

# Applying Percent



## “What do snowboards have to do with math?”

How much money would you save buying a snowboard that is 35% off its original price of \$169? You could use the equation  $d = 0.35 \cdot 169$  to find the **discount**  $d$ . Equations are useful in finding the total cost of an item including the discount and the sales tax.

You will solve problems involving discount and sales tax in Lesson 8-5.

# GETTING STARTED

## ► Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 8. Refer to the lesson or page number in parentheses for review.

### Vocabulary Review

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

- Data refers to pieces of information that are often numerical. (Lesson 2-1)
- The percent equation is written as  $\frac{\text{part}}{\text{base}} = \frac{\text{percent}}{100}$ . (Lesson 7-8)

### Prerequisite Skills

**Multiply.** (Page 560)

- $300 \times 0.02 \times 8$
- $85 \times 0.25 \times 3$
- $560 \times 0.6 \times 4.5$
- $154 \times 0.12 \times 5$

**Simplify. Write as a decimal.** (Lesson 1-3)

- $\frac{22 - 8}{8}$
- $\frac{50 - 33}{50}$
- $\frac{35 - 7}{35}$

**Solve. Round to the nearest tenth if necessary.** (Lesson 4-3)

- $0.4m = 52$
- $21 = 0.28a$
- $13 = 0.06s$
- $0.95z = 37$

**Write each percent as a decimal.** (Lesson 7-6)

- 40%
- 3.25%
- 7.5%

Use the percent proportion to find each number. Round to the nearest tenth if necessary. (Lesson 7-8)

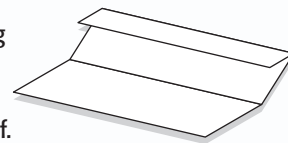
- What percent of 86 is 34?
- 20% of what number is 55?



**Percents** Make this Foldable to help you organize information about percents. Begin with a piece of 11" by 17" paper.

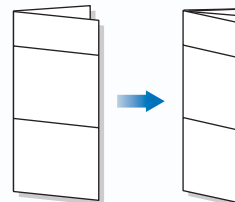
#### STEP 1 Fold

Fold a 2" tab along the long side of the paper. Then fold the rest in half.



#### STEP 2 Open and Fold

Open the paper and fold in half widthwise 3 times to make 8 columns.



#### STEP 3 Open and Label

Draw lines along the folds and label as shown.

Ch 8	8-1	8-2	8-3	8-4	8-5	8-6	Other Facts
Main Ideas							
Examples							



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



**Readiness** To prepare yourself for this chapter with another quiz, visit [msmath2.net/chapter\\_readiness](http://msmath2.net/chapter_readiness)

# Percent and Estimation

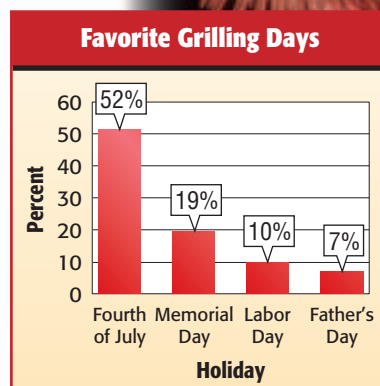
## What You'll LEARN

Estimate percents by using fractions and decimals.

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

**GRILLING** The graph shows the results of a survey in which people were asked which holiday was their favorite for grilling outdoors. Suppose 80 people were surveyed.

1. What fraction of people surveyed chose Labor Day as their favorite grilling day? How many of the 80 people surveyed is this?
2. About 50% of the people surveyed chose the Fourth of July as their favorite grilling day. Explain how you could use a fraction to estimate the number of people who chose this day. Then estimate.
3. Use a fraction to estimate the number of people surveyed who chose Memorial Day as their favorite grilling day.



Source: Market Facts for Butterball Turkey

Sometimes an exact answer is not needed when using percents. In these cases, you can estimate. One way to estimate the percent of a number is to use a fraction.

## EXAMPLES Use Fractions to Estimate

### 1 Estimate 48% of 60.

48% is about 50% or  $\frac{1}{2}$ .

48% of 60  $\approx \frac{1}{2} \cdot 60$  Use  $\frac{1}{2}$  to estimate.

$\approx 30$  Multiply.

So, 48% of 60 is about 30.

### 2 Estimate 82% of 195.

82% is about 80%, which is  $\frac{8}{10}$  or  $\frac{4}{5}$ .

82% of 195  $\approx \frac{4}{5} \cdot 200$  Use  $\frac{4}{5}$  to estimate and round 195 to 200.

$\approx 160$  Multiply.

So, 82% of 195 is about 160.

### 3 Your Turn Estimate by using a fraction.

a. 26% of 80

b. 75% of 23

c. 62% of 507

Another method for estimating the percent of a number is to first find 10% of the number and then multiply. For example,  $70\% = 7 \cdot 10\%$ . So, 70% of a number equals 7 times 10% of the number.

### STUDY TIP

**Percents** To use decimals in estimating, first round percents to the nearest 10%. To find 10% of a number, move the decimal point one place to the left.

### EXAMPLE

### Estimate by Using 10%

**1** Estimate 71% of 300.

**Step 1** Find 10% of the number.

$$\begin{aligned} 10\% \text{ of } 300 &= 0.1 \cdot 300 && \text{To multiply by 10\%, move the} \\ &= 30 && \text{decimal point one place to the left.} \end{aligned}$$

**Step 2** Multiply.

71% is about 70%.

70% of 300 is 7 times 10% of 300.

$$7 \cdot 30 = 210$$

So, 71% of 300 is about 210.

**Your Turn** Estimate by using 10%.

d. 19% of 40

e. 30% of 217

f. 63% of 91

You can also estimate percents of numbers when the percent is greater than 100 or the percent is less than 1.

### EXAMPLES

### Percents Greater Than 100 or Less Than 1

**1** Estimate 122% of 50.

122% is more than 100%, so 122% of 50 is greater than 50.

122% is about 120%.

$$\begin{aligned} 120\% \text{ of } 50 &= (100\% \text{ of } 50) + (20\% \text{ of } 50) && 120\% = 100\% + 20\% \\ &= (1 \cdot 50) + \left(\frac{1}{5} \cdot 50\right) && 100\% = 1 \text{ and } 20\% = \frac{1}{5} \\ &= 50 + 10 \text{ or } 60 && \text{Simplify.} \end{aligned}$$

So, 122% of 50 is about 60.

**1** Estimate  $\frac{1}{4}\%$  of 589.

$\frac{1}{4}\%$  is one fourth of 1%. 589 is about 600.

$$\begin{aligned} 1\% \text{ of } 600 &= 0.01 \cdot 600 && \text{To multiply by 1\%, move the decimal point two} \\ &= 6 && \text{places to the left.} \end{aligned}$$

One fourth of 1% is  $\frac{1}{4} \cdot 6$  or 1.5.

So,  $\frac{1}{4}\%$  of 589 is about 1.5.

**Your Turn** Estimate.

g. 174% of 200

h. 298% of 45

i. 0.25% of 789



**EXAMPLE****Estimate Percent to Solve a Problem**

**POPULATION** In 2000, about 0.5% of the people in Montana were of Asian descent. If Montana had a population of 902,195, estimate the number of people who were of Asian descent.

0.5% is half of 1%.

$$\begin{aligned} 1\% \text{ of } 900,000 &= 0.01 \cdot 900,000 && \text{902,195 is about 900,000.} \\ &= 9,000 \end{aligned}$$

So, 0.5% of 902,195 is about  $\frac{1}{2}$  of 9,000 or 4,500.

So, about 4,500 people in Montana were of Asian descent.

**Skill and Concept Check**

- Describe two different ways to estimate 22% of 136.
- OPEN ENDED** Write a problem in which the answer can be found by estimating 12% of 50.
- FIND THE ERROR** Ian and Mandy are estimating 1.5% of 420. Who is correct? Explain.

Ian

$$\begin{aligned} &1.5\% \text{ of } 420 \\ &\approx 1\% \text{ of } 400 + 0.5\% \text{ of } 400 \\ &= 0.01 \cdot 400 + \frac{1}{2}(0.01 \cdot 400) \\ &= 4 + 2 \text{ or } 6 \end{aligned}$$

Mandy

$$\begin{aligned} &1.5\% \text{ of } 420 \\ &= 1 \cdot 400 + 0.5 \cdot 400 \\ &= 400 + 200 \\ &= 600 \end{aligned}$$

- NUMBER SENSE** Explain whether an estimate for the percent of a number is *always*, *sometimes*, or *never* greater than the actual percent of the number. Give an example or a counterexample to support your answer.

**GUIDED PRACTICE**

Estimate by using fractions.

- 52% of 160
- 30% of 79
- 77% of 22

Estimate by using 10%.

- 40% of 62
- 23% of 400
- 89% of 98

Estimate.

- 151% of 70
- 305% of 6
- $\frac{1}{2}\%$  of 82

- LIFE SCIENCE** The 639 muscles in your body make up about 40% of your total weight. If a person weighs 120 pounds, about how much of the weight is muscle?

## Practice and Applications

Estimate by using fractions.

15. 25% of 408                      16. 80% of 37                      17. 76% of 280  
 18. 39% of 20                      19. 67% of 15.2                      20. 10.5% of 238

Estimate by using 10%.

21. 60% of 39                      22. 20% of 132                      23. 76% of 80  
 24. 37% of 250                      25. 28% of 121                      26. 88% of 207

Estimate.

27. 132% of 54                      28. 224% of 320                      29. 410% of 12  
 30. 198% of 33                      31. 0.4% of 400                      32. 0.9% of 74

**GEOLOGY** For Exercises 33 and 34, use the following information.

Granite, a stone found in New Hampshire and Vermont, is 0.8% water.

33. About how many pounds of water are there in 3,000 pounds of granite?  
 34. About how much water is contained in a 15-pound piece of granite?  
 35. **CRITICAL THINKING** Explain how you could find  $\frac{3}{8}\%$  of a number.

