Applying Percents

BIG Idea

- Solve percent problems using ratios and proportionalities.

Key Vocabulary

percent equation (p. 361)

percent of change (p. 369)

percent proportion (p. 350)

Real-World Link

Boogie Boards You can buy a boogie board in Myrtle Beach, South Carolina, for $25. You will also pay a sales tax of 5%.
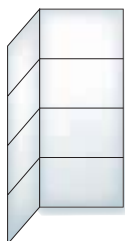
FOLDABLES Study Organizer

Applying Percents Make this Foldable to help you organize your notes. Begin with a piece of 11″ by 17″ paper.

1 **Fold** the paper in half lengthwise.

2 **Open** and refold the paper into fourths along the opposite axis.

3 **Trace** along the fold lines and label each section with a lesson title or number.

7-1	7-2
7-3	7-4
7-5	7-6
7-7	7-8

GET READY for Chapter 7

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 1

Take the Quick Quiz below. Refer to the Quick Review for help.

QUICK Quiz

Multiply. (Prior Grade)

1. $300 \times 0.02 \times 8$ **2.** $85 \times 0.25 \times 3$

3. $560 \times 0.6 \times 4.5$ **4.** $154 \times 0.12 \times 5$

5. MONEY If Nicole saves $0.05 every day, how much money will she have in 3 years? (Prior Grade)

Simplify. Write as a decimal. (Prior Grade)

6. $\dfrac{22 - 8}{8}$ **7.** $\dfrac{50 - 33}{50}$ **8.** $\dfrac{35 - 7}{35}$

9. BASEBALL CARDS Tim has 56 baseball cards. He gives 14 of them away. What decimal represents the portion he has left? (Prior Grade)

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

10. $0.4m = 52$ **11.** $21 = 0.28a$

12. $13 = 0.06s$ **13.** $0.95z = 37$

Write each percent as a decimal.
(Lesson 4-7)

14. 40% **15.** 17% **16.** 110%

17. 157% **18.** 3.25% **19.** 7.5%

20. FOOD Approximately 92% of a watermelon is water. What decimal represents this amount?
(Lesson 4-7)

QUICK Review

Example 1

Evaluate $240 \times 0.03 \times 5$.

$240 \times 0.03 \times 5$

$\quad = 7.2 \times 5$ Multiply 240 by 0.03.

$\quad = 36$ Simplify.

Example 2

Simplify $\dfrac{17 - 8}{8}$. Write as a decimal.

$\dfrac{17 - 8}{8} = \dfrac{9}{8}$ Subtract 8 from 17.

$\quad = 1.125$ Divide 9 by 8.

Example 3

Solve $0.6k = 7.8$

$0.6k = 7.8$ Write the equation.

$\quad k = 13$ Divide each side by 0.6.

Example 4

Write 9.8% as a decimal.

$9.8\% = 0.098$ Move the decimal point two places to the left and remove the percent symbol.

Math Lab
Percent of a Number

Do you enjoy shopping? If so, you may have seen sales or other discounts represented as percents. For example, consider the following situation. A backpack is on sale for 30% off the original price. If the original price of the backpack is $50, how much will you save?

In this situation, you know the percent. You need to find what part of the original price you will save. In this lab, you will use a model to find the percent of a number or *part* of a whole.
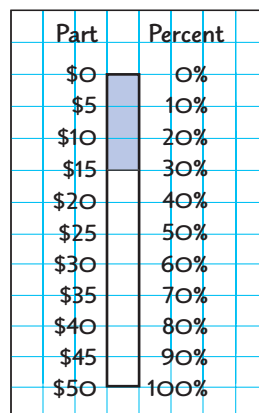
ACTIVITY

1 **Find 30% of $50 using a model.**

STEP 1 Draw a 1-by-10 rectangle as shown on grid paper. Label the units on the right from 0% to 100% as shown.

Part	Percent
	0%
	10%
	20%
	30%
	40%
	50%
	60%
	70%
	80%
	90%
	100%
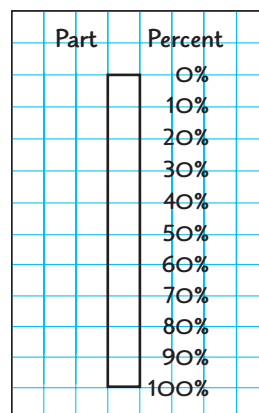
STEP 2 Since $50 represents the original price, mark equal units from $0 to $50 on the left side of the model as shown.

STEP 3 Draw a line from 30% on the right side to the left side of the model as shown and shade the portion of the rectangle above this line.

Part	Percent
$0	0%
$5	10%
$10	20%
$15	30%
$20	40%
$25	50%
$30	60%
$35	70%
$40	80%
$45	90%
$50	100%

The model shows that 30% of $50 is $15. So, you will save $15.

CHECK Your Progress

Draw a model to find the percent of each number.
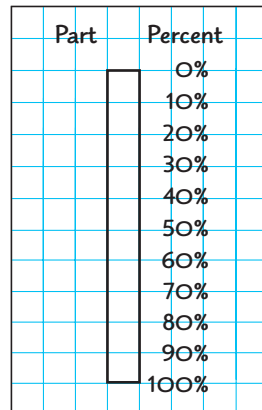
a. 20% of 120   **b.** 60% of 70   **c.** 90% of 400

Suppose a bicycle is on sale for 35% off the original price. How much will you save if the original price of the bicycle is $180?

ACTIVITY
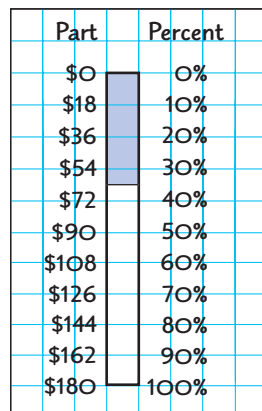
2 **Find 35% of $180 using a model.**

STEP 1 Draw a 1-by-10 rectangle as shown on grid paper. Label the units on the right from 0% to 100% as shown.

Part	Percent
	0%
	10%
	20%
	30%
	40%
	50%
	60%
	70%
	80%
	90%
	100%

Study Tip

Equal Units
For the model at the right, use an interval of $18 since $180 ÷ 10 = $18.

STEP 2 The original price is $180. So, mark equal units from $0 to $180 on the left side of the model as shown.

STEP 3 Draw a line from 35% on the right side to the left side of the model.

Part	Percent
$0	0%
$18	10%
$36	20%
$54	30%
$72	40%
$90	50%
$108	60%
$126	70%
$144	80%
$162	90%
$180	100%

The model shows that 35% of $180 is halfway between $54 and $72, or $63.

So, you will save $63.

✓ CHECK Your Progress

Draw a model to find the percent of each number. If it is not possible to find an exact answer from the model, estimate.

d. 25% of 140   **e.** 7% of 50   **f.** 0.5% of 20

ANALYZE THE RESULTS

1. Tell how to determine the units that get labeled on the left side of a percent model.

2. Explain how to find 40% of 30 using a model.

3. **REASONING** How does knowing 10% of a number help you find the percent of the number when the percent is a multiple of 10%?
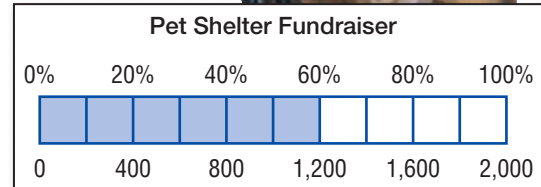
Percent of a Number

GET READY for the Lesson

PETS Some students are collecting money for a local pet shelter. The model shows that they have raised 60% of their $2,000 goal or $1,200.

Pet Shelter Fundraiser

0%	20%	40%	60%	80%	100%

| 0 | 400 | 800 | 1,200 | 1,600 | 2,000 |

1. Sketch the model and label using decimals instead of percents.
2. Sketch the model using fractions instead of percents.
3. Use these models to write two multiplication sentences that are equivalent to 60% of 2,000 = 1,200.

To find the percent of a number such as 60% of 2,000, you can use one of the following methods.

• Write the percent as a fraction and then multiply, or
• Write the percent as a decimal and then multiply.

EXAMPLE **Find the Percent of a Number**

1 **Find 5% of 300.**

To find 5% of 300, you can use either method.

METHOD 1 **Write the percent as a fraction.**

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

$\frac{1}{20}$ of 300 = $\frac{1}{20} \times 300$ or 15

METHOD 2 **Write the percent as a decimal.**

$5\% = \frac{5}{100}$ or 0.05

0.05 of 300 = 0.05 × 300 or 15

So, 5% of 300 is 15.

CHOOSE Your Method

Find the percent of each number.

a. 40% of 70   **b.** 15% of 100   **c.** 55% of 160

EXAMPLE **Use Percents Greater Than 100%**

2 **Find 120% of 75.**

METHOD 1   **Write the percent as a fraction.**

$$120\% = \frac{120}{100} \text{ or } \frac{6}{5}$$
$$\frac{6}{5} \text{ of } 75 = \frac{6}{5} \times 75$$
$$= \frac{6}{5} \times \frac{75}{1} \text{ or } 90$$

METHOD 2   **Write the percent as a decimal.**

$$120\% = \frac{120}{100} \text{ or } 1.2$$
$$1.2 \text{ of } 75 = 1.2 \times 75 \text{ or } 90$$

So, 120% of 75 is 90. Use a model to check the answer.

✓**CHOOSE Your Method**

Find each number.

d. 150% of 20   **e.** 160% of 35

Real-World EXAMPLE

3 **ANALYZE GRAPHS** **Refer to the graph. If 275 students took the survey, how many can be expected to have 3 televisions each in their houses?**

To find 23% of 275, write the percent as a decimal. Then multiply.

$$23\% \text{ of } 275 = 23\% \times 275$$
$$= 0.23 \times 275$$
$$= 63.25$$

Survey Results of Number of Televisions in House
0   2%
1   9%
2   17%
3   23%
4   20%
More than 4   25%
= 5%

So, about 63 students can be expected to have 3 televisions each in their houses.

✓**CHECK Your Progress**

f. **ANALYZE GRAPHS** Refer to the graph above. Suppose 455 students took the survey. How many can be expected to have more than 4 televisions each in their houses?

✓ CHECK Your Understanding

Find each number. Round to the nearest tenth if necessary.

Examples 1–2
(pp. 344–345)

1. 8% of 50
2. 95% of 40
3. 42% of 263
4. 110% of 70
5. 115% of 20
6. 130% of 78

Example 3
(p. 345)

7. TAXES Mackenzie wants to buy a new backpack that costs $50. If the tax rate is 6.5%, how much tax will she pay when she buys the backpack?

Practice and Problem Solving

HOMEWORK HELP	
For Exercises	**See Examples**
8–13, 20–25	1
14–19	2
26–27	3

Find each number. Round to the nearest tenth if necessary.

8. 65% of 186
9. 45% of $432
10. 23% of $640
11. 54% of 85
12. 12% of $230
13. 98% of 15
14. 130% of 20
15. 175% of 10
16. 150% of 128
17. 250% of 25
18. 108% of $50
19. 116% of $250
20. 3.2% of 40
21. 5.4% of 65
22. 23.5% of 128
23. 75.2% of 130
24. 67.5% of 76
25. 18.5% of 500

26. BASEBALL Tomás got on base 60% of the times he was up to bat. If he was up to bat 5 times, how many times did he get on base?

27. TELEVISION In a recent year, 17.7% of households watched the finals of a popular reality series. There are 110.2 million television households in the United States. How many households watched the finals?

Find each number. Round to the nearest hundredth if necessary.

28. $\frac{4}{5}$% of 500
29. $5\frac{1}{2}$% of 60
30. $20\frac{1}{4}$% of 3
31. 1,000% of 99
32. 100% of 79
33. 520% of 100
34. 0.15% of 250
35. 0.3% of 80
36. 0.28% of 50

37. TIPPING A customer wants to tip 15% of the restaurant bill. How much change should there be after the tip if the customer pays with a $50 bill?

Sal's Bistro	
Herbed Salmon	$16.25
Chicken Pasta	15.25
Iced Tea	1.75
Iced Tea	1.75
Total	$35.00

38. INTERNET A family pays $19 each month for Internet access. Next month, the cost will increase 5%. After this increase, what will be the cost for the Internet access?

39. BUSINESS A store sells a certain brand of a lawn mower for $275. Next year, the cost of the lawn mower will increase by 8%. What will be the cost of the lawn mower next year?

ANALYZE GRAPHS For Exercises 40–42, use the graph below that shows the results of a poll of 2,632 listeners. Round to the nearest whole number.

