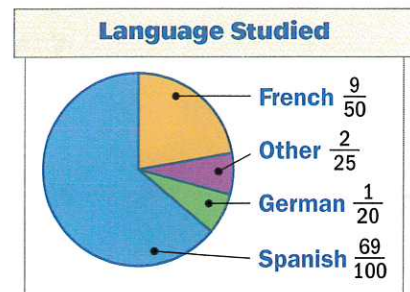
Order the numbers from least to greatest.

- | | |
|--|---|
| 40. 0.022, $\frac{9}{40}$, 22%, 0.228, $\frac{28}{125}$ | 41. 6.6%, $\frac{3}{50}$, 0.0606, 0.6%, 0.606 |
| 42. $\frac{4}{7}$, 0.058, 58, 58%, 0.58% | 43. 212%, 21.2, $\frac{21}{100}$, 0.212, $\frac{21}{10}$ |

44. **Critical Thinking** If a fraction is greater than 1, what do you know about the equivalent percent?

Languages The circle graph shows the world languages that U.S. high school students studied in a recent year. Each fraction in the graph represents part of the total number of U.S. high school students who studied a world language.

45. Which language was the most popular?
46. What percent of the students studied German?
47. What percent of the students studied French or German?
48. What percent of the students did *not* study Spanish?



Copy and complete the statement using $<$, $>$, or $=$.

- | | | |
|---|---|---|
| 49. $\frac{1}{4} \underline{\quad} 26\%$ | 50. $450\% \underline{\quad} \frac{9}{2}$ | 51. $\frac{13}{25} \underline{\quad} 0.5$ |
| 52. $0.0825 \underline{\quad} \frac{17}{200}$ | 53. $4.5\% \underline{\quad} 0.045$ | 54. $101\% \underline{\quad} 0.101$ |



¡Hola!



55. **Critical Thinking** Sometimes a percent is greater than 100, such as a store selling 125% of the number of sweaters it sold last year. Give an example when a percent should *not* be greater than 100.
56. **Measurement** A football field is 100 yards long excluding the end zones. What percent of a mile is a football field's length?
57. **Challenge** Use graph paper to illustrate 45% and 4.5%.
58. **Explain** The table shows the percents of people who buy various types of music. Explain why the data should not be represented in a circle graph. Then find an appropriate way to display the data.

Music	Percent
Rock	24.4%
Pop	12.1%
Rap	11.4%
R&B	10.6%
Country	10.5%

Mixed Review

Write the sentence as an inequality. Then solve. (Lesson 6.6)

59. The sum of 13 and 4 times a number is at most 9.
60. Eight less than the quotient of a number and 6 is greater than -7 .

Choose a Strategy Use a strategy from the list to solve the following problem. Explain your choice of strategy.

61. You work for 4 hours. You spend \$5.75 of the money you earn on a movie ticket and \$2 on popcorn. Then your sister gives you \$3 she owes you. You now have \$19.25. How much were you paid per hour?

Problem Solving Strategies

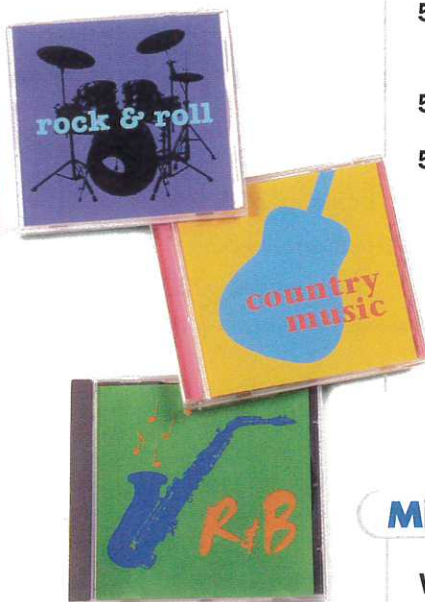
- Guess, Check, and Revise
- Draw a Diagram
- Work Backward
- Solve a Simpler Problem

Basic Skills Find the product or quotient.

62. 9.2×13.4 63. $41.3 \div 11.8$ 64. $9.9 \div 4.5$ 65. 1.98×6

Test-Taking Practice

66. **Multiple Choice** Which numbers are in order from least to greatest?
- A. 0.25, 2.5%, $\frac{2}{7}$ B. 2.5%, 0.25, $\frac{2}{7}$ C. 0.25, $\frac{2}{7}$, 2.5% D. 2.5%, $\frac{2}{7}$, 0.25
67. **Multiple Choice** Which choice shows 53.72% written as a decimal?
- F. 5372 G. 53.72 H. 5.372 I. 0.5372



Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

ratio, p. 317	proportion, p. 322	scale, p. 324
equivalent ratios, p. 317	cross products, p. 323	percent, p. 327
rate, unit rate, p. 318	scale model, p. 324	circle graph, p. 331

Use Your Vocabulary

- Copy and complete: In a(n) ? , the cross products are equal.

7.1 Can you write a unit rate?



EXAMPLE Write 282 miles per 6 hours as a unit rate.

$$\begin{aligned}\frac{282 \text{ miles}}{6 \text{ hours}} &= \frac{282 \div 6}{6 \div 6} \\ &= \frac{47}{1}\end{aligned}$$

Divide numerator and denominator by 6.

Simplify.

ANSWER The unit rate is 47 miles per hour.



Write the rate as a unit rate.

- 30 feet per 4 seconds
- \$3.36 per 2 gallons

7.2–7.3 Can you solve percent problems?



EXAMPLE 36 is 15% of what number?

$$\frac{a}{b} = \frac{p}{100}$$

Write a percent proportion.

$$\frac{36}{b} = \frac{15}{100}$$

Substitute 36 for a and 15 for p .

$$36 \cdot 100 = 15b$$

Cross products property

$$240 = b$$

Divide each side by 15.



Use a percent proportion.

- 72 is what percent of 1200?
- What number is 95% of 26?

7.4 Can you rewrite percents, decimals, and fractions?

Review

EXAMPLE Write 28% as a decimal and as a fraction.

$$28\% = \frac{28}{100} = 0.28$$

Remove % sign and move decimal point two places to the left.

$$28\% = \frac{28}{100} = \frac{7}{25}$$

Write as a fraction and simplify.

ANSWER 28% can be written as 0.28 or $\frac{7}{25}$.



Write the percent as a decimal and as a fraction.

6. 74%

7. 3.8%

8. 16.8%

9. 130%

Stop and Think

about Lessons 7.1–7.4



10. **Writing** Explain how to use the cross products property to check if two ratios form a proportion.

Review Quiz 1

A box of animal crackers contains 6 gorillas, 5 bears, 4 camels, 2 monkeys, 2 sheep, and 1 lion. Write the ratio in simplest form.

1. gorillas to sheep 2. monkeys to camels 3. bears to lions

Find the value of the variable.

4. $\frac{a}{72} = \frac{5}{6}$

5. $\frac{2}{3} = \frac{7}{x}$

6. $\frac{18}{27} = \frac{y}{3}$

7. $\frac{6}{8} = \frac{b}{28}$

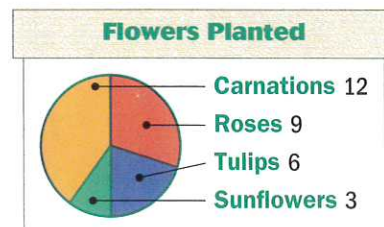
8. $\frac{12}{c} = \frac{23}{92}$

9. $\frac{z+1}{8} = \frac{95}{19}$

10. **Clothing** You save 40% when buying a shirt that originally cost \$29. How much do you save?

Gardening The circle graph shows the numbers of flowers that you planted in a flowerbed.

11. How many flowers did you plant?
12. What percent of the flowerbed is roses?
13. What two types of flowers combine to equal 70%?



LESSON 7.5

Percent of Change

BEFORE

You solved problems with percents.

Now

You'll solve problems with percent of increase or decrease.

WHY?

So you can find tons of hazelnuts produced, as in Ex. 19.

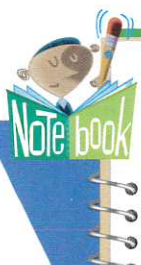
Word Watch

percent of change, p. 338
percent of increase, p. 338
percent of decrease, p. 338

In the Real World

Bears During the summer, a bear's heart rate is about 60 beats per minute, but it can drop to as low as 8 beats per minute during winter. What is the *percent of change* in a bear's heart rate from the summer rate to the winter low rate?

A **percent of change** shows how much a quantity has increased or decreased in relation to the original amount. When the new amount is greater than the original amount, the percent of change is called a **percent of increase**. When the new amount is less than the original amount, it is called a **percent of decrease**.



Percent of Change

Use the following equation to find the percent of change.

$$\text{Percent of change, } p\% = \frac{\text{Amount of increase or decrease}}{\text{Original amount}}$$

HELP with Review

For help with repeating decimals, see p. 242.