### HOMEWORK HELP

For Exercises	See Examples
15–20	1, 2
21–26	3
27–34	4–6

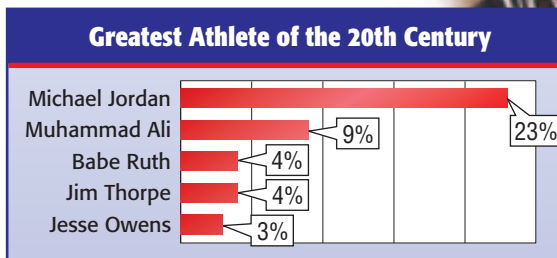
**Extra Practice**  
 See pages 582, 603.

## Spiral Review with Standardized Test Practice

36. **MULTIPLE CHOICE** Estimate 15% of 61.

(A) 30                      (B) 18                      (C) 15                      (D) 9

37. **MULTIPLE CHOICE** In a survey, 1,031 people were asked to choose the greatest athlete of the 20th century. The top five choices are shown at the right. About how many more people chose Michael Jordan than Muhammad Ali? Choose the best estimate.



Source: Gallup Poll

(F) 90 people                      (G) 100 people                      (H) 150 people                      (I) 200 people

Find each number. Round to the nearest tenth if necessary. (Lesson 7-8)

38. 6 is what percent of 15?                      39. Find 72% of 90.  
 40. What number is 120% of 60?                      41. 35% of what number is 55?  
 42. Find 22% of 85. (Lesson 7-7)

### GETTING READY FOR THE NEXT LESSON

**PREREQUISITE SKILL** Solve. Round to the nearest tenth if necessary. (Lesson 4-3)

43.  $40 = 0.8x$                       44.  $10r = 61$                       45.  $25 = 0.07t$                       46.  $56 = 0.32n$



# 8-1b

## Problem-Solving Strategy

A Follow-Up of Lesson 8-1

### What You'll LEARN

Solve problems by determining reasonable answers.

### Reasonable Answers

The meals for our group cost a total of \$38.95. I think we should leave a 15% tip, which would be about \$4.

I think that the tip should be more than that. Let's estimate to find a **reasonable answer**.

#### Explore

We know that the total bill is \$38.95 and we want to leave a 15% tip.

#### Plan

We can round \$38.95 to \$40 and then use mental math to find 15% of 40.

#### Solve

$$10\% \text{ of } 40 = 0.1 \cdot 40 \text{ or } 4 \quad 10\% = 0.1$$

$$5\% \text{ of } 40 = \frac{1}{2} \cdot 4 \text{ or } 2$$

$$15\% \text{ of } 40 = (10\% \text{ of } 40) + (5\% \text{ of } 40) \\ = 4 + 2 \text{ or } 6$$

So, \$6 would be a better amount to leave for a tip.

#### Examine

Use a calculator to check.

$$.15 \times 38.95 = 5.8425$$

5.8425 is close to 6, so the answer is reasonable.

### Analyze the Strategy

1. The last step of the four-step plan for problem solving asks you to examine your solution. **Explain** how you can use estimation with decimals to help you examine a solution.
2. **Write** a problem that has an unreasonable answer and ask a classmate to explain why they think the answer is unreasonable.
3. **Describe** other problem-solving strategies that you could use to determine whether answers are reasonable.

## Apply the Strategy

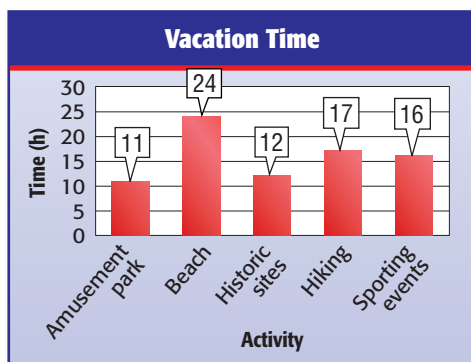
Solve. Use the reasonable answer strategy.

- COMMUNICATION** Sandra makes a long distance phone call to her grandparents and talks for 45 minutes. The phone company charges a rate of \$0.20 per minute. How much does the call cost?
- SHOPPING** Suppose you are buying an entertainment system for \$1,301.90 and the speakers are 57.6% of the total cost. What is a reasonable estimate for the cost of the speakers? Explain.

## Mixed Problem Solving

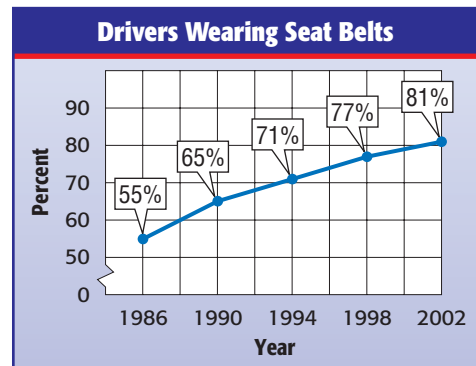
Solve. Use any strategy.

- CHORES** Cameron is using a 2.5-liter container to fill a tank that holds 24 liters of water. How many times will he need to fill the container?
- MUSIC** A survey showed that 73% of teens who use computers listen to music at the same time. Suppose there are 410 teens in your school who use computers. Estimate how many of them listen to music while on the computer.
- VACATION** The graph below shows how the Mason family spent their time during their summer vacation. What percent of the time shown was spent touring historic sites?



- BASKETBALL** Keisha made 18 points in one basketball game. How many possible shot combinations of 2- and 3-pointers could she have made? List the combinations in a table.
- POPULATION** About 9.4% of the people in Texas live in Houston. If the population of Texas is about 20,852,000, estimate the population of Houston.

- SEAT BELTS** The graph shows the percent of drivers who wore seat belts. Predict the percent of drivers who will wear seat belts in 2006. Explain why your answer is reasonable.



Source: Harris Interactive

- GEOMETRY** A rectangle has a length of  $4\frac{1}{4}$  inches and a width of  $3\frac{2}{5}$  inches. Is between 7 and 8 inches a reasonable estimate for the perimeter? Explain.

### 13. STANDARDIZED TEST PRACTICE

Mr. Camacho is purchasing carpet for the two rooms described in the table. Which

Room	Dimensions
living room	15 ft by 18 ft
TV room	18 ft by 20 ft

expression shows the number of square yards of carpet that he needs?

- $[(15 \times 18) + (18 \times 20)] \div (3 \times 3)$
- $[(15 \times 18(2 \times 20)) \div 3]$
- $[(15 \times 18) + (18 \times 20)] \div 3$
- $(15 \times 18 \times 20) \div (3 \times 3)$

# Algebra: The Percent Equation

## What You'll LEARN

Solve problems by using the percent equation.

## NEW Vocabulary

percent equation

## Link to READING

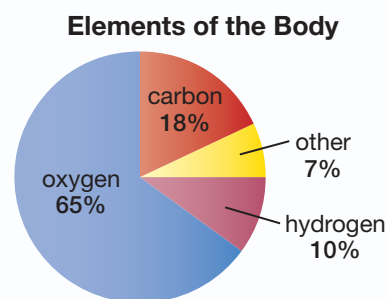
### Everyday Meaning of

**Base:** the bottom of something considered as its support, as in the base of a column

## WHEN am I ever going to use this?

**PHYSICAL SCIENCE** The graph shows three main elements that make up most of the human body.

1. Suppose a person weighs 120 pounds. Use the percent proportion to find the number of pounds of oxygen, carbon, and hydrogen.
2. Express the percent of each element as a decimal.
3. Multiply each decimal by 120. Record your results.
4. Compare the answers to Exercises 1 and 3.



Source: *The New York Times Almanac*

In Lesson 7-8, you used the percent proportion  $\frac{\text{part}}{\text{base}} = \frac{\text{percent}}{100}$  to find the missing part, percent, or base. You can also use an equation.

$$\frac{\text{part}}{\text{base}} = \text{percent} \quad \text{The percent is written as a decimal.}$$

$$\frac{\text{part}}{\text{base}} \cdot \text{base} = \text{percent} \cdot \text{base} \quad \text{Multiply each side by the base.}$$

$$\text{part} = \text{percent} \cdot \text{base} \quad \leftarrow \text{This form is called the percent equation.}$$

## Concept Summary

## Types of Percent Problems

Type	Example	Equation
Find the Part	What number is 50% of 6?	$n = 0.5 \cdot 6$
Find the Percent	3 is what percent of 6?	$3 = n \cdot 6$
Find the Base	3 is 50% of what number?	$3 = 0.5 \cdot n$

## EXAMPLE Find the Part

**1** What number is 12% of 350? **Estimate**  $0.1 \cdot 350 = 35$

12% or 0.12 is the percent and 350 is the base. Let  $n$  represent the part.

$$\text{part} = \text{percent} \cdot \text{base}$$

$$n = 0.12 \cdot 350 \quad \text{Write an equation.}$$

$$n = 42 \quad \text{Multiply. The part is 42.}$$

So, 42 is 12% of 350. **This is close to the estimate.**

### EXAMPLE Find the Percent

1 21 is what percent of 40? **Estimate**  $\frac{21}{40} \approx \frac{1}{2}$  or 50%

Let  $n$  represent the percent.

$$\text{part} = \text{percent} \cdot \text{base}$$

$$21 = n \cdot 40 \quad \text{Write an equation.}$$

$$\frac{21}{40} = \frac{40n}{40}$$

Divide each side by 40.

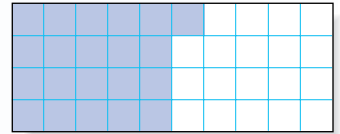
$$0.525 = n$$

Simplify.

$$52.5\% = n$$

Write 0.525 as a percent.

So, 21 is 52.5% of 40. This is close to the estimate.



### STUDY TIP

**Percent** Remember to write the decimal as a percent in your final answer.

### EXAMPLE Find the Base

1 13 is 26% of what number? **Estimate** 13 is 25% or  $\frac{1}{4}$  of 52.

Let  $n$  represent the base.

$$\text{part} = \text{percent} \cdot \text{base}$$

$$13 = 0.26 \cdot n \quad \text{Write an equation.}$$

$$\frac{13}{0.26} = \frac{0.26n}{0.26}$$

Divide each side by 0.26.

$$50 = n$$

The base is 50.

So, 13 is 26% of 50. Compare to the estimate.