Radio Listeners

40. How many people listen to the radio during work?

41. How many people like to listen to the radio while they are at the gym?

42. Determine how many more people listen to the radio in the car than at home.
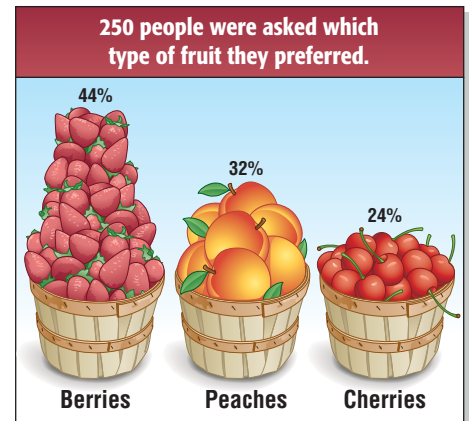
Use mental math to find each percent. Justify your answer.

43. 53% of 60   44. 24% of 48   45. 75% of 19

ANALYZE GRAPHS For Exercises 46–49, use the graph that shows the results of a favorite fruit survey.

46. How many people were surveyed?

47. Of those surveyed, how many people prefer peaches?

48. Which type of fruit did more than 100 people prefer?

49. Of those surveyed, how many people did *not* prefer cherries? Explain how you arrived at the answer.

250 people were asked which type of fruit they preferred.

44%   32%   24%

Berries   Peaches   Cherries

50. **SHOPPING** The Leather Depot sells a certain leather coat for $179.99. If sales tax is 6.25%, what will be the approximate total cost of the coat?

51. **SCHOOL** Suppose there are 20 questions on a multiple-choice test. If 25% of the answers are choice B, how many of the answers are *not* choice B?

52. **COMMISSION** In addition to her salary, Ms. Lopez earns a 3% *commission*, or fee paid based on a percent of her sales, on every vacation package that she sells. One day, she sold the three vacation packages shown. What was her total commission?

Package #1	Package #2	Package #3
$2,375	$3,950	$1,725

53. **OPEN ENDED** Give two examples of real-world situations in your life in which you would find the percent of a number.

54. **SELECT A TECHNIQUE** Maggie uses a $50 gift card to buy a pair of shoes that costs $24.99 and a purse that costs $19.99. If the tax rate is 7%, will the gift card cover the entire purchase? Select and use one or more of the following techniques to solve the problem. Justify your selection(s).

mental math	number sense	estimation

55. **CHALLENGE** Suppose you add 10% of a number to the number, and then you subtract 10% of the total. Is the result *greater than*, *less than*, or *equal to* the original number? Explain your reasoning.

56. **WRITING IN MATH** Explain which method you prefer to use to find the percent of a number: write the percent as a fraction or write the percent as a decimal. Explain your reasoning.

TEST PRACTICE

57. Reggie has memorized 60% of the 50 state capitals for a social studies test. How many more capitals does Reggie need to memorize before the test?

A 35   **C** 20

B 30   **D** 18

58. **SHORT RESPONSE** Tanner has 200 baseball cards. Of those, 42% are in mint condition. How many of the cards are *not* in mint condition?

Spiral Review

59. **PETS** In Rebecca's class, 17 out of 24 students have pets. What percent of the students have pets? Round to the nearest percent. (Lesson 6-9)

60. **MODELS** On a scale model of a building, 3 in. = 12 ft. If the model is 8 inches tall, how tall is the actual building? (Lesson 6-8)

Add or subtract. Write in simplest form. (Lesson 6-2)

61. $\frac{7}{10} - \frac{1}{10}$ **62.** $\frac{20}{21} - \frac{3}{7}$ **63.** $\frac{5}{6} - \frac{1}{8}$

64. **ALGEBRA** What are the next three numbers in the pattern 3, 10, 17, 24, …? (Lesson 1-9)

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. (Lesson 3-3)

65. $12b = 144$ **66.** $9x = 630$ **67.** $8,100 = 100k$

READING to SOLVE PROBLEMS

Meaning of Percent

When you solve percent problems, look for three parts: the *part*, the *whole*, and the *percent*. Consider this example.

The table at the right shows the results of a survey about favorite flavor of sugarless gum.

Favorite Flavor of Sugarless Gum	
Flavor	**Number**
Cinnamon	10
Peppermint	18
Watermelon	12
Total	40

● **Part**

  Ten students chose cinnamon as their favorite.

● **Whole**

  Forty students were surveyed.

● **Percent**

  25% of the students who were surveyed (10 out of 40) chose cinnamon as their favorite.
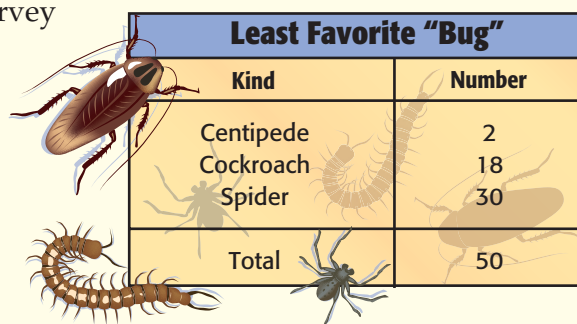
Using all three parts, 25% of 40 is 10.

PRACTICE

Identify each statement as the *part*, the *whole*, or the *percent*. Then write a sentence using all three parts.

1. The table at the right shows the results of a survey about which "bugs" people dislike most.
   a. Fifty people were surveyed.
   b. 60% disliked spiders the most.
   c. Thirty people disliked spiders.

Least Favorite "Bug"	
Kind	**Number**
Centipede	2
Cockroach	18
Spider	30
Total	50

2. Suppose you find a sale at the mall.
   a. Everything was 20% off.
   b. The original price of a jacket was $30.
   c. You saved $6.

3. You and your family are eating at a restaurant.
   a. The meal cost $34.
   b. You want to leave a tip of 15%.
   c. The tip is $5.10.

4. Your sister plays basketball.
   a. She usually makes 75% of her free throws.
   b. In the last game, she made 6 free throws.
   c. She had 8 free throws.

The Percent Proportion

MAIN IDEA

Solve problems using the percent proportion.

New Vocabulary

percent proportion

Math Online

glencoe.com

• Extra Examples
• Personal Tutor
• Self-Check Quiz
• Reading in the Content Area

▶ **GET READY** for the Lesson

MONSTER TRUCKS The tires on a monster truck weigh approximately 3,600 pounds. The entire truck weighs about 11,000 pounds.

1. Write the ratio of tire weight to total weight as a fraction.

2. Use a calculator to write the fraction as a decimal to the nearest hundredth.

3. What percent of the monster truck's weight is the tires?

In a **percent proportion**, one ratio or fraction compares part of a quantity to the whole quantity, also called the *base*. The other ratio is the equivalent percent written as a fraction with a denominator of 100.

4 out of **5** is **80%.**

$$\frac{\text{part} \rightarrow 4}{\text{whole} \rightarrow 5} = \frac{80}{100} \Big\} \text{percent}$$

When given two of these pieces of information—part, whole, or percent—you can use the proportion to find the missing information.

EXAMPLE Find the Percent

1 **What percent of $15 is $9?**

The number 15 comes after the word *of*, so the whole is 15. You are asked to find the percent, so the part is the remaining number, 9.

Words	What percent of $15 is $9?
Variable	Let *n*% represent the percent.
Proportion	$\frac{\text{part} \rightarrow 9}{\text{whole} \rightarrow 15} = \frac{n}{100} \Big\} \text{percent}$

$\dfrac{9}{15} = \dfrac{n}{100}$ Write the proportion.

$9 \cdot 100 = 15 \cdot n$ Find the cross products.

$900 = 15n$ Simplify.

$\dfrac{900}{15} = \dfrac{15n}{15}$ Divide each side by 15.

$60 = n$

So, $9 is 60% of $15.

Find each number. Round to the nearest tenth if necessary.

a. What percent of 25 is 20?   b. $12.75 is what percent of $50?

EXAMPLE **Find the Part**

2 **What number is 40% of 120?**

The percent is 40%. Since the number 120 comes after the word *of*, the whole is 120. You are asked to find the part.

Words	What number is 40% of 120?
Variable	Let p represent the part.
Proportion	$\dfrac{\text{part}}{\text{whole}} \rightarrow \dfrac{p}{120} = \dfrac{40}{100}$ } percent

$$\frac{p}{120} = \frac{40}{100}$$ Write the proportion.

$p \cdot 100 = 120 \cdot 40$ Find the cross products.

$100p = 4{,}800$ Simplify.

$$\frac{100p}{100} = \frac{4{,}800}{100}$$ Divide each side by 100.

$p = 48$

So, 48 is 40% of 120.

✓ CHECK Your Progress

Find each number. Round to the nearest tenth if necessary.

c. What number is 5% of 60?   d. 12% of 85 is what number?

Study Tip

The Percent Proportion
The part usually comes before or after the word *is* and the whole usually comes before or after the word *of*.

EXAMPLE **Find the Whole**

3 **18 is 25% of what number?**

The percent is 25%. The words *what number* come after the word *of*. So, you are asked to find the whole. Thus, 18 is the part.

Words	18 is 25% of what number?
Variable	Let w represent the whole.
Proportion	$\dfrac{\text{part}}{\text{whole}} \rightarrow \dfrac{18}{w} = \dfrac{25}{100}$ } percent

$$\frac{18}{w} = \frac{25}{100}$$ Write the proportion.

$18 \cdot 100 = w \cdot 25$ Find the cross products.

$1{,}800 = 25w$ Simplify.

$$\frac{1{,}800}{25} = \frac{25w}{25}$$ Divide each side by 25.

$72 = w$

So, 18 is 25% of 72.

✓CHECK Your Progress

Find each number. Round to the nearest tenth if necessary.

e. 40% of what number is 26?   **f.** 80 is 75% of what number?

Real-World EXAMPLE

4 **ANIMALS** The average adult male Western Lowland gorilla eats about 33.5 pounds of fruit each day. How much food does the average adult male gorilla eat each day?

You know that 33.5 pounds of fruit is 67% of the total amount eaten daily. So, the problem asks 33.5 is 67% of what number. Thus, you need to find the whole.

Western Lowland Gorilla's Diet	
Food	**Percent**
Fruit	67%
Seeds, Leaves, Stems, and Pith	17%
Insects/ Insect Larvae	16%

$$\frac{33.5}{w} = \frac{67}{100}$$ Write the proportion.

$33.5 \cdot 100 = w \cdot 67$ Find the cross products.

$3{,}350 = 67w$ Simplify.

$$\frac{3{,}350}{67} = \frac{67w}{67}$$ Divide each side by 67.

$50 = w$

So, the average adult male gorilla eats 50 pounds of food each day.

✓CHECK Your Progress

g. **ZOO** If 200 of the 550 reptiles in a zoo are on display, what percent of the reptiles are on display? Round to the nearest whole number.

Types of Percent Problems   Key Concept

| Type	Example	Proportion
Find the Percent	What percent of 6 is 3?	$\frac{3}{6} = \frac{n}{100}$
Find the Part	What number is 50% of 6?	$\frac{p}{6} = \frac{50}{100}$
Find the Whole	3 is 50% of what number?	$\frac{3}{w} = \frac{50}{100}$

CHECK Your Understanding

Find each number. Round to the nearest tenth if necessary.

1. What percent of 50 is 18?
2. What percent of $90 is $9?
3. What number is 2% of 35?
4. What number is 25% of 180?
5. 9 is 12% of which number?
6. 62 is 90.5% of what number?

7. **MEASUREMENT** If a box of Brand A cereal contains 10 cups of cereal, how many more cups of cereal are in a box of Brand B cereal?
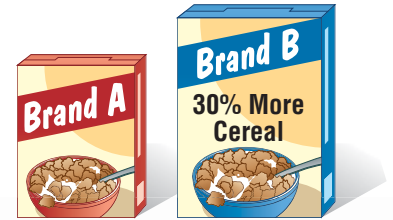
Practice and Problem Solving

Find each number. Round to the nearest tenth if necessary.

8. What percent of 60 is 15?
9. $3 is what percent of $40?
10. What number is 15% of 60?
11. 12% of 72 is what number?
12. 9 is 45% of what number?
13. 75 is 20% of what number?

14. **SCHOOL** Roman has 2 red pencils in his backpack. If this is 25% of the total number of pencils, how many pencils are in his backpack?

15. **BASKETBALL** Lisa and Michelle scored 48% of their team's points. If their team had a total of 50 points, how many points did they score?

16. **SHOES** A pair of sneakers are on sale as shown. This is 75% of the original price. What was the original price of the shoes?

17. **BOOKS** Of the 60 books on a bookshelf, 24 are nonfiction. What percent of the books are nonfiction?

Sale Price
$51

Find each number. Round to the nearest hundredth if necessary.