EXAMPLE 1

Finding a Percent of Decrease

To find the percent of decrease in a bear's heart rate as described above, use the percent of change equation.

$$p\% = \frac{60 - 8}{60}$$

Write amount of decrease and divide by original amount.

$$= \frac{52}{60}$$

Subtract.

$$= 0.86\bar{6}$$

Write fraction as a decimal.

ANSWER The percent of decrease is about 86.7%.

Watch Out!



Make sure you use the original amount, not the new amount, in the denominator when finding a percent of change.

EXAMPLE 2 Finding a Percent of Increase

School A school had 825 students enrolled last year. This year, 870 students are enrolled. Find the percent of increase.

Solution

$$p\% = \frac{870 - 825}{825}$$

Write amount of increase and divide by original amount.

$$= \frac{45}{825}$$

Subtract.

$$= 0.0545$$

Write fraction as a decimal.

ANSWER The percent of increase is about 5.5%.

Your turn now Tell whether the change is an *increase* or *decrease*. Then find the percent of change.

1. Original amount: 50
New amount: 36
2. Original amount: 10
New amount: 29.5
3. Original amount: 90
New amount: 110

What do you think?

Science



Everglades

During the wet season, water flows south through the Everglades at a rate of 100 feet per day. How many days does it take water to flow one mile?

Decimal Method A shortcut to finding a percent of a number is to write the percent as a decimal and then find the product of the decimal and the number. For example, 10% of $60 = 0.10(60) = 6$.

EXAMPLE 3 Using Percent of Increase

Everglades From October to November one year, there was about a 27.4% increase in attendance at Everglades National Park. There were 59,084 visitors in October. About how many people visited in November?

Solution

- (1) Find the increase.

$$\text{Increase} = 27.4\% \text{ of } 59,084$$

$$= 0.274(59,084)$$

Write 27.4% as a decimal.

$$\approx 16,189$$

Multiply.

- (2) Add the increase to the original amount.

$$\text{New Amount} \approx 59,084 + 16,189$$

$$= 75,273$$

ANSWER About 75,273 people visited the park in November.

Getting Ready to Practice

1. **Vocabulary** Copy and complete: When the original amount is less than the new amount, the percent of change is called a(n) ? .

Tell whether the change is an *increase* or *decrease*. Then find the percent of change.

2. Original amount: 10
New amount: 14
3. Original amount: 20
New amount: 16

Find the new amount.

4. 78 is decreased by 22%. 5. 105 is decreased by 78%.
6. **Tennis** In 1975, there were 130,000 tennis courts in the United States. This number increased by 69% from 1975 to 1985. The number then increased by 9% from 1985 to 1995. How many tennis courts were there in the United States in 1985 and in 1995?

- (1) Find the number of tennis courts in 1985.
- (2) Find the amount of the second increase.
- (3) Find the number of tennis courts in 1995.



Practice and Problem Solving

Decide Tell whether the change is an *increase* or *decrease*. Then find the percent of change.

7. 10 rabbits to 16 rabbits 8. 360 pounds to 352 pounds
9. \$33,300 to \$31,080 10. 12,200 voters to 13,908 voters
11. 50 minutes to 45 minutes 12. 350 meters to 420 meters

Find the new amount.

13. 1100 is increased by 4%. 14. 24,700 is decreased by 13%.
15. 8 is increased by 60%. 16. 65 is decreased by 30%.
17. 88,450 is decreased by 12.5%. 18. 26,856 is increased by 14.6%.
19. **Hazelnuts** Oregon produces 98% of the hazelnuts grown in the United States. One year, Oregon produced 46,650 tons of hazelnuts. The crop decreased by 67% the following year. How many tons of hazelnuts were produced in Oregon the second year?

HELP

with Homework

Example Exercises

- 1 7-12
- 2 7-12
- 3 13-19



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Find the percent of increase or decrease.

20. x to $4x$ 21. $6b$ to $9b$ 22. y to $\frac{3}{8}y$ 23. $4.5a$ to $2.25a$

In Exercises 24–27, tell whether the statement is *true* or *false*.
Explain your reasoning.

24. An increase from 1 to 3 is a 200% increase.
25. Multiplying a number by 5 is a 500% increase.
26. Multiplying a number by $\frac{1}{4}$ is a 25% decrease.
27. Dividing a number by 5 is an 80% decrease.
28. **Coins** In 1996, a 1943 copper penny was sold for \$82,500. What was the percent of increase in the penny's value in 1943 to the value it was sold for in 1996?
29. **Population** The population of the United States in 1992 was about 255,374,000. In 2002, it was about 280,562,000. Find the approximate percent of increase to the nearest tenth.
30. **Challenge** A number increases by 50%, then decreases by 50%. What is the percent of change from the original number to the final number?
31. **Enlargements** You have a photograph that is 6 inches by 4 inches. You want to enlarge it so that these dimensions are increased by 50%. What will the new dimensions be? What will be the percent of increase in the area of the new photograph?

Mixed Review



Find the product or quotient. (Lesson 5.7)

32. $4.412 \cdot 0.36$ 33. $-6.7 \cdot 0.8$ 34. $-0.91 \div 0.35$

Solve the equation. (Lesson 6.3)

35. $14.2 + 1.4x = -5.4$ 36. $0.2s - 1.3 = 0.3$ 37. $1.14y - 2 = y + 1.64$

Basic Skills Solve the equation.

38. $7x = 63$ 39. $1.5c = 18$ 40. $2.5n = 80$

Test-Taking Practice



41. **Extended Response** The average person in the United States was predicted to spend 114 hours playing video games in 2002. The prediction of the average time spent on video games increased by about 19.3% from 2002 to 2003. Estimate the predicted hours for 2003. Explain your method. Find the actual prediction for 2003 using the given information. Compare your estimate to the actual prediction.

LESSON 7.6

Percent Applications

BEFORE

You solved problems with percent of increase or decrease.

Now

You'll solve percent application problems.

WHY?

So you can find the sale price of a pair of jeans, as in Ex. 18.

Word Watch

markup, p. 342
discount, p. 342

In the Real World

Guitars You are shopping for a guitar and find one with an original price of \$160. The store is offering a 30% *discount* on all guitars. What is the sale price of the guitar?



Markup and Discount A retail store buys items from manufacturers at *wholesale prices*. The store then sells the items to customers at *retail prices*. The increase in the wholesale price of an item is a **markup**. A decrease in the price of an item is a **discount**. You can find the retail price or sale price of an item using the equations below.

$$\text{Retail price} = \text{Wholesale price} + \text{Markup}$$

$$\text{Sale price} = \text{Original price} - \text{Discount}$$

EXAMPLE 1 Finding a Sale Price

To find the sale price of the guitar above, use the sale price equation.

Solution

- (1) Find the amount of the discount.

$$\begin{aligned} \text{Discount} &= 30\% \text{ of } \$160 \\ &= 0.3(160) && \text{Write 30\% as a decimal.} \\ &= 48 && \text{Multiply.} \end{aligned}$$

- (2) Subtract the discount from the original price.

$$160 - 48 = 112$$

ANSWER The sale price of the guitar is \$112.

Your turn now Find the sale price.

- | | |
|--|---|
| 1. Original price: \$25
Percent discount: 10% | 2. Original price: \$85.50
Percent discount: 30% |
|--|---|



HELP**with Solving**

Remember that the markup must be added to the wholesale price to find the retail price.

EXAMPLE 2 Finding a Retail Price

Clothing A shirt has a wholesale price of \$16. The percent markup is 120%. What is the retail price?

Solution

- (1) Find the amount of the markup.

$$\begin{aligned}\text{Markup} &= 120\% \text{ of } \$16 \\ &= 1.2(16) && \text{Write 120\% as a decimal.} \\ &= 19.2 && \text{Multiply.}\end{aligned}$$

- (2) Add the markup to the wholesale price.

$$16 + 19.2 = 35.2$$

ANSWER The retail price of the shirt is \$35.20.

Sales Tax and Tips Sales tax and tips are amounts that are added to the price of some purchases. Sales tax and tips are usually calculated using a percent of the purchase price.

EXAMPLE 3 Finding Sales Tax

Compact Disc Player A portable CD player costs \$48 before tax. The sales tax is 4.5%. What is the total cost?

Solution

- (1) Find the amount of the sales tax.

$$\begin{aligned}4.5\% \text{ of } \$48 &= 0.045(48) \\ &= 2.16\end{aligned}$$

- (2) Add the sales tax to the price of the portable CD player.

$$48 + 2.16 = 50.16$$

ANSWER The total cost of the CD player is \$50.16.

Your turn now Find the retail price.

3. Wholesale price: \$64
Percent markup: 85%

4. Wholesale price: \$35
Percent markup: 110%

Find the total cost.

5. Price: \$8.90
Sales tax: 5%

6. Price: \$54.07
Sales tax: 7%

EXAMPLE 4 Finding Sales Tax and Tip

Restaurants Your food bill at a restaurant is \$24. You leave a 20% tip. The sales tax is 6%. What is the total cost of the meal?