2 **Your Turn** Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- a. What percent of 125 is 75?      b. 39 is 84% of what number?

### REAL-LIFE MATH

**TECHNOLOGY** The following cities in the United States have the highest percent of cell phone users.

Anchorage, AK	56%
Chicago, IL	55%
Honolulu, HI	54%
Atlanta, GA	52%
Detroit, MI	52%

Source: Polk's Research



### EXAMPLE Apply the Percent Equation

1 **TECHNOLOGY** Finland has the highest percent of people who have cell phones, 67.8%. If there are about 3,499,000 people with cell phones, what is the population of Finland?

**Words** 3,499,000 is 67.8% of what number?

**Symbols** Let  $n$  represent the base.

**Equation**  $3,499,000 = 0.678 \cdot n$

67.8% is written as the decimal 0.678.

$$3,499,000 = 0.678 \cdot n \quad \text{Write the equation.}$$

$$\frac{3,499,000}{0.678} = \frac{0.678n}{0.678} \quad \text{Divide each side by 0.678. Use a calculator.}$$

$$5,160,767 \approx n \quad \text{Simplify.}$$

The population of Finland is about 5,160,767.



## Skill and Concept Check

1. **State** whether the following problem represents a missing part, a missing percent, or a missing base.  
*17 is 10% of what number?*
2. **OPEN ENDED** Write a real-life problem that can be solved by using the percent equation. State whether you need to find the part, the percent, or the base, and then solve.

## GUIDED PRACTICE

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

3. What number is 88% of 300?
4. 75 is what percent of 150?
5. 3 is 12% of what number?
6. 84 is 60% of what number?
7. **BASEBALL** In 2003, Derek Jeter had 156 hits in 482 times at bat. What was his *batting average*, or the percent of times at bat that were hits? Round the percent to the nearest tenth. Then write as a decimal.



**Data Update** How do current batting averages of other baseball players compare to Derek Jeter's average in 2003? Visit [msmath2.net/data\\_update](http://msmath2.net/data_update) to learn more.

## Practice and Applications

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

8. What number is 65% of 98?
9. Find 53% of 470.
10. 9 is what percent of 45?
11. 26 is what percent of 96?
12. 84 is 75% of what number?
13. 17 is 40% of what number?
14. Find 24% of 25.
15. What percent of 64 is 30?
16. 98 is what percent of 392?
17. 33% of what number is 1.45?
18. Find 13.5% of 520.
19. What number is 75.2% of 600?
20. What number is 4% of 82.1?
21. 14 is 2.8% of what number?
22. Find 135% of 64.
23. What percent of 200 is 230?
24. **SALES** Ms. Allon received a \$325 *commission*, which is a fee paid based on a percent of her sales. If her sales totaled \$8,125, what is the percent that she earns?

**NUMBER THEORY** For Exercises 25 and 26, consider the whole numbers 1 through 100.

25. For what percent of these numbers will the digits add to 5?
26. For what percent of these numbers will the digits add to an even number? an odd number?

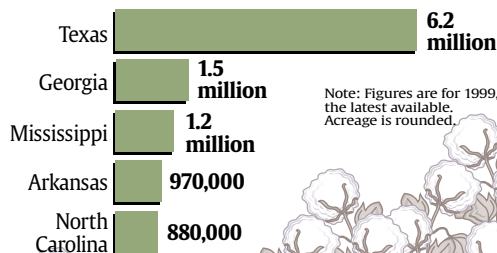
## HOMEWORK HELP

For Exercises	See Examples
8–23	1–3
24–28	4

**Extra Practice**  
See pages 583, 603.

**Texas is the king of cotton**

Almost 14.9 million acres are planted in cotton in the USA. Top cotton states, by acreage:



Note: Figures are for 1999, the latest available. Acreage is rounded.

Source: Agriculture Department, Cotton and Wool Outlook, April 2000

By Hilary Wasson and Marcy E. Mullins, USA TODAY

**CROPS** For Exercises 27–29, use the graphic at the right. It shows the acres of cotton planted in the top five states. Round to the nearest percent.

27. About what percent of the cotton planted in the United States is planted in Texas?
28. About what percent of U.S. cotton is planted in North Carolina?
29. What percent of U.S. cotton is planted in states other than those listed on the graphic?
30. **MULTI STEP** A cargo of 18,000 tons of grain is 14% water due to moisture. Another cargo of 26,000 tons of grain is 12.2% water. Which contains more water? How much more?
31. **CRITICAL THINKING** If you need to find the percent of a number, explain how you can predict whether the part will be less than, greater than, or equal to the number.

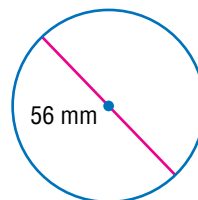
## Spiral Review with Standardized Test Practice

32. **MULTIPLE CHOICE** 23 is what percent of 64? Round to the nearest tenth.  
 Ⓐ 2.8%      Ⓑ 33.4%      Ⓒ 34.0%      Ⓓ 35.9%
33. **MULTIPLE CHOICE** 56 is 16% of what number? Round to the nearest tenth.  
 Ⓕ 300.5      Ⓖ 305.0      Ⓗ 305.5      Ⓘ 350.0

**Estimate by using fractions.** (Lesson 8-1)

34. 11% of 79
35. 30.5% of 50
36. 48% of 311
37. **NUTRITION** A cup of fruit yogurt has approximately 315 milligrams of calcium. This is about 24% of the recommended daily allowance for people 9 to 18 years old. How many milligrams of calcium is recommended per day for people 9 to 18 years old? (Lesson 7-8)

38. **GEOMETRY** Find the circumference of the circle.  
 Use  $\frac{22}{7}$  for  $\pi$ . (Lesson 6-9)



39. Find the greatest common factor of 72 and 270.  
 (Lesson 5-2)

### GETTING READY FOR THE NEXT LESSON

**PREREQUISITE SKILL** Use the percent proportion to find each number. Round to the nearest tenth if necessary. (Lesson 7-9)

40. What number is 45% of 60?
41. What percent of 180 is 30?
42. 20% of what number is 18?
43. 50% of what number is 15.8?



**What You'll LEARN**

Use sampling to collect data.

**Sampling****INVESTIGATE** *Work as a class.*

To determine the favorite lunches of students at your school, you could ask each student. A more practical method is to survey a representative group of students and use that data to make a conclusion. This method is called **sampling**.



Term	Definition
<b>population</b>	total group of people or items in which the survey is interested
<b>sample</b>	part of the population
<b>sample size</b>	number of people or items in the survey

It is important to obtain a sample that is **unbiased**, that is, not limited or not favoring a particular outcome. Suppose you put the ID numbers of all the students in a box and randomly choose 65 numbers. This sample is unbiased because it is:

- a *random sample*. Each member of the population, or students at your school, has an equal chance of being selected.
- large enough to provide accurate data.

**Writing Math**

*Work in groups of three.*

**State whether each sample is random. Explain.**

1. To determine the favorite spectator sport for women over 25 years old, 350 women over 25 are surveyed at a professional basketball game.
2. To collect data about the study habits of middle school students in the Franklin School District, the name of every middle school student in the district is placed in a bag and 250 names are randomly selected.

**For Exercises 3–7, refer to the information below.**

Suppose you are to survey students in your school.

3. Formulate a hypothesis about students' activities.
4. Design and conduct a survey. Describe the technique that you used to get a random sample.
5. Organize and display the results of your survey in a table or graph.
6. Analyze ways in which the wording of your questions might have changed the outcome of the survey.
7. Use the results of your survey to evaluate your hypothesis.

**STUDY TIP**

**Unbiased** An unbiased sample is representative of the population.

# 8-3

## Statistics: Using Statistics to Predict

### What You'll LEARN

Predict actions of a larger group by using a sample.

### NEW Vocabulary

survey  
population  
random sample

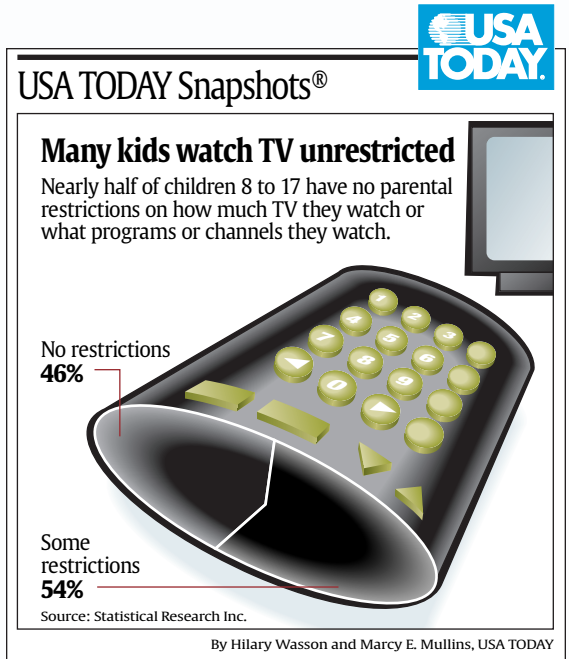
### REVIEW Vocabulary

**data:** pieces of information that are often numerical (Lesson 2-1)

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

**TELEVISION** The graphic shows the results of a survey in which children were asked whether they had rules about what they watched on television.

1. What ages of children are represented?
2. Can you tell how many were surveyed? Explain.
3. Describe how you could use the graphic to predict how many students in your school have no restrictions on their television viewing.



A **survey** is a question or set of questions designed to collect data about a specific group of people, called the **population**. If a survey uses a **random sample** of a population, or a sample chosen without preference, you can assume that the sample represents the population. Then you can use the results to make predictions about the population.

### EXAMPLE Predict Using Percent Proportion

**TELEVISION** Refer to the survey results in the graphic above. Predict how many of the 1,250 Gallatin Middle School students have some restrictions on the television that they watch.

You can use the percent proportion and the survey results to predict what part of the population of students have TV restrictions.

part of the population	→	$\frac{a}{b} = \frac{p}{100}$	Percent proportion
entire population	→	$\frac{a}{1,250} = \frac{54}{100}$	Survey results: $54\% = \frac{54}{100}$
		$100a = 1,250(54)$	Cross products
		$a = 675$	Simplify.