18. What percent of 25 is 30?
19. What number is 8.2% of 50?
20. 40 is 50% of what number?
21. 12.5% of what number is 24?
22. What number is 0.5% of 8?
23. What percent of 300 is 0.6?

24. **BUSINESS** The first week of June, there were 404 customers at an ice cream parlor. Eight weeks later, the number of customers was 175% of this amount. How many customers were there eight weeks later?

25. **MONEY** Ajamu saves 40% of his allowance each week. If he saves $16 in 5 weeks, how much allowance does Ajamu receive each week?

26. **SCHOOL** A class picture includes 95% of the students. Seven students were absent. How many students are in the class?

ASTRONOMY For Exercises 27–29, use the table shown.

27. Mercury's radius is what percent of Jupiter's radius?

28. If the radius of Mars is about 13.7% of Neptune's radius, what is the radius of Neptune?

Planet	Radius (km)
Mercury	2,440
Mars	3,397
Jupiter	71,492

29. Earth's radius is about 261.4% of Mercury's radius. What is the radius of Earth?
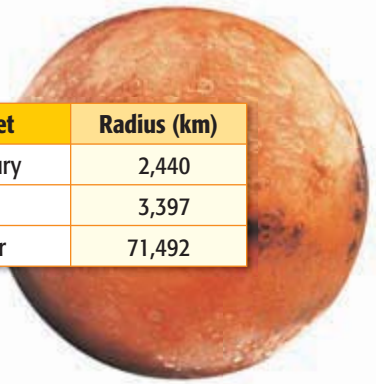
H.O.T. Problems

30. **OPEN ENDED** Write a proportion that can be used to find the percent scored on a science quiz that has 10 questions.

31. **CHALLENGE** Without calculating, arrange the following from greatest to least value. Justify your reasoning.

20% of 100, 20% of 500, 5% of 100

32. **WRITING IN MATH** Create a problem involving a percent that can be solved by using the proportion $\frac{3}{b} = \frac{15}{100}$.

TEST PRACTICE

33. Of the 273 students in a school, 95 volunteered to work the book sale. About what percent of the students did *not* volunteer?

   A 55%

   B 65%

   C 70%

   D 75%

34. A customer at a restaurant leaves a tip of $2.70. This amount is 15% of the total bill. Which equation can be used to find x, the total amount of the food bill?

   F $\frac{2.70}{15} = \frac{15}{100}$ **H** $\frac{15}{2.70} = \frac{x}{100}$

   G $\frac{2.70}{x} = \frac{15}{100}$ **J** $\frac{x}{2.70} = \frac{15}{100}$

Spiral Review

Find each number. Round to the nearest tenth if necessary. (Lesson 7-1)

35. What is 25% of 120?   36. Find 45% of 70.

37. **PLANTS** A plant was 275% taller than the month before. What decimal represents this percent? (Lesson 6-9)

MEASUREMENT Complete. (Lesson 6-4)

38. 3,000 lb = ▇ T   39. 36 in. = ▇ ft   40. $4\frac{1}{2}$ lb = ▇ oz

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply. (Lesson 5-5)

41. $\frac{1}{2} \cdot 60$ 42. $\frac{3}{4} \cdot 28$ 43. $\frac{2}{5} \cdot 45$

Percent and Estimation

GET READY for the Lesson

MUSIC Refer to the graph below.

Learning to Play an Instrument

	Men	Women
Private Lessons	29%	40%
Lessons at School	26%	30%
Taught Self	21%	12%
Took School Band/Orchestra	17%	17%
Taught by Parent/Relative	6%	6%
Taught by Friend	8%	2%

Percent
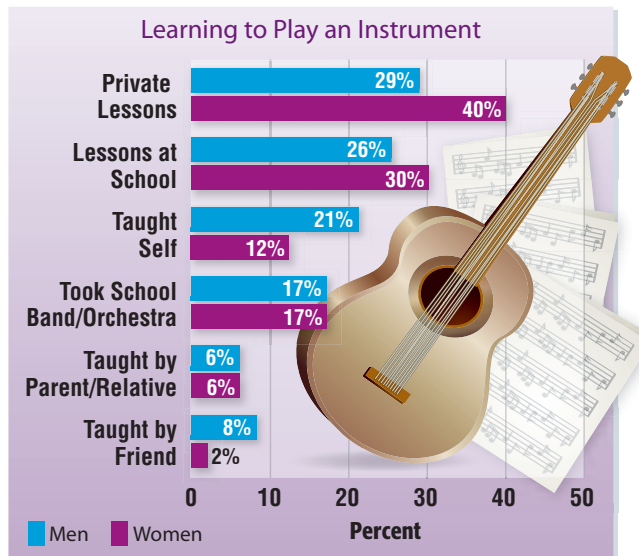
1. What fraction of women took lessons at school? If 200 women were surveyed, how many of them took lessons at school?

2. Use a fraction to estimate the number of men who took lessons at school. Assume 200 men were surveyed.

Sometimes an exact answer is not needed when using percents. One way to estimate the percent of a number is to use a fraction.

Real-World EXAMPLE

1 **SPORTS** In a recent year, quarterback Carson Palmer completed 62% of his passes. He threw 520 passes. About how many did he complete?

62% of $520 \approx 60\%$ of 520 $62\% \approx 60\%$

$\approx \dfrac{3}{5} \cdot 520$ $60\% = \dfrac{6}{10}$ or $\dfrac{3}{5}$

≈ 312 Multiply.

So, Carson Palmer completed about 312 out of 520 passes.

CHECK Your Progress

a. **REPTILES** Box turtles have been known to live for 120 years. American alligators have been known to live 42% as long as box turtles. About how long can an American alligator live?

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

Real-World EXAMPLE

2 **MONEY** Marita decides to leave a 20% tip on a restaurant bill of **$14.72. About how much money should she tip the restaurant server?**

You need to estimate 20% of $14.72.

METHOD 1   Use a fraction to estimate.

20% is $\frac{2}{10}$ or $\frac{1}{5}$.

20% of $14.72 $\approx \frac{1}{5}$ · $15.00   20% = $\frac{1}{5}$ and round $14.72 to $15.00.

$\approx$ $3.00   Multiply.

METHOD 2   Use 10% of a number to estimate.

Step 1   Find 10% of the number.
$14.72 is about $15.00.
10% of $15.00 = 0.1 · $15.00   To multiply by 10%, move the
= $1.50   decimal point one place to the left.

Step 2   Multiply.
20% of $15.00 is 2 times 10% of $15.00.
2 · $1.50 = $3.00

So, Marita should tip the restaurant server about $3.00.

✅ CHOOSE Your Method

b. **MONEY** Dante plans to put 80% of his paycheck into a savings account. His paycheck this week was $295. About how much money will he put into his savings account?

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

Study Tip
Check for Reasonableness
When estimating the percent of a number and the percent is greater than 100, the estimate will always be greater than the number.

EXAMPLES   Percents Greater Than 100 or Less Than 1

3 Estimate 122% of 50.

122% is about 120%.

120% of 50 = (100% of 50) + (20% of 50)   120% = 100% + 20%

$= (1 \cdot 50) + \left(\frac{1}{5} \cdot 50\right)$ 100% = 1 and 20% = $\frac{1}{5}$

= 50 + 10 or 60   Simplify.

So, 122% of 50 is about 60.

Real-World Link . . . .
In a recent year, the Internal Revenue Service estimated that Americans paid $15.37 billion in tips.

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

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

$$1\% \text{ of } 600 = 0.01 \cdot 600 \qquad \text{Write 1\% as 0.01.}$$
$$= 6 \qquad \text{To multiply by 1\%, move the decimal point two places to the left.}$$

One fourth of 6 is $\frac{1}{4} \cdot 6$ or 1.5. So, $\frac{1}{4}$% of 589 is about 1.5.

✔ **CHECK Your Progress**

Estimate.

c. 174% of 200   **d.** 298% of 45   **e.** 0.25% of 789

Real-World EXAMPLE

5 **CELL PHONES** In a recent year, there were about 200 million people in the U.S. with cell phones. Of those, about 0.5% used their phone as an MP3 player. Estimate the number of people who used their phone as an MP3 player.

0.5% is half of 1%.

$$1\% \text{ of } 200 \text{ million} = 0.01 \cdot 200{,}000{,}000$$
$$= 2{,}000{,}000$$

So, 0.5% of 200,000,000 is about $\frac{1}{2}$ of 2,000,000 or 1,000,000.

So, about 1,000,000 people used their phone as an MP3 player.

✔ **CHECK Your Progress**

f. **ATTENDANCE** Last year, 639 students attended a summer camp. Of those who attended this year, 0.9% also attended last year. About how many people attended the camp two years in a row?

✔ **CHECK Your Understanding**

Examples 1–4 (pp. 355–357)

Estimate.

1. 52% of 10   **2.** 7% of 20   **3.** 38% of 62

4. 79% of 489   **5.** 151% of 70   **6.** $\frac{1}{2}$% of 82

Example 1 (p. 355)

7. **BUSINESS** A bicycle store increases its prices by 23%. About how much more will a customer pay for a bicycle that originally costs $200?

Example 2 (p. 356)

8. **BIRTHDAYS** Of the 78 teenagers at a youth camp, 63% have birthdays in the spring. About how many have birthdays in the spring?

Example 5 (p. 357)

9. **GEOGRAPHY** About 0.8% of the land in Maine is federally owned. If Maine is 19,847,680 acres, about how many acres are federally owned?

Estimate.

10. 47% of 70

11. 21% of 90

12. 39% of 120

13. 76% of 180

14. 57% of 29

15. 92% of 104

16. 24% of 48

17. 28% of 121

18. 88% of 207

19. 62% of 152

20. 65% of 152

21. 72% of 238

22. MONEY Jessica spent $42 at the hair salon. About how much money should she tip the hair stylist if she wants to leave a 15% tip?

23. HEALTH You use 43 muscles to frown. When you smile, you use 32% of these same muscles. About how many muscles do you use when you smile?

Estimate.

24. 132% of 54

25. 224% of 320

26. $\frac{1}{2}$% of 412

27. $\frac{3}{4}$% of 168

28. 0.4% of 510

29. 0.9% of 74

30. GEOGRAPHY The United States has 12,383 miles of coastline. If $\frac{4}{5}$% of the U.S. coastline is located in Georgia, about how many miles of coastline are in Georgia?

31. BIRDS During migration, 450,000 sandhill cranes stop to rest in Nebraska. About 0.6% of these cranes stop to rest in Oregon. About how many sandhill cranes stop in Oregon during migration?

Estimate.

32. 67% of 8.7

33. 54% of 76.8

34. 32% of 89.9

35. 10.5% of 238

36. 22.2% of 114

37. 98.5% of 45

ANALYZE GRAPHS For Exercises 38–40, use the graph shown.

Amanda's Day

Homework 13%
School 27%
Extracurricular Activities 8%
Other 19%
Sleep 33%
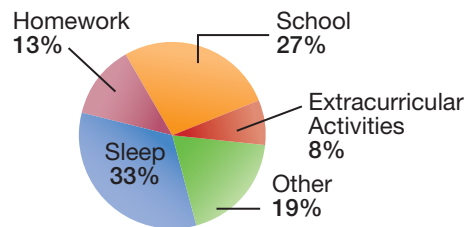
38. About how many hours does Amanda spend doing her homework each day?

39. About how many more hours does Amanda spend sleeping than doing the activities in the "other" category? Justify your answer.

40. What is the approximate number of minutes Amanda spends each day on extracurricular activities?

41. ANALYZE GRAPHS 2,075 tennis fans were asked to name the greatest all time female tennis player. The top five responses are shown. About how many more people chose Martina Navratilova than Steffi Graf?
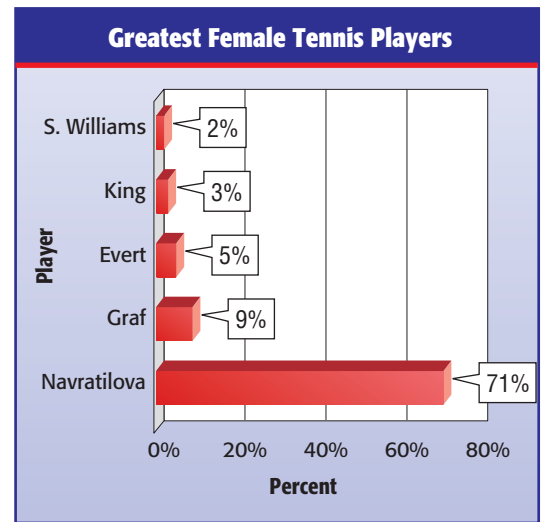
42. ANIMALS The average white rhinoceros gives birth to a single calf that weighs about 3.8% as much as its mother. If the mother rhinoceros weighs 3.75 tons, about how many pounds does its calf weigh?