Solution

- (1) Find the amount of the tip.

$$\begin{aligned} 20\% \text{ of } \$24 &= 0.20(24) \\ &= 4.8 \end{aligned}$$

- (2) Find the amount of the sales tax.

$$\begin{aligned} 6\% \text{ of } \$24 &= 0.06(24) \\ &= 1.44 \end{aligned}$$

- (3) Add the food bill, tip, and sales tax.

$$24 + 4.8 + 1.44 = 30.24$$

ANSWER The total cost of the meal is \$30.24.

Your turn now Find the total cost.

7. Your food bill at a restaurant is \$35. The sales tax is 5%. You leave a 15% tip. What is the total cost of the meal?

7.6

Exercises

More Practice, p. 733



INTERNET

eWorkbook Plus

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Getting Ready to Practice

1. **Vocabulary** Copy and complete: To find the retail price, add the ? to the wholesale price.

Find the sale price or retail price.

- | | |
|---|---|
| 2. Original price: \$60
Percent discount: 15% | 3. Original price: \$28.50
Percent discount: 60% |
| 4. Wholesale price: \$25
Percent markup: 65% | 5. Wholesale price: \$14.50
Percent markup: 140% |
| 6. Lamps A lamp costs \$25.75. The sales tax is 4%. What is the total cost? | |
| 7. Restaurants Your food bill at a restaurant is \$30. You leave a 20% tip. The sales tax is 6%. What is the total cost of the meal? | |





Example	Exercises
1	8-13, 20-25
2	8-13, 20-25
3	14-17
4	14-17



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- eTutorial Plus

Practice and Problem Solving

Find the sale price or retail price. Round to the nearest cent.

- | | |
|--|--|
| 8. Original price: \$42
Percent discount: 30% | 9. Wholesale price: \$19
Percent markup: 110% |
| 10. Wholesale price: \$16.49
Percent markup: 130% | 11. Original price: \$22.40
Percent discount: 25% |
| 12. Original price: \$54.75
Percent discount: 20% | 13. Wholesale price: \$65.40
Percent markup: 55% |

Find the total cost. Round to the nearest cent.

- | | |
|---|--|
| 14. Original price: \$72
Sales tax: 6% | 15. Original price: \$58.40
Sales tax: 5.5% |
| 16. Food bill: \$25.80
Tip: 18%
Sales tax: 4.5% | 17. Food bill: \$18
Tip: 20%
Sales tax: 5% |
18. **Jeans** The wholesale price of a pair of jeans is \$15. A store marks up the price by 75%. When the jeans don't sell, the store offers a 20% discount. What is the sale price of the jeans?
19. **Critical Thinking** A store is having an end of season sale and offers a discount of 40% on all coats. One week later the store discounts the coats an additional 60%. Is the store giving away the coats for free? Explain your reasoning.

Tell whether the new price is a *discount* or *markup*. Then find the percent of discount or markup.

- | | | |
|---|--|--|
| 20. Old price: \$32
New price: \$24 | 21. Old price: \$45
New price: \$40.50 | 22. Old price: \$19
New price: \$33.25 |
| 23. Old price: \$55
New price: \$121 | 24. Old price: \$12.50
New price: \$22.50 | 25. Old price: \$199.99
New price: \$119.99 |
26. **Writing** People often leave tips between 15% and 20% on restaurant bills. Find both the 15% and 20% tips of a food bill that totals \$24.20. Explain why people often leave a tip between 15% and 20% rather than leaving exactly 15% or 20%.
27. **Tipping** You order a pizza to be delivered. The bill comes to \$12.60. You give the delivery person \$15 and tell them to keep the change. What percent tip did you give? Round to the nearest percent.
28. **DVDs** A DVD has a regular price of \$26 and is on sale for \$16.90. What is the percent discount?
29. **Subscription** A magazine subscription has a regular price of \$24.50. You pay \$14.70 for your subscription. What is the percent discount?





30. **Estimation** The original price of an item is \$42 and the percent of discount is 25%. Explain how to estimate the sale price.
31. **Challenge** A total restaurant bill including sales tax and tip is \$33. The tax is 4% and the tip is 16% of the bill before tax. What was the food bill before tax and tip?
32. **Shopping** A basketball has a wholesale price of \$12 and is marked up 115%. Later it is discounted 15%. The sales tax is 4.5%. Find the final cost of the basketball including tax. Round to the nearest cent.

Mixed Review



Solve the equation. (Lesson 6.2)

33. $4a = a + 9$

34. $n - 2 = 2n - 9$

Use a percent proportion. (Lesson 7.3)

35. What number is 35% of 80?

36. 308 is what percent of 440?

Basic Skills Solve the equation.

37. $2.4b = 108$

38. $8.5y = 51$

39. $3.5x = 140$

40. $1.6d = 38.4$

Test-Taking Practice



41. **Multiple Choice** A book costs \$7.95 and is on sale for 15% off. The sales tax is 6%. What is the total cost of the book?
- A. \$5.64 B. \$7.16 C. \$7.74 D. \$8.27
42. **Multiple Choice** You and two friends eat at a restaurant and split the total bill evenly. The food bill is \$20.88. Sales tax is 5%. You leave a 20% tip. How much should each person pay?
- F. \$6.96 G. \$7.31 H. \$8.35 I. \$8.70



Shrink Ray

Ray invents two zappers that shrink and enlarge things. After shrinking almost everything in the house to 40% of its original size, Ray's mother demands that he return things to normal. What percent setting should he use to zap objects back to their original size?

If Ray had instead used the zapper to enlarge things by 60%, what percent setting would he use on the shrink zapper to get them back to their normal size?



LESSON 7.7

Using the Percent Equation

BEFORE

You solved percent problems using proportions.

Now

You'll solve percent problems using the percent equation.

WHY?

So you can find the interest paid on a bank loan, as in Ex. 25.

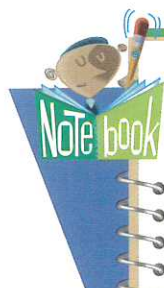
Word Watch

interest, p. 348
principal, p. 348
annual interest rate, p. 348

In the Real World

Beaches In a survey of 2000 people, 26.7% said that they had visited a beach during the past year. Find the number of people who said they had visited a beach.

In Lesson 7.3, you solved percent problems with proportions. You can also use the decimal method from Lesson 7.5 to solve percent problems.



The Percent Equation

To represent the statement " a is p percent of b " use the equation:

$$a = p\% \cdot b$$

$$p \text{ part of the base} = p \text{ percent} \cdot \text{Base}$$

EXAMPLE 1 Finding Part of a Base

To find the number of people who said they had visited a beach in the past year, use the percent equation.

$$a = p\% \cdot b$$

Write percent equation.

$$= 26.7\% \cdot 2000$$

Substitute 26.7 for p and 2000 for b .

$$= 0.267 \cdot 2000$$

Write percent as a decimal.

$$= 534$$

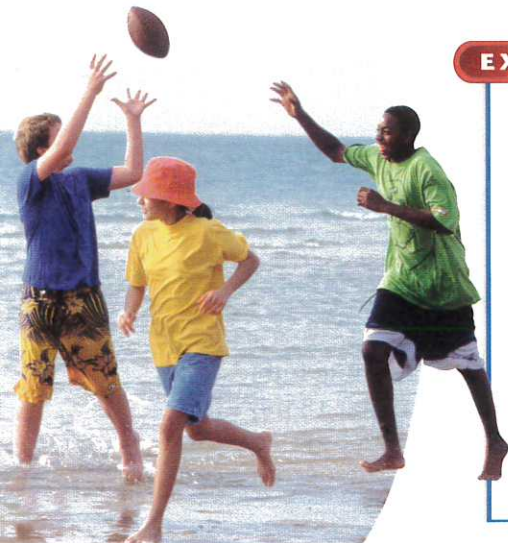
Multiply.

ANSWER The number of people who said they had visited a beach during the past year is 534.

Your turn now Use the percent equation.

1. Find 45% of 700.

2. Find 24.5% of 800.





EXAMPLE 2 Finding a Base

Student Council Marc received 273, or 35%, of the votes in the student council election. How many students voted in the election?

Solution

$$a = p\% \cdot b \quad \text{Write percent equation.}$$

$$273 = 35\% \cdot b \quad \text{Substitute 273 for } a \text{ and 35 for } p.$$

$$273 = 0.35 \cdot b \quad \text{Write 35\% as a decimal.}$$

$$780 = b \quad \text{Divide each side by 0.35.}$$

ANSWER In the election, 780 students voted.

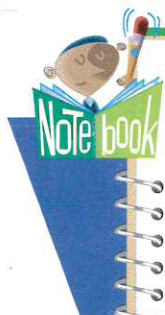
Your turn now Solve using the percent equation.

3. 6.4 is 62.5% of what number? 4. 15 is what percent of 120?

HELP with Vocabulary

When you borrow money from a bank, you pay back interest as well as the amount you borrowed.

Simple Interest **Interest** is an amount paid for the use of money. **Principal** is the amount you borrow or deposit. When interest is paid only on the principal, it is called simple interest. The percent of the principal you pay or earn per year is the **annual interest rate**.