So, about 675 of the Gallatin Middle School students have some television restrictions.

### READING in the Content Area

For strategies in reading this lesson, visit [msmath2.net/reading](http://msmath2.net/reading).



## REAL-LIFE MATH

**COMMUNICATION** The survey at the right also found that 92% of people 12 to 17 years old use the Internet to send E-mails.



You can also use the percent equation to make predictions using survey results.

### EXAMPLE Predict Using Percent Equation

**COMMUNICATION** A survey showed that 74% of people 12 to 17 years old use the Internet to send instant messages. Predict how many of the 2,450 students at Washington Middle School send instant messages.

You need to predict how many of the 2,450 students send instant messages.

<b>Words</b>	What number is 74% of 2,450?
<b>Variable</b>	Let $n$ represent the number.
<b>Equation</b>	$n = 0.74 \cdot 2,450$

$$n = 0.74 \cdot 2,450 \quad \text{Write the equation.}$$

$$n = 1,813 \quad \text{Multiply.}$$

So, you could predict that about 1,813 students at Washington Middle School use the Internet to send instant messages.

## Skill and Concept Check

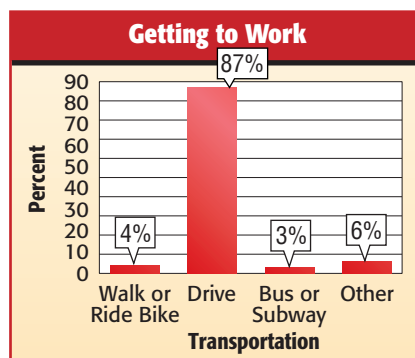
- Writing Math** Explain how to use a sample to predict what a group of people prefer.
- OPEN ENDED** Find a newspaper or magazine article that has a table or graph. Identify the population and explain how you think the results were found.

## GUIDED PRACTICE

- SPENDING** The circle graph shows the results of a poll to which 60,000 teens responded. Predict how many of the approximately 28 million teens in the United States would buy a music CD if they were given \$20.
- TRANSPORTATION** The graph shows the results of a survey in which working adults in America were asked how they get to work. Use the data to predict how many working adults in America out of 143 million walk or ride a bicycle to work.



Source: USA WEEKEND



Source: Gallup Poll

## Practice and Applications

5. **COMPUTERS** The table shows the results of a survey in which students were asked how they use a personal computer at home. Use the results to predict how many of the 1,745 Allegheny Valley Middle School students use a PC for homework.

PC Use	Percent
educational programs	93%
homework	80%
games	70%

Source: U.S. Census Bureau

### HOMESCHOOL HELP

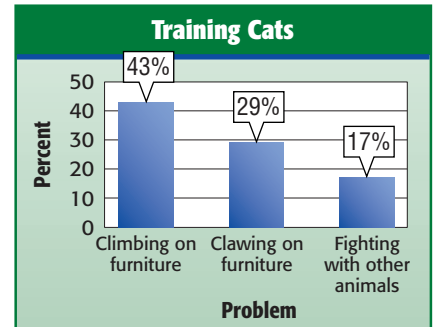
For Exercises 5–8 See Examples 1, 2

5–8 1, 2

Extra Practice  
See pages 583, 603.

6. **CAMERAS** In a survey, 14% of teens said they own a digital camera. Predict how many of the 420,000 teens in Arizona own digital cameras.

**CATS** For Exercises 7 and 8, use the graphic at the right. It shows the percent of cat owners who train their cats to prevent each problem.



Source: Purina Cat Chow

7. Out of 255 cat owners, how many would you predict have trained their cat not to climb on furniture?
8. Predict how many cat owners in a group of 316 have trained their cat not to claw furniture.

9. **CRITICAL THINKING** A survey found that 80% of teens enjoy going to the movies in their free time. This was the response of 5,200 teens that were surveyed. What was the total number of teens surveyed?

## Spiral Review with Standardized Test Practice

10. **MULTIPLE CHOICE** A survey of 80 seventh graders at Lincoln Middle School was taken to find how they get to school each day. The results are shown in the table. Of the 423 seventh graders in the school, predict how many walk to school.

Getting to School	Percent
take a bus	33%
walk	29%
adult drives	18%
other	20%

- (A) 23      (B) 64      (C) 123      (D) 394

11. **SHORT RESPONSE** A survey showed that 16% of the people in Tennessee over the age of 16 belong to a fitness center. Predict how many of the 5 million people in Tennessee over the age of 16 belong to a fitness center.

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 8-2)

12. What number is 12% of 60?      13. 54 is 72% of what number?
14. Estimate 30% of 149. (Lesson 8-1)

### GETTING READY FOR THE NEXT LESSON

**PREREQUISITE SKILL** Simplify. Write as a decimal. (Lesson 1-3)

15.  $\frac{10 - 7}{10}$

16.  $\frac{50 - 18}{50}$

17.  $\frac{22 - 4}{4}$

18.  $\frac{39 - 15}{15}$



# Mid-Chapter Practice Test

## Vocabulary and Concepts

1. Describe two methods that can be used to estimate the percent of a number. (Lesson 8-1)
2. Explain what the *population* is in a survey. (Lesson 8-3)

## Skills and Applications

Estimate by using fractions. (Lesson 8-1)

3. 20% of 392
4. 78% of 112
5. 52% of 295

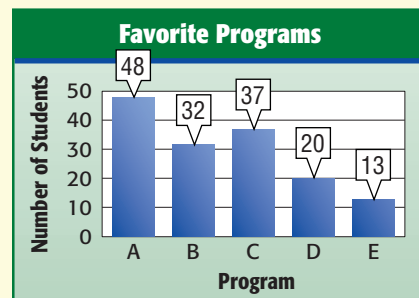
Estimate by using 10%. (Lesson 8-1)

6. 30% of 42
7. 79% of 88
8. 41.5% of 212

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 8-2)

9. What number is 35% of 72?
10. 16.1 is what percent of 70?
11. 27.2 is 68% of what number?
12. 16% of 32 is what number?

**ENTERTAINMENT** For Exercises 13 and 14, refer to the graph at the right. It shows the results of a survey of students' favorite TV programs at Morgan Middle School. (Lesson 8-3)



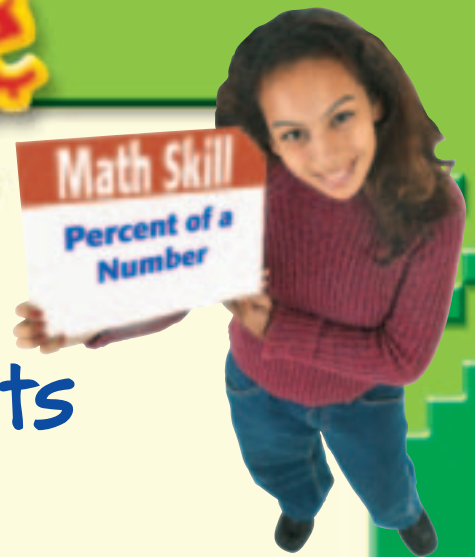
13. What percent of the students surveyed preferred Program A?
14. How many of the 925 students in the school would you expect to choose Program A as their favorite?

## Standardized Test Practice

15. **MULTIPLE CHOICE** Miyoki has read 82% of a book that has 214 pages. Which is the best estimate of the number of pages that she has read? (Lesson 8-1)
  - A 16 pages
  - B 50 pages
  - C 80 pages
  - D 160 pages
16. **MULTIPLE CHOICE** A cookie company received 1,600 E-mails in one week. Of those E-mails, 12.5% were people requesting catalogues. How many people requested catalogues that week? (Lesson 8-2)
  - F 2,000 people
  - G 1,280 people
  - H 200 people
  - I 128 people

# The Game Zone

A Place To Practice Your Math Skills



## Spinning for Percents

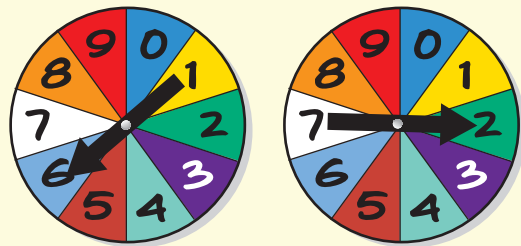
### ● GET READY!

**Players:** two or three

**Materials:** 6 index cards, 2 spinners

### ● GET SET!

- Copy the numbers 11, 28, 45, 62, 84, and 98 onto index cards, one number per card.
- Shuffle the cards and place them facedown in a pile.
- Label equal sections of two spinners with the digits 0 through 9.
- Decide which spinner will stand for digits in the tens place and which spinner will stand for the ones place. The number formed by spinning both spinners is the percent.



These spinners represent 62%.

### ● GO!

- One player selects the top card from the pile.
- The player spins both spinners and records the percent that is formed. He or she then finds that percent of the number that is on the index card. Round to the nearest whole number if necessary. This is the player's score for this turn.
- Continue in this way, taking turns selecting a card, until no cards remain in the pile.
- **Who Wins?** The player with the greatest total score wins.

# 8-4

## Percent of Change

### HANDS-ON Mini Lab

#### Materials

- paper strips
- scissors
- tape

#### What You'll LEARN

Find the percent of increase or decrease.

#### NEW Vocabulary

percent of change  
percent of increase  
percent of decrease

*Work with a partner.*

You can use paper strips to model a 50% increase.

- Begin with two paper strips. On each strip, label 0% on the left side and 100% on the right side.



- Fold one of the paper strips in half. Mark 50% in the center.



- Cut the second strip at the 50% mark and tape the piece onto the end of the first strip. The new longer strip represents a 50% increase or 150%.



**Model each percent of change.**

- 25% increase
- 75% increase
- 30% increase
- Describe** a model that represents a 100% increase, a 200% increase, and a 300% increase.
- Describe** how this process would change to show percent of decrease.

One way to describe a change in quantities is to use percent of change.