Greatest Female Tennis Players

Player	Percent
S. Williams	2%
King	3%
Evert	5%
Graf	9%
Navratilova	71%

0% 20% 40% 60% 80%
Percent

43. POPULATION According to the 2000 U.S. Census, about 7.8% of the people in Minnesota live in Minneapolis. If the population of Minnesota is about 4,920,000, estimate the population of Minnesota.

CLEANING For Exercises 44 and 45, use the following information.

A cleaning solution is made up of 0.9% chlorine bleach.

44. About how many ounces of bleach are in 189 ounces of cleaning solution?

45. About how many ounces of bleach would be found in 412 ounces of cleaning solution?

H.O.T. Problems

46. OPEN ENDED Write a real-world problem in which the answer can be found by estimating 12% of 50.

47. CHALLENGE Explain how you could find $\frac{3}{8}$% of $800.

48. FIND THE ERROR Tom and Elsa are estimating 1.5% of 210. Who is correct? Explain.

Tom:
1.5% of 210
$\approx$ 1% of 200 + 0.5% of 200
$= 0.01 \cdot 200 + \frac{1}{2}(0.01 \cdot 200)$
$= 2 + 1$ or 3

Elsa:
1.5% of 210
$\approx 1 \cdot 200 + 0.5 \cdot 200$
$= 200 + 100$
$= 300$

49. NUMBER SENSE Is an estimate for the percent of a number *always*, *sometimes*, or *never* greater than the actual percent of the number? Give an example or a counterexample to support your answer.

50. **WRITING IN MATH** Estimate 22% of 136 using two different methods. Justify the steps used in each method.

TEST PRACTICE

51. The graph shows the results of a survey of 510 students.

Pet Preferences

Bird 8%
Cat 24%
Other 5%
Fish 20%
None 5%
Dog 38%
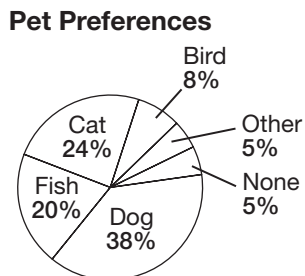
Which is the best estimate for the number of students who prefer cats?

A 75   **C** 225

B 125   **D** 450

52. Megan is buying an entertainment system for $1,789.43. The speakers are 39.7% of the total cost. Which is the best estimate for the cost of the speakers?

F $540   **H** $720

G $630   **J** $810

53. Daniel decides to leave a 20% tip for a restaurant bill of $28.92. About how much money should he tip the restaurant server?

A $2.00   **C** $4.00

B $3.00   **D** $6.00

Spiral Review

Find each number. Round to the nearest tenth if necessary. (Lesson 7-2)

54. 6 is what percent of 15?

55. Find 72% of 90.

56. What number is 120% of 60?

57. 35% of what number is 55?

58. **HEALTH** Adults have 32 teeth. Children have 62.5% as many teeth as adults. How many teeth do children have? (Lesson 7-1)

Estimate. (Lesson 5-1)

59. $\dfrac{8}{9} + \dfrac{1}{12}$

60. $\dfrac{4}{7} + \dfrac{7}{16}$

61. $\dfrac{7}{8} - \dfrac{7}{16}$

62. $\dfrac{4}{5} - \dfrac{9}{10}$

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

63. $40 = 0.8x$

64. $10r = 61$

65. $0.07t = 25$

66. $56 = 0.32n$

GET READY for the Next Lesson

Solve each equation. Check your solution. (Lesson 3-3)

67. $14 = n \cdot 20$

68. $25 = n \cdot 40$

69. $28.5 = n \cdot 38$

70. $36 = n \cdot 80$

Algebra: The Percent Equation

▶ GET READY for the Lesson

ARTHROPODS There are about 854,000 different species of spiders, insects, crustaceans, millipedes, and centipedes on Earth. The graph shows that 88% of the total numbers of species of arthropods are insects.

Arthropods

Millipedes and Centipedes **1%**

Crustaceans **4%**

7% Spiders
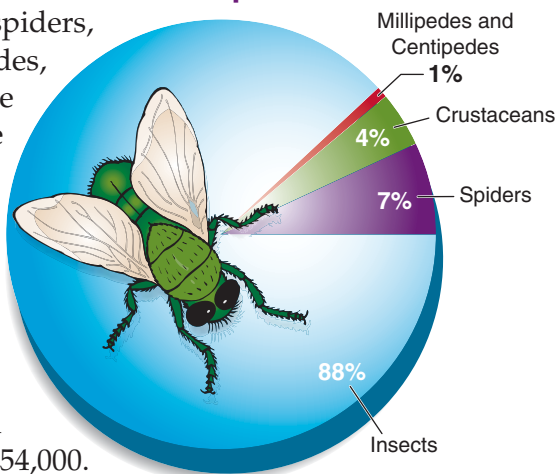
88% Insects

1. Use the percent proportion to find how many species are insects.
2. Express the percent of insects as a decimal. Then multiply the decimal by 854,000.

In Lesson 7-2, you used a percent proportion to find the missing part, percent, or whole. You can also use an equation. The percent equation is another form of the percent proportion.

$$\frac{\text{part}}{\text{whole}} = \text{percent}$$
The percent must be written as a decimal or fraction.

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

$$\text{part} = \text{percent} \cdot \text{whole}$$
← This form is called the **percent equation**.

EXAMPLE Find the Part

1 What number is 12% of 150? **Estimate** 12% of 150 ≈ 0.1 · 150 or 15

Write 12% as a decimal, 0.12. The whole is 150. You need to find the part. Let p represent the part.

part = percent · whole

$p = 0.12 \cdot 150$ Write the percent equation.

$p = 18$ Multiply. The part is 18.

So, 18 is 12% of 150. **Check for Reasonableness** 18 is close to 15. ✔

Study Tip

Percent Equation
A percent must always be converted to a decimal or a fraction when it is used in an equation.

✓ CHECK Your Progress

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

a. What is 6% of 19?

b. Find 72% of 90.

EXAMPLE **Find the Percent**

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

The part is 21. The whole is 40. You need to find the percent.
Let n represent the percent.

$$\underbrace{\text{part}} = \underbrace{\text{percent}} \cdot \underbrace{\text{whole}}$$

$21 = n \cdot 40$ Write the percent equation.

$\frac{21}{40} = \frac{40n}{40}$ Divide each side by 40.

$0.525 = n$ Since n represents the decimal
form, the percent is 52.5%.

So, 21 is 52.5% of 40.

Check for Reasonableness $52.5\% \approx 50\%$ ✔

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

CHECK Your Progress

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

c. 35 is what percent of 70?   **d.** What percent of 125 is 75?

e. What percent of 40 is 9?   **f.** 27 is what percent of 150?

EXAMPLE **Find the Whole**

3 **13 is 26% of what number?** **Estimate** $\frac{1}{4}$ of 48 = 12

The part is 13. The percent is 26, which when written as a decimal,
is 0.26. You need to find the whole. Let w represent the whole.

$$\underbrace{\text{part}} = \underbrace{\text{percent}} \cdot \underbrace{\text{whole}}$$

$13 = 0.26 \cdot w$ Write the percent equation. 26% = 0.26

$\frac{13}{0.26} = \frac{0.26w}{0.26}$ Divide each side by 0.26.

$50 = w$ The number is 50.

So, 13 is 26% of 50.

Check for Reasonableness 50 is close to 48. ✔

CHECK Your Progress

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

g. 39 is 84% of what number?   **h.** 26% of what number is 45?

i. 14% of what number is 7?   **j.** 24 is 32% of what number?

4 **CELL PHONES** A survey found that 25% of people age 18–24 gave up their home phone and only use a cell phone. If 3,264 people only use a cell phone, how many people were surveyed?

Words	3,264 people is 25% of what number of people?
Variable	Let n represent the number of people.
Equation	$3,264 \;=\; 0.25 \;\cdot\; n$

$3,264 = 0.25 \cdot n$ Write the percent equation. 25% = 0.25

$\dfrac{3,264}{0.25} = \dfrac{0.25n}{0.25}$ Divide each side by 0.25. Use a calculator.

$13,056 \approx n$ Simplify.

The number of people surveyed is about 13,056.

Real-World Link . . . .
In the U.S., Anchorage, Alaska, has the highest percent of cell phone users.
Source: Polk's Research

✓ **CHECK Your Progress**

k. **POPULATION** The Louisville-Jefferson County metropolitan area contains 17.2% of the population of Kentucky. If the population of Kentucky is about 4,040,000 people, what is the population of the Louisville-Jefferson County metropolitan area?

Types of Percent Problems   Concept Summary

Type	Example	Proportion
Find the Part	What number is 50% of 6?	$p = 0.5 \cdot 6$
Find the Percent	3 is what percent of 6?	$3 = n \cdot 6$
Find the Whole	3 is 50% of what number?	$3 = 0.5 \cdot w$

✓ **CHECK Your Understanding**

Examples 1–3
(pp. 361–362)

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

1. What number is 88% of 300?
2. What number is 12% of 250?
3. 75 is what percent of 150?
4. 24 is what percent 120?
5. 3 is 12% of what number?
6. 84 is 60% of what number?

Example 4
(p. 363)

7. **BUSINESS** A local bakery sold 60 loaves of bread in one day. If 65% of these were sold in the afternoon, how many loaves were sold in the afternoon?

Practice and Problem Solving

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.
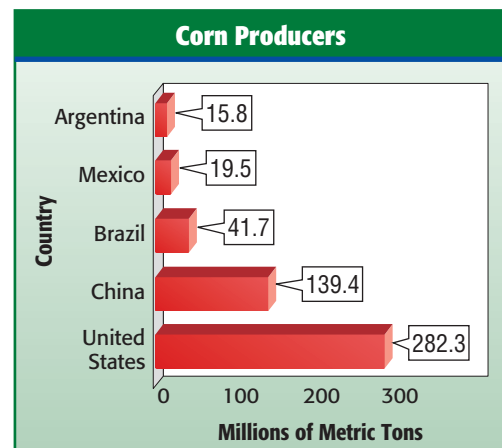
8. What number is 65% of 98?

9. Find 39% of 65.

10. Find 24% of 25.

11. What number is 53% of 470?

12. 9 is what percent of 45?

13. What percent of 96 is 26?

14. What percent of 392 is 98?

15. 30 is what percent of 64?

16. 33% of what number is 1.45?

17. 84 is 75% of what number?

18. 17 is 40% of what number?

19. 80% of what number is 64?

20. **BOOKS** Emma bought 6 new books for her collection. This increased her collection by 12%. How many books did she have before her purchases?

21. **VIDEO GAMES** A store sold 550 video games during the month of December. If this made up 12.5% of their yearly video game sales, about how many video games did the store sell all year?

22. **MEASUREMENT** The length of Giselle's arm is 27 inches. The length of her lower arm is 17 inches. About what percent of Giselle's arm is her lower arm?

23. **LOBSTERS** Approximately 0.02% of North Atlantic lobsters are born bright blue in color. Out of 5,000 North Atlantic lobsters, how many would you expect to be blue in color?

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

24. Find 135% of 64.

25. What number is 0.4% of 82.1?

26. 450 is 75.2% of what number?

27. What percent of 200 is 230?

28. **SALARY** Suppose you earn $6 per hour at your part-time job. What will your new hourly rate be after a 2.5% raise?

ANALYZE GRAPHS About 672 million metric tons of corn was produced worldwide in 2006. For Exercises 29–31, use the graph at the right.

29. About what percent of corn was produced in the United States?

30. About what percent of corn was produced in Mexico?

31. What percent of the world's corn production do Brazil and China make together?

Corn Producers

Country	Millions of Metric Tons
Argentina	15.8
Mexico	19.5
Brazil	41.7
China	139.4
United States	282.3

EXTRA PRACTICE
See pages 685, 710.

32. MEASUREMENT A pool that holds 320 cubic feet of water is 84% filled to capacity. Another pool that holds 400 cubic feet of water is 82.5% filled to capacity. Which pool contains more water? How much more?

H.O.T. Problems

33. OPEN ENDED Write a percent problem for which the percent is greater than 100% and the part is known. Use the percent equation to solve your problem to find the base.

34. CHALLENGE 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.

35. WRITING IN MATH Compare the percent equation and the percent proportion. Then explain when it might be easier to use the percent equation rather than the percent proportion.

TEST PRACTICE

36. In a survey, 100 students were asked to choose their favorite take-out food. The table shows the results.

Favorite Take-Out Food	
Type of Food	**Percent**
Pizza	40
Sandwiches	32
Fried chicken	28

Based on this data, predict how many out of 1,800 students would choose sandwiches.

