

# 6 Percents

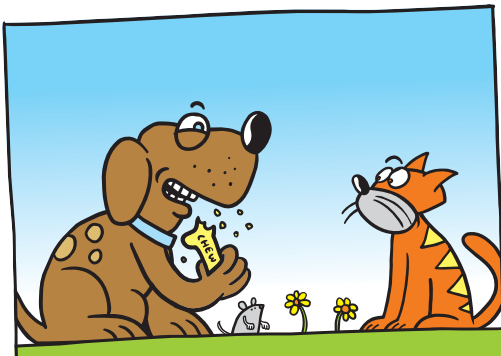
- 6.1 Percents and Decimals
- 6.2 Comparing and Ordering Fractions, Decimals, and Percents
- 6.3 The Percent Proportion
- 6.4 The Percent Equation
- 6.5 Percents of Increase and Decrease
- 6.6 Discounts and Markups
- 6.7 Simple Interest



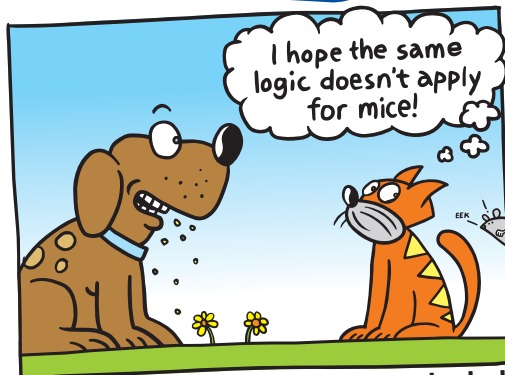
"Here's my sales strategy. I buy each dog bone for \$0.05."



"Then I mark each one up to \$1. Then, I have a 75% off sale. Cool, huh?"



"At 4 a day, I have chewed 17,536 dog biscuits. At only 99.9% pure, that means that..."

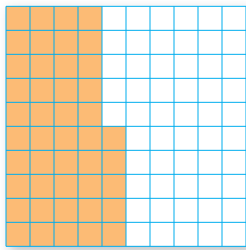


"I have swallowed seventeen and a half contaminated dog biscuits during the past twelve years."

# What You Learned Before

## ● Writing Percents as Fractions

**Example 1** Write 45% as a fraction in simplest form.



$$45\% = \frac{45}{100}$$

$$= \frac{9}{20}$$

Write as a fraction with a denominator of 100.

Simplify.

∴ So,  $45\% = \frac{9}{20}$ .

### Try It Yourself

Write the percent as a fraction or mixed number in simplest form.

- |         |         |         |         |
|---------|---------|---------|---------|
| 1. 16%  | 2. 40%  | 3. 68%  | 4. 85%  |
| 5. 148% | 6. 150% | 7. 105% | 8. 276% |

## ● Writing Fractions as Percents

**Example 2** Write  $\frac{3}{25}$  as a percent.

$$\frac{3}{25} = \frac{12}{100} = 12\%$$

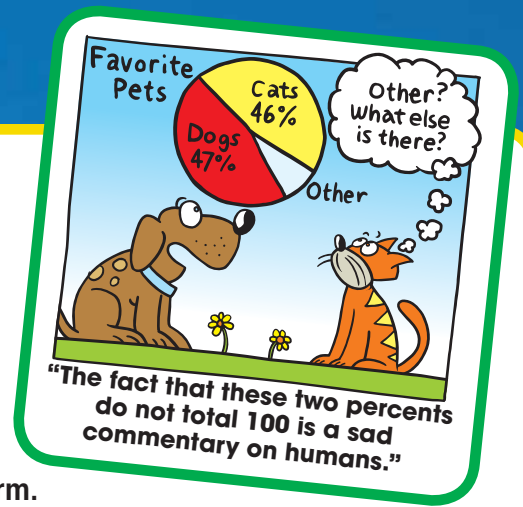
↗ × 4  
↘ × 4

Because  $25 \times 4 = 100$ , multiply the numerator and denominator by 4. Write the numerator with a percent symbol.

### Try It Yourself

Write the fraction or mixed number as a percent.

- |                    |                      |                     |                     |
|--------------------|----------------------|---------------------|---------------------|
| 9. $\frac{9}{25}$  | 10. $\frac{43}{50}$  | 11. $\frac{11}{20}$ | 12. $\frac{3}{5}$   |
| 13. $1\frac{1}{4}$ | 14. $1\frac{12}{25}$ | 15. $1\frac{4}{5}$  | 16. $2\frac{3}{10}$ |



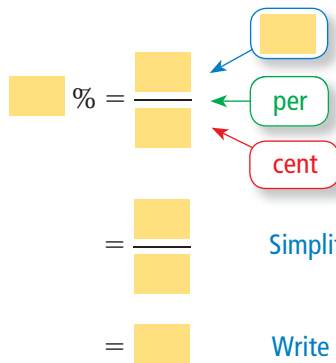
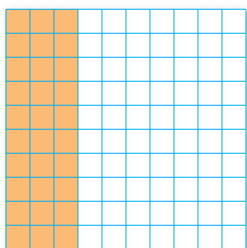
# 6.1 Percents and Decimals

**Essential Question** How does the decimal point move when you rewrite a percent as a decimal and when you rewrite a decimal as a percent?

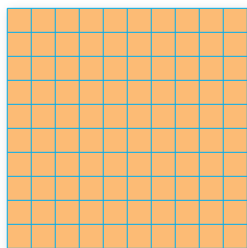
## 1 ACTIVITY: Writing Percents as Decimals

Work with a partner. Write the percent shown by the model. Write the percent as a decimal.

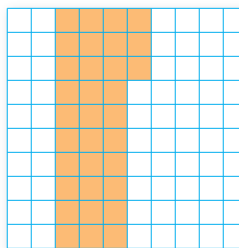
a.



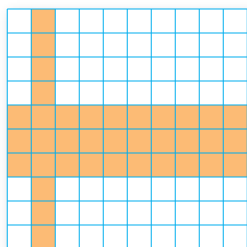
b.



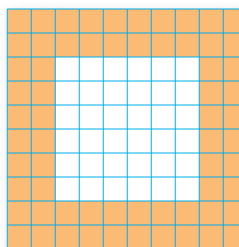
c.



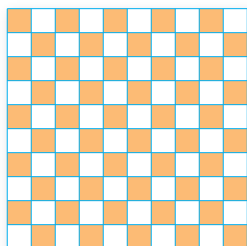
d.



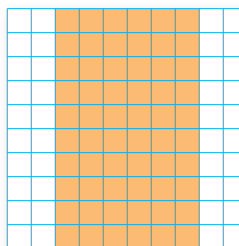
e.



f.



g.



### Percents and Decimals

In this lesson, you will

- write percents as decimals.
- write decimals as percents.
- solve real-life problems.

## 2 ACTIVITY: Writing Percents as Decimals

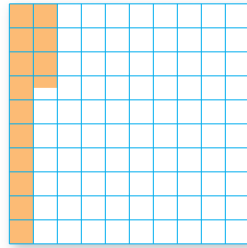
### Math Practice

#### Communicate Precisely

How can reading the fraction aloud help you write it as a decimal?

Work with a partner. Write the percent as a decimal.

a. 13.5%



$$\begin{aligned} \square \% &= \frac{\square}{\square} \\ &= \frac{\square}{\square} \\ &= \square \end{aligned}$$

per  
cent

Multiply numerator and denominator by 10.

Write fraction as a decimal.

b. 12.5%

c. 3.8%

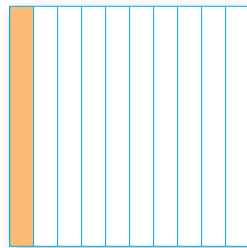
d. 0.5%

## 3 ACTIVITY: Writing Decimals as Percents

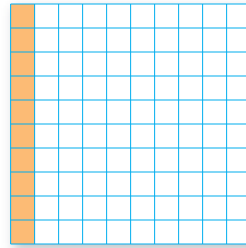
Work with a partner. Draw a model to represent the decimal. Write the decimal as a percent.

a. 0.1

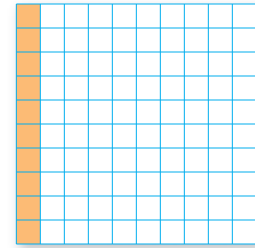
$$0.1 = 0.10 = \frac{\square}{\square} = \square \%$$



One



Ten



Percent

b. 0.24

c. 0.58

d. 0.05

### What Is Your Answer?

- IN YOUR OWN WORDS** How does the decimal point move when you rewrite a percent as a decimal and when you rewrite a decimal as a percent?
- Explain why the decimal point moves when you rewrite a percent as a decimal and when you rewrite a decimal as a percent.

### Practice

Use what you learned about percents and decimals to complete Exercises 7–12 and 19–24 on page 218.

## Key Idea

### Writing Percents as Decimals

**Words** Remove the percent symbol. Then divide by 100, or just move the decimal point two places to the left.

**Numbers**  $23\% = 23.\% = 0.23$

## EXAMPLE 1 Writing Percents as Decimals

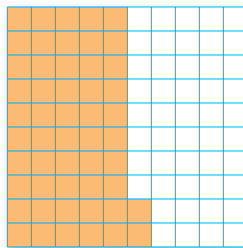
### Study Tip

When moving the decimal point, you may need to place one or more zeros in the number.

- a. Write 52% as a decimal.

$$52\% = 52.\% = 0.52$$

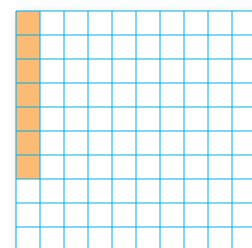
**Check**



- b. Write 7% as a decimal.

$$7\% = 07.\% = 0.07$$

**Check**



## On Your Own

Write the percent as a decimal. Use a model to check your answer.

1. 24%      2. 3%      3. 107%      4. 92.7%

**Now You're Ready**  
Exercises 7–18

## Key Idea

### Writing Decimals as Percents

**Words** Multiply by 100, or just move the decimal point two places to the right. Then add a percent symbol.

**Numbers**  $0.36 = 0.36 = 36\%$

## EXAMPLE 2 Writing Decimals as Percents

- a. Write 0.47 as a percent.

$$0.47 = 0.47 = 47\%$$

- b. Write 0.663 as a percent.

$$0.663 = 0.663 = 66.3\%$$

- c. Write 1.8 as a percent.

$$1.8 = 1.80 = 180\%$$

- d. Write 0.009 as a percent.

$$0.009 = 0.009 = 0.9\%$$

**On Your Own**

Write the decimal as a percent. Use a model to check your answer.

5. 0.94

6. 1.2

7. 0.316

8. 0.005

**EXAMPLE 3 Writing a Fraction as a Percent and a Decimal**

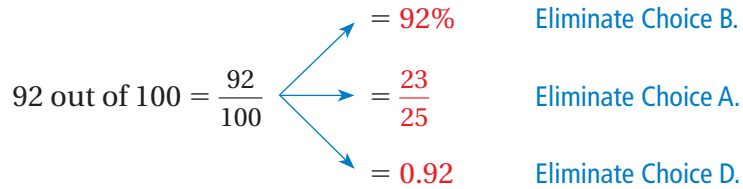
On a math test, you get 92 out of a possible 100 points. Which of the following is *not* another way of expressing 92 out of 100?

(A)  $\frac{23}{25}$

(B) 92%

(C)  $\frac{17}{20}$

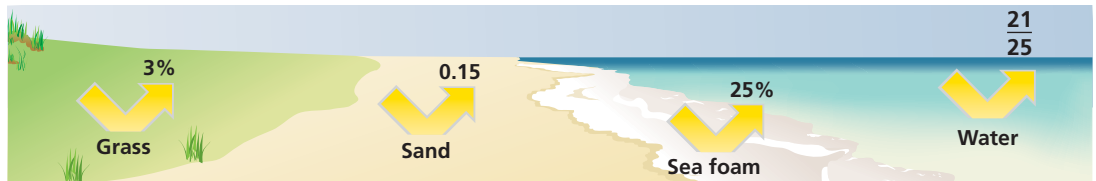
(D) 0.92



So, the correct answer is (C).

**EXAMPLE 4 Real-Life Application**

The figure shows the portions of ultraviolet (UV) rays reflected by four different surfaces. How many times more UV rays are reflected by water than by sea foam?



Write 25% and  $\frac{21}{25}$  as decimals.

**Sea foam:**  $25\% = 25.\% = 0.25$

**Water:**  $\frac{21}{25} = \frac{84}{100} = 0.84$

Divide 0.84 by 0.25:  $0.25 \overline{)0.84} \rightarrow 25 \overline{)84.00}$

So, water reflects about 3.4 times more UV rays than sea foam.

**On Your Own**

9. Write “18 out of 100” as a percent, a fraction, and a decimal.
10. In Example 4, how many times more UV rays are reflected by water than by sand?