#### Noteables

#### Key Concept: Percent of Change

**Words** A **percent of change** is a ratio that compares the change in quantity to the original amount.

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

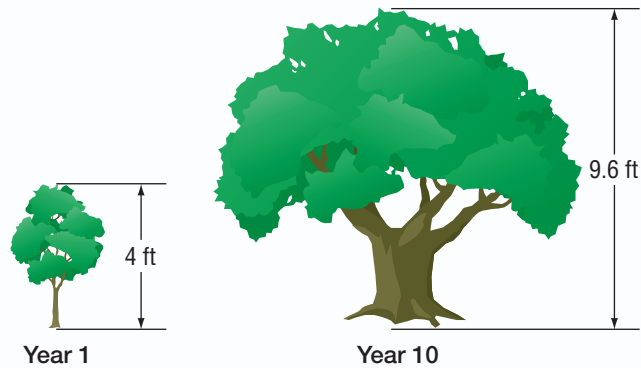
If the original quantity is increased, then it is called a **percent of increase**. If the original quantity is decreased, then it is called a **percent of decrease**.

$$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}} \leftarrow \begin{array}{l} \text{new amount} - \\ \text{original amount} \end{array}$$

$$\text{percent of decrease} = \frac{\text{amount of decrease}}{\text{original amount}} \leftarrow \begin{array}{l} \text{original amount} - \\ \text{new amount} \end{array}$$

**EXAMPLE****Find Percent of Increase**

- 1 TREES** Find the percent of change in tree height from year 1 to year 10. Round to the nearest whole percent if necessary.



Since the new height is greater than the original height, this is a percent of increase. The amount of increase is  $9.6 - 4$  or 5.6 feet.

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

$$= \frac{5.6}{4} \quad \text{Substitution}$$

$$= 1.4 \quad \text{Simplify.}$$

$$= 140\% \quad \text{Write 1.4 as a percent.}$$

The percent of increase in the tree height is 140%.

**REAL-LIFE CAREERS****How Does a Stockbroker Use Math?**

A stockbroker must be able to compare percents of change of different stock prices.

**Research**

For information about a career as a stockbroker, visit: [msmath2.net/careers](http://msmath2.net/careers)

**EXAMPLE****Find Percent of Decrease**

- 1 STOCKS** Find the percent of change if the original price of a stock was \$75 and the new price is \$60. Round to the nearest whole percent if necessary.

Stock	Price
original	\$75
new	\$60

Since the new price is less than the original price, this is a percent of decrease. The amount of decrease is  $75 - 60$  or \$15.

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

$$= \frac{15}{75} \quad \text{Substitution}$$

$$= 0.2 \quad \text{Simplify.}$$

$$= 20\% \quad \text{Write 0.2 as a percent.}$$

The percent of decrease of the stock is 20%.

- 3 Your Turn** Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

a. original: 10  
new: 13

b. original: 20  
new: 15



## Skill and Concept Check

- OPEN ENDED** Write a percent of change problem using 14 and 25. State whether there is a percent of increase or decrease. Then solve.
- NUMBER SENSE** The costs of two different shelf stereo systems are decreased by \$10. The original costs were \$90 and \$60, respectively. Without calculating, which had greater percent of decrease? Explain.
- FIND THE ERROR** Jada and Miranda are finding the percent of change from 46 to 130. Who is correct? Explain.

$$\begin{array}{c} \text{Jada} \\ \frac{130 - 46}{46} \approx 1.83 \text{ or } 183\% \end{array}$$

$$\begin{array}{c} \text{Miranda} \\ \frac{130 - 46}{130} \approx 0.65 \text{ or } 65\% \end{array}$$

### GUIDED PRACTICE

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

- |                                      |                                  |                                |
|--------------------------------------|----------------------------------|--------------------------------|
| 4. original: 30<br>new: 24           | 5. original: \$126<br>new: \$150 | 6. original: 624<br>new: 702   |
| 7. original: \$75.80<br>new: \$94.75 | 8. original: 1.6<br>new: 0.95    | 9. original: 20.5<br>new: 35.5 |

10. **SPORTS** The table shows the number of people ages 7 to 17 who played soccer. What was the percent of increase in soccer players from 1990 to 2000? Round to the nearest whole percent.

Playing Soccer	
Year	Number (millions)
1990	10.9
2000	12.9

Source: National Sporting Goods Association



## Practice and Applications

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

- |                                   |                                       |  |
|-----------------------------------|---------------------------------------|--|
| 11. original: 15<br>new: 18       | 12. original: 100<br>new: 140         | 13. original: \$12<br>new: \$6         |
| 14. original: \$240<br>new: \$320 | 15. original: 48<br>new: 14           | 16. original: 360<br>new: 120          |
| 17. original: 125<br>new: 87.5    | 18. original: \$15.60<br>new: \$11.70 | 19. original: \$89.50<br>new: \$105.20 |
| 20. original: 132<br>new: 125.4   | 21. original: 782<br>new: 789.82      | 22. original: 12<br>new: 60            |

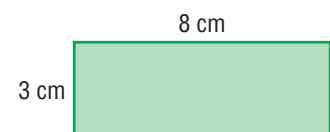
### HOMework HELP

For Exercises 11–31	See Examples 1, 2
------------------------	----------------------

**Extra Practice**  
See pages 583, 603.

**GEOMETRY** For Exercises 23 and 24, refer to the rectangle at the right. Suppose the side lengths are doubled.

- Find the percent of increase in the perimeter.
- Find the percent of increase in the area.



25. **SALES** Use the graphic at the right to find the percent of change in ketchup sales from 2000 to 2001.
26. **EDUCATION** A person with a high school diploma earns an average of \$16,053 per year. A person with some college earns an average of \$25,686 per year. What is the percent of increase?
27. **POPULATION** On July 1, 2003, the U.S. had an estimated 290,809,777 residents. This is 9,386,546 more than on April 1, 2000. To the nearest tenth, what was the percent of change in population?
28. **ART** In 2001, the sales of fine art were \$40.8 billion. Art sales are projected to increase by 25% from 2001 to 2005. What is the projected amount of art sales in 2005?



Source: Heinz North America

**ALLOWANCES** For Exercises 29–31, refer to the table at the right.

29. Find the percent of increase of allowance from age 13 to 14. Round to the nearest whole percent.
30. State two consecutive ages where the change in allowance is a percent of decrease. Then find the percent of decrease. Round to the nearest tenth.
31. Between which two consecutive years is the percent of increase the greatest? What is the percent of increase? Round to the nearest whole percent.
32. **CRITICAL THINKING** If a quantity increases by 10% and then decreases by 10%, will the result be the original quantity? Explain.

Age	Average Weekly Allowance
12	\$9.58
13	\$9.52
14	\$13.47
15	\$15.57
16	\$17.84
17	\$30.66

Source: www.kidsmoney.org

## Spiral Review with Standardized Test Practice

33. **MULTIPLE CHOICE** The table shows the average number of hours that Americans worked in 1990 and in 2000. Find the percent of increase to the nearest tenth.
- (A) 19.0%      (B) 2.0%      (C) 1.9%      (D) 0.2%
34. **SHORT RESPONSE** Find the percent of decrease from 85 to 68.
35. **FOOD** In a survey of 150 students at Kennedy Middle School, 48% said that their favorite type of pizza crust is thick crust. Predict how many of the 1,375 students in the school prefer thick crust pizza. (Lesson 8-3)

Year	Time (h)
1990	1,943
2000	1,979

Source: International Labor Organization

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 8-2)

36. 30% of what number is 17?      37. What is 21% of 62?

### GETTING READY FOR THE NEXT LESSON

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

38. 6.5%      39.  $5\frac{1}{2}\%$       40.  $8\frac{1}{4}\%$       41.  $6\frac{3}{4}\%$



**What You'll LEARN**

Solve problems involving sales tax and discount.

**NEW Vocabulary**

sales tax  
discount

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

**COMPUTERS** Julie Ann plans to buy a new computer with a flat screen that costs \$1,299. She lives in Florida where there is a sales tax of 6%.

1. Calculate the sales tax by finding 6% of \$1,299.
2. What will be the total cost including the sales tax?
3. Use a calculator to multiply 1.06 and 1,299. How does the result compare to your answer in Exercise 2?

One everyday use of percent is sales tax. **Sales tax** is an additional amount of money charged on items that people buy. The local, state, or federal government receives this money. The total cost of an item is the regular price plus the sales tax.

**EXAMPLE Find the Total Cost**

- 1 TECHNOLOGY** A graphing calculator costs \$90, and the sales tax is 4.25%. What is the total cost of the calculator?

First, find the sales tax.

$$\begin{aligned} 4.25\% \text{ of } \$90 &= 0.0425 \cdot 90 \\ &\approx 3.83 \quad \text{The sales tax is } \$3.83. \end{aligned}$$

Next, add the sales tax to the regular price.

$$3.83 + 90 = 93.83$$

The total cost of the calculator is \$93.83.

Another way to find the cost of an item with sales tax is to add the percent of tax to 100%.

**EXAMPLE Find the Total Cost**

- 1 CLOTHES** What is the total cost of a sweatshirt if the regular price is \$42 and the sales tax is  $5\frac{1}{2}\%$ ?

$$100\% + 5\frac{1}{2}\% = 105\frac{1}{2}\% \quad \text{Add the percent of tax to 100\%.}$$

The total cost is  $105\frac{1}{2}\%$  of the regular price.

$$\begin{aligned} 105\frac{1}{2}\% \text{ of } \$42 &= 1.055 \cdot 42 \quad \text{Use a calculator.} \\ &= 44.31 \end{aligned}$$

The total cost of the sweatshirt is \$44.31.

**Discount** is the amount by which the regular price of an item is reduced. The sale price is the regular price minus the discount.



### EXAMPLE Find the Sale Price

**MULTIPLE-CHOICE TEST ITEM** Alan wants to buy a snowboard that has a regular price of \$169. This week, the snowboard is on sale at a 35% discount. What is the sale price of the snowboard?

- (A) \$59.15    (B) \$109.85    (C) \$134.00    (D) \$228.15

#### Read the Test Item

The sale price is \$169 minus the discount.