Simple Interest

Words To find simple interest I , find the product of the principal P , the annual interest rate r written as a decimal, and the time t in years.

Algebra $I = Prt$

EXAMPLE 3 Finding Simple Interest

You deposit \$500 in a savings account that pays a simple interest rate of 2.5% per year. How much interest will you earn after 18 months?

Solution

$$I = Prt \quad \text{Write formula for simple interest.}$$

$$= (500)(0.025)(1.5) \quad \text{Substitute values. 18 months = 1.5 years}$$

$$= 18.75 \quad \text{Multiply.}$$

ANSWER You will earn \$18.75 in interest.

Getting Ready to Practice

1. **Vocabulary** Copy and complete: To find simple interest, multiply the annual rate written as a decimal, the time in years, and the ?.

Solve using the percent equation.

2. What number is 46% of 900? 3. 205 is what percent of 250?
 4. 132 is 24% of what number? 5. What number is 95% of 420?
 6. **Guided Problem Solving** A savings account pays a 3% annual interest rate. How much must you put in the savings account to earn \$100 in interest in 6 months?

- (1) Write the simple interest formula.
 (2) Substitute known values in the formula.
 (3) Solve the equation for P . Round to the nearest cent.

Practice and Problem Solving

HELP

with Homework

Example Exercises

- 1 7-16
 2 7-16
 3 17-18


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Solve using the percent equation.

7. What number is 65% of 320? 8. What number is 6% of 450?
 9. What number is 120% of 55? 10. What number is 0.4% of 150?
 11. 115 is 46% of what number? 12. 26 is 130% of what number?
 13. 62.4 is 80% of what number? 14. 289.25 is 89% of what number?
 15. 3 is what percent of 600? 16. 291.04 is what percent of 856?

Find the amount of simple interest earned.

17. Principal: \$250 18. Principal: \$940.
 Annual rate: 2% Annual rate: 3.5%
 Time: 3 years Time: 30 months
 19. **Weather** In Charlotte, North Carolina, an average of 112 days of the year have precipitation of 0.01 inch or more. What percent of days in Charlotte have precipitation of 0.01 inch or more? Round your answer to the nearest percent.
 20. **Writing** Are the solutions of $\frac{12}{b} = \frac{3}{100}$ and $12 = 3\% \cdot b$ the same or different? Explain your reasoning.

What do you think?

Geography



Texas

There are about 10,500 acres of cropland in Texas planted with peppers. What percent of cropland in Texas is planted with peppers? Round to the nearest hundredth of a percent.

Copy and complete the statement with $<$, $>$, or $=$.

21. 60% of 75 $\underline{\quad}$ 75% of 60

22. 30% of 120 $\underline{\quad}$ 120% of 30

23. **Look for a Pattern** Copy and complete the table by finding the percent of each number. Describe the relationship you see among the three percents in each row.

	5%	10%	15%
22	?	2.2	?
50	?	?	?
76	?	?	?

24. **Savings** How much money must you deposit in a savings account that pays a 4% simple annual interest rate to earn \$50 in 2 years?
25. **Loan** You borrow \$1200 from the bank. The bank charges an annual simple interest rate of 9.5%. It takes you 15 months to pay back the loan. How much interest do you pay on the loan? What is the total amount that you pay the bank?
26. **Texas** The area of the state of Texas is 171.1 million acres. Of this, 26.9 million acres are cropland. What percent of Texas is cropland? Round your answer to the nearest hundredth of a percent.
27. **Challenge** *Compound interest* on a savings account is earned on both the principal and on any interest that has already been earned. You deposit \$500 into an account that earns 4% compounded annually. How much will you have in your account after the third year? after the sixth year? Round your answers to the nearest cent.

Mixed Review

Find the quotient. (Lesson 5.4)

28. $\frac{8}{3} \div \frac{32}{21}$

29. $\frac{5}{9} \div \frac{2}{3}$

30. $\frac{11}{14} \div \frac{1}{2}$

In Exercises 31–33, solve the equation or inequality. (Lessons 6.3, 6.5)

31. $5.4 - 4.6x = 19.2$

32. $\frac{3}{8}u - \frac{1}{2} = \frac{7}{12}$

33. $3n - 27 \leq -5n + 64$

34. Solve the proportion $\frac{8}{25} = \frac{7}{d}$. (Lesson 7.2)

Test-Taking Practice



35. **Multiple Choice** What percent of 75 is 30?

A. 30%

B. 40%

C. 45%

D. 75%

36. **Short Response** Vicki hears on the local news that 37.5% of the movie theaters in her city, or 6 theaters, offer discount tickets to students. Write an equation that could be used to determine the number of theaters in Vicki's city. Then solve the equation.



CALCULATOR

Technology Activity

Compound Interest

GOAL Use a calculator to compute compound interest.

HELP with Vocabulary

Compound interest is interest earned on both the principal and on any interest that has already been earned.

Example

Mark deposits \$2000 into an account that pays an interest rate of 3.5% compounded annually. He doesn't add or remove money from his account for 4 years. How much money will Mark have in 4 years?

Solution

The balance of an account after a year can be found by multiplying the principal balance by the quantity one plus the annual interest rate. Use the keystrokes below to find the amount of money in the account in 4 years.

Keystrokes

2000 \times 1.035 $=$
 $=$
 $=$
 $=$

Display

2070 In 1 year
2142.45 In 2 years
2217.43575 In 3 years
2295.046001 In 4 years

ANSWER Mark will have \$2295.05 in his account in 4 years.

Your turn now

Find the balance of the account earning compound interest.

- Principal: \$7000
Annual rate: 2%
Time: 4 years
- Principal: \$7000
Annual rate: 4%
Time: 2 years
- Principal: \$1995
Annual rate: 6.5%
Time: 10 years
- You deposit \$1500 into an account that pays an interest rate of 4% compounded annually. Your friend deposits \$1500 into an account that pays a simple annual interest rate of 4%. Compare the balances of the two accounts after 5 years.

Guess, Check, and Revise

Look for a Pattern

Draw a Diagram

Act It Out

Perform an Experiment

Work Backward

Make a Table

Perform an Experiment

Problem You are playing a board game that involves rolling 2 cubes numbered from 1 to 6. If your cubes sum to an even number, you may advance your game piece forward. If your cubes sum to an odd number, you may not move your piece. Predict the number of times you will be able to move forward in 100 rolls.



1 Read and Understand

Read the problem carefully.

The problem asks you to predict the number of times you will roll two number cubes that sum to an even number in 100 rolls.

2 Make a Plan

Decide on a strategy to use.

Because it might take a while to roll number cubes 100 times, you can make a prediction by performing an experiment. Roll two number cubes 20 times and use the results to make a prediction.

3 Solve the Problem

Reread the problem and perform an experiment.

First, roll two number cubes 20 times and record the results as shown.

Results

5, 12, 7, 9, 4, 8, 7, 6, 6, 3, 8, 4, 7, 5, 6, 9, 2, 4, 10, 11

There are 11 even numbers and 9 odd numbers.

Then, use the results of the experiment to set up and solve a proportion.

$$\frac{\text{Number of even numbers in 20 rolls}}{20 \text{ rolls}} = \frac{\text{Number of even numbers in 100 rolls}}{100 \text{ rolls}}$$

$$\frac{11}{20} = \frac{x}{100}$$

$$\frac{11}{20} \cdot 100 = \frac{x}{100} \cdot 100$$

$$55 = x$$

You predict that you will get 55 even numbers in 100 rolls.

4 Look Back

To test the accuracy of your prediction, perform another experiment and compare the results.



Practice the Strategy

Use the strategy *perform an experiment*.

- Marbles** You conduct an experiment by randomly drawing 10 marbles from a bag of 100 red and blue marbles, and recording how many of each color were drawn. The results of 5 of these experiments are shown below. Estimate how many marbles of each color are in the bag. Explain.

	1	2	3	4	5
Red	6	7	5	7	6
Blue	4	3	5	3	4

- Spinner** You are playing a board game that uses a spinner like the one below to determine how many spaces to move. The spinner seems to give the result "5" more often than it should. Describe an experiment you could use to test this assumption. What results would support the assumption?



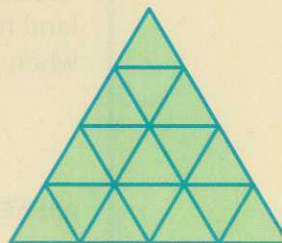
- Names** Write each of the letters of your name on a slip of paper. Place all the slips into a bag and then randomly draw one slip. Record what letter it is, replace it, and repeat the process. Design an experiment to help you predict the number of times you would draw a consonant in 60 draws. Describe your experiment.
- Socks** A drawer has exactly 20 white socks and 20 black socks. You randomly draw two socks 100 times and replace them after each draw. Describe an experiment you could use to predict how many times out of 100 you would draw matching socks.



Mixed Problem Solving

Use any strategy to solve the problem.