## Vocabulary and Concept Check

**MATCHING** Match the decimal with its equivalent percent.

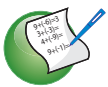
- |          |         |          |           |
|----------|---------|----------|-----------|
| 1. 0.42  | 2. 4.02 | 3. 0.042 | 4. 0.0402 |
| A. 4.02% | B. 42%  | C. 4.2%  | D. 402%   |
5. **OPEN-ENDED** Write three different decimals that are between 10% and 20%.
6. **WHICH ONE DOESN'T BELONG?** Which one does *not* belong with the other three? Explain your reasoning.

70%

0.7

$\frac{7}{10}$

0.07



## Practice and Problem Solving

Write the percent as a decimal.

- |            |            |            |
|------------|------------|------------|
| 1 7. 78%   | 8. 55%     | 9. 18.5%   |
| 10. 57.4%  | 11. 33%    | 12. 9%     |
| 13. 47.63% | 14. 91.25% | 15. 166%   |
| 16. 217%   | 17. 0.06%  | 18. 0.034% |

Write the decimal as a percent.

- |            |            |            |
|------------|------------|------------|
| 2 19. 0.74 | 20. 0.52   | 21. 0.89   |
| 22. 0.768  | 23. 0.99   | 24. 0.49   |
| 25. 0.487  | 26. 0.128  | 27. 3.68   |
| 28. 5.12   | 29. 0.0371 | 30. 0.0046 |

31. **ERROR ANALYSIS** Describe and correct the error in writing 0.86 as a percent.



$$0.86 = \overset{\text{red X}}{00.86} = 0.0086\%$$

32. **MUSIC** Thirty-six percent of the songs on your MP3 player are pop songs. Write this percent as a decimal.
33. **CAT** About 0.34 of the length of a cat is its tail. Write this decimal as a percent.
34. **COMPUTER** Write the percent of free space on the computer as a decimal.

Volume	Capacity	Free Space	% Free Space
(C:)	149 GB	133 GB	89 %

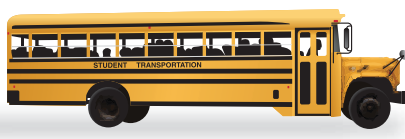
Write the percent as a fraction in simplest form and as a decimal.

- |         |           |            |
|---------|-----------|------------|
| 35. 36% | 36. 23.5% | 37. 16.24% |
|---------|-----------|------------|

38. **SCHOOL** The percents of students who travel to school by car, bus, and bicycle are shown for a school of 825 students.



Car: 20%



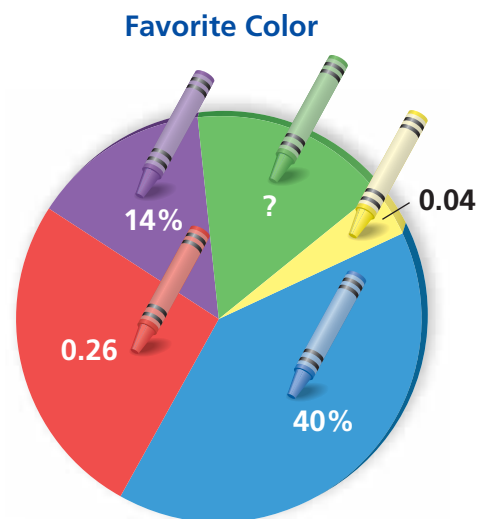
School bus: 48%



Bicycle: 8%

- Write the percents as decimals.
  - Write the percents as fractions.
  - What percent of students use another method to travel to school?
39. **ELECTIONS** In an election, the winning candidate receives 60% of the votes. What percent of the votes does the other candidate receive?
40. **COLORS** Students in a class were asked to tell their favorite color.

- What percent said red, blue, or yellow?
- How many times more students said red than yellow?
- Use two methods to find the percent of students who said green. Which method do you prefer?



41. **Problem Solving** In the first 42 Super Bowls,  $0.1\bar{6}$  of the MVPs (most valuable players) were running backs.
- What percent of the MVPs were running backs?
  - What fraction of the MVPs were *not* running backs?



## Fair Game Review What you learned in previous grades & lessons

Write the decimal as a fraction or mixed number in simplest form.

(Skills Review Handbook)

42. 0.46                      43. 0.31                      44. 2.2                      45. 4.32

Simplify the expression. (Section 3.1)

46.  $4x + 3 - 9x$                       47.  $5 + 3.2n - 6 - 4.8n$   
 48.  $2y - 5(y - 3)$                       49.  $-\frac{1}{2}(8b + 3) + 3b$

50. **MULTIPLE CHOICE** Ham costs \$4.48 per pound. Cheese costs \$6.36 per pound. You buy 1.5 pounds of ham and 0.75 pound of cheese. How much more do you pay for the ham? (Skills Review Handbook)

- (A) \$1.41                      (B) \$1.95                      (C) \$4.77                      (D) \$6.18



**Essential Question** How can you order numbers that are written as fractions, decimals, and percents?

## 1 ACTIVITY: Using Fractions, Decimals, and Percents

Work with a partner. Decide which number form (fraction, decimal, or percent) is more common. Then find which is greater.



a. 7% sales tax or  $\frac{1}{20}$  sales tax



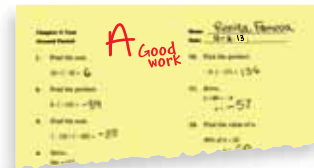
b. 0.37 cup of flour or  $\frac{1}{3}$  cup of flour

c.  $\frac{5}{8}$ -inch wrench or 0.375-inch wrench



d.  $12\frac{3}{5}$  dollars or 12.56 dollars

e. 93% test score or  $\frac{7}{8}$  test score



f.  $5\frac{5}{6}$  fluid ounces or 5.6 fluid ounces

## Fractions, Decimals, and Percents

In this lesson, you will

- compare and order fractions, decimals, and percents.
- solve real-life problems.

## 2 ACTIVITY: Ordering Numbers

Work with a partner to order the following numbers.

$\frac{1}{8}$    11%    $\frac{3}{20}$    0.172   0.32   43%   7%   0.7    $\frac{5}{6}$

- Decide on a strategy for ordering the numbers. Will you write them all as fractions, decimals, or percents?
- Use your strategy and a number line to order the numbers from least to greatest. (Note: Label the number line appropriately.)



### 3 ACTIVITY: The Game of Math Card War

#### Math Practice

##### Make Sense of Quantities

What strategies can you use to determine which number is greater?

#### Preparation:

- Cut index cards to make 40 playing cards.
- Write each number in the table onto a card.

#### To Play:

- Play with a partner.
- Deal 20 cards facedown to each player.
- Each player turns one card faceup. The player with the greater number wins. The winner collects both cards and places them at the bottom of his or her cards.
- Suppose there is a tie. Each player lays three cards facedown, then a new card faceup. The player with the greater of these new cards wins. The winner collects all 10 cards and places them at the bottom of his or her cards.
- Continue playing until one player has all the cards. This player wins the game.

75%	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{3}{10}$	0.3	25%	0.4	0.25	100%	0.27
0.75	$66\frac{2}{3}\%$	12.5%	40%	$\frac{1}{4}$	4%	0.5%	0.04	$\frac{1}{100}$	$\frac{2}{3}$
0	30%	5%	$\frac{27}{100}$	0.05	$33\frac{1}{3}\%$	$\frac{2}{5}$	0.333...	27%	1%
1	0.01	$\frac{1}{20}$	$\frac{1}{8}$	0.125	$\frac{1}{25}$	$\frac{1}{200}$	0.005	0.666...	0%

### What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you order numbers that are written as fractions, decimals, and percents? Give an example with your answer.
5. All but one of the U.S. coins shown has a name that is related to its value. Which one is it? How are the names of the others related to their values?



#### Practice

Use what you learned about ordering numbers to complete Exercises 4–7, 16, and 17 on page 224.

When comparing and ordering fractions, decimals, and percents, write the numbers as all fractions, all decimals, or all percents.

### EXAMPLE 1 Comparing Fractions, Decimals, and Percents

a. Which is greater,  $\frac{3}{20}$  or 16%?

Write  $\frac{3}{20}$  as a percent:  $\frac{3}{20} = \frac{15}{100} = 15\%$

∴ 15% is less than 16%. So, 16% is the greater number.

b. Which is greater, 79% or 0.08?

Write 79% as a decimal:  $79\% = 79.\% = 0.79$

∴ 0.79 is greater than 0.08. So, 79% is the greater number.

### On Your Own

- Which is greater, 25% or  $\frac{7}{25}$ ?
- Which is greater, 0.49 or 94%?

**Now You're Ready**  
Exercises 4–15

### EXAMPLE 2 Real-Life Application

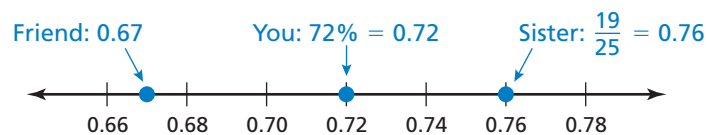
You, your sister, and a friend each take the same number of shots at a soccer goal. You make 72% of your shots, your sister makes  $\frac{19}{25}$  of her shots, and your friend makes 0.67 of his shots. Who made the fewest shots?

Write 72% and  $\frac{19}{25}$  as decimals.

**You:**  $72\% = 72.\% = 0.72$

**Sister:**  $\frac{19}{25} = \frac{76}{100} = 0.76$

Graph the decimals on a number line.



∴ 0.67 is the least number. So, your friend made the fewest shots.

### Study Tip

It is usually easier to order decimals or percents than to order fractions.

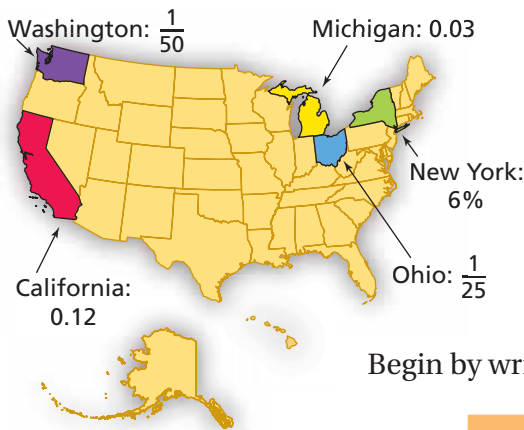
### Remember

To order numbers from least to greatest, write them as they appear on a number line from left to right.

### On Your Own

3. You make 75% of your shots, your sister makes  $\frac{13}{20}$  of her shots, and your friend makes 0.7 of his shots. Who made the most shots?

### EXAMPLE 3 Real-Life Application



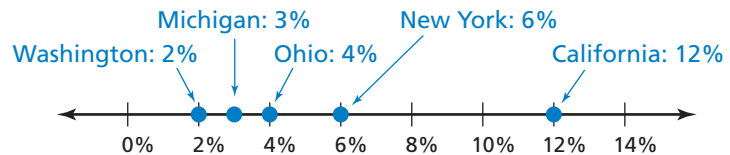
The map shows the portions of the U.S. population that live in five states.

List the five states in order by population from least to greatest.

Begin by writing each portion as a fraction, a decimal, and a percent.

State	Fraction	Decimal	Percent
Michigan	$\frac{3}{100}$	0.03	3%
New York	$\frac{6}{100}$	0.06	6%
Washington	$\frac{1}{50}$	0.02	2%
California	$\frac{12}{100}$	0.12	12%
Ohio	$\frac{1}{25}$	0.04	4%

Graph the percent for each state on a number line.



- ∴ The states in order by population from least to greatest are Washington, Michigan, Ohio, New York, and California.

### On Your Own

4. The portion of the U.S. population that lives in Texas is  $\frac{2}{25}$ . The portion that lives in Illinois is 0.042. Reorder the states in Example 3 including Texas and Illinois.

## Vocabulary and Concept Check

- NUMBER SENSE** Copy and complete the table.
- NUMBER SENSE** How would you decide whether  $\frac{3}{5}$  or 59% is greater? Explain.
- WHICH ONE DOESN'T BELONG?** Which one does *not* belong with the other three? Explain your reasoning.

40%

$\frac{2}{5}$

0.4

0.04

Fraction	Decimal	Percent
$\frac{18}{25}$	0.72	
$\frac{17}{20}$		85%
$\frac{13}{50}$		
	0.62	
		45%

## Practice and Problem Solving

Tell which number is greater.

4. 0.9, 95%
5. 20%, 0.02
6.  $\frac{37}{50}$ , 37%
7. 50%,  $\frac{13}{25}$
8. 0.086, 86%
9. 76%, 0.67
10. 60%,  $\frac{5}{8}$
11. 0.12, 1.2%
12. 17%,  $\frac{4}{25}$
13. 140%, 0.14
14.  $\frac{1}{3}$ , 30%
15. 80%,  $\frac{7}{9}$

Use a number line to order the numbers from least to greatest.

16. 38%,  $\frac{8}{25}$ , 0.41
17. 68%, 0.63,  $\frac{13}{20}$
18.  $\frac{43}{50}$ , 0.91,  $\frac{7}{8}$ , 84%
19. 0.15%,  $\frac{3}{20}$ , 0.015
20. 2.62,  $2\frac{2}{5}$ , 26.8%, 2.26, 271%
21.  $\frac{87}{200}$ , 0.44, 43.7%,  $\frac{21}{50}$

- TEST** You answered 21 out of 25 questions correctly on a test. Did you reach your goal of getting at least 80%?
- POPULATION** The table shows the portions of the world population that live in four countries. Order the countries by population from least to greatest.