#### Solve the Test Item

**Method 1** First, find the amount of the discount  $d$ .

$$\begin{aligned} \text{part} &= \text{percent} \cdot \text{base} \\ d &= 0.35 \cdot 169 && \text{Use the percent equation.} \\ d &= 59.15 && \text{The discount is \$59.15.} \end{aligned}$$

So, the sale price is  $\$169 - \$59.15$  or  $\$109.85$ .

**Method 2** First, subtract the percent of discount from 100%.

$$100\% - 35\% = 65\%$$

So, the sale price  $s$  is 65% of the regular price.

$$\begin{aligned} s &= 0.65 \cdot 169 && \text{Use the percent equation.} \\ s &= 109.85 && \text{The sale price is \$109.85.} \end{aligned}$$

So, the sale price of the snowboard is \$109.85. The answer is B.

### EXAMPLE Find the Percent of Discount

**MUSIC** An electric guitar is on sale as shown at the right. What is the percent of discount?

First, find the *amount* of discount.

$$\$299.95 - \$179.99 = \$119.96$$

Next, use the percent equation to find the percent discount.

Words	\$119.96 is what percent of \$299.95?
Variable	Let $n$ represent the percent.
Equation	$119.96 = n \cdot 299.95$

$$119.96 = n \cdot 299.95 \quad \text{Write the equation.}$$

$$0.40 \approx n \quad \text{Divide each side by 299.95 and simplify.}$$

The percent of discount is about 40%.

#### Your Turn

a. Find the percent of discount if the sale price of the guitar is \$224.96.

Original Price:

~~\$299.95~~

Now: \$179.99



#### Test-Taking Tip

##### Elimination

The sale price of an item is less than the regular price. Eliminate any choices in which the sale price given is greater than the regular price.

#### STUDY TIP

**Discount** You also could have used the percent proportion to find what percent \$119.96 is of \$299.95.



## Skill and Concept Check

1. **Find** the sales tax of a \$98 chair if the tax rate is 7%.
2. **Writing Math** Describe two methods for finding the sale price of an item that is discounted 30%. Which method do you prefer? Explain.
3. **OPEN ENDED** Give an example of the regular price of an item and the total cost including sales tax if the tax rate is 5.75%.

### GUIDED PRACTICE

**Find the total cost or sale price to the nearest cent.**

4. \$2.95 notebook; 5% tax
5. \$1,575 computer; 15% discount
6. \$119.50 skateboard; 20% off
7. \$46 shoes; 2.9% tax

**Find the percent of discount to the nearest percent.**

8. lotion: regular price, \$4.50  
sale price, \$2.25
9. in-line skates: regular price, \$99  
sale price, \$90
10. **VIDEO GAMES** What is the sales tax of a \$178.90 video game system if the tax rate is 3.75%?

## Practice and Applications

**Find the total cost or sale price to the nearest cent.**

11. \$58 ski lift ticket; 20% discount
12. \$1,500 computer; 7% tax
13. \$99 CD player; 5% tax
14. \$12.25 pen set; 60% discount
15. \$4.30 notebook; 40% discount
16. \$7.50 meal; 6.5% tax
17. \$39.60 sweater; 33% discount
18. \$89.75 scooter;  $7\frac{1}{4}\%$  sales tax

19. **BOOKS** A book about candle making is \$24.95. Find the total cost of the book including the 4.5% sales tax.
20. **TICKETS** A local movie theater is selling movie tickets for \$5.25 during the first week of May. The regular price of a ticket is \$6.75. What is the percent of discount to the nearest percent?

**Find the percent of discount to the nearest percent.**

21. calendar: regular price, \$9  
sale price, \$2.25
22. telescope: regular price, \$180  
sale price, \$126
23. concert tickets: regular price, \$44  
sale price, \$34
24. TV: regular price, \$625  
sale price, \$562.50
25. **MULTI STEP** A sound system has a regular price of \$249. Find the total cost if it is on sale for 50% off and the sales tax is 5.75%.
26. **MULTI STEP** Suppose your restaurant bill comes to \$28.35. Find your total cost if the tax is 6.25% and you leave a 20% tip on the amount before tax.

HOMEWORK HELP	
For Exercises	See Examples
11–19, 25–31	1–3
20–24	4
Extra Practice See pages 584, 603.	

**MOUNTAIN BIKES** For Exercises 27–30, use the information below and at the right.

A mountain bike has a regular price of \$575.

27. Suppose Antonio lives in Mississippi. What is the total cost of the bike including tax?
28. If the mountain bike is on sale with a 25% discount, how much will Antonio pay for the bike, including tax?
29. Before 8 A.M., the bike will be discounted an additional 15% off the already discounted price. What will be the sale price, not including tax?
30. **RESEARCH** Use the Internet or another source to find the current tax rates of the states listed in the table or of other states. Find the cost of the bike including tax in one of these states.
31. **PROFIT** To make a profit, stores sell items for more than they paid. The increase in price is called the *markup*. Suppose Sports Galore purchases tennis racquets for \$45 each. Find the markup price if the racquets are sold for 28% over the price paid for them.
32. **CRITICAL THINKING** Find the total percent of change on the price of an item if it is 15% off and the sales tax is 5%. Does it matter in which order the discount and the sales tax are applied? Explain.

State	2004 Sales Tax Rate
Arkansas	6%
Illinois	6.25%
Mississippi	7%
New York	4.25%

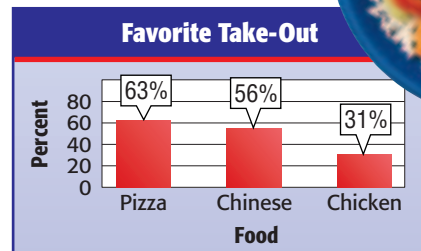
Source: www.salestaxinstitute.com

## Spiral Review with Standardized Test Practice

33. **MULTIPLE CHOICE** A T-shirt at the mall costs \$14.95. It is on sale for 30% off. What is the sale price to the nearest cent?  
 (A) \$4.49      (B) \$10.47      (C) \$10.50      (D) \$10.65
34. **SHORT RESPONSE** All of a department store's jackets are 20% off. To the nearest cent, what is the total cost of a jacket if the original price is \$74.99 and the sales tax is  $8\frac{1}{2}\%$ ?

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*. (Lesson 8-4)

35. original: 4      36. original: \$556      37. original: 20.5  
 new: 6      new: \$500      new: 35.5
38. **FOOD** The graph shows the results of a survey in which magazine readers were asked to name their favorite take-out foods. Predict how many out of 5,000 readers would choose Chinese food as one of their favorite take-out foods. (Lesson 8-3)



Source: Bon Appetit

### GETTING READY FOR THE NEXT LESSON

**PREREQUISITE SKILL** Multiply. (Lesson 6-4)

39.  $790 \cdot 0.185 \cdot 2$
40.  $45 \cdot 0.04 \cdot 9$
41.  $600 \cdot 0.03 \cdot 5\frac{1}{2}$
42.  $162 \cdot 0.25 \cdot 3\frac{1}{2}$



[msmath2.net/self\\_check\\_quiz](http://msmath2.net/self_check_quiz)



# 8-6

# Simple Interest

## What You'll LEARN

Solve problems involving simple interest.

## NEW Vocabulary

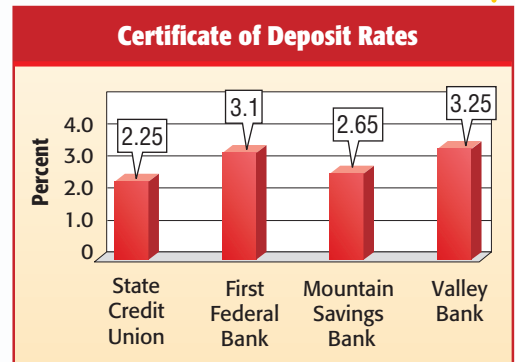
simple interest  
principal

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

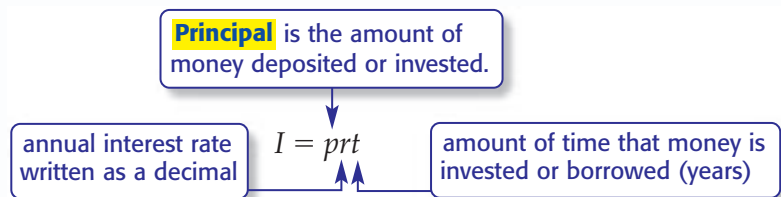
**INVESTING** Brooke plans to invest \$1,000 in a certificate of deposit (CD). The graph shows CD rates for one year at various banks.

1. Calculate 2.25% of \$1,000 to find the amount of money that Brooke can earn in one year for a CD at State Credit Union.

2. Find the amount of money that she can earn in one year at the other three banks.



When you deposit money in a CD, the amount that you earn is called interest. **Simple interest** is the amount paid or earned for the use of money. To find simple interest  $I$ , use the following formula.



## EXAMPLES Find Interest Earned

**SAVINGS** Raini has \$750 in a savings account that pays 3% simple interest. How much interest will he earn in each amount of time?

**1** 4 years

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 750 \cdot 0.03 \cdot 4 \quad \text{Replace } p \text{ with } \$750, r \text{ with } 0.03, \text{ and } t \text{ with } 4.$$

$$I = 90 \quad \text{Simplify.}$$

Raini will earn \$90 in interest in 4 years.

**1** 9 months

$$9 \text{ months} = \frac{9}{12} \text{ or } 0.75 \text{ year} \quad \text{Write the time as years.}$$

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 750 \cdot 0.03 \cdot 0.75 \quad p = \$750, r = 0.03, t = 0.75$$

$$I \approx 16.88 \quad \text{Simplify.}$$

Raini will earn \$16.88 in interest in 9 months.

## READING Math

**Formulas** Read  $I = prt$  as *Interest is equal to principal times rate times time.*

The formula  $I = prt$  can also be used to find the interest owed when you borrow money. In this case,  $p$  is the amount of money borrowed, and  $t$  is the amount of time the money is borrowed.

### EXAMPLE Find Interest Paid on a Loan

- LOANS** Emilio's father borrows \$1,200 from the bank for a riding lawn mower. The interest rate is 8% per year. How much simple interest will he pay if he takes 2 years to repay the loan?