- Shopping** You pick out a sweater and a pair of pants. When you get to the cashier, you find that all sweaters are on sale for 40% off the original price and your bill is \$40.40. So, you decide to add two more sweaters to your purchase, bringing the bill to \$81.20. How much does one pair of pants cost? What is the original price of one sweater?
- Groups** A class is divided into groups of four. Betty, Jamal, Fiona, and Juan are in one group. Each person's name is written on a separate slip of paper. The teacher draws a name each week (and then replaces it for the next week) to find the leader of the group for that week. How often do you predict Fiona's name will be picked in 36 weeks?
- Triangles** How many triangles are shown in the figure? Be sure to count triangles of different sizes.



LESSON 7.8

Simple Probability

BEFORE

You found ratios.

Now

You'll find probabilities of events.

WHY?

So you can find the probability of a batter getting a hit, as in Ex. 24.

Word Watch

outcome, event, p. 354
 favorable outcome, p. 354
 probability of an event, p. 354
 theoretical probability, p. 354
 experimental probability, p. 355

Activity

You can toss a coin to perform a probability experiment.

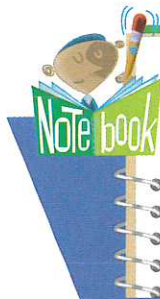
- (1) Copy and complete the table at the right by tossing a coin 20 times.
- (2) Use the data to write each ratio below. Then compare the ratios.

Number of heads	?
Number of tails	?

- a. $\frac{\text{Number of heads}}{\text{Total number of coin tosses}}$
- b. $\frac{\text{Number of tails}}{\text{Total number of coin tosses}}$

- (3) **Comparing Results** Combine your results with those of the other students in your class. Compare the class ratios with your own ratios.

In the activity, you performed an experiment. The possible results of an experiment are **outcomes**. An **event** is a collection of outcomes. Once you specify an event, the outcomes for that event are called **favorable outcomes**. The **probability of an event** is the likelihood that the event will occur.



Probability of an Event

The **theoretical probability** of an event when all outcomes are equally likely is:

$$P(\text{event}) = \frac{\text{Number of favorable outcomes}}{\text{Number of possible outcomes}}$$

EXAMPLE 1

Using Theoretical Probability

Use theoretical probability to predict the number of times a coin will land heads up in 50 coin tosses. There are two equally likely outcomes when you toss the coin, heads or tails.

$$P(\text{heads}) = \frac{\text{Number of favorable outcomes}}{\text{Number of possible outcomes}} = \frac{1}{2}$$

ANSWER You can predict that $\frac{1}{2}$, or 25, of the tosses will land heads up.

HELP with Solving

A probability can be expressed as a fraction, as a decimal, or as a percent.

An **experimental probability** is based on the results of a sample or experiment. Experimental probability is the ratio of number of favorable outcomes to total number of times the experiment was performed.

EXAMPLE 2 Finding Experimental Probability

You roll a number cube 100 times. Your results are shown. Find the experimental probability of rolling a 6.

Number	Rolls	Number	Rolls
1	17	4	16
2	15	5	14
3	20	6	18

Solution

$$\begin{aligned}
 P(\text{rolling a 6}) &= \frac{18}{100} \quad \leftarrow \begin{array}{l} \text{Number of favorable outcomes} \\ \text{Total number of rolls} \end{array} \\
 &= 0.18 = 18\%
 \end{aligned}$$

ANSWER The experimental probability of rolling a 6 is 18%.

EXAMPLE 3 Using Experimental Probability

You randomly draw a button from a bag of red, blue, green, and yellow buttons 18 times. Each time you record its color and place it back in the bag. There are 80 buttons in the bag. Predict how many are red.

Color	Tally
Red	
Blue	
Green	
Yellow	

Solution

- Find the experimental probability of drawing a red button.

$$\begin{aligned}
 P(\text{red}) &= \frac{10}{18} \quad \leftarrow \begin{array}{l} \text{Number of favorable outcomes} \\ \text{Total number of draws} \end{array} \\
 &= \frac{5}{9} \quad \text{Simplify.}
 \end{aligned}$$

- Multiply the probability by the total number of buttons and round to the nearest whole number.

$$\frac{5}{9} \times 80 \approx 44$$

ANSWER You can predict that there are 44 red buttons in the bag.


Your turn now Use the information in Example 3.

- There are 18 green buttons in the bag. What is the theoretical probability of drawing a green button at random? What is the experimental probability?

Getting Ready to Practice

- Vocabulary** Copy and complete: The favorable outcomes for rolling an even number on a number cube are ?, ?, and ?.
- Socks** You have 4 white socks, 2 black socks, and 2 brown socks. What is the probability that you will choose a black sock at random from these socks?
- Find the Error** A student spins a two-color spinner 20 times. The pointer lands on red 7 times and on blue 13 times. Describe and correct the error in the solution.

Experimental probability

 of spinning red = $\frac{7}{13}$

Practice and Problem Solving

HELP

with Homework

Example Exercises

- | | |
|---|------------|
| 1 | 4-9, 20-22 |
| 2 | 10-14 |
| 3 | 15-18 |



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You randomly draw a tile from a bag that contains 10 A-tiles, 7 E-tiles, 6 I-tiles, 5 O-tiles, and 2 U-tiles. Find the probability of the event.

- | | |
|---------------------------|--------------------------|
| 4. You draw an A. | 5. You draw an I. |
| 6. You draw an I or an O. | 7. You draw an E or a U. |
| 8. You draw a Z. | 9. You draw a vowel. |

You roll a number cube 250 times. Your results are shown in the table. Find the experimental probability of the event.

10. You roll a 4.

11. You roll a 2.

12. You roll a number greater than 3.

13. You roll an odd number.

14. You roll a number divisible by 1.

Number	Outcomes	Number	Outcomes
1	40	4	50
2	42	5	35
3	48	6	35

You randomly draw a marble from a bag of 120 marbles. You record its color and replace it. Use the results to estimate the number of marbles in the bag that are the given color.

- | | |
|------------|-----------|
| 15. Yellow | 16. Green |
| 17. Red | 18. Blue |

Red	Yellow	Green
7	3	5



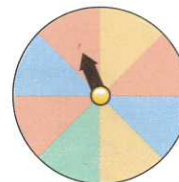
19. **Toes** In a survey of 896 people, 409 responded that their second toes are longer than their big toes. What is the probability that a randomly chosen person from the survey has a longer second toe?

Find the probability of the event.

20. *Not* rolling a 2 on a number cube

21. *Not* spinning blue on the spinner

22. *Not* spinning blue, red, or yellow on the spinner



23. **Writing** Describe the difference between experimental and theoretical probability.

24. **Softball** Sharon and Erica are both softball players. Out of 20 times at bat, Sharon got 7 hits. Out of 35 times at bat, Erica got 10 hits. Who do you think is more likely to get a hit her next time at bat? Explain.

25. **Number Cube** Rachel rolled a number cube 24 times and got a 6 once. She thinks that her chances of getting a 6 on her next roll are high. Explain why her chances are no different than on any other roll.

26. **Challenge** You have 15 coins in your pocket: 4 quarters, 3 pennies, 5 dimes, and 3 nickels. Why wouldn't theoretical probability be a good way to predict which coin you pull out of your pocket?

Mixed Review

27. Find the percent of increase from 140 to 154. (*Lesson 7.5*)
28. You deposit \$750 in an account with a simple annual interest rate of 2.75%. Find the interest you will earn after 30 months. Round to the nearest cent. (*Lesson 7.7*)

Basic Skills Find the sum.

29. $-47 + 19$ 30. $20 + (-18)$ 31. $-7 + (-25)$ 32. $-32 + (-56)$

Test-Taking Practice

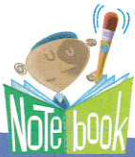
33. **Multiple Choice** What is the probability of getting a number divisible by 3 when rolling a number cube?

- A. $\frac{3}{10}$ B. $\frac{1}{3}$ C. $\frac{1}{2}$ D. $\frac{2}{3}$

34. **Multiple Choice** In a group of 40 people, 24 prefer dogs to cats. One person is selected at random from the larger group. What is the probability that the person will prefer dogs to cats?

- F. 0.16 G. 0.24 H. 0.4 I. 0.6

Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

percent of change, p. 338
percent of increase, p. 338
percent of decrease, p. 338
markup, discount, p. 342
interest, annual interest rate, p. 348
principal, p. 348
outcome, favorable outcome, p. 354
event, probability of an event, p. 354
theoretical probability, p. 354
experimental probability, p. 355

Use Your Vocabulary

1. Describe how to find theoretical probability.

7.5–7.6 Can you find a sale price?



EXAMPLE A pair of shoes has an original price of \$40. What is the sale price after a 15% discount?

$$40 \times 0.15 = 6$$

Multiply to find discount.

$$40 - 6 = 34$$

Subtract discount from original price.

ANSWER The sale price of the shoes is \$34.



Find the sale price or retail price.

2. Wholesale price: \$30
Percent markup: 70%

3. Original price: \$72
Percent discount: 18%

7.7 Can you use the percent equation?



EXAMPLE What number is 26% of 300?

$$a = p\% \cdot b$$

Write percent equation.

$$a = 26\% \cdot 300$$

Substitute 26 for p and 300 for b .

$$a = 78$$

Multiply.