Country	Brazil	India	Russia	United States
Portion of World Population	2.8%	$\frac{7}{40}$	$\frac{1}{50}$	0.044

**PRECISION** Order the numbers from least to greatest.

24. 66.1%, 0.66,  $\frac{2}{3}$ , 0.667

25.  $\frac{2}{9}$ , 21%,  $0.2\bar{1}$ ,  $\frac{11}{50}$

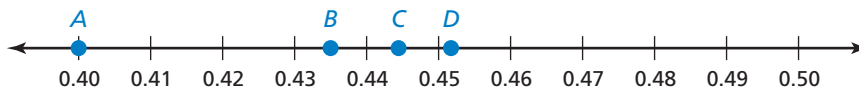
Tell which letter shows the graph of the number.

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

27. 45.2%

28. 0.435

29.  $\frac{4}{9}$



30. **TOUR DE FRANCE** The Tour de France is a bicycle road race. The whole race is made up of 21 small races called *stages*. The table shows how several stages compare to the whole Tour de France in a recent year. Order the stages from shortest to longest.

Stage	1	7	8	17	21
Portion of Total Distance	$\frac{11}{200}$	0.044	$\frac{6}{125}$	0.06	4%

31. **SLEEP** The table shows the portions of the day that several animals sleep.

- Order the animals by sleep time from least to greatest.
- Estimate the portion of the day that you sleep.
- Where do you fit on the ordered list?



Animal	Portion of Day Sleeping
Dolphin	0.433
Lion	56.3%
Rabbit	$\frac{19}{40}$
Squirrel	$\frac{31}{50}$
Tiger	65.8%

32. **Number Sense** Tell what whole number you can substitute for  $a$  in each list so the numbers are ordered from least to greatest. If there is none, explain why.

a.  $\frac{2}{a}, \frac{a}{22}, 33\%$

b.  $\frac{1}{a}, \frac{a}{8}, 33\%$



## Fair Game Review

What you learned in previous grades & lessons

Tell whether the ratios form a proportion. (Section 5.2)

33.  $\frac{6}{10}, \frac{9}{15}$

34.  $\frac{7}{16}, \frac{28}{80}$

35.  $\frac{20}{12}, \frac{35}{21}$

36. **MULTIPLE CHOICE** What is the solution of  $2n - 4 > -12$ ? (Section 4.4)

(A)  $n < -10$

(B)  $n < -4$

(C)  $n > -2$

(D)  $n > -4$

## 6.3 The Percent Proportion

**Essential Question** How can you use models to estimate percent questions?

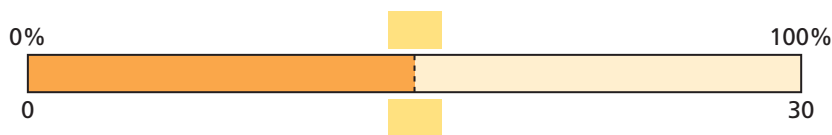
The statement “25% of 12 is 3” has three numbers. In real-life problems, any one of these numbers can be unknown.

Question	Which number is missing?	Type of Question
What is 25% of 12?	3	Find a part of a number.
3 is what percent of 12?	25%	Find a percent.
3 is 25% of what?	12	Find the whole.

### 1 ACTIVITY: Estimating a Part

Work with a partner. Use a model to estimate the answer to each question.

- a. What number is 50% of 30?



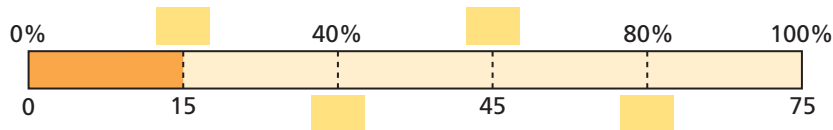
So, from the model,  $\square$  is 50% of 30.

- b. What number is 75% of 30?      c. What number is 40% of 30?  
 d. What number is 6% of 30?      e. What number is 65% of 30?

### 2 ACTIVITY: Estimating a Percent

Work with a partner. Use a model to estimate the answer to each question.

- a. 15 is what percent of 75?



So, from the model, 15 is  $\square$  of 75.

- b. 5 is what percent of 20?      c. 18 is what percent of 40?  
 d. 50 is what percent of 80?      e. 75 is what percent of 50?

**Percent Proportion**  
 In this lesson, you will

- use the percent proportion to find parts, wholes, and percents.

### 3 ACTIVITY: Estimating a Whole

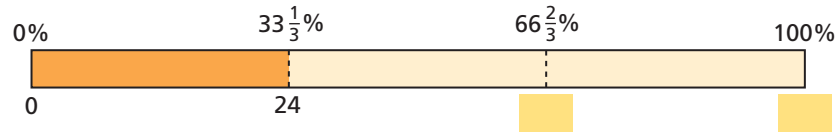
#### Math Practice

##### Use a Model

What quantities are given? How can you use the model to find the unknown quantity?

Work with a partner. Use a model to estimate the answer to each question.

- a. 24 is  $33\frac{1}{3}\%$  of what number?



So, from the model, 24 is  $33\frac{1}{3}\%$  of .

- b. 13 is 25% of what number?      c. 110 is 20% of what number?  
d. 75 is 75% of what number?      e. 81 is 45% of what number?

### 4 ACTIVITY: Using Ratio Tables

Work with a partner. Use a ratio table to answer each question. Then compare your answer to the estimate you found using the model.

- 1d a. What number is 6% of 30?

Part	6		
Whole	100		30

- 1e b. What number is 65% of 30?

Part	65		
Whole	100		30

- 2c c. 18 is what percent of 40?

Part	18		
Whole	40		100

- 3e d. 81 is 45% of what number?

Part	45		81
Whole	100		

## What Is Your Answer?

5. **IN YOUR OWN WORDS** How can you use models to estimate percent questions? Give examples to support your answer.  
6. Complete the proportion below using the given labels.

percent			
whole			
100			
part			

### Practice

Use what you learned about estimating percent questions to complete Exercises 5–10 on page 230.



 **Key Idea**
**The Percent Proportion**

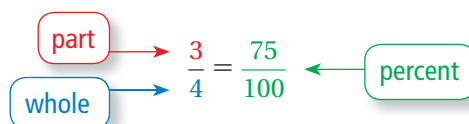
**Words** You can represent “ $a$  is  $p$  percent of  $w$ ” with the proportion

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

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

**Numbers**

3 out of 4 is 75%.



$$\frac{3}{4} = \frac{75}{100}$$

 **Study Tip**

In percent problems, the word *of* is usually followed by the whole.

**EXAMPLE 1 Finding a Percent**

What percent of 15 is 12?

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

Write the percent proportion.

$$\frac{12}{15} = \frac{p}{100}$$

Substitute 12 for  $a$  and 15 for  $w$ .

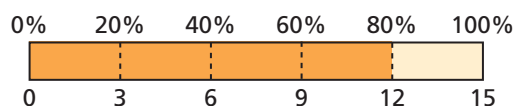
$$100 \cdot \frac{12}{15} = 100 \cdot \frac{p}{100}$$

Multiplication Property of Equality

$$80 = p$$

Simplify.

So, 80% of 15 is 12.

**EXAMPLE 2 Finding a Part**

What number is 36% of 50?

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

Write the percent proportion.

$$\frac{a}{50} = \frac{36}{100}$$

Substitute 50 for  $w$  and 36 for  $p$ .

$$50 \cdot \frac{a}{50} = 50 \cdot \frac{36}{100}$$

Multiplication Property of Equality

$$a = 18$$

Simplify.

So, 18 is 36% of 50.

### EXAMPLE 3 Finding a Whole

150% of what number is 24?

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

Write the percent proportion.

$$\frac{24}{w} = \frac{150}{100}$$

Substitute 24 for  $a$  and 150 for  $p$ .

$$24 \cdot 100 = w \cdot 150$$

Cross Products Property

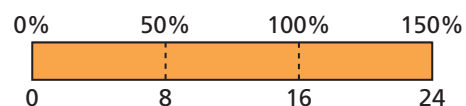
$$2400 = 150w$$

Multiply.

$$16 = w$$

Divide each side by 150.

∴ So, 150% of 16 is 24.



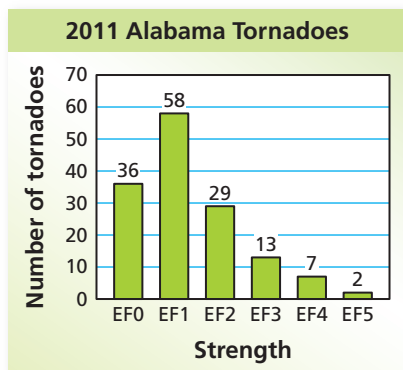
### On Your Own

Now You're Ready  
Exercises 11–18

Write and solve a proportion to answer the question.

1. What percent of 5 is 3?
2. 25 is what percent of 20?
3. What number is 80% of 60?
4. 10% of 40.5 is what number?
5. 0.1% of what number is 4?
6.  $\frac{1}{2}$  is 25% of what number?

### EXAMPLE 4 Real-Life Application



The bar graph shows the strengths of tornadoes that occurred in Alabama in 2011. What percent of the tornadoes were EF1s?

The total number of tornadoes, 145, is the *whole*, and the number of EF1 tornadoes, 58, is the *part*.

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

Write the percent proportion.

$$\frac{58}{145} = \frac{p}{100}$$

Substitute 58 for  $a$  and 145 for  $w$ .

$$100 \cdot \frac{58}{145} = 100 \cdot \frac{p}{100}$$

Multiplication Property of Equality

$$40 = p$$

Simplify.

∴ So, 40% of the tornadoes were EF1s.

### On Your Own

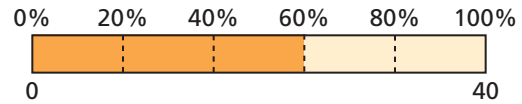
7. Twenty percent of the tornadoes occurred in central Alabama on April 27. How many tornadoes does this represent?



STEM  
VIDEO

## Vocabulary and Concept Check

- VOCABULARY** Write the percent proportion in words.
- WRITING** Explain how to use a proportion to find 30% of a number.
- NUMBER SENSE** Write and solve the percent proportion represented by the model.



- WHICH ONE DOESN'T BELONG?** Which proportion does *not* belong with the other three? Explain your reasoning.

$$\frac{15}{w} = \frac{50}{100}$$

$$\frac{12}{15} = \frac{40}{n}$$

$$\frac{15}{25} = \frac{p}{100}$$

$$\frac{a}{20} = \frac{35}{100}$$

## Practice and Problem Solving

Use a model to estimate the answer to the question. Use a ratio table to check your answer.

- What number is 24% of 80?
- 15 is what percent of 40?
- 15 is 30% of what number?
- What number is 120% of 70?
- 20 is what percent of 52?
- 48 is 75% of what number?

Write and solve a proportion to answer the question.

11. What percent of 25 is 12?
12. 14 is what percent of 56?
13. 25% of what number is 9?
14. 36 is 0.9% of what number?
15. 75% of 124 is what number?
16. 110% of 90 is what number?
17. What number is 0.4% of 40?
18. 72 is what percent of 45?



$$\begin{aligned} \frac{a}{w} &= \frac{p}{100} \\ \frac{a}{34} &= \frac{40}{100} \\ a &= 13.6 \end{aligned}$$

- ERROR ANALYSIS** Describe and correct the error in using the percent proportion to answer the question below.

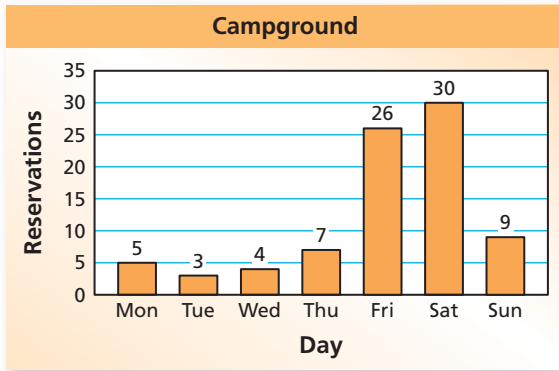
“40% of what number is 34?”

- FITNESS** Of 140 seventh-grade students, 15% earn the Presidential Physical Fitness Award. How many students earn the award?
- COMMISSION** A salesperson receives a 3% commission on sales. The salesperson receives \$180 in commission. What is the amount of sales?



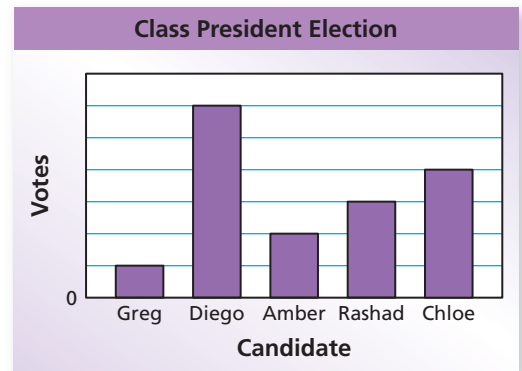
Write and solve a proportion to answer the question.