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 1,200 \cdot 0.08 \cdot 2 \quad \text{Replace } p \text{ with } \$1,200, r \text{ with } 0.08, \text{ and } t \text{ with } 2.$$

$$I = 192 \quad \text{Simplify.}$$

Emilio's father will pay \$192 in interest in 2 years.

### EXAMPLE Find Total Paid on a Credit Card

- CREDIT CARDS** Cory charged a \$600 TV on his credit card with an interest rate of 21%. If he has no other charges on the card, how much money will he owe after one month?

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 600 \cdot 0.21 \cdot \frac{1}{12} \quad \text{Replace } p \text{ with } \$600, r \text{ with } 0.21, \text{ and } t \text{ with } \frac{1}{12}.$$

$$I = 10.5 \quad \text{Simplify.}$$

The interest owed after one month is \$10.50. So, the total amount owed would be \$600 + \$10.50 or \$610.50.

## Skill and Concept Check

- List the steps you would use to find the simple interest on a \$500 loan at 6% interest rate for 18 months.
- OPEN ENDED** Suppose you earn 3% on a \$1,200 deposit for 5 years. Investigate how the interest is affected if the rate or the time is increased.

## GUIDED PRACTICE

Find the interest earned to the nearest cent for each principal, interest rate, and time.

- \$640, 3%, 2 years
- \$1,500, 4.25%, 4 years

Find the interest paid to the nearest cent for each loan balance, interest rate, and time.

- \$4,500, 9%, 3.5 years
- \$290, 12.5%, 6 months

- HISTORY** In 2002, a \$5 bank note from 1886 was sold to a collector for \$103,500. Suppose a person had deposited the \$5 in a bank in 1886 with an interest rate of 4%. After 116 years, how much simple interest would have been earned on the account?



## Practice and Applications

Find the interest earned to the nearest cent for each principal, interest rate, and time.

8. \$1,050, 4.6%, 2 years  
9. \$250, 2.85%, 3 years  
10. \$500, 3.75%, 1 year  
11. \$3,000, 5.5%, 2 years  
12. \$875, 6%, 4 months  
13. \$98.50,  $6\frac{1}{2}\%$ , 16 months

Find the interest paid to the nearest cent for each loan balance, interest rate, and time.

14. \$1,000, 7%, 2 years  
15. \$725, 6.25%, 1 year  
16. \$2,700, 8.2%, 3 years  
17. \$175.80, 12%, 1.25 years  
18. \$925,  $19\frac{1}{2}\%$ , 3 months  
19. \$800, 10.5%, 30 months

**INVESTING** For Exercises 20–22, use the following information.

Marcus has \$1,800 from his summer job to invest.

20. If he invests in a CD for 3 years at a rate of 5.25%, how much will the CD be worth after 3 years?  
21. Suppose he invests the \$1,800 for 2 years and earns \$144. What was the rate of interest?  
22. Marcus would like to have \$2,340 altogether. If he invests his money at 5% interest, in how many years will he have \$2,340?  
23. **CRITICAL THINKING** Mrs. Williams deposits \$600 in an account that pays 4.5% annually. At the end of the year, the interest earned is added to the principal. Find the total amount in her account each year for 3 years.

### HOMEWORK HELP

For Exercises	See Examples
8–13	1, 2
14–19	3
20–22	4

**Extra Practice**  
See pages 584, 603.

## Spiral Review with Standardized Test Practice

24. **MULTIPLE CHOICE** Antonia opened a savings account that pays 6.5% simple interest. How much money will be in Antonia's account after 3 years if she deposited \$250 at the beginning and never made any more deposits?  
(A) \$48.75      (B) \$248.75      (C) \$298.75      (D) \$300.00
25. **MULTIPLE CHOICE** Mr. McMahon bought a \$562 freezer using a credit card that charges 18% annual interest. If he does not make any payments or any additional charges, how much will he owe after 1 month?  
(F) \$553.57      (G) \$570.43      (H) \$578.86      (I) \$663.16
26. Find the total cost of a \$13.99 music CD if the tax rate is 7%. (Lesson 8-5)

Find each percent of change. Round to the nearest whole percent if necessary.

State whether the percent of change is an *increase* or *decrease*. (Lesson 8-4)

27. original: 35  
new: 45  
28. original: 60  
new: 38  
29. original: \$2.75  
new: \$1.80



# 8-6b

# Spreadsheet Investigation

## A Follow-Up of Lesson 8-6

### What You'll LEARN

Use a spreadsheet to calculate simple interest.

## Simple Interest

A computer spreadsheet is a useful tool for quickly calculating simple interest for different values of principal, rate, and time.

### ACTIVITY

Max plans on opening a “Young Savers” account at his bank. The current rate on the account is 4%. He wants to see how different starting balances, rates, and times will affect his account balance. To find the balance at the end of 2 years for different principal amounts, he enters the values  $B2 = 4$  and  $C2 = 2$  into the spreadsheet below.

	A	B	C	D	E
1	Principal (p)	Rate (r)	Time (t)	Interest (I)	New Balance
2		4	2		
3	500	=B2/100	=C2	=A3*B3*C3	=A3+D3
4	1000	=B2/100	=C2	=A4*B4*C4	=A4+D4
5	1500	=B2/100	=C2	=A5*B5*C5	=A5+D5
6	2000	=B2/100	=C2	=A6*B6*C6	=A6+D6
7	2500	=B2/100	=C2	=A7*B7*C7	=A7+D7

For each principal given in column A, simple interest is calculated for any values of rate and time entered in B2 and C2, respectively.

The spreadsheet adds simple interest to the principal.

### EXERCISES

- Why is the rate in column B divided by 100?
- What is the balance in Max's account after 2 years if the principal is \$1,500 and the simple interest rate is 4%?
- How much interest does Max earn in 2 years if his account has a principal of \$2,000 and an interest rate of 4%?
- Suppose you wanted to add a new row to the spreadsheet that represents a principal of \$3,000. List each of the cell entries (A8, B8, C8, D8, and E8) that you would enter.
- What entries for cells B2 and C2 would you use to calculate the simple interest on a principal of \$1,500 at a rate of 7% for a 9-month period? What is the balance of this account at the end of the 9 months?
- Explain how a spreadsheet is more useful than a pencil and paper when finding simple interest.

## Vocabulary and Concept Check

discount (p. 355)

percent equation (p. 340)

percent of change (p. 350)

percent of decrease (p. 350)

percent of increase (p. 350)

population (p. 345)

principal (p. 358)

random sample (p. 345)

sales tax (p. 354)

simple interest (p. 358)

survey (p. 345)

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

- The sale price of an item is the regular price minus the discount.
- When taking a survey, the total group of people that the survey is interested in is called the sample.
- To find a percent of increase, compare the amount of the increase to the new amount.
- The formula for simple interest is  $I = prt$ .
- A sample is representative of the population if it is random.
- A method for estimating the percent of a number is to find 21% of the number and then multiply.
- The percent equation is part = percent · base.
- A tax is the amount by which the regular price of an item is reduced.
- The principal is the amount of money deposited or borrowed.
- A sample is a question or set of questions designed to collect data about a specific group of people.

## Lesson-by-Lesson Exercises and Examples

8-1

**Percent and Estimation** (pp. 334–337)

Estimate by using fractions.

- 25% of 81
- 33% of 122
- 77% of 38
- 19.5% of 96

Estimate by using 10%.

- 12% of 77
  - 88% of 400
  - 52% of 1,000
  - 21% of 53
19. **PETS** About 12% of 291 households in a neighborhood have fish. Estimate how many households have fish.

**Example 1** Estimate 52% of 495.

52% is about 50% or  $\frac{1}{2}$ , and 495 is about 500.

52% of 495  $\approx \frac{1}{2} \cdot 500$  or 250

So, 52% of 495 is about 250.

**Example 2** Estimate 68% of 80.

10% of 80 =  $0.1 \cdot 80$  or 8 Find 10% of 80.

68% is about 70%.

$7 \cdot 8 = 56$  70% of 80  $\approx 7 \cdot (10\% \text{ of } 80)$

So, 68% of 80 is about 56.

## 8-2 Algebra: The Percent Equation (pp. 340–343)

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- 32 is what percent of 50?
- 65% of what number is 39?
- Find 42% of 300.
- 7% of 92 is what number?
- 12% of what number is 108?

### Example 3 27 is what percent of 90?

27 is the part and 90 is the base.

Let  $n$  represent the percent.

$$\text{part} = \text{percent} \cdot \text{base}$$

$$27 = n \cdot 90 \quad \text{Write an equation.}$$

$$\frac{27}{90} = \frac{90n}{90} \quad \text{Divide each side by 90.}$$

$$0.3 = n \quad \text{The percent is 30\%.}$$

So, 27 is 30% of 90.

## 8-3 Statistics: Using Statistics to Predict (pp. 345–347)

**CAREERS** In a university survey, 5.5% of the incoming freshmen chose elementary teacher as a career goal and 6.4% chose engineer.

- Predict how many of the 3,775 freshmen would choose a career as an elementary teacher.
- How many of the 3,775 freshmen would you expect to choose a career as an engineer?

**Example 4** In a survey of 150 students at McAuliffe Middle School, 12% said they have after-school jobs. Predict how many of the 644 students at the school have after-school jobs.

Find 12% of 644.

$$n = 0.12 \cdot 644 \quad \text{Write an equation.}$$

$$= 77.28 \quad \text{Multiply.}$$

So, you could predict that about 77 students at McAuliffe Middle School have after-school jobs.

## 8-4 Percent of Change (pp. 350–353)

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

- original: 172      28. original: \$200  
new: 254            new: \$386
- original: 75        30. original: \$49.95  
new: 60              new: \$54.95
- GAMES** A computer game that sold for \$24.95 last year is now priced at \$27.95. Find the percent of change.

**Example 5** A magazine that originally cost \$2.75 is now \$3.55. Find the percent of change. Round to the nearest whole percent.

The new price is greater than the original price, so this is a percent of increase.

$$\text{amount of increase} = 3.55 - 2.75 \text{ or } 0.80$$

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

$$= \frac{0.80}{2.75} \quad \text{Substitution}$$

$$\approx 0.29 \quad \text{Simplify.}$$

The percent of increase is about 29%.