4. 72 is 75% of what number?
5. What number is 34% of 856?

7.8 Can you find the probability of an event?

Review

EXAMPLE Two scientists spin a Belgian euro coin 250 times and it lands heads up 140 times. Find the experimental probability of the coin landing heads up.

Use the results to find the experimental probability.

$$\begin{aligned} P(\text{heads}) &= \frac{140}{250} && \leftarrow \text{Number of favorable outcomes} \\ &&& \leftarrow \text{Total number of spins} \\ &= \frac{14}{25} = 0.56 = 56\% \end{aligned}$$



6. You randomly draw a marble out of a bag that contains 8 red, 5 yellow, and 4 blue marbles. Find the probability of drawing each color.

Stop and Think

about Lessons 7.5–7.8

7. **Critical Thinking** You invest \$300 at a simple annual interest rate of 3.5% for one year. How much would you need to invest at a 2% simple annual interest rate to earn the same amount of interest that year?

Review Quiz 2

Tell whether the change is an *increase* or *decrease*. Then find the percent of change.

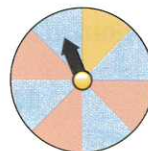
- Original amount: \$120
New amount: \$138
- Original amount: 260 miles
New amount: 169 miles
- Retail** A shirt has a \$20 wholesale price and is marked up 50%. The sales tax is 5%. What is the total cost of the shirt?

Solve using the percent equation.

- 75 is 125% of what number?
- 552.5 is what percent of 85,000?
- Koalas** Koalas absorb only about 25% of the fiber they eat. How much fiber is absorbed by a koala that eats 10.5 ounces of fiber per day?

You spin the spinner below 40 times. Predict how many times the spinner lands on the specified color.

- Red
- Blue
- Yellow



Chapter Review

Vocabulary

ratio, equivalent ratios, p. 317
 rate, unit rate, p. 318
 proportion, p. 322
 cross products, p. 323
 scale model, scale, p. 324
 percent, p. 327
 circle graph, p. 331
 percent of change, p. 338
 percent of increase, p. 338
 percent of decrease, p. 338

markup, discount, p. 342
 interest, p. 348
 principal, p. 348
 annual interest rate, p. 348
 outcome, p. 354
 event, p. 354
 favorable outcome, p. 354
 probability of an event, p. 354
 theoretical probability, p. 354
 experimental probability, p. 355

Vocabulary Review

Copy and complete the statement.

- If you write $\frac{180 \text{ miles}}{3 \text{ hours}}$ as $\frac{60 \text{ miles}}{1 \text{ hour}}$, you have written the rate as a(n) ? .
- A(n) ? is a ratio whose denominator is 100.
- The theoretical probability of an event is the ratio of the number of ? to the number of ? .

Match the word with the correct definition.

- | | |
|-------------------------|--|
| 4. annual interest rate | A. the amount of money that you borrow or deposit |
| 5. interest | B. the amount paid for the use of money |
| 6. principal | C. the percent of the principal that you pay or earn each year |

Review Questions

Write the equivalent rate. (Lesson 7.1)

7. $\frac{286.8 \text{ m}}{\text{min}} = \frac{? \text{ m}}{\text{sec}}$

8. $\frac{4.2 \text{ in.}}{\text{month}} = \frac{? \text{ in.}}{\text{year}}$

9. $\frac{6 \text{ times}}{\text{min}} = \frac{? \text{ times}}{\text{hour}}$

Solve the proportion. (Lesson 7.2)

10. $\frac{5}{13} = \frac{18}{c}$

11. $\frac{48}{36} = \frac{x}{6}$

12. $\frac{n}{12} = \frac{7}{8}$

13. $\frac{25}{b} = \frac{55}{22}$

Review Questions

Use a percent proportion. (Lesson 7.3)

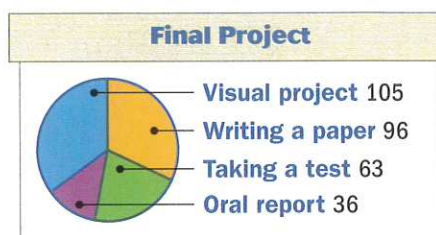
14. What number is 500% of 16? 15. 200.2 is 65% of what number?
16. 44 is what percent of 80? 17. 1.7 is what percent of 340?

Write the decimal or fraction as a percent. (Lesson 7.4)

18. 0.43 19. 0.003 20. $\frac{3}{10}$ 21. $\frac{29}{20}$

Final Project In Exercises 22–24, use the circle graph. It shows the results of a survey of 300 students who were asked what they would choose for a final project. (Lesson 7.4)

22. What percent of students chose an oral report?
23. What fraction of students chose a visual project? Write the fraction in simplest form.
24. Which final project was chosen by 21% of the students?



25. **Moving** A moving van's load changes from 800 to 984 pounds after picking up an appliance. Find the percent of increase. (Lesson 7.5)

Find the sale price or retail price. (Lesson 7.6)

26. Wholesale price: \$22.40 27. Original price: \$21.25
Percent markup: 60% Percent discount: 32%

Find the amount of simple interest earned in 3 years. (Lesson 7.7)

28. Principal: \$460 29. Principal: \$1540
Annual rate: 3.5% Annual rate: 2.75%

30. **Fundraiser** At a school fundraiser, the science club made 58% of their money selling juice, 27% selling cookies, and 15% selling apples. The club made \$87 selling juice. How much did the club make selling cookies? How much did they make selling apples? (Lesson 7.7)

Find the probability of the event. (Lesson 7.8)

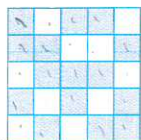
31. A random 5-digit ZIP code ends with a number less than 5.
32. You roll a number cube and get a 7.
33. A number less than 4 is randomly drawn from the numbers 1, 2, 3, and 4.



Chapter Test

Write the ratio of shaded to unshaded squares.

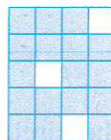
1.



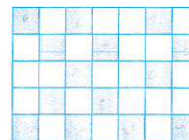
2.



3.



4.



Write the rate as a unit rate.

5. $\frac{156 \text{ miles}}{3 \text{ hours}}$

6. $\frac{18 \text{ servings}}{6 \text{ people}}$

7. $\frac{448 \text{ cycles}}{5 \text{ days}}$

8. $\frac{54 \text{ meters}}{21 \text{ seconds}}$

Find the value of the variable

9. $\frac{12}{16} = \frac{18}{a}$

10. $\frac{15}{6} = \frac{d}{4}$

11. $\frac{9}{n} = \frac{21}{14}$

12. $\frac{t-3}{12} = \frac{11}{6}$

13. **Maps** The road distance from Miami, Florida, to Columbia, South Carolina, on a map is about 6.7 centimeters. The scale is 1 cm : 150 km. What is the actual distance from Miami to Columbia?

14. **Survey** In a survey, 34%, or 102 people, said they enjoy in-line skating. How many people were surveyed?

Write the percent as a decimal and as a fraction.

15. 0.7%

16. 419%

17. 8%

18. 7.8%

Find the percent of increase or decrease.

19. Original amount: 40
New amount: 36

20. Original amount: 225
New amount: 324

21. Original amount: 258
New amount: 6.45

22. **Food** Your food bill at a restaurant totals \$26. There is a 6.5% sales tax and you leave a 16% tip. What is the total cost of the meal?

23. **Recycling** The average person in the United States generates about 4.5 pounds of waste per day. About 30% of this waste is recycled. About how many pounds of waste are recycled per person per day?

A box contains 9 tiles that together spell the word "TENNESSEE." You draw at random one tile from the box. Find the probability of the event.

24. Drawing an E

25. Drawing an S





Chapter Standardized Test

Test-Taking Strategy Avoid spending too much time on one question. Skip questions you have trouble with, and return to them after you have finished.

Multiple Choice

1. Which ratio is *not* equivalent to $\frac{3}{7}$?
A. $\frac{9}{21}$ B. $\frac{1.5}{3.5}$ C. $\frac{300}{700}$ D. $\frac{18}{39}$
2. Susan types at a speed of 54 words per minute. What is her typing speed in words per second?
F. 5400 words per second
G. 3240 words per second
H. $1.\bar{1}$ words per second
I. 0.9 word per second
3. Which choice shows $\frac{10 \text{ feet}}{4 \text{ seconds}}$ correctly written as a unit rate?
A. $\frac{5 \text{ ft}}{2 \text{ sec}}$ B. $\frac{5 \text{ ft}}{\text{sec}}$ C. $\frac{2.5 \text{ ft}}{\text{sec}}$ D. $\frac{2 \text{ ft}}{5 \text{ sec}}$
4. A scale model of a school building is 11 inches long and 3 inches high. The actual building is 231 feet long. How tall is the actual building?
F. 21 ft G. 33 ft
H. 63 ft I. 99 ft
5. Which choice is equal to 0.48?
A. 4.8% B. $\frac{2}{5}$
C. $\frac{12}{25}$ D. 480%
6. A crowd of 280 people grows to a crowd of 315 people. What is the percent of increase?
F. $11.\bar{1}\%$ G. 12.5% H. 35% I. $88.\bar{8}\%$

7. An item with a wholesale price of \$8.40 is marked up 60%. What is the retail price?
A. \$3.36 B. \$5.04 C. \$13.44 D. \$14.40
8. You and your friend are leaving a tip after eating dinner. The cost of the dinner is \$15.35. You want to leave *about* an 18% tip. How much should you leave as a tip?
F. \$1.25 G. \$2.75 H. \$8.50 I. \$18.00
9. You randomly draw a marble from a bag of 3 red, 8 yellow, and 13 blue marbles. What is the probability that the marble is yellow?
A. $\frac{13}{24}$ B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{1}{8}$

Short Response

10. You deposit \$1350 into a savings account that pays a simple annual interest rate of 2.8%. How much interest will you earn in 15 months? Compare this to the interest you would earn for the same amount of time in an account with a simple annual interest rate of 4%.