A 504 **C** 680

B 576 **D** 720

37. If 60% of a number is 18, what is 90% of the number?

F 3 **H** 27

G 16 **J** 30

38. Taryn's grandmother took her out to dinner. If the dinner was $34 and she left a 20% tip, how much money did Taryn's grandmother spend?

A $6.80 **C** $39.50

B $27.20 **D** $40.80

Spiral Review

39. RESTAURANT Mitchell spent $13 on dinner. About how much money should he tip the server if he wants to leave a 15% tip? (Lesson 7-3)

Find each number. Round to the nearest hundredth if necessary. (Lesson 7-2)

40. What percent of 15 is 20?

41. 20.5% of what number is 35?

42. What number is 0.5% of 10?

GET READY for the Next Lesson

43. PREREQUISITE SKILL To estimate the age of a dog in human years, count the first year as 15 human years, the second year as 10 human years, and all of the following years as 3 human years. How old in human years is a 6-year-old dog? (Lesson 1-1)

Problem-Solving Investigation

MAIN IDEA: Solve problems by determining reasonable answers.

P.S.I. TEAM +

e-Mail: DETERMINE REASONABLE ANSWERS

Doug: My dad painted 25% of my bedroom in 28 minutes. I think the whole project will take about 3 hours.

YOUR MISSION: Determine whether it is reasonable for Doug's dad to paint the bedroom in 3 hours.

Understand	Twenty-five percent of the room has been painted in 28 minutes. Doug thinks it will take a total of 3 hours to paint the whole room.
Plan	Since 25% or $\frac{1}{4}$ of the room was painted in about 30 minutes, use a model of 25%.
Solve	Round 28 minutes to 30 minutes
	30 minutes × 4 = 120 minutes
	120 min = 2 h
	So, 2 hours would be a better estimate than 3 hours.
Check	Thirty minutes is $\frac{1}{2}$ hour. Since $\frac{1}{2}$ × 4 = 2, 2 hours is reasonable answer. ✔

Within Solve:

25% | | | (30 min) → 25% 25% 25% 25% (30 min 30 min 30 min 30 min)

Analyze The Strategy

1. Describe other problem-solving strategies that you could use to determine whether answers are reasonable.

2. **WRITING IN MATH** Write two word problems. One should have a reasonable answer and the other should not.
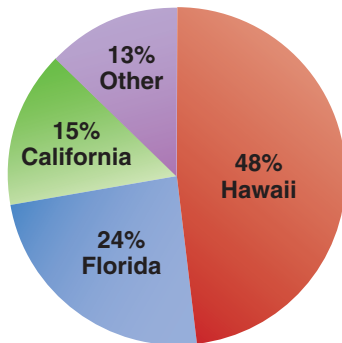
Determine reasonable answers for Exercises 3–6.

3. **SAVING** Aliayah saves $11 each month for her class trip. What is a reasonable estimate for the amount of money she will have saved after a year: about $100, $120, or $160? Explain.

4. **SCHOOL** Of 423 students, 57.6% live within 5 miles of the school. What is a reasonable estimate for the number of students living within 5 miles of the school? Explain.

5. **EXERCISE** A survey showed that 61% of middle school students do some kind of physical activity every day. If there are 828 middle school students in your school, would the number of students who exercise be about 300, 400, or 500? Explain.

6. **ANALYZE GRAPHS** A travel agency surveyed 140 families about their favorite vacation spots. Is 60, 70, or 80 families a reasonable estimate for the number of families that did *not* choose Hawaii?
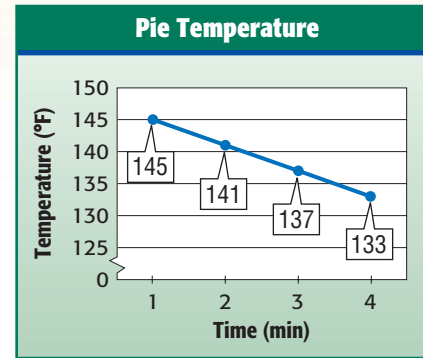
Favorite Vacation Spots

- 13% Other
- 15% California
- 48% Hawaii
- 24% Florida

Use any strategy to solve Exercises 7–13. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES
- Guess and check.
- Make an organized list.
- Look for a pattern.
- Determine Reasonable Answers.

7. **COINS** John has 10 coins that total $0.83. What are the coins?

8. **ANALYZE GRAPHS** Refer to the graph. A pie is set out to cool. Is it reasonable to estimate that the pie will be 90°F after ten minutes of cooling?

Pie Temperature

Temperature (°F): 150, 145, 140, 135, 130, 125, 0
Values: 145, 141, 137, 133
Time (min): 1, 2, 3, 4

9. **SHOPPING** Deshawn wants to buy a shirt that has a regular price of $41, but is now on sale for 25% off. Is $25, $30, or $35 the best estimate for the cost of the shirt?

10. **BOWLING** In bowling, you get a spare when you knock down the ten pins in two throws. How many possible ways are there to get a spare?

11. **TIPS** Shawnda decides to leave a 20% tip on a restaurant bill of $17.50. How much should she tip the restaurant server?

12. **FUNDRAISER** During a popcorn sale for a fundraiser, the soccer team gets to keep 25% of the sales. One box of popcorn sells for $1.50, and the team has sold 510 boxes so far. Has the team raised a total of $175?

13. **MEASUREMENT** How many square yards of carpet are needed to carpet the two rooms described below? Explain.

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

Find each number. Round to the nearest tenth if necessary. (Lesson 7-1)

1. Find 17% of 655.

2. What is 235% of 82?

3. Find 75% of 160.

4. What number is 162.2% of 55?

5. **MULTIPLE CHOICE** Ayana has 220 coins in her piggy bank. Of those, 45% are pennies. How many coins are not pennies? (Lesson 7-1)

   A 121   **C** 109

   B 116   **D** 85

Find each number. Round to the nearest tenth if necessary. (Lesson 7-2)

6. What percent of 84 is 12?

7. 15 is 25% of what number?

8. 85% of 252 is what number?

ANALYZE GRAPHS For Exercises 9 and 10, refer to the graph that shows the results of a survey of 200 students' favorite DVDs.

Favorite DVDs
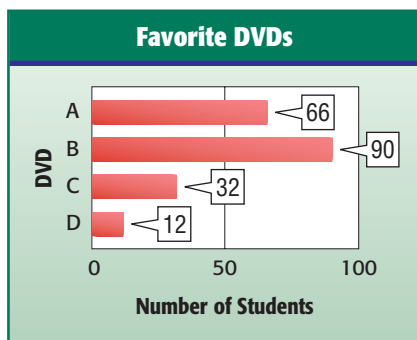
9. What percent of students preferred DVD A?

10. Which DVD did about 15% of students prefer?

Estimate. (Lesson 7-3)

11. 20% of 392   12. 78% of 112

13. 52% of 295   14. 30% of 42

15. 79% of 88   16. 41.5% of 212

17. **MULTIPLE CHOICE** A football player has made about 75% of the field goals he has attempted in his career. If he attempts 41 field goals in one season, about how many would he be expected to make?

   A 35   **C** 25

   B 30   **D** 20

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 7-4)

18. What number is 35% of 72?

19. 16.1 is what percent of 70?

20. 27.2 is 68% of what number?

21. 16% of 32 is what number?

22. 55% of what number is 1.265?

23. 17 is 40% of what number?

24. **ANALYZE TABLES** The table shows the costs of owning a dog over an average 11-year lifespan. What percent of the total cost is veterinary bills? (Lesson 7-4)

Dog Ownership Costs	
Item	**Cost ($)**
Food	4,020
Veterinary Bills	3,930
Grooming, Equipment	2,960
Training	1,220
Other	2,470

Source: American Kennel Club

25. **SHOPPING** A desktop computer costs $849.75 and the hard drive is 61.3% of the total cost. What is a reasonable estimate for the cost of the hard drive? (Lesson 7-5)

MAIN IDEA

Find the percent of increase or decrease.

New Vocabulary

percent of change
percent of increase
percent of decrease

Math Online

glencoe.com

- Concepts In Motion
- Extra Examples
- Personal Tutor
- Self-Check Quiz

▷ MINI Lab

You can model a 50% increase using straws.

100%

50%

150%

- Begin with two straws. The first straw will represent 100%.
- Cut the second straw in half. One part represents 50%.
- Tape the two straws together. This new straw represents a 50% increase or 150% of the original straw.

Model each percent of change.

1. 25% increase
2. 75% increase
3. 30% increase
4. Describe a model that represents a 100% increase, a 200% increase, and a 300% increase.
5. 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.

Percent of Change	Key Concept
Words	A **percent of change** is a ratio that compares the change in quantity to the original amount.
Equation	percent of change $= \dfrac{\text{amount of change}}{\text{original amount}}$

The percent of change is based on the 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**.

$$\textbf{percent of increase} = \frac{\textbf{amount of increase}}{\textbf{original amount}} \quad \longleftarrow \text{new} - \text{original}$$

$$\textbf{percent of decrease} = \frac{\textbf{amount of decrease}}{\textbf{original amount}} \quad \longleftarrow \text{original} - \text{new}$$

Find Percent of Increase

1 **GASOLINE** Find the percent of change in the cost of gasoline from 1970 to 2007. Round to the nearest whole percent if necessary.

1970

★ GAS ★   2007

$1.30   ★ GAS ★

$2.85
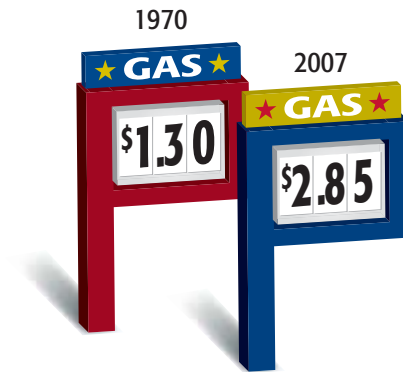
Since the 2007 price is greater than the 1970 price, this is a percent of increase. The amount of increase is $2.85 − $1.30 or $1.55.

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

$= \dfrac{\$1.55}{\$1.30}$ Substitution

≈ 1.19 Simplify.

$\approx 119\%$ Write 1.19 as a percent.

The cost of gasoline increased 119% from 1970 to 2007.

> **Study Tip**
>
> **Percents**
> In the percent of change formula, the decimal representing the percent of change must be written as a percent.

✓ **CHECK Your Progress**

a. **MEASUREMENT** Find the percent of change from 10 yards to 13 yards.

EXAMPLE **Find Percent of Decrease**

2 **DVD RECORDER** Yusuf bought a DVD recorder for $280. Now, it is on sale for $220. Find the percent of change in the price. Round to the nearest whole percent if necessary.

Since the new price is less than the original price, this is a percent of decrease. The amount of decrease is $280 − $220 or $60.

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

$= \dfrac{\$60}{\$280}$ Substitution

≈ 0.21 Simplify.

$\approx 21\%$ Write 0.21 as a percent.

The price of the DVD recorder decreased by about 21 percent.

✓ **CHECK Your Progress**

b. **MONEY** Find the percent of change from $20 to $15.

TEST EXAMPLE

3 The table shows about how many people attended the home games of a high school football team for five consecutive years. Which statement is supported by the information in the table?

Attendance of Home Games	
Year	Total Attendance (thousands)
2003	16.6
2004	16.4
2005	15.9
2006	17.4
2007	17.6

A The attendance in 2006 was 15% greater than the attendance in 2005.

B The greatest decrease in attendance occurred from 2003 to 2004.

C The attendance in 2005 was 3% less than the attendance in 2004.

D The greatest increase in attendance occurred from 2006 to 2007.

Read the Item

You need to determine which statement is best supported by the information given in the table.

Solve the Item

- Check **A**. The percent of change from 2005 to 2006 was $\frac{17.4 - 15.9}{15.9}$ or about 10%, not 15%.

- Check **B**.
  From 2003 to 2004, the decrease was $16.6 - 16.4$ or 0.2.
  From 2004 to 2005, the decrease was $16.4 - 15.9$ or 0.5.
  This statement is not supported by the information.

- Check **C**. The percent of change from 2004 to 2005 was $\frac{16.4 - 15.9}{16.4}$ or about 3%. This statement is supported by the information.

- Check **D**.
  From 2005 to 2006, the increase was $17.4 - 15.9$ or 1.5.
  From 2006 to 2007, the increase was $17.6 - 17.4$ or 0.2.
  This statement is not supported by the information.

The solution is **C**.

Test-Taking Tip

Check the Results If you have time, check all of the choices given. By doing so, you will verify that your choice is correct.

✔ CHECK Your Progress

c. Which of the following represents the greatest percent of change?

   F A savings account that had $500 now has $470.