22. 0.5 is what percent of 20?                      23. 14.2 is 35.5% of what number?
24.  $\frac{3}{4}$  is 60% of what number?                      25. What number is 25% of  $\frac{7}{8}$ ?
26. **HOMEWORK** You are assigned 32 math exercises for homework. You complete 87.5% of these before dinner. How many do you have left to do after dinner?



27. **HOURLY WAGE** Your friend earns \$10.50 per hour. This is 125% of her hourly wage last year. How much did your friend earn per hour last year?
28. **CAMPSITE** The bar graph shows the numbers of reserved campsites at a campground for one week. What percent of the reservations were for Friday or Saturday?

29. **PROBLEM SOLVING** A classmate displays the results of a class president election in the bar graph shown.
- What is missing from the bar graph?
  - What percent of the votes does the last-place candidate receive? Explain your reasoning.
  - There are 124 votes total. How many votes does Chloe receive?



30. **REASONING** 20% of a number is  $x$ . What is 100% of the number? Assume  $x > 0$ .
31. **Structure** Answer each question. Assume  $x > 0$ .
- What percent of  $8x$  is  $5x$ ?
  - What is 65% of  $80x$ ?



## Fair Game Review what you learned in previous grades & lessons

Evaluate the expression when  $a = -15$  and  $b = -5$ . (Section 1.5)

32.  $a \div b$

33.  $\frac{b + 14}{a}$

34.  $\frac{b^2}{a + 5}$

35. **MULTIPLE CHOICE** What is the solution of  $9x = -1.8$ ? (Section 3.4)

(A)  $x = -5$

(B)  $x = -0.2$

(C)  $x = 0.2$

(D)  $x = 5$

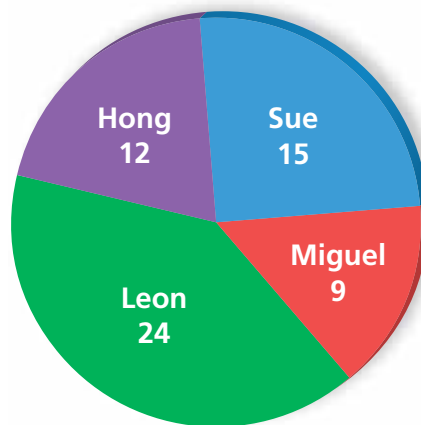
## 6.4 The Percent Equation

**Essential Question** How can you use an equivalent form of the percent proportion to solve a percent problem?

### 1 ACTIVITY: Solving Percent Problems Using Different Methods

Work with a partner. The circle graph shows the number of votes received by each candidate during a school election. So far, only half the students have voted.

Votes Received by Each Candidate



- a. Complete the table.

Candidate	Number of votes received
	Total number of votes
Sue	
Miguel	
Leon	
Hong	

- b. Find the percent of students who voted for each candidate. Explain the method you used to find your answers.
- c. Compare the method you used in part (b) with the methods used by other students in your class. Which method do you prefer? Explain.

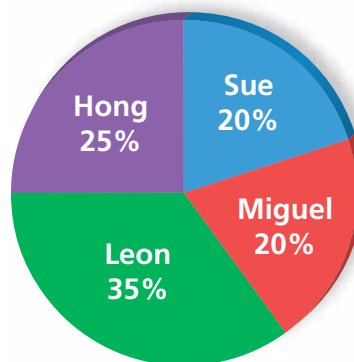
### 2 ACTIVITY: Finding Parts Using Different Methods

**Percent Equation**  
In this lesson, you will

- use the percent equation to find parts, wholes, and percents.
- solve real-life problems.

Work with a partner. The circle graph shows the final results of the election.

Final Results



- a. Find the number of students who voted for each candidate. Explain the method you used to find your answers.
- b. Compare the method you used in part (a) with the methods used by other students in your class. Which method do you prefer? Explain.

### 3 ACTIVITY: Deriving the Percent Equation

Work with a partner. In Section 6.3, you used the percent proportion to find the missing percent, part, or whole. You can also use the *percent equation* to find these missing values.

- a. Complete the steps below to find the percent equation.

$$\frac{\text{part}}{\text{whole}} = \text{percent} \quad \text{Definition of percent}$$

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

$$\text{part} = \square \cdot \square \quad \begin{array}{l} \text{Divide out common factors.} \\ \text{This is the percent equation.} \end{array}$$

- b. Use the percent equation to find the number of students who voted for each candidate in Activity 2. How does this method compare to the percent proportion?

### 4 ACTIVITY: Identifying Different Equations

Work with a partner. Without doing any calculations, choose the equation that you cannot use to answer each question.

- a. What number is 55% of 80?

$$a = 0.55 \cdot 80$$

$$a = \frac{11}{20} \cdot 80$$

$$80a = 0.55$$

$$\frac{a}{80} = \frac{55}{100}$$

- b. 24 is 60% of what number?

$$\frac{24}{w} = \frac{60}{100}$$

$$24 = 0.6 \cdot w$$

$$\frac{24}{60} = w$$

$$24 = \frac{3}{5} \cdot w$$

#### Math Practice

##### Justify Conclusions

How can you justify the equations that you chose?

### What Is Your Answer?

5. **IN YOUR OWN WORDS** How can you use an equivalent form of the percent proportion to solve a percent problem?
6. Write a percent proportion and a percent equation that you can use to answer the question below.

16 is what percent of 250?

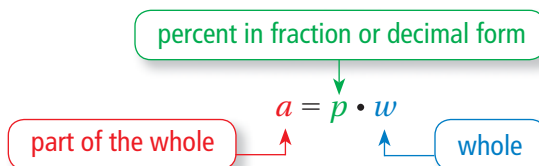
#### Practice

Use what you learned about solving percent problems to complete Exercises 4–9 on page 236.

## Key Idea

### The Percent Equation

**Words** To represent “ $a$  is  $p$  percent of  $w$ ,” use an equation.



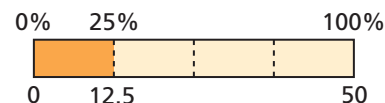
**Numbers**

$$15 = 0.5 \cdot 30$$

### EXAMPLE 1 Finding a Part of a Number

What number is 24% of 50?

**Estimate**



#### Common Error

Remember to convert a percent to a fraction or a decimal before using the percent equation. For Example 1, write 24% as  $\frac{24}{100}$ .

$$a = p \cdot w$$

Write percent equation.

$$= \frac{24}{100} \cdot 50$$

Substitute  $\frac{24}{100}$  for  $p$  and 50 for  $w$ .

$$= 12$$

Simplify.

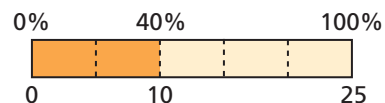
So, 12 is 24% of 50.

**Reasonable?**  $12 \approx 12.5$  ✓

### EXAMPLE 2 Finding a Percent

9.5 is what percent of 25?

**Estimate**



$$a = p \cdot w$$

Write percent equation.

$$9.5 = p \cdot 25$$

Substitute 9.5 for  $a$  and 25 for  $w$ .

$$\frac{9.5}{25} = \frac{p \cdot 25}{25}$$

Division Property of Equality

$$0.38 = p$$

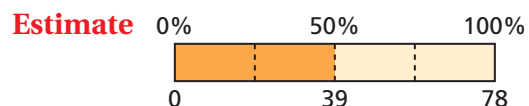
Simplify.

Because 0.38 equals 38%,  
9.5 is 38% of 25.

**Reasonable?**  $38\% \approx 40\%$  ✓

### EXAMPLE 3 Finding a Whole

39 is 52% of what number?



$$a = p \cdot w$$

Write percent equation.

$$39 = 0.52 \cdot w$$

Substitute 39 for  $a$  and 0.52 for  $p$ .

$$75 = w$$

Divide each side by 0.52.

∴ So, 39 is 52% of 75.

**Reasonable?**  $75 \approx 78$  ✓

### On Your Own

**Now You're Ready**  
Exercises 10–17

Write and solve an equation to answer the question.

1. What number is 10% of 20?
2. What number is 150% of 40?
3. 3 is what percent of 600?
4. 18 is what percent of 20?
5. 8 is 80% of what number?
6. 90 is 18% of what number?

### EXAMPLE 4 Real-Life Application

#### 8th Street Cafe

DATE: MAY04'13 05:45PM  
TABLE: 29  
SERVER: JANE

Food Total	27.50
Tax	1.65
<b>Subtotal</b>	<b>29.15</b>

TIP: \_\_\_\_\_

TOTAL: \_\_\_\_\_

*Thank You*

a. Find the percent of sales tax on the food total.

Answer the question: \$1.65 is what percent of \$27.50?

$$a = p \cdot w$$

Write percent equation.

$$1.65 = p \cdot 27.50$$

Substitute 1.65 for  $a$  and 27.50 for  $w$ .

$$0.06 = p$$

Divide each side by 27.50.

∴ Because 0.06 equals 6%, the percent of sales tax is 6%.

b. Find the amount of a 16% tip on the food total.

Answer the question: What tip amount is 16% of \$27.50?

$$a = p \cdot w$$

Write percent equation.

$$= 0.16 \cdot 27.50$$

Substitute 0.16 for  $p$  and 27.50 for  $w$ .

$$= 4.40$$

Multiply.

∴ So, the amount of the tip is \$4.40.

### On Your Own

7. **WHAT IF?** Find the amount of a 20% tip on the food total.




**Vocabulary and Concept Check**

- VOCABULARY** Write the percent equation in words.
- REASONING** A number  $n$  is 150% of number  $m$ . Is  $n$  greater than, less than, or equal to  $m$ ? Explain your reasoning.
- DIFFERENT WORDS, SAME QUESTION** Which is different? Find “both” answers.

What number is 20% of 55?

55 is 20% of what number?

20% of 55 is what number?

$0.2 \cdot 55$  is what number?


**Practice and Problem Solving**

Answer the question. Explain the method you chose.

- What number is 24% of 80?
- 15 is 30% of what number?
- 20 is what percent of 52?
- 15 is what percent of 40?
- What number is 120% of 70?
- 48 is 75% of what number?

Write and solve an equation to answer the question.

- 20% of 150 is what number?
- 35% of what number is 35?
- 29 is what percent of 20?
- What percent of 300 is 51?
- 45 is what percent of 60?
- 0.8% of 150 is what number?
- 0.5% of what number is 12?
- 120% of what number is 102?

**ERROR ANALYSIS** Describe and correct the error in using the percent equation.

18. What number is 35% of 20?

**X**

$$a = p \cdot w$$

$$= 35 \cdot 20$$

$$= 700$$

19. 30 is 60% of what number?

**X**

$$a = p \cdot w$$

$$= 0.6 \cdot 30$$

$$= 18$$

- COMMISSION** A salesperson receives a 2.5% commission on sales. What commission does the salesperson receive for \$8000 in sales?
- FUNDRAISING** Your school raised 125% of its fundraising goal. The school raised \$6750. What was the goal?
- SURFBOARD** The sales tax on a surfboard is \$12. What is the percent of sales tax?

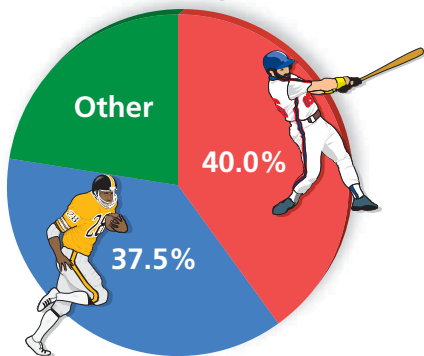


**PUZZLE** There were  $n$  signers of the Declaration of Independence. The youngest was Edward Rutledge, who was  $x$  years old. The oldest was Benjamin Franklin, who was  $y$  years old.

23.  $x$  is 25% of 104. What was Rutledge's age?
24. 7 is 10% of  $y$ . What was Franklin's age?
25.  $n$  is 80% of  $y$ . How many signers were there?
26.  $y$  is what percent of  $(n + y - x)$ ?



### Favorite Sport



27. **LOGIC** How can you tell whether the percent of a number will be *greater than*, *less than*, or *equal to* the number? Give examples to support your answer.

28. **SURVEY** In a survey, a group of students were asked their favorite sport. Eighteen students chose "other" sports.

- a. How many students participated?
- b. How many chose football?

29. **WATER TANK** Water tank  $A$  has a capacity of 550 gallons and is 66% full. Water tank  $B$  is 53% full. The ratio of the capacity of Tank  $A$  to Tank  $B$  is 11 : 15.

- a. How much water is in Tank  $A$ ?
- b. What is the capacity of Tank  $B$ ?
- c. How much water is in Tank  $B$ ?

30. **TRUE OR FALSE?** Tell whether the statement is *true* or *false*. Explain your reasoning.

If  $W$  is 25% of  $Z$ , then  $Z : W$  is 75 : 25.

31. **Reasoning** The table shows your test results for math class. What test score do you need on the last exam to earn 90% of the total points?