Extended Response

11. You draw a marble at random from a bag of red, blue, green, and yellow marbles 24 times. Each time you record its color and place it back in the bag of 75 marbles. The results are shown in the table below. How many of each color marble do you predict are in the bag? Explain.

Red	Blue	Green	Yellow
7	3	5	9

Strategies for Answering Short Response Questions

Scoring Rubric

Full credit

- answer is correct, and
- work and reasoning are included

Partial credit

- answer is correct, but reasoning is incorrect, or
- answer is incorrect, but reasoning is correct

No credit

- no answer is given or
- answer makes no sense

Problem

You work for your uncle this summer. He pays you \$20 on your first day. Each day after that, you will get a raise. You can choose from 2 payment plans. With Plan A, you earn a \$5 raise each day. With Plan B, you earn a 20% raise each day. Which plan is a better deal?

Full credit solution

Plan B is a better deal if you work more than 5 days.

Day	1	2	3	4	5	6
Plan A pay	20.00	25.00	30.00	35.00	40.00	45.00
Plan A total	20.00	45.00	75.00	110.00	150.00	195.00
Plan B pay	20.00	24.00	28.80	34.56	41.47	49.76
Plan B total	20.00	44.00	72.80	107.36	148.83	198.59

Data is used to justify the solution.

The question is answered clearly and in complete sentences.

- Plan A is better if you work 5 days or less, but Plan B is better if you work more than 5 days. By day 6, the pay with a 20% increase is more than the pay with a \$5 raise, so it will continue to be the better plan.

Partial credit solution

I think Plan B is better than Plan A.

Day	1	2	3	4	5	6
Plan A	20.00	25.00	30.00	35.00	40.00	45.00
Plan B	20.00	24.00	28.80	34.56	41.47	49.76

The calculations are correct.

The reasoning is faulty, because the total amount earned was not considered.

- The first 4 days, Plan A is better. The next 2 days, Plan B is better. By day 5 Plan B pays you more money, so it is the better plan.

Partial credit solution

The data does not include information past Day 4. So, the answer is incorrect.

- Plan A is better. The table shows that over the first four days, Plan A pays out \$2.64 more than Plan B.

Day	1	2	3	4
Plan A	20.00	25.00	30.00	35.00
Plan B	20.00	24.00	28.80	34.56
Difference	0	1.00	1.20	0.44

The data is calculated correctly.

No credit solution

The answer is incorrect.

- Plan A is better.

Day	1	2	3	4
Plan A	20.00	25.00	30.00	35.00
Plan B	20.00	24.00	26.00	28.00

The data is not calculated correctly.

Your turn now

Score each solution to the short response question below as **full credit**, **partial credit**, or **no credit**. Explain your reasoning.

Problem The Spiff travels 226.8 miles on 14 gallons of gas. The Flyte travels 280 miles on 17.5 gallons of gas. Which car is more fuel efficient?

- The Spiff is the more fuel efficient car because it gets 16.2 miles per gallon. The Flyte gets 16 miles per gallon.
- The Flyte gets 16 miles per gallon, because $280 \div 17.5 = 16$. The Spiff gets 16.2 miles per gallon, because $226.8 \div 14 = 16.2$. The more fuel efficient car gets a greater number of miles per gallon. Because 16.2 is greater than 16, the Spiff is more fuel efficient.

Watch Out!



Be sure to explain your reasoning clearly.

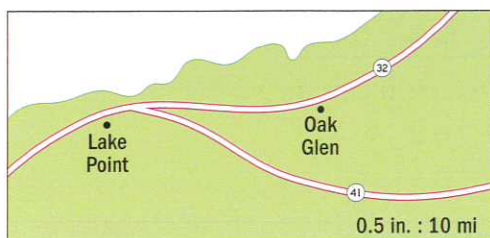
UNIT 2

Chapters 4-7

PRACTICING Test-Taking Skills

Short Response

- Joanne is using a map to plan her trip. Measure the distance, in inches, between the two cities on the map. Then use the scale on the map to estimate the actual distance in miles.



- John has a pile of quarters. Justin has five more than twice as many quarters as John. Jason has three times as many quarters as John. Justin and Jason have the same number of quarters. How much money does John have? Write your answer in dollars and cents.
- Amber is shopping for a new watch. The first watch she finds is on sale for 10% off the original price of \$35.95. The second watch she finds is on sale for 20% off the original price of \$38.25. There is an 8% sales tax on both watches. Which watch costs less? Explain your answer.
- Michelle needs at least \$75 for a school trip. She has \$22 already. Michelle makes \$5 per hour babysitting. How many hours does she need to babysit in order to have enough money for her trip? Write and solve an inequality to answer the question.
- A bowl contains 5 yellow marbles, 4 green marbles, 3 blue marbles, and 2 red marbles. Kim picks one marble at random. What is the probability that Kim's marble is *not* green? Explain your answer.

- Vincent's math teacher gives a test every 14 school days, and his English teacher gives a test every 8 school days. Vincent had a math test and an English test today. When will Vincent have an English test and a math test on the same day again? Give the smallest number of school days possible.
- Ryan, Nelson, and Mia worked together on a project. Ryan completed 35% of the project, and Nelson completed $\frac{2}{5}$ of the project. How much of the project did Mia complete? Give your answer as a fraction and as a percent.
- A baseball coach counts the number of home runs that each player hits in a season. The table shows the current totals.

Player	Number of Home Runs
Carmine	5
Larry	2
Ray	4
Anthony	6
Michael	0
David	6
Paul	5
Mickey	4
Frank	3

What is the mean number of home runs hit by the team? How many players hit more home runs than this average?

- Trish parks in front of a parking meter at 2:15 P.M. After 6:00 P.M., she doesn't have to pay to park. The meter only takes quarters, and \$.25 pays for 30 minutes of parking. Trish plans to leave her car in the same place until 8:00 P.M. How much money should she put in the meter? Give your answer in dollars and cents. Explain.

Multiple Choice

10. A softball team keeps two kinds of bats in the equipment bag. There are 15 metal bats and 9 wooden bats. A player chooses her bat at random. What is the probability that the bat is made of wood?
- A. $\frac{3}{8}$ B. $\frac{8}{15}$ C. $\frac{3}{5}$ D. $\frac{5}{8}$
11. The circumference of a circular swimming pool is about 38 feet. What is the best estimate of the pool's diameter?
- F. 6 ft G. 6.3 ft H. 12.1 ft I. 12.6 ft
12. A long distance telephone call costs \$.25 for the first minute, and each minute after the first costs \$.15. How many minutes long is a call that costs \$1.75?
- A. 9 minutes B. 10 minutes
C. 11 minutes D. 12 minutes
13. Lucia has 5 quarters for every 7 nickels in her purse. Lucia wants to know how many nickels she has if she has 35 quarters. Which proportion can Lucia use?
- F. $\frac{n}{35} = \frac{5}{7}$ G. $\frac{35}{n} = \frac{7}{5}$
H. $\frac{5}{n} = \frac{7}{35}$ I. $\frac{35}{n} = \frac{5}{7}$
14. What is the prime factorization of 80?
- A. $2^4 \cdot 5$ B. $2^2 \cdot 4 \cdot 5$
C. $2^3 \cdot 10$ D. $2^2 \cdot 20$
15. Three scout troops are each divided into small groups. Every small group has exactly 4 scouts in it, and every scout is in a small group. How many total scouts could be in each of the three troops?
- F. 12, 21, 27 G. 36, 40, 60
H. 6, 18, 24 I. 10, 40, 80

Extended Response

16. Mr. Fay has given his students 20 homework assignments. The table shows the number of homework assignments that each student has completed so far. Find the median number of assignments completed.

Amy	Bill	Dan	Dave	Erin	Jack	Kyle	Matt	Mike	Ron	Tara
17	16	19	20	17	18	17	15	16	19	20

Jillian was left off of Mr. Fay's list by mistake. What is the minimum number of assignments Jillian must complete in order for the median of the group to be 17.5? Explain your answer.