   G An MP3 player that stored 15 GB now stores 30 GB.

   H A plant grew from 3 inches to 8 inches in one month.

   J An airplane ticket that was originally priced at $345 is now $247.

✔ **CHECK Your Understanding**

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

Examples 1, 2
(p. 370)

1. 30 inches to 24 inches

2. 20.5 meters to 35.5 meters

3. $126 to $150

4. $75.80 to $94.75

Example 3
(p. 371)

5. MULTIPLE CHOICE The table shows the number of youth 7 years and older who played soccer from 1998 to 2006. Which statement is supported by the information in the table?

Playing Soccer	
Year	Number (millions)
1998	13.2
2000	12.9
2002	13.7
2004	13.3
2006	14.0

Source: National Sporting Goods Association

A The greatest decrease in the number of players occurred from 1998 to 2000.

B There were 7% fewer youth playing soccer in 2004 than in 2002.

C The number of players in 2002 was 6% greater than the number of players in 2000.

D There were 10% more youth playing soccer in 2000 than in 1998.

▶ **Practice and Problem Solving**

For Exercises 6–19, find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.

HOMEWORK HELP	
For Exercises	See Examples
6–7, 14–15 18–19	1
8–13 16–17	2
39, 40	3

6. 15 yards to 18 yards

7. 100 acres to 140 acres

8. $12 to $6

9. 48 notebooks to 14 notebooks

10. 125 centimeters to 87.5 centimeters

11. $15.60 to $11.70

12. 1.6 hours to 0.95 hour

13. 132 days to 125.4 days

14. $240 to $320

15. 624 feet to 702 feet

16. BOOKS On Monday, Kenya spent 60 minutes reading her favorite book. Today, she spent 45 minutes reading this book.

17. EXERCISE Three months ago, Ernesto could walk 2 miles in 40 minutes. Today he can walk 2 miles in 25 minutes.

18. SCHOOL Last school year the enrollment of Gilboa Middle School was 465 students. This year the enrollment is 525.

19. MONEY Jake had $782 in his checking account. He now has $798.

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.
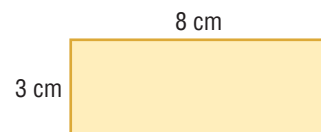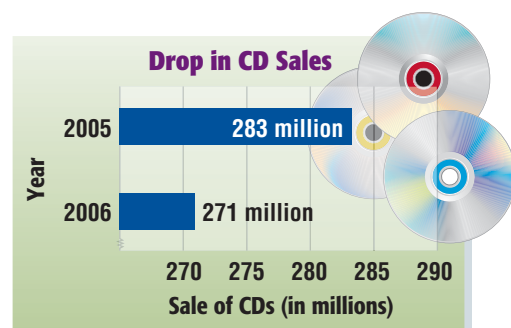
20. $\frac{1}{2}$ to $\frac{1}{4}$

21. $\frac{4}{6}$ to $\frac{1}{6}$

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

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

MEASUREMENT For Exercises 24 and 25, refer to the rectangle at the right. Suppose the side lengths are doubled.

8 cm

3 cm

24. Find the percent of change in the perimeter.

25. Find the percent of change in the area.

26. **MUSIC PHONES** Between 2006 and 2007, music phone owners increased from 6.8 million to 33 million. Find the percent of increase. Round to the nearest whole percent.

27. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would find the percent of change.

28. **ANALYZE GRAPHS** Use the graphic shown to find the percent of change in CD sales from 2005 to 2006.

29. **SHOES** In 2009, shoe sales for a certain company were $25.9 billion. Sales are expected to increase by about 20% from 2009 to 2010. Find the projected amount of shoe sales in 2010.

Drop in CD Sales

Year	Sale of CDs (in millions)
2005	283 million
2006	271 million

270 275 280 285 290
**Sale of CDs (in millions)**

Source: Fox News

30. **BABYSITTING** The table shows how many hours Catalina spent babysitting during the months of April and May. If Catalina charges $6.50 per hour, what is the percent of change in the amount of money earned from April to May?

Month	Hours Worked
April	40
May	32

ANALYZE GRAPHS For Exercises 31–33, refer to the graph.

31. Find the percent of decrease of truck sales from 2004 to 2005. Round to the nearest whole percent.

32. Find the percent of increase of truck sales from 2003 to 2004. Round to the nearest whole percent.

33. Between which two consecutive years is the percent of increase the greatest? What is the percent of increase? Round to the nearest whole percent.

Truck Sales
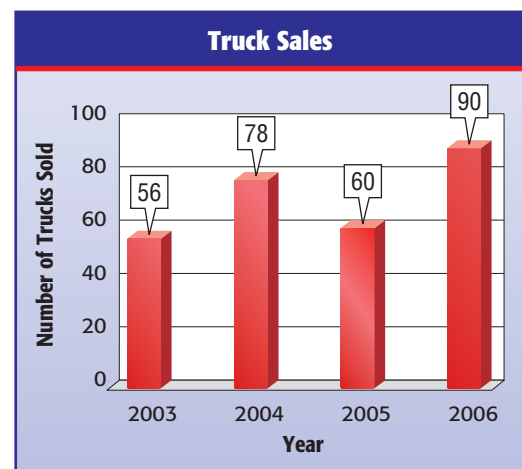
Year	Number of Trucks Sold
2003	56
2004	78
2005	60
2006	90

H.O.T. Problems

34. **OPEN ENDED** Write a percent of change problem using the quantities 14 and 25, and state whether there is a percent of increase or decrease. Find the percent of change.

35. **NUMBER SENSE** The costs of two different sound systems were decreased by $10. The original costs of the systems were $90 and $60, respectively. Without calculating, which had greater percent of decrease? Explain.

36. **FIND THE ERROR** Sade and Trish are finding the percent of change from $52 to $125. Who is correct? Explain.

Sade: $\dfrac{\$125 - \$52}{\$52} \approx 1.40$ or 140%

Trish: $\dfrac{\$125 - \$52}{\$125} \approx 0.58$ or 58%

Sade

Trish

37. **CHALLENGE** If a quantity increases by 10% and then decreases by 10%, will the result be the original quantity? Explain.

38. **WRITING IN MATH** Explain how you know whether a percent of change is a percent of increase or a percent of decrease.

TEST PRACTICE

39. Which of the following represents the least percent of change?

   A A coat that was originally priced at $90 is now $72.

   B A puppy who weighed 6 ounces at birth now weighs 96 ounces.

   C A child grew from 54 inches to 60 inches in 1 year.

   D A savings account increased from $500 to $550 in 6 months.

40. If each dimension of the rectangle is doubled, what is the percent of increase in the area?

   15 cm

   12 cm
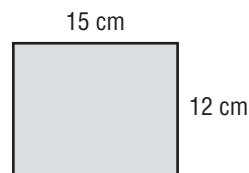
   F 100%   **H** 300%

   G 200%   **J** 400%

Spiral Review

ALGEBRA **Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.** (Lesson 7-4)

41. **FOOD** Of 823 students 47.2% of the students chose pizza as their favorite food. What is a reasonable estimate for the number of students who chose pizza as their favorite food? Explain. (Lesson 7-5)

42. 30% of what number is 17?   43. What is 21% of 62?

44. **SHOPPING** Four pounds of pecans cost $12.75. How much is this per pound? (Lesson 6-2)

GET READY for the Next Lesson

PREREQUISITE SKILL **Write each percent as a decimal.** (Lesson 6-8)

45. 6.5%   46. $5\frac{1}{2}\%$ 47. $8\frac{1}{4}\%$ 48. $6\frac{3}{4}\%$

Sales Tax and Discount

▷ GET READY for the Lesson

KAYAKS Horatio plans to buy a new kayak that costs $1,849. He lives in North Carolina where there is a 4.25% sales tax.

1. Calculate the sales tax by finding 4.25% of $1,849. Round to the nearest cent.

2. What will be the total cost including the sales tax?

3. Multiply 1.0425 and 1,849. How does the result compare to your answer in Exercise 2?

Sales tax is an additional amount of money charged on items that people buy. The total cost of an item is the regular price plus the sales tax.

EXAMPLE   Find the Total Cost

1 **ELECTRONICS** A DVD player costs $140, and the sales tax is 5.75%. What is the total cost of the DVD player?

METHOD 1   Add sales tax to the regular price.

First, find the sales tax.

5.75% of $140 = 0.0575 × 140   Write 5.75% as a decimal.
                = 8.05   The sales tax is $8.05.

Next, add the sales tax to the regular price.
$8.05 + $140 = $148.05

METHOD 2   Add the percent of tax to 100%.

100% + 5.75% = 105.75%   Add the percent of tax to 100%.

The total cost is 105.75% of the regular price.

105.75% of $140 = 1.0575 × $140   Write 105.75% as a decimal.
                = $148.05   Multiply.

So, the total cost of the DVD player is $148.05.

✔ CHOOSE Your Method

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

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**

2 **BOOGIE BOARDS** A boogie board that has a regular price of $69 is on sale at a 35% discount. What is the sale price of the boogie board?

METHOD 1 Subtract the discount from the regular price.

First, find the amount of the discount.

35% of $69 = 0.35 · $69   Write 35% as a decimal.
           = $24.15   The discount is $24.15.

Next, subtract the discount from the regular price.
$69 − $24.15 = $44.85

METHOD 2 Subtract the percent of discount from 100%.

100% − 35% = 65%   Subtract the discount from 100%.

The sale price is 65% of the regular price.

65% of $69 = 0.65 · $69   Write 65% as a decimal.
           = 44.85   Multiply.

So, the sale price of the boogie board is $44.85.

✓CHOOSE Your Method

b. **MUSIC** A CD that has a regular price of $15.50 is on sale at a 25% discount. What is the sale price of the CD?

Study Tip

Percent Equation
Remember that, in the percent equation, the percent must be written as a decimal. Since the sale price is 70% of the original price, use 0.7 to represent 70% in the percent equation.

EXAMPLE **Find the Original Price**

3 **CELL PHONES** A cell phone is on sale for 30% off. If the sale price is $239.89, what is the original price?

The sale price is 100% − 30% or 70% of the original price.

Words $239.89 is 70% of what price?

Variable   Let p represent the original price.

Equation $239.89 = 0.7 \times p$

$239.89 = 0.7p$ Write the equation.

$\dfrac{239.89}{0.7} = \dfrac{0.7p}{0.7}$ Divide each side by 0.7.

$342.70 = p$ Simplify.

The original price is $342.70.

✓CHECK Your Progress

c. Find the original price if the sale price of the cell phone is $205.50.

CHECK Your Understanding

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

Example 1
(p. 375)

1. $2.95 notebook; 5% tax

2. $46 shoes; 2.9% tax

Example 2
(p. 376)

3. $1,575 computer; 15% discount

4. $119.50 skateboard; 20% off

Example 3
(p. 376)

5. **IN-LINE SKATES** A pair of in-line skates is on sale for $90. If this price represents a 9% discount from the original price, what is the original price to the nearest cent?

Practice and Problem Solving

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

6. $58 ski lift ticket; 20% discount

7. $1,500 computer; 7% tax

8. $99 CD player; 5% tax

9. $12.25 pen set; 60% discount

10. $4.30 makeup; 40% discount

11. $7.50 meal; 6.5% tax

12. $39.60 sweater; 33% discount

13. $89.75 scooter; $7\frac{1}{4}$% tax

14. **COSMETICS** A bottle of hand lotion is on sale for $2.25. If this price represents a 50% discount from the original price, what is the original price to the nearest cent?

15. **TICKETS** At a movie theater, the cost of admission to a matinee is $5.25. If this price represents a 30% discount from the evening price, find the evening price to the nearest cent.

Find the original price to the nearest cent.

16. calendar: discount, 75%
     sale price, $2.25

17. telescope: discount, 30%
     sale price, $126

18. **VIDEO GAMES** What is the sales tax of a $178.90 video game system if the tax rate is 5.75%?

19. **RESTAURANTS** A restaurant bill comes to $28.35. Find the total cost if the tax is 6.25% and a 20% tip is left on the amount before tax.

SKATEBOARDS For Exercises 20–22, use the information in the table at the right.

A skateboard costs $320, not including the sales tax.

20. What is the total cost of the skateboard, including tax in Washington?

State	2007 Sales Tax Rate
Washington	6.5%
Kansas	5.3%
North Carolina	4.25%

Source: Federation of Tax Administrators

21. What is the total cost of the skateboard, including tax, in North Carolina?

22. A store in Kansas has the skateboard on sale for 20% off. If the sales tax is calculated after the discount, what is the cost of the skateboard?

23. CHALLENGE A gift store is having a sale in which all items are discounted 20%. Including tax, Colin paid $21 for a picture frame. If the sales tax rate is 5%, what was the original price of the picture frame?