Test Score	Point Value
83%	100
91.6%	250
88%	150
?	300



## Fair Game Review

What you learned in previous grades & lessons

Simplify. Write the answer as a decimal. (*Skills Review Handbook*)

32.  $\frac{10 - 4}{10}$

33.  $\frac{25 - 3}{25}$

34.  $\frac{105 - 84}{84}$

35.  $\frac{170 - 125}{125}$

36. **MULTIPLE CHOICE** There are 160 people in a grade. The ratio of boys to girls is 3 to 5. Which proportion can you use to find the number  $x$  of boys? (*Section 5.3*)

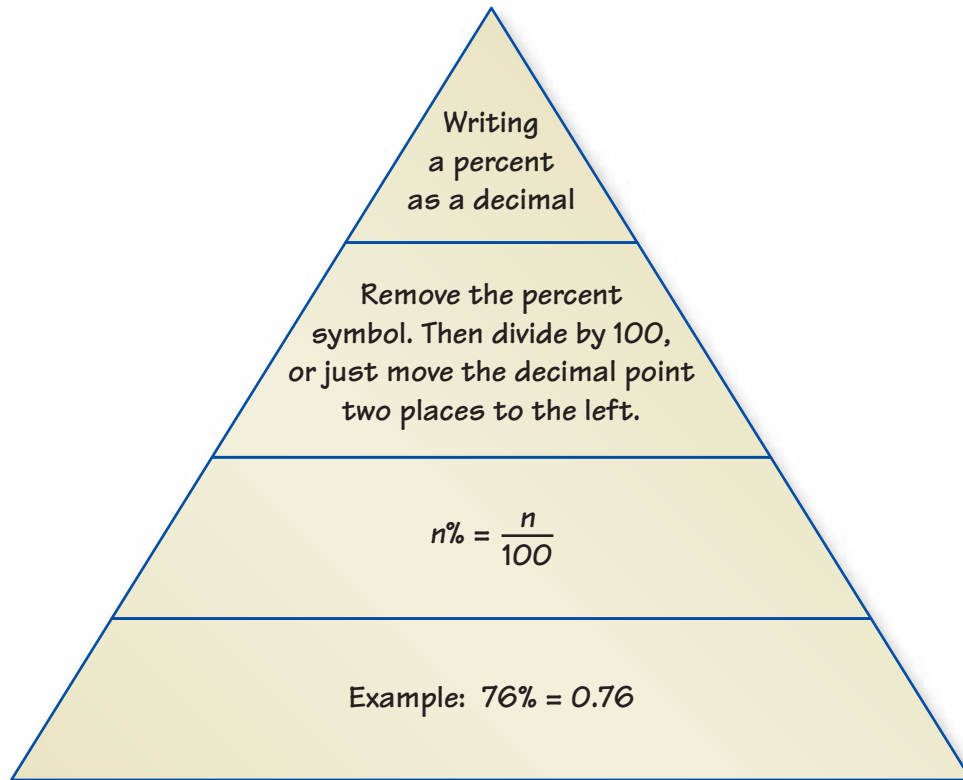
(A)  $\frac{3}{8} = \frac{x}{160}$

(B)  $\frac{3}{5} = \frac{x}{160}$

(C)  $\frac{5}{8} = \frac{x}{160}$

(D)  $\frac{3}{5} = \frac{160}{x}$

You can use a **summary triangle** to explain a concept. Here is an example of a summary triangle for writing a percent as a decimal.



## On Your Own

Make summary triangles to help you study these topics.

1. writing a decimal as a percent
2. comparing and ordering fractions, decimals, and percents
3. the percent proportion
4. the percent equation

After you complete this chapter, make summary triangles for the following topics.

- |                      |                    |
|----------------------|--------------------|
| 5. percent of change | 6. discount        |
| 7. markup            | 8. simple interest |



"I found this great **summary triangle** in my *Beautiful Beagle Magazine*."

# 6.1–6.4 Quiz

Write the percent as a decimal. (Section 6.1)

1. 34%                      2. 0.12%                      3. 62.5%

Write the decimal as a percent. (Section 6.1)

4. 0.67                      5. 5.35                      6. 0.685

Tell which number is greater. (Section 6.2)

7.  $\frac{11}{15}$ , 74%                      8. 3%, 0.3

Use a number line to order the numbers from least to greatest. (Section 6.2)

9. 125%,  $\frac{6}{5}$ , 1.22                      10. 42%, 0.43,  $\frac{17}{40}$

Write and solve a proportion to answer the question. (Section 6.3)

11. What percent of 15 is 6?                      12. 35 is what percent of 25?  
13. What number is 40% of 50?                      14. 0.5% of what number is 5?

Write and solve an equation to answer the question. (Section 6.4)

15. What number is 28% of 75?                      16. 42 is 21% of what number?  
17. **FISHING** On a fishing trip, 38% of the fish that you catch are perch. Write this percent as a decimal. (Section 6.1)  
18. **SCAVENGER HUNT** The table shows the results of 8 teams competing in a scavenger hunt. Which team collected the most items? Which team collected the fewest items? (Section 6.2)

Team	1	2	3	4	5	6	7	8
Portion Collected	$\frac{3}{4}$	0.8	77.5%	0.825	$\frac{29}{40}$	76.25%	$\frac{63}{80}$	81.25%



19. **COMPLETIONS** A quarterback completed 68% of his passes in a game. He threw 25 passes. How many passes did the quarterback complete? (Section 6.3)  
20. **TEXT MESSAGES** You have 44 text messages in your inbox. How many messages can your cell phone hold? (Section 6.4)

# 6.5 Percents of Increase and Decrease

**Essential Question** What is a percent of decrease? What is a percent of increase?

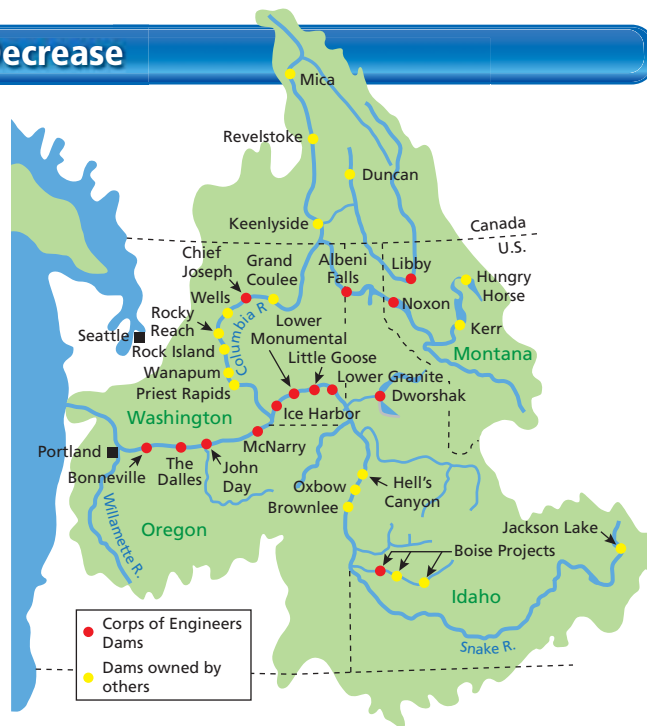
## 1 ACTIVITY: Percent of Decrease

**Work with a partner.**

Each year in the Columbia River Basin, adult salmon swim upriver to streams to lay eggs and hatch their young.

To go up the river, the adult salmon use fish ladders. But to go down the river, the young salmon must pass through several dams.

At one time, there were electric turbines at each of the eight dams on the main stem of the Columbia and Snake Rivers. About 88% of the young salmon passed through these turbines unharmed.



- a. Copy and complete the table to show the number of young salmon that made it through the dams.

Dam	0	1	2	3	4	5	6	7	8
Salmon	1000	880	774						

### Percents

In this lesson, you will

- find percents of increase.
- find percents of decrease.

$$88\% \text{ of } 1000 = 0.88 \cdot 1000 = 880$$

$$88\% \text{ of } 880 = 0.88 \cdot 880 = 774.4 \approx 774$$

- b. Display the data in a bar graph.
- c. By what percent did the number of young salmon decrease when passing through each dam?

## 2

## ACTIVITY: Percent of Increase

Math  
PracticeConsider Similar  
Problems

How is this activity similar to the previous activity?

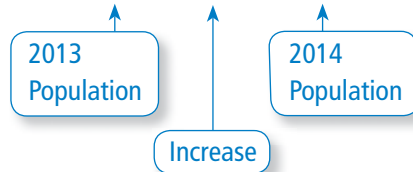
Work with a partner. In 2013, the population of a city was 18,000 people.

- a. An organization projects that the population will increase by 2% each year for the next 7 years. Copy and complete the table to find the populations of the city for 2014 through 2020. Then display the data in a bar graph.

For 2014:

$$\begin{aligned} 2\% \text{ of } 18,000 &= 0.02 \cdot 18,000 \\ &= 360 \end{aligned}$$

$$18,000 + 360 = 18,360$$



Year	Population
2013	18,000
2014	18,360
2015	
2016	
2017	
2018	
2019	
2020	



- b. Another organization projects that the population will increase by 3% each year for the next 7 years. Repeat part (a) using this percent.
- c. Which organization projects the larger populations? How many more people do they project for 2020?

## What Is Your Answer?

3. **IN YOUR OWN WORDS** What is a percent of decrease? What is a percent of increase?
4. Describe real-life examples of a percent of decrease and a percent of increase.

### Practice

Use what you learned about percent of increase and percent of decrease to complete Exercises 4–7 on page 244.

**Key Vocabulary**

percent of change,  
p. 242  
percent of increase,  
p. 242  
percent of decrease,  
p. 242  
percent error, p. 243

A **percent of change** is the percent that a quantity changes from the original amount.

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

**Key Idea****Percents of Increase and Decrease**

When the original amount increases, the percent of change is called a **percent of increase**.

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

When the original amount decreases, the percent of change is called a **percent of decrease**.

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

**EXAMPLE 1** Finding a Percent of Increase

The table shows the numbers of hours you spent online last weekend. What is the percent of change in your online time from Saturday to Sunday?

Day	Hours Online
Saturday	2
Sunday	4.5

The number of hours on Sunday is greater than the number of hours on Saturday. So, the percent of change is a percent of increase.

$$\begin{aligned} \text{percent of increase} &= \frac{\text{new amount} - \text{original amount}}{\text{original amount}} \\ &= \frac{4.5 - 2}{2} && \text{Substitute.} \\ &= \frac{2.5}{2} && \text{Subtract.} \\ &= 1.25, \text{ or } 125\% && \text{Write as a percent.} \end{aligned}$$

So, your online time increased 125% from Saturday to Sunday.

**On Your Own**

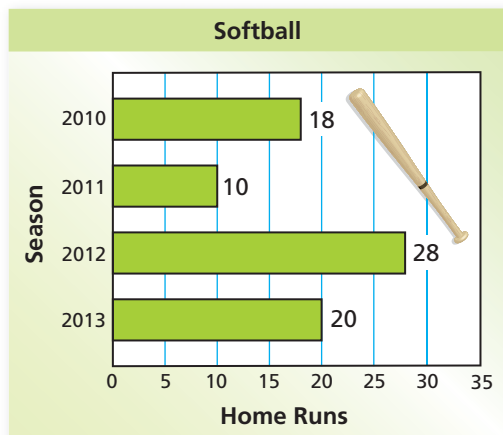
Find the percent of change. Round to the nearest tenth of a percent if necessary.

- 10 inches to 25 inches
- 57 people to 65 people



## EXAMPLE 2 Finding a Percent of Decrease

The bar graph shows a softball player's home run totals. What was the percent of change from 2012 to 2013?



The number of home runs decreased from 2012 to 2013. So, the percent of change is a percent of decrease.

$$\begin{aligned}\text{percent of decrease} &= \frac{\text{original amount} - \text{new amount}}{\text{original amount}} \\ &= \frac{28 - 20}{28} && \text{Substitute.} \\ &= \frac{8}{28} && \text{Subtract.} \\ &\approx 0.286, \text{ or } 28.6\% && \text{Write as a percent.}\end{aligned}$$

So, the number of home runs decreased about 28.6%.

## Key Idea

### Percent Error

A **percent error** is the percent that an estimated quantity differs from the actual amount.

$$\text{percent error} = \frac{\text{amount of error}}{\text{actual amount}}$$

### Study Tip

The amount of error is always positive.

## EXAMPLE 3 Finding a Percent Error

You estimate that the length of your classroom is 16 feet. The actual length is 21 feet. Find the percent error.

The amount of error is  $21 - 16 = 5$  feet.

$$\begin{aligned}\text{percent error} &= \frac{\text{amount of error}}{\text{actual amount}} && \text{Write percent error equation.} \\ &= \frac{5}{21} && \text{Substitute.} \\ &\approx 0.238, \text{ or } 23.8\% && \text{Write as a percent.}\end{aligned}$$

The percent error is about 23.8%.

## On Your Own

**Now You're Ready**  
Exercises 8–15  
and 18

- In Example 2, what was the percent of change from 2010 to 2011?
- WHAT IF?** In Example 3, your friend estimates that the length of the classroom is 23 feet. Who has the greater percent error? Explain.