17. Cindy wants to use a 20% discount coupon to buy a coat that originally cost \$78. She also wants to use a 10% discount coupon to buy a sweater that originally cost \$36. To find the total cost of the items after the discounts, Cindy found the sum of their original prices and subtracted 30% of the total. Explain the mistake that Cindy made. Then show how to find the correct total cost before sales tax.

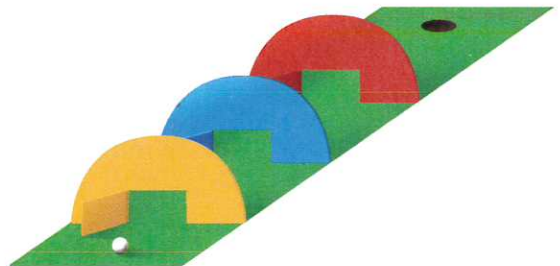
Cumulative Practice for Chapters 4–7

Chapter 4

Multiple Choice In Exercises 1–7, choose the letter of the correct answer.

- What is the prime factorization of 54?
(Lesson 4.1)
A. $6 \cdot 9$ B. $6 \cdot 3^2$ C. $2 \cdot 3^3$ D. $2^2 \cdot 3^3$
- What is the greatest common factor of 72 and 90? (Lesson 4.2)
F. 6 G. 9 H. 12 I. 18
- Which fractions are equivalent? (Lesson 4.3)
A. $\frac{5}{8}, \frac{3}{16}$ B. $\frac{15}{30}, \frac{60}{80}$ C. $\frac{18}{72}, \frac{7}{28}$ D. $\frac{12}{24}, \frac{8}{24}$
- Which set of fractions is ordered from least to greatest? (Lesson 4.5)
F. $\frac{3}{16}, \frac{1}{4}, \frac{3}{8}, \frac{1}{2}$ G. $\frac{3}{8}, \frac{1}{2}, \frac{3}{16}, \frac{1}{4}$
H. $\frac{3}{8}, \frac{1}{4}, \frac{1}{2}, \frac{3}{16}$ I. $\frac{3}{8}, \frac{1}{2}, \frac{1}{4}, \frac{3}{16}$
- What is the value of the expression $4^2 \cdot 4^3 - 5^3$? (Lesson 4.6)
A. -899 B. 81 C. 899 D. 10,800
- What is the value of the expression $3 \cdot 3^{-5}$? (Lesson 4.7)
F. $\frac{1}{81}$ G. $\frac{1}{5}$ H. 45 I. 81
- Which is *not* in scientific notation? (Lesson 4.8)
A. 1×10^6 B. 4.4×10^{-2}
C. 8.03×10^4 D. 13.4×10^{-8}

- Short Response** Train A leaves the station every 12 minutes. Train B leaves every 15 minutes. A bus leaves every 8 minutes. How often do two trains and a bus depart at the same time? Explain. (Lesson 4.4)
- Extended Response** A hole at a miniature golf course has 3 doors that swing open on different schedules. You see the 3 doors open at the same time. After 4 seconds, the red door opens again. Two seconds after that, the blue door opens. The red door opens after 2 more seconds. One second later, the yellow door opens. (Lesson 4.4)



- How often does each door open?
- How often do all 3 doors open at the same time? Explain your answer.

Chapter 5

Multiple Choice In Exercises 10–16, choose the letter of the correct answer.

- You need $4\frac{1}{2}$ yards of fabric for drapes and $3\frac{1}{2}$ yards for a bedspread. How many yards of fabric should you purchase? (Lesson 5.1)
A. $1\frac{1}{2}$ B. $7\frac{1}{2}$ C. 8 D. $8\frac{1}{2}$

11. Find the difference $\frac{18}{21} - \frac{6}{14}$. (Lesson 5.2)

F. $\frac{3}{7}$ G. $\frac{4}{7}$ H. $\frac{6}{7}$ I. $\frac{12}{7}$

12. Find the product $-1\frac{1}{2} \cdot \frac{9}{20}$. (Lesson 5.3)

A. $-1\frac{9}{20}$ B. $-1\frac{1}{20}$ C. $-\frac{27}{40}$ D. $-\frac{3}{10}$

13. What is the value of a in the equation

$$\frac{2}{3}a = -12? \text{ (Lesson 5.4)}$$

F. -27 G. -18 H. -12 I. -2

14. In your class, $\frac{21}{30}$ of the students ride the bus to school. What is another way to write this number? (Lesson 5.5)

A. 0.24 B. 0.33 C. 0.66 D. 0.7

15. What is the value of the expression $-2.643 + (-9.9)$? (Lesson 5.6)

F. -12.543 G. -11.643

H. 7.257 I. 12.543

16. What is the value of the expression $-2.84 \cdot 8.6$? (Lesson 5.7)

A. -24.424 B. -11.44

C. 5.76 D. 24.424

17. **Short Response** Four friends shared a pizza. Each person ate only whole slices. Kerry ate $\frac{1}{6}$ of the pizza, and Amy ate 0.25 of the pizza. Brian ate 0.5 of the pizza. Jeff ate $\frac{1}{12}$ of the pizza. Who ate the most pizza? (Lesson 5.5)

18. **Extended Response** Rebecca's long distance plan charges \$.10 per minute before 7:00 P.M. and \$.05 per minute after 7:00 P.M. Rebecca begins a long distance call at 6:39 P.M. and ends the call at 7:12 P.M. (Lessons 5.6, 5.7)

- Find the cost of the phone call.
- At 7:15 P.M. Rebecca makes another long distance call. She talks for the same amount of time as she did on the previous call. Find the cost of the second phone call.
- What is the price difference of Rebecca's first call and her second call?

Chapter 6

Multiple Choice In Exercises 19–23, choose the letter of the correct answer.

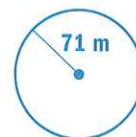
19. What is the value of n in the equation $3n + 9 + 4n = 2$? (Lesson 6.1)

A. -2 B. -1 C. 1 D. 2

20. What is the value of x in the equation $22 + x = 37 + 6x$? (Lesson 6.2)

F. -3 G. 3 H. 6 I. 12

21. Find the circumference of the circle. Use 3.14 for π . (Lesson 6.4)



A. 45.22 m B. 111.47 m
C. 222.94 m D. 445.88 m

22. What is the solution to the inequality $2y - 5 < 7$? (Lesson 6.5)

F. $y < -6$ G. $y > -6$
H. $y < 6$ I. $y > 6$

UNIT 2

PRACTICING Test-Taking Skills

Chapters

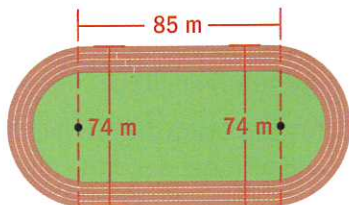
4-7

Cumulative Practice continued

23. Mark has \$40 to spend on CDs that cost \$11.95 each. What is the greatest number of CDs that Mark can buy? (Lesson 6.6)

A. 2 B. 3 C. 4 D. 5

24. **Short Response** The diagram shows the approximate measures of a track. Find the perimeter. Explain your steps. Round your answer to the nearest 100. (Lesson 6.4)



25. **Extended Response** Pat rode his bike at a speed of 9 mi/h. Rick rode at a speed of 8 mi/h. Pat rode 13.5 miles. (Lesson 6.3)
- How many hours and minutes did Pat spend riding?
 - Rick rode his bike for the same amount of time as Pat. How far did Rick ride?
 - Pat and Rick ride at the same speeds for another 45 minutes. Find the total distance traveled by each person.

Chapter 7

Multiple Choice In Exercises 26–31, choose the letter of the correct answer.

26. Lauren types 1040 words in 20 minutes. What is Lauren's typing speed in words per minute? (Lesson 7.1)
- A. 52 B. 104 C. 208 D. 5700
27. Solve the proportion $\frac{7}{23} = \frac{49}{x}$. (Lesson 7.2)
- F. 7 G. 115 H. 161 I. 207

28. 18 is what percent of 45? (Lesson 7.3)

A. 9% B. 40% C. 50% D. 60%

29. The cost of a concert ticket increased by 4%. The new cost is \$31.20. What was the cost before the increase? (Lesson 7.5)

F. \$18.00 G. \$29.50 H. \$30.00 I. \$31.80

30. What is the total cost of a television priced at \$86.90 with 7% sales tax? (Lesson 7.6)

A. \$66.88 B. \$80.82 C. \$89.99 D. \$92.98

31. Joan invested \$100 in an account that pays 5% simple annual interest. What is the account balance after 5 years? (Lesson 7.7)

F. \$105 G. \$125 H. \$150 I. \$525

32. **Short Response** Houses on your block are numbered 31 through 50. You choose a house at random. What is the probability that the house you choose has a 4 in its number? Explain your answer. (Lesson 7.8)

33. **Extended Response** The graph shows the results of a poll in which 504 people would choose to be a zookeeper. (Lesson 7.4)

- How many people chose rodeo star?
- Find the total number of people who participated in the poll.
- How many people chose either a veterinarian or a pet store owner?