24. 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%.

25. Which One Doesn't Belong? In each pair, the first value is the regular price of an item and the second value is the sale price. Identify the pair that does not have the same percent of discount as the other three. Explain.

| $24, $18 | $50, $25 | $12, $9 | $80, $60 |

26. WRITING IN MATH Describe two methods for finding the sale price of an item that is discounted 30%. Which method do you prefer? Explain.

TEST PRACTICE

27. A computer software store is having a sale. The table shows the regular price, r, and the sales price, s, of various items.

Item	Regular Price (r)	Sale Price (s)
A	$5.00	$4.00
B	$8.00	$6.40
C	$10.00	$8.00
D	$15.00	$12.00

Which formula can be used to calculate the sale price?

A $s = r \times 0.2$ **C** $s = r \times 0.8$

B $s = r - 0.2$ **D** $s = r - 0.8$

28. A chair that costs $210 was reduced by 40% for a one day sale. After the sale, the sale price was increased by 40%. What is the price of the chair?

F $176.40   **H** $205.50

G $185.30   **J** $210.00

29. Juanita paid $10.50 for a T-shirt at the mall. It was on sale for 30% off. What was the original price before the discount?

A $3.15   **C** $15.00

B $7.35   **D** $35.00

Spiral Review

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 7-6)

30. 4 hours to 6 hours   **31.** $500 to $456   **32.** 20.5 meters to 35.5 meters

33. TRAVEL Out of a 511-mile trip, Mya drove about 68% on Monday. Determine a reasonable estimate for the number of miles she drove on Monday. (Lesson 7-5)

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply. Write in simplest form. (Lesson 5-5)

34. $\frac{2}{7} \cdot \frac{4}{5}$

35. $\frac{1}{8} \cdot \frac{4}{9}$

36. $\frac{6}{11} \cdot \frac{9}{24}$

7-8 Simple Interest

GET READY for the Lesson

INVESTING Suni plans to save the $200 she received for her birthday. The graphs shows the average yearly rates at three different banks.

1. Calculate 2.50% of $200 to find the amount of money Suni can earn in one year at Federal Credit Bank.

2. Calculate 2.75% of $200 to find the amount of money Suni can earn in one year at First Bank.

Savings Rates
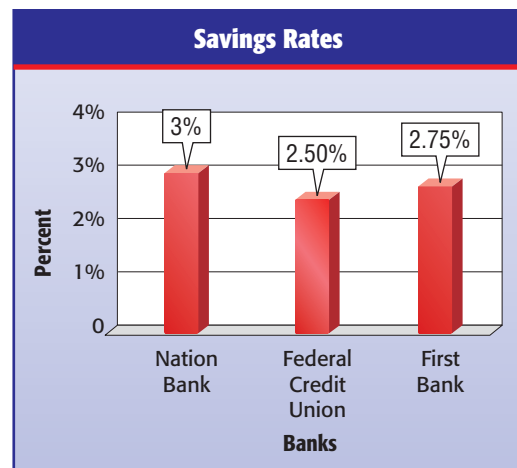
Principal is the amount of money deposited or borrowed.
Simple interest is the amount paid or earned for the use of money. To find simple interest I, use the following formula.

$$I = prt$$

Interest — Annual interest rate, written as a decimal
Principal — Time, expressed in years.

EXAMPLES Find Interest Earned

CHECKING Arnold has $580 in a savings account that pays 3% simple interest. How much interest will he earn in each amount of time?

1 5 years

$I = prt$	Formula for simple interest
$I = 580 \cdot 0.03 \cdot 5$	Replace p with $580, r$ with 0.03, and t with 5.
$I = 87$	Simplify.

Arnold will earn $87 in interest in 5 years.

2 6 months

6 months $= \frac{6}{12}$ or 0.5 year	Write the time as years.
$I = prt$	Formula for simple interest
$I = 580 \cdot 0.03 \cdot 0.5$	$p = \$580, r = 0.03, t = 0.5$
$I \approx 8.7$	Simplify.

Arnold will earn $8.70 in interest in 6 months.

SAVINGS Jenny has $1,560 in a savings account that pays 2.5% simple interest. How much interest will she earn in each amount of time?

a. 3 years   **b.** 6 months

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

3 **LOANS** Rondell's parents borrow $6,300 from the bank for a new car. The interest rate is 6% per year. How much simple interest will they pay if they take 2 years to repay the loan?

$I = prt$ Formula for simple interest

$I = 6{,}300 \cdot 0.06 \cdot 2$ Replace p with $6,300, r with 0.06, and t with 2.

$I = 756$ Simplify.

Rondell's parents will pay $756 in interest in 2 years.

c. **LOANS** Mrs. Hanover borrows $1,400 at a rate of 5.5% per year. How much simple interest will she pay if it takes 8 months to repay the loan?

EXAMPLE   Find Total Paid on a Credit Card

4 **CREDIT CARDS** Derrick's dad bought new tires for $900 using a credit card. His card has an interest rate of 19%. If he has no other charges on his card and does not pay off his balance at the end of the month, how much money will he owe after one month?

$I = prt$ Formula for simple interest

$I = 900 \cdot 0.19 \cdot \dfrac{1}{12}$ Replace p with $900, r with 0.19, and t with $\dfrac{1}{12}$.

$I = 14.25$ Simplify.

The interest owed after one month is $14.25. So, the total amount owed would be $900 + $14.25 or $914.25.

d. **CREDIT CARDS** An office manager charged $425 worth of office supplies on a charge card with an interest rate of 9.9%. How much money will he owe if he makes no other charges on the card and does not pay off the balance at the end of the month?

Real-World Career . . . .

How does a Car Salesperson Use Math?
A car salesperson must be able to determine values of cars, calculate interest rates, and determine monthly payments.

Math Online
For more information go to glencoe.com.

Study Tip

Fractions of Years
Remember to express 1 month as $\dfrac{1}{12}$ year in the formula.

CHECK Your Understanding

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

1. $640, 3%, 2 years
2. $1,500, 4.25%, 4 years
3. $580, 2%, 6 months
4. $1,200, 3.9%, 8 months

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

5. $4,500, 9%, 3.5 years
6. $290, 12.5%, 6 months

7. **FINANCES** The Masters family financed a computer that costs $1,200. If the interest rate is 19%, how much will the family owe after one month if no payments are made?

Practice and Problem Solving

Find the simple 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%, 4 months
11. $3,000, 5.5%, 9 months

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

12. $1,000, 7%, 2 years
13. $725, 6.25%, 1 year
14. $2,700, 8.2%, 3 months
15. $175.80, 12%, 8 months

16. **CREDIT CARDS** Leon charged $75 at an interest rate of 12.5%. How much will Leon have to pay after one month if he makes no payments?

17. **TRAVEL** A family charged $1,345 in travel expenses. If no payments are made, how much will they owe after one month if the interest rate is 7.25%?

BANKING For Exercises 18 and 19, use the table.

18. What is the simple interest earned on $900 for 9 months?

19. Find the simple interest earned on $2,500 for 18 months.

Home Savings and Loan	
Time	**Rate**
6 months	2.4%
9 months	2.9%
12 months	3.0%
18 months	3.1%

INVESTING For Exercises 20 and 21, use the following information.

Ramon has $4,200 to invest for college.

20. If Ramon invests $4,200 for 3 years and earns $630, what was the simple interest rate?

21. Ramon's goal is to have $5,000 after 4 years. Is this possible if he invests with a rate of return of 6%? Explain.

22. **OPEN ENDED** Suppose you earn 3% on a $1,200 deposit for 5 years. Explain how the simple interest is affected if the rate is increased by 1%. What happens if the time is increased by 1 year?

23. **CHALLENGE** Mrs. Antil deposits $800 in a savings account that earns 3.2% interest annually. At the end of the year, the interest is added to the principal or original amount. She keeps her money in this account for three years without withdrawing any money. Find the total in her account after each year for three years.

24. **WRITING IN MATH** List the steps you would use to find the simple interest on a $500 loan at 6% interest rate for 18 months. Then find the simple interest.

TEST PRACTICE

25. Jada invests $590 in a money market account. Her account pays 7.2% simple interest. If she does not add or withdraw any money again, how much interest will Jada's account earn after 4 years of simple interest?

   A $75.80

   B $158.67

   C $169.92

   D $220.67

26. Mr. Sprockett borrows $3,500 from his bank to buy a used car. The loan has a 7.4% annual simple interest rate. If it takes Mr. Sprockett two years to pay back the loan, what is the total amount he will be paying?

   F $3,012

   G $4,018

   H $4,550

   J $3,598

Spiral Review

27. Find the total cost of a $19.99 DVD if the tax rate is 7%. (Lesson 7-7)

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 7-6)

28. 35 birds to 45 birds   **29.** 60 inches to 38 inches   **30.** $2.75 to $1.80

Divide. Write in simplest form. (Lesson 5-7)

31. $\frac{3}{5} \div \frac{1}{2}$ **32.** $\frac{4}{7} \div \frac{5}{8}$ **33.** $2\frac{2}{3} \div 1\frac{1}{4}$

Problem Solving in Art

Real-World Unit Project

It's Golden! It's time to complete your project. Use the information and data you have gathered about the Golden Ratio to prepare a Power Point presentation. Be sure to include your reports and calculations in your presentation.

Math Online Unit Project at glencoe.com

Spreadsheet Lab
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.

Simple Interest.xls

◇	A	B	C	D	E	
1	Principal (*p*)	Rate (*r*)	Time (*t*)	Interest (*I*)	New Balance	
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	

Sheet 1 / Sheet 2 / Sheet 3

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.

ANALYZE THE RESULTS

1. Why is the rate in column B divided by 100?

2. What is the balance in Max's account after 2 years if the principal is $1,500 and the simple interest rate is 4%?

3. How much interest does Max earn in 2 years if his account has a principal of $2,000 and a simple interest rate of 4%?

4. Is the amount of principal proportional to the interest Max earns if his account earns 4% simple interest over 2 years? Explain.

5. Is the amount of principal proportional to the balance in Max's account if it earns 4% simple interest over 2 years? Explain.

6. 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?

7. What is the balance of this account at the end of the 9 months?

FOLDABLES
Study Organizer

▶ **GET READY to Study**

Be sure the following Big Ideas are noted in your Foldable.

7-1	7-2
7-3	7-4
7-5	7-6
7-7	7-8

BIG Ideas

Percent of a Number (Lesson 7-1)
• To find the percent of a number, first write the percent as either a fraction or decimal and then multiply.

Percent Proportion (Lesson 7-2)

$$\frac{\text{part}}{\text{whole}} = \frac{n}{100} \Big\} \text{ percent}$$

Percent and Estimation (Lesson 7-3)
• One way to estimate the percent of a number is to use a fraction. The other way is to first find 10% of the number and then multiply.

Percent Equation (Lesson 7-4)

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

Percent of Change (Lesson 7-6)
• A percent of change is a ratio that compares the change in quantity to the original amount.

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

Sales Tax and Discount (Lesson 7-7)
• Sales tax is an additional amount of money charged on items. The total cost of an item is the regular price plus the sales tax.

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

Simple Interest (Lesson 7-8)
• Simple interest is the amount paid or earned for the use of money.

$$I = prt$$

Key Vocabulary

discount (p. 375)   percent proportion (p. 350)
percent equation (p. 361) principal (p. 379)
percent of change (p. 369) sales tax (p. 375)
percent of decrease (p. 369) simple interest (p. 379)
percent of increase (p. 369)

Vocabulary Check

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

1. The sale price of a discounted item is the regular price <u>minus</u> the discount.

2. A ratio that compares the change in quantity to the original amount is called the <u>percent of change</u>.

3. A <u>percent proportion</u> compares part of a quantity to the whole quantity using a percent.

4. The formula for simple interest is <u>$I = prt$</u>.

5. A method for estimating the percent of a number is to find <u>21%</u> of the number and then multiply.

6. The equation part = percent • whole is known as the <u>principal</u> equation.

7. The <u>principal</u> is the amount of money deposited or borrowed.

8. A <u>tax</u> is the amount by which the regular price of an item is reduced.

9. To find a percent of increase, compare the amount of the increase to the <u>new</u> amount.

10. If the new amount is greater than the original amount, then the percent of change is percent of <u>decrease</u>.

Lesson-by-Lesson Review

7-1 Percent of a Number (pp. 344–348)

Find each number. Round to the nearest tenth if necessary.

11. Find 78% of 50.

12. 45.5% of 75 is what number?

13. What is 225% of 60?

14. 0.75% of 80 is what number?

Example 1 Find 24% of 200.

24% of 200

$= 24\% \times 200$ Write the expression.