**Vocabulary and Concept Check**

- VOCABULARY** How do you know whether a percent of change is a *percent of increase* or a *percent of decrease*?
- NUMBER SENSE** Without calculating, which has a greater percent of increase?
  - 5 bonus points on a 50-point exam
  - 5 bonus points on a 100-point exam
- WRITING** What does it mean to have a 100% decrease?



**Practice and Problem Solving**

Find the new amount.

- 8 meters increased by 25%
- 15 liters increased by 60%
- 50 points decreased by 26%
- 25 penalties decreased by 32%

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

- 12 inches to 36 inches
- 75 people to 25 people
- 50 pounds to 35 pounds
- 24 songs to 78 songs
- 10 gallons to 24 gallons
- 72 paper clips to 63 paper clips
- 16 centimeters to 44.2 centimeters
- 68 miles to 42.5 miles
- ERROR ANALYSIS** Describe and correct the error in finding the percent increase from 18 to 26.



$$\frac{26 - 18}{26} \approx 0.31 = 31\%$$



- VIDEO GAME** Last week, you finished Level 2 of a video game in 32 minutes. Today, you finish Level 2 in 28 minutes. What is your percent of change?
- PIG** You estimate that a baby pig weighs 20 pounds. The actual weight of the baby pig is 16 pounds. Find the percent error.

- CONCERT** You estimate that 200 people attended a school concert. The actual attendance was 240 people.
  - Find the percent error.
  - What other estimate gives the same percent error? Explain your reasoning.

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

20.  $\frac{1}{4}$  to  $\frac{1}{2}$

21.  $\frac{4}{5}$  to  $\frac{3}{5}$

22.  $\frac{3}{8}$  to  $\frac{7}{8}$

23.  $\frac{5}{4}$  to  $\frac{3}{8}$

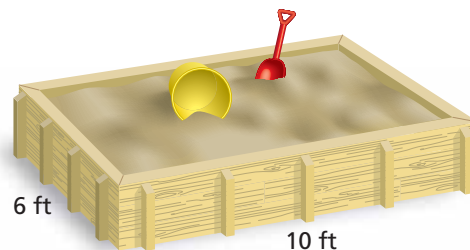
24. **CRITICAL THINKING** Explain why a change from 20 to 40 is a 100% increase, but a change from 40 to 20 is a 50% decrease.

25. **POPULATION** The table shows population data for a community.

Year	Population
2007	118,000
2013	138,000

- What is the percent of change from 2007 to 2013?
- Use this percent of change to predict the population in 2019.

26. **GEOMETRY** Suppose the length and the width of the sandbox are doubled.



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

27. **CEREAL** A cereal company fills boxes with 16 ounces of cereal. The acceptable percent error in filling a box is 2.5%. Find the least and the greatest acceptable weights.



28. **PRECISION** Find the percent of change from June to September in the time to run a mile.

29. **CRITICAL THINKING** A number increases by 10%, and then decreases by 10%. Will the result be *greater than*, *less than*, or *equal* to the original number? Explain.

30. **DONATIONS** Donations to an annual fundraiser are 15% greater this year than last year. Last year, donations were 10% greater than the year before. The amount raised this year is \$10,120. How much was raised 2 years ago?

31. **Reasoning** Forty students are in the science club. Of those, 45% are girls. This percent increases to 56% after new girls join the club. How many new girls join?



## Fair Game Review What you learned in previous grades & lessons

Write and solve an equation to answer the question. (Section 6.4)

32. What number is 25% of 64?

33. 39.2 is what percent of 112?

34. 5 is 5% of what number?

35. 18 is 32% of what number?

36. **MULTIPLE CHOICE** Which set of ratios does *not* form a proportion? (Section 5.2)

(A)  $\frac{1}{4}, \frac{6}{24}$

(B)  $\frac{4}{7}, \frac{7}{10}$

(C)  $\frac{16}{24}, \frac{2}{3}$

(D)  $\frac{36}{10}, \frac{18}{5}$

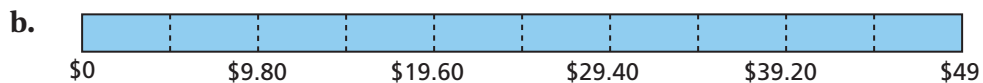
# 6.6 Discounts and Markups

## Essential Question How can you find discounts and selling prices?

### 1 ACTIVITY: Comparing Discounts

Work with a partner. The same pair of sneakers is on sale at three stores. Which one is the best buy? Explain.

- a. Regular Price: \$45      b. Regular Price: \$49      c. Regular Price: \$39



### 2 ACTIVITY: Finding the Original Price

Work with a partner.

- a. You buy a shirt that is on sale for 30% off. You pay \$22.40. Your friend wants to know the original price of the shirt. Show how you can use the model below to find the original price.



- b. Explain how you can use the percent proportion to find the original price.



#### Percents

In this lesson, you will

- use percent of discounts to find prices of items.
- use percent of markups to find selling prices of items.

### 3 ACTIVITY: Finding Selling Prices

#### Math Practice

##### Make Sense of Quantities

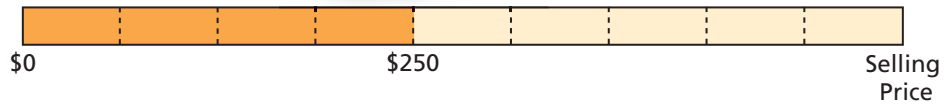
What do the quantities represent?  
What is the relationship between the quantities?

You own a small jewelry store. You increase the price of the jewelry by 125%.

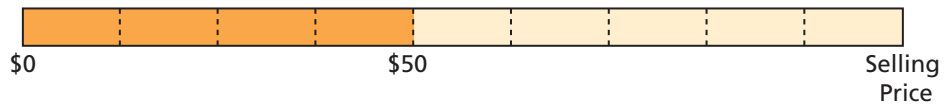
Work with a partner. Use a model to estimate the selling price of the jewelry. Then use a calculator to find the selling price.



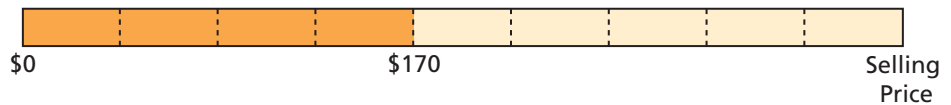
- a. Your cost is \$250.



- b. Your cost is \$50.



- c. Your cost is \$170.



## What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you find discounts and selling prices? Give examples of each.

#### Practice

Use what you learned about discounts to complete Exercises 4, 9, and 14 on page 250.

**Key Vocabulary**

discount, p. 248  
markup, p. 248

**Key Ideas**
**Discounts**

A **discount** is a decrease in the original price of an item.

**Markups**

To make a profit, stores charge more than what they pay. The increase from what the store pays to the selling price is called a **markup**.

**EXAMPLE 1 Finding a Sale Price**

The original price of the shorts is \$35. What is the sale price?

**Method 1:** First, find the discount. The discount is 25% of \$35.



$$\begin{aligned}
 a &= p \cdot w && \text{Write percent equation.} \\
 &= 0.25 \cdot 35 && \text{Substitute 0.25 for } p \text{ and 35 for } w. \\
 &= 8.75 && \text{Multiply.}
 \end{aligned}$$

Next, find the sale price.

sale price	=	original price	−	discount
		35		8.75
		= 26.25		

∴ So, the sale price is \$26.25.

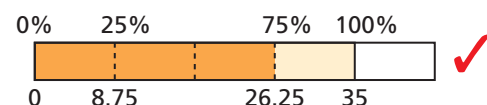
**Method 2:** First, find the percent of the original price.

$$100\% - 25\% = 75\%$$

Next, find the sale price.

$$\begin{aligned}
 \text{sale price} &= 75\% \text{ of } \$35 \\
 &= 0.75 \cdot 35 \\
 &= 26.25
 \end{aligned}$$

∴ So, the sale price is \$26.25.

**Check**

**On Your Own**

- The original price of a skateboard is \$50. The sale price includes a 20% discount. What is the sale price?

**Study Tip**

A 25% discount is the same as paying 75% of the original price.

**Now You're Ready**  
Exercises 4–8

## EXAMPLE 2 Finding an Original Price



What is the original price of the shoes?

The sale price is  
 $100\% - 40\% = 60\%$   
of the original price.

Answer the question: 33 is 60% of what number?

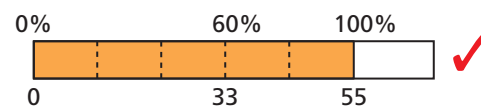
$$a = p \cdot w \quad \text{Write percent equation.}$$

$$33 = 0.6 \cdot w \quad \text{Substitute 33 for } a \text{ and } 0.6 \text{ for } p.$$

$$55 = w \quad \text{Divide each side by } 0.6.$$

So, the original price of the shoes is \$55.

**Check**



## EXAMPLE 3 Finding a Selling Price

A store pays \$70 for a bicycle. The percent of markup is 20%. What is the selling price?



**Method 1:** First, find the markup. The markup is 20% of \$70.

$$\begin{aligned} a &= p \cdot w \\ &= 0.20 \cdot 70 \\ &= 14 \end{aligned}$$

Next, find the selling price.

$$\begin{aligned} \text{selling price} &= \text{cost to store} + \text{markup} \\ &= 70 + 14 \\ &= 84 \end{aligned}$$

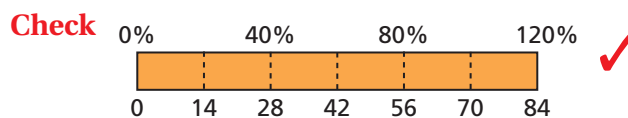
So, the selling price is \$84.

**Method 2:** Use a ratio table. The selling price is 120% of the cost to the store.

Percent	Dollars
100%	\$70
20%	\$14
120%	\$84

Annotations:  $\div 5$  (from 100% to 20%),  $\times 6$  (from 20% to 120%),  $\div 5$  (from \$70 to \$14),  $\times 6$  (from \$14 to \$84).

So, the selling price is \$84.



### On Your Own

**Now You're Ready**  
Exercises 9–13  
and 17–19

- The discount on a DVD is 50%. It is on sale for \$10. What is the original price of the DVD?
- A store pays \$75 for an aquarium. The markup is 20%. What is the selling price?

## Vocabulary and Concept Check

- WRITING** Describe how to find the sale price of an item that has been discounted 25%.
- WRITING** Describe how to find the selling price of an item that has been marked up 110%.
- REASONING** Which would you rather pay? Explain your reasoning.
  - 6% tax on a discounted price or 6% tax on the original price
  - 30% markup on a \$30 shirt or \$30 markup on a \$30 shirt

## Practice and Problem Solving

Copy and complete the table.

	Original Price	Percent of Discount	Sale Price
1 4.	\$80	20%	
5.	\$42	15%	
6.	\$120	80%	
7.	\$112	32%	
8.	\$69.80	60%	
2 9.		25%	\$40
10.		5%	\$57
11.		80%	\$90
12.		64%	\$72
13.		15%	\$146.54
14.	\$60		\$45
15.	\$82		\$65.60
16.	\$95		\$61.75



Find the selling price.

17. Cost to store: \$50  
Markup: 10%
18. Cost to store: \$80  
Markup: 60%
19. Cost to store: \$140  
Markup: 25%

20. **YOU BE THE TEACHER** The cost to a store for an MP3 player is \$60. The selling price is \$105. A classmate says that the markup is 175% because  $\frac{\$105}{\$60} = 1.75$ . Is your classmate correct? If not, explain how to find the correct percent of markup.



21. **SCOOTER** The scooter is on sale for 90% off the original price. Which of the methods can you use to find the sale price? Which method do you prefer? Explain.

Multiply \$45.85 by 0.9.

Multiply \$45.85 by 0.1.

Multiply \$45.85 by 0.9, then add to \$45.85.

Multiply \$45.85 by 0.9, then subtract from \$45.85.

22. **GAMING** You are shopping for a video game system.
- At which store should you buy the system?
  - Store A has a weekend sale. What discount must Store A offer for you to buy the system there?

Store	Cost to Store	Markup
A	\$162	40%
B	\$155	30%
C	\$160	25%

23. **STEREO** A \$129.50 stereo is discounted 40%. The next month, the sale price is discounted 60%. Is the stereo now “free”? If not, what is the sale price?

24. **CLOTHING** You buy a pair of jeans at a department store.
- What is the percent of discount to the nearest percent?
  - What is the percent of sales tax to the nearest tenth of a percent?
  - The price of the jeans includes a 60% markup. After the discount, what is the percent of markup to the nearest percent?

#### Department Store

Jeans	39.99
Discount	-10.00
Subtotal	29.99
Sales Tax	1.95
Total	31.94

*Thank You*



25. **Critical Thinking** You buy a bicycle helmet for \$22.26, which includes 6% sales tax. The helmet is discounted 30% off the selling price. What is the original price?



## Fair Game Review what you learned in previous grades & lessons

Evaluate. (*Skills Review Handbook*)

26.  $2000(0.085)$

27.  $1500(0.04)(3)$

28.  $3200(0.045)(8)$

29. **MULTIPLE CHOICE** Which measurement is greater than 1 meter? (*Skills Review Handbook*)

(A) 38 inches

(B) 1 yard

(C) 3.4 feet

(D) 98 centimeters



# 6.7 Simple Interest

**Essential Question** How can you find the amount of simple interest earned on a savings account? How can you find the amount of interest owed on a loan?