**Mixed Problem Solving**For mixed problem-solving practice,  
see page 603.**8-5 Sales Tax and Discount** (pp. 354–357)

Find the total cost or sale price to the nearest cent.

32. \$25 backpack; 7% tax
33. \$210 bicycle; 15% discount
34. \$8,000 car;  $5\frac{1}{2}\%$  tax
35. \$40 sweater; 33% discount
36. \$6.25 address book, 40% discount

Find the percent of discount to the nearest percent.

37. shirt: regular price: \$42  
sale price: \$36
38. snack: regular price, \$2.50  
sale price: \$1
39. boots: regular price, \$78  
sale price: \$70
40. DVD: regular price, \$24.99  
sale price: \$19.99

**Example 6** A new computer system is priced at \$2,499. Find the total cost if the sales tax is 6.5%.

First, find the sales tax.

$$6.5\% \text{ of } \$2,499 = 0.065 \cdot 2,499 \\ \approx 162.44$$

Next, add the sales tax to the original price. The total cost is  $162.44 + 2,499$  or \$2,661.44.**Example 7** A pass at a water park is \$58. At the end of the season, the same pass costs \$46.40. What is the percent of discount?

$$58 - 46.40 = 11.60 \quad \text{Find the amount of discount.}$$

Next, find what percent of 58 is 11.60.

$$11.60 = n \cdot 58 \quad \text{Write an equation.}$$

$$0.2 = n \quad \text{Divide each side by 58.}$$

The percent of discount is 20%.

**8-6 Simple Interest** (pp. 358–360)

Find the interest earned to the nearest cent for each principal, interest rate, and time.

41. \$475, 5%, 2 years
42. \$5,000, 10%, 3 years
43. \$2,500, 11%,  $1\frac{1}{2}$  years

Find the interest paid to the nearest cent for each loan balance, interest rate, and time.

44. \$3,200, 8%, 4 years
45. \$450, 13.5%, 2 years
46. \$1,980, 21%, 9 months
47. **LOANS** Brian has a loan balance of \$1,000. If he pays off the balance over 2 years at an annual simple interest rate of 18%, what is the total amount that he will pay?

**Example 8** Find the interest earned on \$400 at 9% for 3 years.

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 400 \cdot 0.09 \cdot 3 \quad p = \$400, r = 0.09, t = 3$$

$$I = 108 \quad \text{Simplify.}$$

The interest earned is \$108.

**Example 9** Elisa has a loan for \$1,300. The interest rate is 7%. If she pays it off in 6 months, how much interest will she pay?

$$I = prt \quad \text{Formula for simple interest}$$

$$I = 1,300 \cdot 0.07 \cdot 0.5 \quad p = \$1,300, r = 0.07, t = 0.5$$

$$I = 45.5 \quad \text{Simplify.}$$

The interest she will pay after 6 months is \$45.50.

## Practice Test

## Vocabulary and Concepts

1. Describe percent of change.
2. State the formula used to compute simple interest.

## Skills and Applications

Estimate.

3. 18% of 246
4. 145% of 81
5. 71% of 324

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

6. Find 14% of 65.
7. What number is 36% of 294?
8. 82% of what number is 73.8?
9. 75 is what percent of 50?

**BOOKS** For Exercises 10 and 11, refer to the table. It shows the results of a survey in which students at Haskell Middle School were asked to name their favorite types of fiction.

10. Predict how many of the 845 students at Haskell Middle School would choose science fiction as their favorite type.
11. How many of the 845 students would you expect to select mystery as their favorite type of fiction?

Type of Fiction	Percent
historical fiction	8%
mystery	24%
science fiction	38%
sports	30%

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

12. original: \$60  
new: \$75
13. original: 145  
new: 216
14. original: 48  
new: 40

Find the total cost or sale price to the nearest cent.

15. \$1,730 treadmill,  $6\frac{1}{2}\%$  sales tax
16. \$16 hat, 55% discount

Find the interest earned for each principal, interest rate, and time.

17. \$3,000, 5.5%, 5 years
18. \$2,600, 4%, 3 months

19. **LOANS** Leah borrows \$2,200 to buy new furniture. Her loan has an annual interest rate of 16%. Find the simple interest that Leah will owe after 1 year.

## Standardized Test Practice

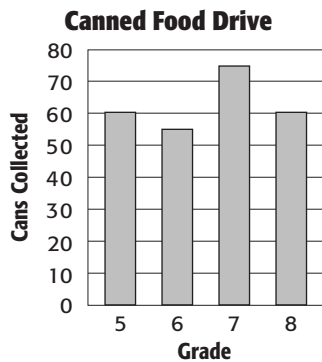
20. **MULTIPLE CHOICE** James earned \$38 last week from mowing lawns in his neighborhood. This week, he earned \$52. What was the percent of change?  
 A 37% decrease     B 27% decrease     C 27% increase     D 37% increase



**PART 1** Multiple Choice

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

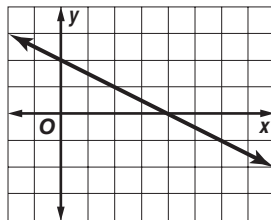
1. Students at Karlon School are collecting canned foods for the local food pantry. The graph shows how many cans students in four of the grades collected in the first week.



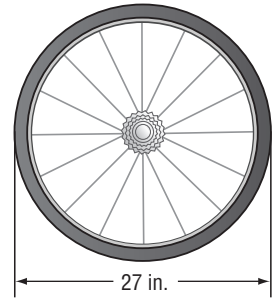
How many total cans did students in the 5th, 6th, 7th, and 8th grades collect during the first week? (Lesson 2-7)

- (A) 75 cans                      (B) 120 cans  
 (C) 240 cans                    (D) 250 cans
2. Greenapple Books has 25 copies of this week's national best-selling book. On Friday, 12 copies of the book were sold. On Saturday, 7 copies of the book were returned. Which represents the copies of this book that Greenapple Books now has available? (Lesson 3-5)
- (F) -5    (G) 5    (H) 19    (I) 20
3. Find the slope of the line graphed below. (Lesson 4-7)

- (A) -2  
 (B)  $-\frac{1}{2}$   
 (C)  $\frac{1}{2}$   
 (D) 2



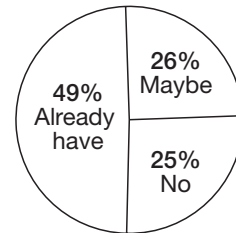
4. How far will you travel after 10 complete turns of the bicycle wheel shown at the right? Use 3.14 for  $\pi$ .



- (Lesson 6-9)
- (F) 84.8 in.  
 (G) 270 in.  
 (H) 847.8 in.  
 (I) 1,695.6 in.

5. The graph shows the results of an online poll to which 1,721 high school students responded.

**Getting a Summer Job**



Source: Alloy online poll

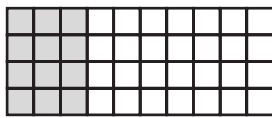
Estimate how many of the students already had a summer job when they responded to the poll. (Lesson 8-1)

- (A) 50    (B) 500    (C) 850    (D) 1,850
6. Zoe finished reading 85% of her book. If the book is 280 pages long, how many pages has she read? (Lesson 8-2)
- (F) 185    (G) 208    (H) 238    (I) 265
7. A survey showed that 85% of youths who went to summer camp when they were 11 years old also attended summer camp when they were 12 years old. Out of 300 11-year-olds who went to summer camp this year, predict how many will go to summer camp next year. (Lesson 8-3)
- (A) 385    (B) 255    (C) 245    (D) 45

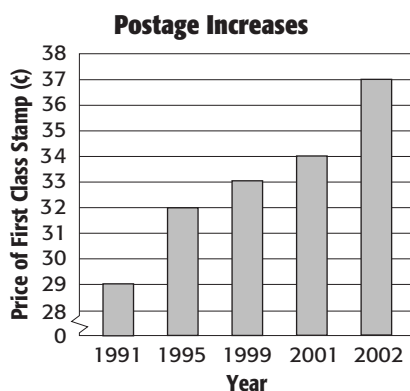
**PART 2** Short Response/Grid In

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

- Jamal bought 2.4 meters of blue ribbon and 110 centimeters of white ribbon. How many centimeters longer is the blue ribbon than the white ribbon? (Lesson 1-8)
- Write a percent to represent the shaded area of the model. (Lesson 5-5)



- A 5-pound bag of potatoes costs \$3.75. At that rate, how much does a 4-pound bag of the same potatoes cost? (Lesson 7-3)
- A survey showed that 9 out of 10 teens expect to make a charitable contribution or volunteer during the holidays. Based on that survey, how many teenagers in a class of 400 expect to give money or volunteer the next holiday season? (Lesson 8-3)
- What was the percent of increase in the price of first class stamps from 2001 to 2002? Round to the nearest whole percent. (Lesson 8-4)



Source: U.S. Postal Service

- Midtown Veterinarians cared for 125 animals on Monday and 100 animals on Tuesday. What is the percent of decrease in number of animals? (Lesson 8-4)

- Mr. Martinez wants to purchase a sound system that costs \$245. If 6.2% sales tax is added, what will be the total cost of the system? (Lesson 8-5)
- Kaitlyn and Camilia each have money in savings accounts, as shown below.

Money in the Bank		
Name	Principal	Rate
Kaitlyn	\$ 400	3%
Camilia	\$ 300	6%

Whose savings account will earn more interest after 1 year? (Lesson 8-6)

- If a principal amount of \$600 earned \$75 in  $2\frac{1}{2}$  years, find the interest rate. (Lesson 8-6)

**PART 3** Extended Response

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

- The Sybil family is working on its budget.
  - Their rent increased from \$750 to \$907.50 a month. What is the percent of increase? (Lesson 8-4)
  - Their landlord said that she would decrease the \$907.50 monthly rent payment by 6% if the family swept the stairwell of the apartment building each week. If the Sybil family takes the landlord's offer, describe two ways to find how much rent they would pay. (Lesson 8-5)

**TEST-TAKING TIP**

**Question 17** Remember to show all of your work. You may be able to get partial credit for your answers, even if they are not entirely correct.