$= 0.24 \times 200$ Write 24% as a decimal.

$= 48$ Multiply.

So, 24% of 200 is 48.

7-2 The Percent Proportion (pp. 350–354)

Find each number. Round to the nearest tenth if necessary.

15. **SOCCER** A soccer team lost 30% of their games. If they played 20 games, how many did they win?

16. 6 is what percent of 120?

17. Find 0.8% of 35.

18. What percent of 375 is 40?

19. **PHONE SERVICE** A family pays $21.99 each month for their long distance phone service. This is 80% of the original price of the phone service. What is the original price of the phone service? Round to the nearest cent if necessary.

Example 2 What percent of 90 is 18?

$\dfrac{18}{90} = \dfrac{n}{100}$ Write the proportion.

$18 \cdot 100 = 90 \cdot n$ Find the cross products.

$1{,}800 = 90n$ Simplify.

$\dfrac{1{,}800}{90} = \dfrac{90n}{90}$ Divide each side by 90.

$20 = n$ So, 18 is 20% of 90.

Example 3 52 is 65% of what number?

$\dfrac{52}{w} = \dfrac{65}{100}$ Write the proportion.

$52 \cdot 100 = w \cdot 65$ Find the cross products.

$5{,}200 = 65w$ Simplify.

$\dfrac{5{,}200}{65} = \dfrac{65w}{65}$ Divide each side by 65.

$80 = w$ So, 52 is 65% of 80.

7-3 Percent and Estimation (pp. 355–360)

Estimate.

20. 25% of 81

21. 33% of 122

22. 77% of 38

23. 19.5% of 96

Estimate by using 10%.

24. 12% of 77

25. 88% of 400

26. **BOOKS** About 26% of the 208 books in Deja's collection are nonfiction. Estimate how many of Deja's books are nonfiction.

Example 4 Estimate 52% of 495.

$52\% \approx 50\%$ or $\dfrac{1}{2}$, and $495 \approx 500$.

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

So, 52% of 495 is about 250.

Example 5 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% of 80)

So, 68% of 80 is about 56.

7-4 **Algebra: The Percent Equation** (pp. 361–365)

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

27. 32 is what percent of 50?

28. 65% of what number is 39?

29. Find 42% of 300.

30. 7% of 92 is what number?

31. 12% of what number is 108?

32. **SALONS** A local hair salon increased their sales of hair products by about 12.5% this week. If they sold 48 hair products, how many hair products did they sell last week?

Example 6 **27 is what percent of 90?**

27 is the part and 90 is the base.

Let n represent the percent.

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

$27 = n \cdot 90$ Write an equation.

$\dfrac{27}{90} = \dfrac{90n}{90}$ Divide each side by 90.

$0.3 = n$ The percent is 30%.

So, 27 is 30% of 90.

7-5 **PSI: Determine Reasonable Answers** (pp. 366–367)

Determine a reasonable answer for each problem.

33. **CABLE TV** In a survey of 1,813 consumers, 18% said that they would be willing to pay more for cable if they got more channels. Is 3.3, 33, or 333 a reasonable estimate for the number of consumers willing to pay more for cable?

34. **SCHOOL** There are 880 students at Medina Middle School. If 68% of the students are involved in sports, would the number of students involved in sports be about 510, 630, or 720?

35. **VACATION** Suppose you are going on vacation for $689 and the airfare accounts for 43.5% of the total cost. What is a reasonable cost of the airfare?

Example 7 **Mr. Swanson harvested 1,860 pounds of apples from one orchard, 1,149 pounds from another, and 905 pounds from a third. The apples will be placed in crates that hold 42 pounds of apples. Will Mr. Swanson need 100, 200, or 400 crates?**

Since an exact answer is not needed, we can estimate the total of pounds.

$$
\begin{array}{ccc}
1,860 & \rightarrow & 1,900 \\
1,149 & \rightarrow & 1,100 \\
+\ 905 & \rightarrow & +\ 900 \\
\hline
& & 3,900
\end{array}
$$

Since $3,900 \div 40$ is about 100, it is reasonable that 100 crates need to be ordered.

7-6   **Percent of Change**   (pp. 369–374)

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

36. original: 172
new: 254

37. original: $200
new: $386

38. original: 75
new: 60

39. original: $49.95
new: $54.95

40. Tyree bought a collectible comic book for $49.62 last year. This year, he sold it for $52.10. Find the percent of change of the price of the comic book. Round to the nearest percent.

Example 8 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.

amount of increase $= 3.55 - 2.75$ or 0.80

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

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

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

The percent of increase is about 29%.

7-7   **Sales Tax and Discount**   (pp. 375–378)

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

41. $25 backpack; 7% tax

42. $210 bicycle; 15% discount

43. $8,000 car; $5\frac{1}{2}$% tax

44. $40 sweater; 33% discount

Find the percent of discount to the nearest percent.

45. shirt: regular price: $42
        sale price: $36

46. boots: regular price: $78
        sale price: $70

47. **MONEY** At the media store a certain DVD normally costs $21.99. This week the DVD is on sale for 25% off. Tara buys the DVD and pays using a $20 bill. Not including tax, how much change will she receive to the nearest cent?

Example 9 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% of $\$2,499 = 0.065 \cdot 2,499$

$$\approx 162.44$$

Next, add the sales tax. The total cost is $162.44 + 2,499$ or $2,661.44$.

Example 10 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?

$58 - 46.40 = 11.60$ Find the amount of discount.

Next, find what percent of 58 is 11.60.

$11.60 = n \cdot 58$ Write an equation.

$0.2 = n$ Divide each side by 58.

The percent of discount is 20%.

7-8 Simple Interest (pp. 379–382)

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

48. $475, 5%, 2 years

49. $5,000, 10%, 3 years

50. $2,500, 11%, $1\frac{1}{2}$ years

51. **SAVINGS** Tonya deposited $450 into a savings account earning 3.75% annual simple interest. How much interest will she earn in 6 years?

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

52. $3,200, 8%, 4 years

53. $1,980, 21%, 9 months

54. **CREDIT CARDS** David bought a computer for $600 using his credit card. The interest rate on his credit card is 19%. How much will he pay in all for the computer, if he pays off the balance at the end of 2 years?

Example 11 Find the interest earned on $400 at 9% for 3 years.

$I = prt$ Simple interest formula

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

$I = 108$ Simplify.

The interest earned is $108.

Example 12 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?

$I = prt$ Simple interest formula

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

$I = 45.5$ Simplify.

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

Find each number. Round to the nearest tenth if necessary.

1. Find 55% of 164.

2. What is 355% of 15?

3. Find 25% of 80.

4. **MULTIPLE CHOICE** Of 365 students, 210 bought a hot lunch. About what percent of the students did *not* buy a hot lunch?

 A 35%   C 56%
 B 42%   D 78%

Estimate.

5. 18% of 246   6. 145% of 81

7. 71% of 324   8. 56% of 65.4

9. **COMMUNICATION** Theresa makes a long distance phone call and talks for 50 minutes. Of these minutes, 25% were spent talking to her brother. Would the time spent talking with her brother be about 8, 12, or 15 minutes? Explain your reasoning.

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

10. Find 14% of 65.

11. What number is 36% of 294?

12. 82% of what number is 73.8?

13. 75 is what percent of 50?

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

14. $60 to $75

15. 145 meters to 216 meters

16. 48 minutes to 40 minutes

FOOD For Exercises 17 and 18, use the table below. It shows the results of a survey in which 175 students were asked what type of food they wanted for their class party.

Type of Food	Percent
Subs	32%
Tex-Mex	56%
Italian	12%

17. How many of the 175 students chose Italian food for their class party?

18. How many students chose Tex-Mex food for the party?

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

19. $2,200 computer, $6\frac{1}{2}$% sales tax

20. $16 hat, 55% discount

21. $35.49 jeans, 33% discount

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

22. $750, 3%, 4 years

23. $1,050, 4.6%, 2 years

24. $2,600, 4%, 3 months

25. **MULTIPLE CHOICE** Mr. Jackson borrows $3,500 to renovate his home. His loan has an annual simple interest rate of 15%. If he pays off the loan after 6 months, about how much will he pay in all?

 F $3,763
 G $3,500
 H $3,720
 J $4,025

PART 1 Multiple Choice

Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1. Sarah wants to buy pillows for her living room. Which store offers the best buy on pillows?

Store	Sale Price
A	3 pillows for $40
B	4 pillows for $50
C	2 pillows for $19
D	1 pillow for $11

   A Store A
   B Store B
   C Store C
   D Store D

2. The graph below shows the attendance at a summer art festival from 2002 to 2007. If the trend in attendance continues, which is the best prediction of the attendance at the art festival in 2010?

Art Festival Attendance
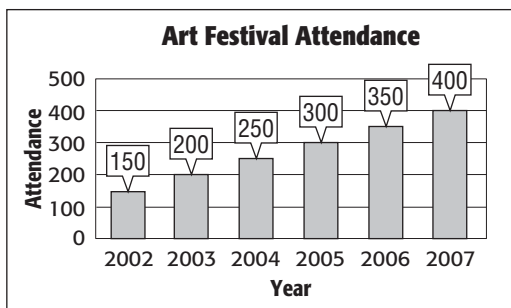
   F Fewer than 200
   G Between 500 and 600
   H Between 700 and 800
   J More than 800

3. At their annual car wash, the science club washes 30 cars in 45 minutes. At this rate, how many cars will they wash in 1 hour?

   A 40   C 50
   B 45   D 60

4. The cost of Ken's haircut was $23.95. If he wants to give his hair stylist a 15% tip, about how much of a tip should he leave?

   F $2.40
   G $3.60
   H $4.60
   J $4.80

5. At a pet store, 38% of the animals are dogs. If there are a total of 88 animals at the pet store, which equation can be used to find x, the number of dogs at the pet store?

   A $\dfrac{x}{88} = \dfrac{100}{38}$

   B $\dfrac{38}{88} = \dfrac{100}{x}$

   C $\dfrac{x}{88} = \dfrac{38}{100}$

   D $\dfrac{100}{88} = \dfrac{x}{38}$

6. An architect made a model of an office building using a scale of 1 inch equals 3 meters. If the height of the model is 12.5 inches, which of the following represents the actual height of the building?

   F 40.0 m
   G 37.5 m
   H 36.0 m
   J 28.4 m

7. Mrs. Stewart painted the door to her deck. The door is a rectangle with length x feet and width y feet. In the middle of the door, there is a rectangular panel of glass that measures 5 feet by 2 feet. Which expression gives the painted area of the door in square feet?

   A $x + y - 10$
   B $xy + 10$
   C $xy - 10$
   D $x + y + 10$

8. At a grocery store, half-gallons of milk are on sale 5 for $4. Find the cost of 7 half-gallons of milk to the nearest cent.

   F $2.86   **H** $5.40

   G $4.75   **J** $5.60

9. If point *B* is translated 3 units to the left and 2 units up, what will be point *B*'s new coordinates?
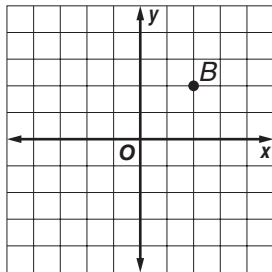
   A (−3, 2)   **C** (4, −1)

   B (5, 0)   **D** (−1, 4)

10. In Nadia's DVD collection, she has 8 action DVDs, 12 comedy DVDs, 7 romance DVDs, and 3 science fiction DVDs. What percent of Nadia's DVD collection are comedies?

   F 25%   **H** 35%

   G 30%   **J** 40%

11. Cassandra bought 2 dozen juice boxes priced at 6 juice boxes for $2.29 and 24 snack packages priced at 8 snack packages for $6.32. What is the total amount, not including tax, she spent on juice boxes and snack packages?

   A $34.44   **C** $28.12

   B $32.15   **D** $25.83

PART 2   Short Response/Grid In

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

12. The average cost of a 2-bedroom apartment in Grayson was $625 last year. This year, the average cost is $650. What is the percent of increase from last year to this year?

13. A necklace regularly sells for $18.00. The store advertises a 15% discount. What is the sale price of the necklace in dollars?

PART 3   Extended Response

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

TEST-TAKING TIP

Question 14 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.

14. Cable Company A increases their rates from $98 a month to $101.92 a month.

   a. What is the percent of increase?

   b. Cable Company B offers their cable for $110 dollars a month, but gives a 10% discount for new customers. Describe two ways to find the cost for new customers.

   c. If you currently use Cable Company A, would it make sense to change to Cable Company B?

NEED EXTRA HELP?														
If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Go to Lesson...	6-2	2-6	6-2	7-1	7-2	6-8	3-6	6-6	2-3	7-5	6-1	7-6	7-7	7-6