**Simple interest** is money earned on a savings account or an investment. It can also be money you pay for borrowing money.

Write the annual interest rate in decimal form.

$$\begin{array}{ccccccc}
 \boxed{\text{Simple interest}} & = & \boxed{\text{Principal}} & \times & \boxed{\text{Annual interest rate}} & \times & \boxed{\text{Time}} \\
 (\$) & & (\$) & & (\% \text{ per yr}) & & (\text{Years}) \\
 I & = & P & r & t
 \end{array}$$

## 1 ACTIVITY: Finding Simple Interest

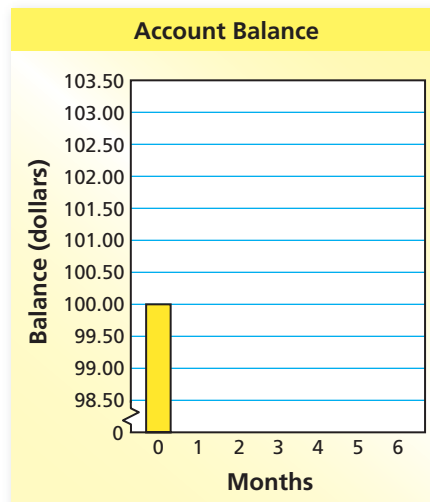
Work with a partner. You put \$100 in a savings account. The account earns 6% simple interest per year. (a) Find the interest earned and the balance at the end of 6 months. (b) Copy and complete the table. Then make a bar graph that shows how the balance grows in 6 months.

- a.  $I = Prt$  Write simple interest formula.  
 =  Substitute values.  
 =  Multiply.

At the end of 6 months, you earn \$  in interest. So, your balance is \$ .

b.

Time	Interest	Balance
0 month	\$0	\$100
1 month		
2 months		
3 months		
4 months		
5 months		
6 months		



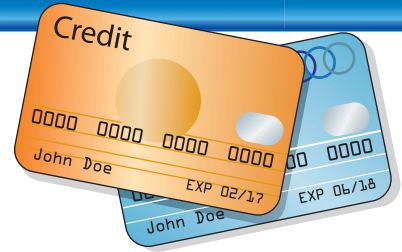
### Percents

In this lesson, you will

- use the simple interest formula to find interest earned or paid, annual interest rates, and amounts paid on loans.

## 2 ACTIVITY: Financial Literacy

Work with a partner. Use the following information to write a report about credit cards. In the report, describe how a credit card works. Include examples that show the amount of interest paid each month on a credit card.



### Math Practice

#### Use Other Resources

What resources can you use to find more information about credit cards?

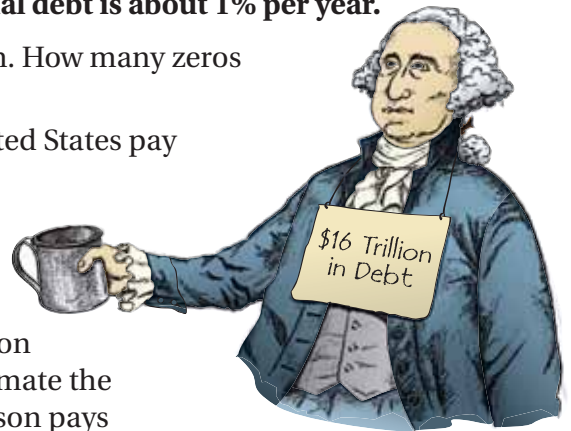
#### U.S. Credit Card Data

- A typical household with credit card debt in the United States owes about \$16,000 to credit card companies.
- A typical credit card interest rate is 14% to 16% per year. This is called the annual percentage rate.

## 3 ACTIVITY: The National Debt

Work with a partner. In 2012, the United States owed about \$16 trillion in debt. The interest rate on the national debt is about 1% per year.

- Write \$16 trillion in decimal form. How many zeros does this number have?
- How much interest does the United States pay each year on its national debt?
- How much interest does the United States pay each day on its national debt?
- The United States has a population of about 314 million people. Estimate the amount of interest that each person pays per year toward interest on the national debt.



## What Is Your Answer?

- IN YOUR OWN WORDS** How can you find the amount of simple interest earned on a savings account? How can you find the amount of interest owed on a loan? Give examples with your answer.

### Practice

Use what you learned about simple interest to complete Exercises 4–7 on page 256.

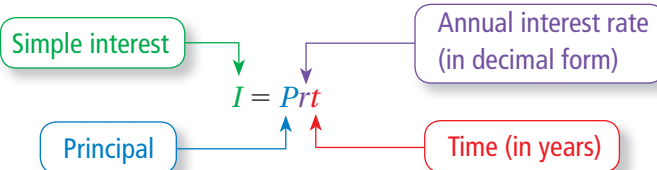
**Key Vocabulary**

interest, p. 254  
 principal, p. 254  
 simple interest,  
 p. 254

**Interest** is money paid or earned for the use of money. The **principal** is the amount of money borrowed or deposited.

**Key Idea**
**Simple Interest**

**Words** **Simple interest** is money paid or earned only on the principal.

**Algebra**

**EXAMPLE 1 Finding Interest Earned**

You put \$500 in a savings account. The account earns 3% simple interest per year. (a) What is the interest earned after 3 years?  
 (b) What is the balance after 3 years?

a.  $I = Prt$  Write simple interest formula.  
 $= 500(0.03)(3)$  Substitute 500 for  $P$ , 0.03 for  $r$ , and 3 for  $t$ .  
 $= 45$  Multiply.

∴ So, the interest earned is \$45 after 3 years.

b. To find the balance, add the interest to the principal.

∴ So, the balance is  $\$500 + \$45 = \$545$  after 3 years.

**EXAMPLE 2 Finding an Annual Interest Rate**

You put \$1000 in an account. The account earns \$100 simple interest in 4 years. What is the annual interest rate?

$I = Prt$  Write simple interest formula.  
 $100 = 1000(r)(4)$  Substitute 100 for  $I$ , 1000 for  $P$ , and 4 for  $t$ .  
 $100 = 4000r$  Simplify.  
 $0.025 = r$  Divide each side by 4000.

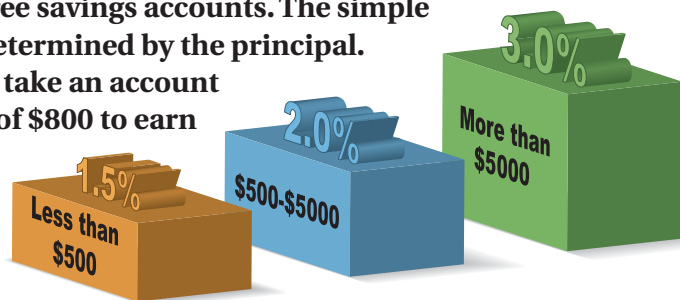
∴ So, the annual interest rate of the account is 0.025, or 2.5%.

### On Your Own

- In Example 1, what is the balance of the account after 9 months?
- You put \$350 in an account. The account earns \$17.50 simple interest in 2.5 years. What is the annual interest rate?

### EXAMPLE 3 Finding an Amount of Time

A bank offers three savings accounts. The simple interest rate is determined by the principal. How long does it take an account with a principal of \$800 to earn \$100 in interest?



The pictogram shows that the interest rate for a principal of \$800 is 2%.

$$I = Prt$$

Write simple interest formula.

$$100 = 800(0.02)(t)$$

Substitute 100 for  $I$ , 800 for  $P$ , and 0.02 for  $r$ .

$$100 = 16t$$

Simplify.

$$6.25 = t$$

Divide each side by 16.

∴ So, the account earns \$100 in interest in 6.25 years.

### EXAMPLE 4 Finding an Amount Paid on a Loan



You borrow \$600 to buy a violin. The simple interest rate is 15%. You pay off the loan after 5 years. How much do you pay for the loan?

$$I = Prt$$

Write simple interest formula.

$$= 600(0.15)(5)$$

Substitute 600 for  $P$ , 0.15 for  $r$ , and 5 for  $t$ .

$$= 450$$

Multiply.

To find the amount you pay, add the interest to the loan amount.

∴ So, you pay  $\$600 + \$450 = \$1050$  for the loan.

### On Your Own

- In Example 3, how long does it take an account with a principal of \$10,000 to earn \$750 in interest?
- WHAT IF?** In Example 4, you pay off the loan after 2 years. How much money do you save?

## Vocabulary and Concept Check

- VOCABULARY** Define each variable in  $I = Prt$ .
- WRITING** In each situation, tell whether you would want a *higher* or *lower* interest rate. Explain your reasoning.
  - you borrow money
  - you open a savings account
- REASONING** An account earns 6% simple interest. You want to find the interest earned on \$200 after 8 months. What conversions do you need to make before you can use the formula  $I = Prt$ ?

## Practice and Problem Solving

An account earns simple interest. (a) Find the interest earned. (b) Find the balance of the account.

- \$600 at 5% for 2 years
  - \$1500 at 4% for 5 years
  - \$350 at 3% for 10 years
  - \$1800 at 6.5% for 30 months
  - \$700 at 8% for 6 years
  - \$1675 at 4.6% for 4 years
  - \$925 at 2% for 2.4 years
  - \$5200 at 7.36% for 54 months

- ERROR ANALYSIS** Describe and correct the error in finding the simple interest earned on \$500 at 6% for 18 months.

**X** 
$$I = (500)(0.06)(18)$$
$$= \$540$$

Find the annual interest rate.

- $I = \$24, P = \$400, t = 2$  years
  - $I = \$562.50, P = \$1500, t = 5$  years
  - $I = \$54, P = \$900, t = 18$  months
  - $I = \$160.67, P = \$2000, t = 8$  months

Find the amount of time.

- $I = \$30, P = \$500, r = 3\%$
  - $I = \$720, P = \$1000, r = 9\%$
  - $I = \$54, P = \$800, r = 4.5\%$
  - $I = \$450, P = \$2400, r = 7.5\%$

- BANKING** A savings account earns 5% simple interest per year. The principal is \$1200. What is the balance after 4 years?
- SAVINGS** You put \$400 in an account. The account earns \$18 simple interest in 9 months. What is the annual interest rate?
- CD** You put \$3000 in a CD (certificate of deposit) at the promotional rate. How long will it take to earn \$336 in interest?

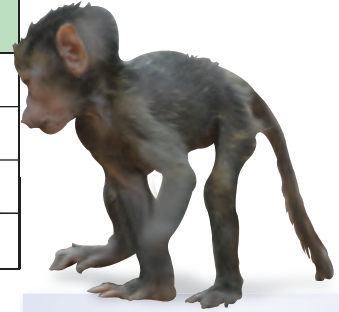


**Find the amount paid for the loan.**

- 4 24. \$1500 at 9% for 2 years                      25. \$2000 at 12% for 3 years  
 26. \$2400 at 10.5% for 5 years                      27. \$4800 at 9.9% for 4 years

**Copy and complete the table.**

	Principal	Interest Rate	Time	Simple Interest
28.	\$12,000	4.25%	5 years	
29.		6.5%	18 months	\$828.75
30.	\$15,500	8.75%		\$5425.00
31.	\$18,000		54 months	\$4252.50



**Zoo Trip**

Tickets	67.70
Food	62.34
Gas	<u>45.50</u>
Total Cost	?

32. **ZOO** A family charges a trip to the zoo on a credit card. The simple interest rate is 12%. The charges are paid after 3 months. What is the total amount paid for the trip?  
 33. **MONEY MARKET** You deposit \$5000 in an account earning 7.5% simple interest. How long will it take for the balance of the account to be \$6500?



34. **LOANS** A music company offers a loan to buy a drum set for \$1500. What is the monthly payment?  
 35. **REASONING** How many years will it take for \$2000 to double at a simple interest rate of 8%? Explain how you found your answer.  
 36. **PROBLEM SOLVING** You have two loans, for 2 years each. The total interest for the two loans is \$138. On the first loan, you pay 7.5% simple interest on a principal of \$800. On the second loan, you pay 3% simple interest. What is the principal for the second loan?

37. **Critical Thinking** You put \$500 in an account that earns 4% annual interest. The interest earned each year is added to the principal to create a new principal. Find the total amount in your account after each year for 3 years.



**Fair Game Review** What you learned in previous grades & lessons

Solve the inequality. Graph the solution. (Section 4.2)

38.  $x + 5 < 2$                       39.  $b - 2 \geq -1$                       40.  $w + 6 \leq -3$   
 41. **MULTIPLE CHOICE** What is the solution of  $4x + 5 = -11$ ? (Section 3.5)  
 (A)  $x = -4$                       (B)  $x = -1.5$                       (C)  $x = 1.5$                       (D)  $x = 4$

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary. (Section 6.5)

- 8 inches to 24 inches
- 300 miles to 210 miles

Find the original price, discount, sale price, or selling price. (Section 6.6)

- Original price: \$30  
Discount: 10%  
Sale price: ?
- Original price: \$55  
Discount: ?  
Sale price: \$46.75
- Original price: ?  
Discount: 75%  
Sale price: \$74.75
- Cost to store: \$152  
Markup: 50%  
Selling price: ?

An account earns simple interest. Find the interest earned, principal, interest rate, or time. (Section 6.7)

- Interest earned: ?  
Principal: \$1200  
Interest rate: 2%  
Time: 5 years
- Interest earned: \$25  
Principal: \$500  
Interest rate: 5%  
Time: ?
- Interest earned: \$76  
Principal: \$800  
Interest rate: ?  
Time: 2 years
- Interest earned: \$119.88  
Principal: ?  
Interest rate: 3.6%  
Time: 3 years

11. **HEIGHT** You estimate that your friend is 50 inches tall. The actual height of your friend is 54 inches. Find the percent error. (Section 6.5)

12. **DIGITAL CAMERA** A digital camera costs \$230. The camera is on sale for 30% off, and you have a coupon for an additional 15% off the sale price. What is the final price? (Section 6.6)

13. **WATER SKIS** The original price of the water skis was \$200. What is the percent of discount? (Section 6.6)



**2 Ways to Own:**

- \$75 cash back with 3.5% simple interest
- No interest for 2 years



14. **SAXOPHONE** A saxophone costs \$1200. A store offers two loan options. Which option saves more money if you pay the loan in 2 years? (Section 6.7)

15. **LOAN** You borrow \$200. The simple interest rate is 12%. You pay off the loan after 2 years. How much do you pay for the loan? (Section 6.7)

## Review Key Vocabulary

percent of change, p. 242  
percent of increase, p. 242  
percent of decrease, p. 242

percent error, p. 243  
discount, p. 248  
markup, p. 248

interest, p. 254  
principal, p. 254  
simple interest, p. 254

## Review Examples and Exercises

### 6.1 Percents and Decimals (pp. 214–219)

a. Write 64% as a decimal.

$$64\% = \underset{\text{red}}{64}\% = 0.64$$

b. Write 0.023 as a percent.

$$0.023 = \underset{\text{red}}{0.023} = 2.3\%$$

### Exercises

Write the percent as a decimal. Use a model to check your answer.

1. 76%

2. 6%

3. 334%

Write the decimal as a percent. Use a model to check your answer.

4. 0.15

5. 1.24

6. 0.097

### 6.2 Comparing and Ordering Fractions, Decimals, and Percents (pp. 220–225)

Which is greater,  $\frac{9}{10}$  or 88%?

Write  $\frac{9}{10}$  as a percent:  $\frac{9}{10} = \frac{90}{100} = 90\%$

∴ 88% is less than 90%. So,  $\frac{9}{10}$  is the greater number.

### Exercises

Tell which number is greater.

7.  $\frac{1}{2}$ , 52%

8.  $\frac{12}{5}$ , 245%

9. 0.46, 43%

10. 0.023, 22%

Use a number line to order the numbers from least to greatest.

11.  $\frac{41}{50}$ , 0.83, 80%

12.  $\frac{9}{4}$ , 220%, 2.15

13. 0.67, 66%,  $\frac{2}{3}$

14. 0.88,  $\frac{7}{8}$ , 90%



## 6.3

## The Percent Proportion (pp. 226–231)

a. What percent of 24 is 9?

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

Write the percent proportion.

$$\frac{9}{24} = \frac{p}{100}$$

Substitute 9 for  $a$  and 24 for  $w$ .

$$100 \cdot \frac{9}{24} = 100 \cdot \frac{p}{100}$$

Multiplication Property of Equality

$$37.5 = p$$

Simplify.

So, 37.5% of 24 is 9.

b. What number is 15% of 80?

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

Write the percent proportion.

$$\frac{a}{80} = \frac{15}{100}$$

Substitute 80 for  $w$  and 15 for  $p$ .

$$80 \cdot \frac{a}{80} = 80 \cdot \frac{15}{100}$$

Multiplication Property of Equality

$$a = 12$$

Simplify.

So, 12 is 15% of 80.

c. 120% of what number is 54?

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

Write the percent proportion.

$$\frac{54}{w} = \frac{120}{100}$$

Substitute 54 for  $a$  and 120 for  $p$ .

$$54 \cdot 100 = w \cdot 120$$

Cross Products Property

$$5400 = 120w$$

Multiply.

$$45 = w$$

Divide each side by 120.

So, 120% of 45 is 54.

### Exercises

Write and solve a proportion to answer the question.

15. What percent of 60 is 18?

16. 40 is what percent of 32?

17. What number is 70% of 70?

18.  $\frac{3}{4}$  is 75% of what number?

## 6.4

## The Percent Equation (pp. 232–237)

- a. What number is 72% of 25?

$$\begin{aligned} a &= p \cdot w && \text{Write percent equation.} \\ &= 0.72 \cdot 25 && \text{Substitute 0.72 for } p \text{ and 25 for } w. \\ &= 18 && \text{Multiply.} \end{aligned}$$

∴ So, 72% of 25 is 18.

- b. 28 is what percent of 70?

$$\begin{aligned} a &= p \cdot w && \text{Write percent equation.} \\ 28 &= p \cdot 70 && \text{Substitute 28 for } a \text{ and 70 for } w. \\ \frac{28}{70} &= \frac{p \cdot 70}{70} && \text{Division Property of Equality} \\ 0.4 &= p && \text{Simplify.} \end{aligned}$$

∴ Because 0.4 equals 40%, 28 is 40% of 70.

- c. 22.1 is 26% of what number?

$$\begin{aligned} a &= p \cdot w && \text{Write percent equation.} \\ 22.1 &= 0.26 \cdot w && \text{Substitute 22.1 for } a \text{ and 0.26 for } p. \\ 85 &= w && \text{Divide each side by 0.26.} \end{aligned}$$

∴ So, 22.1 is 26% of 85.

## Exercises

Write and solve an equation to answer the question.

19. What number is 24% of 25?                      20. 9 is what percent of 20?
21. 60.8 is what percent of 32?                      22. 91 is 130% of what number?
23. 85% of what number is 10.2?                      24. 83% of 20 is what number?
25. **PARKING** 15% of the school parking spaces are handicap spaces. The school has 18 handicap spaces. How many parking spaces are there?
26. **FIELD TRIP** Of the 25 students on a field trip, 16 students bring cameras. What percent of the students bring cameras?



## 6.5 Percents of Increase and Decrease (pp. 240–245)

The table shows the numbers of skim boarders at a beach on Saturday and Sunday. What was the percent of change in boarders from Saturday to Sunday?

The number of skim boarders on Sunday is less than the number of skim boarders on Saturday. So, the percent of change is a percent of decrease.

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

$$= \frac{12 - 9}{12} \quad \text{Substitute.}$$

$$= \frac{3}{12} \quad \text{Subtract.}$$

$$= 0.25 = 25\% \quad \text{Write as a percent.}$$

Day	Number of Skim Boarders
Saturday	12
Sunday	9



∴ So, the number of skim boarders decreased by 25% from Saturday to Sunday.

### Exercises

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

27. 6 yards to 36 yards                      28. 120 meals to 52 meals
29. **MARBLES** You estimate that a jar contains 68 marbles. The actual number of marbles is 60. Find the percent error.

## 6.6 Discounts and Markups (pp. 246–251)

What is the original price of the tennis racquet?

The sale price is  $100\% - 30\% = 70\%$  of the original price.

Answer the question: 21 is 70% of what number?

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

$$21 = 0.7 \cdot w \quad \text{Substitute 21 for } a \text{ and } 0.7 \text{ for } p.$$

$$30 = w \quad \text{Divide each side by } 0.7.$$

∴ So, the original price of the tennis racquet is \$30.



### Exercises

Find the sale price or original price.

30. Original price: \$50  
Discount: 15%  
Sale price: ?
31. Original price: ?  
Discount: 20%  
Sale price: \$75

## 6.7

**Simple Interest** (pp. 252–257)

You put \$200 in a savings account. The account earns 2% simple interest per year.

a. What is the interest earned after 4 years?

b. What is the balance after 4 years?

a.	$I = Prt$	Write simple interest formula.
	$= 200(0.02)(4)$	Substitute 200 for $P$ , 0.02 for $r$ , and 4 for $t$ .
	$= 16$	Multiply.

∴ So, the interest earned is \$16 after 4 years.

b. To find the balance, add the interest to the principal.

∴ So, the balance is  $\$200 + \$16 = \$216$  after 4 years.

You put \$500 in an account. The account earns \$55 simple interest in 5 years. What is the annual interest rate?

	$I = Prt$	Write simple interest formula.
	$55 = 500(r)(5)$	Substitute 55 for $I$ , 500 for $P$ , and 5 for $t$ .
	$55 = 2500r$	Simplify.
	$0.022 = r$	Divide each side by 2500.

∴ So, the annual interest rate of the account is 0.022, or 2.2%.

**Exercises**

An account earns simple interest.

a. Find the interest earned.

b. Find the balance of the account.

32. \$300 at 4% for 3 years

33. \$2000 at 3.5% for 4 years

Find the annual simple interest rate.

34.  $I = \$17$ ,  $P = \$500$ ,  $t = 2$  years

35.  $I = \$426$ ,  $P = \$1200$ ,  $t = 5$  years

Find the amount of time.

36.  $I = \$60$ ,  $P = \$400$ ,  $r = 5\%$

37.  $I = \$237.90$ ,  $P = \$1525$ ,  $r = 2.6\%$

38. **SAVINGS** You put \$100 in an account. The account earns \$2 simple interest in 6 months. What is the annual interest rate?

# 6 Chapter Test



Write the percent as a decimal.

1. 0.96%                      2. 65%                      3. 25.7%

Write the decimal as a percent.

4. 0.42                      5. 7.88                      6. 0.5854

Tell which number is greater.

7.  $\frac{16}{25}$ , 65%                      8. 56%, 5.6

Use a number line to order the numbers from least to greatest.

9. 85%,  $\frac{15}{18}$ , 0.84                      10. 58.3%, 0.58,  $\frac{7}{12}$

Answer the question.

11. What percent of 28 is 21?                      12. 64 is what percent of 40?  
13. What number is 80% of 45?                      14. 0.8% of what number is 6?

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

15. 4 strikeouts to 10 strikeouts                      16. \$24 to \$18

Find the sale price or selling price.

17. Original price: \$15                      18. Cost to store: \$5.50  
Discount: 5%                      Markup: 75%  
Sale price: ?                      Selling price: ?

An account earns simple interest. Find the interest earned or the principal.

19. Interest earned: ?                      20. Interest earned: \$27  
Principal: \$450                      Principal: ?  
Interest rate: 6%                      Interest rate: 1.5%  
Time: 8 years                      Time: 2 years

21. **BASKETBALL** You, your cousin, and a friend each take the same number of free throws at a basketball hoop. Who made the most free throws?  
22. **PARKING LOT** You estimate that there are 66 cars in a parking lot. The actual number of cars is 75.

Player	Made
You	$\frac{17}{20}$
Cousin	0.8
Friend	87.5%

- a. Find the percent error.  
b. What other estimate gives the same percent error? Explain your reasoning.  
23. **INVESTMENT** You put \$800 in an account that earns 4% simple interest. Find the total amount in your account after each year for 3 years.



5. Which list of numbers is in order from least to greatest?

F.  $0.8, \frac{5}{8}, 70\%, 0.09$

H.  $\frac{5}{8}, 70\%, 0.8, 0.09$

G.  $0.09, \frac{5}{8}, 0.8, 70\%$

I.  $0.09, \frac{5}{8}, 70\%, 0.8$

6. What is the value of  $\frac{9}{8} \div \left(-\frac{11}{4}\right)$ ?



7. A pair of running shoes is on sale for 25% off the original price.



Which price is closest to the sale price of the running shoes?

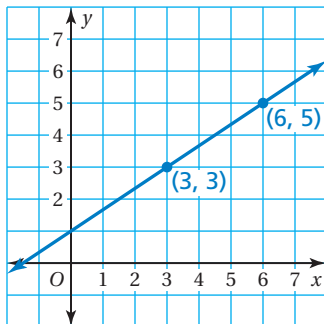
A. \$93

C. \$124

B. \$99

D. \$149

8. What is the slope of the line?



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

H. 2

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

I. 3

9. Brad solved the equation in the box shown.

What should Brad do to correct the error that he made?

$$-3(2 + w) = -45$$

$$2 + w = -15$$

$$w = -17$$

- A. Multiply  $-45$  by  $-3$  to get  $2 + w = 135$ .
- B. Add 3 to  $-45$  to get  $2 + w = -42$ .
- C. Add 2 to  $-15$  to get  $w = -13$ .
- D. Divide  $-45$  by  $-3$  to get 15.

10. You are comparing the costs of a certain model of ladder at a hardware store and at an online store.

Think  
Solve  
Explain



*Part A* What is the cost of the ladder at each of the stores? Show your work and explain your reasoning.

*Part B* Suppose that the hardware store is offering 10% off the price of the ladder and that the online store is offering free shipping and handling. Which store offers the better final cost? by how much? Show your work and explain your reasoning.

11. Which graph represents the inequality below?

$$-5 - 3x \geq -11$$

