Chapter 6 Percents

🔵 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**

a. Write 52% as a decimal.   b. Write 7% as a decimal.

Study Tip

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

🔘 On Your Own

Now You're Ready
Exercises 7–18

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

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

🔵 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.   b. Write 0.663 as a percent.

c. Write 1.8 as a percent.   d. Write 0.009 as a percent.

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) $\dfrac{23}{25}$ (B) 92%   (C) $\dfrac{17}{20}$ (D) 0.92

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?

3%   Grass   0.15   Sand   25%   Sea foam $\dfrac{21}{25}$ Water

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

Sea foam: $25\% = 25.\% = 0.25$ **Water:** $\dfrac{21}{25} = \dfrac{84}{100} = 0.84$

Divide 0.84 by 0.25: $0.25\overline{)0.84}$ $\longrightarrow$ $25\overline{)84.00}$ = 3.36

∴ 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?

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, $\dfrac{3}{20}$ or 16%?

> **Study Tip**
>
> It is usually easier to order decimals or percents than to order fractions.

   b. Which is greater, 79% or 0.08?

On Your Own

> **Now You're Ready**
> Exercises 4–15

1. Which is greater, 25% or $\dfrac{7}{25}$?   2. Which is greater, 0.49 or 94%?

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 $\dfrac{19}{25}$ of her shots, and your friend makes 0.67 of his shots. Who made the fewest shots?
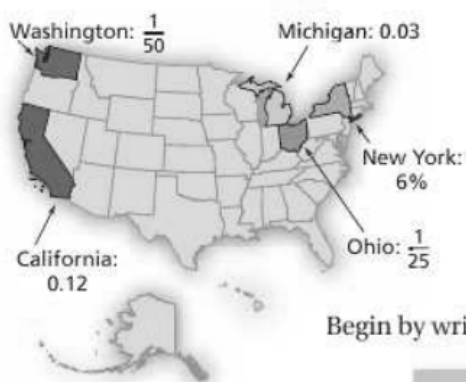
> **Remember**
>
> To order numbers from least to greatest, write them as they appear on a number line from left to right.

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**

Washington: $\frac{1}{50}$ Michigan: 0.03

New York: 6%

California: 0.12

Ohio: $\frac{1}{25}$

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

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.
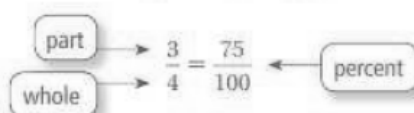
Key Idea

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 $\dfrac{p}{100}$, is the percent.

Numbers   3 out of 4 is 75%.

part $\rightarrow$ $\dfrac{3}{4} = \dfrac{75}{100}$ $\leftarrow$ percent
whole

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.

EXAMPLE **2** **Finding a Part**

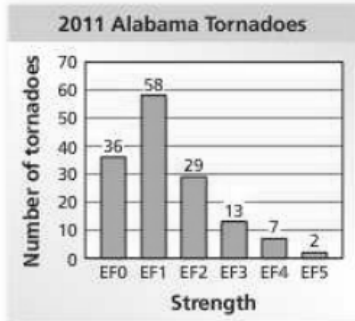**What number is 36% of 50?**

EXAMPLE 3 Finding a Whole

150% of what number is 24?

On Your Own

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

2011 Alabama Tornadoes

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*.

On Your Own

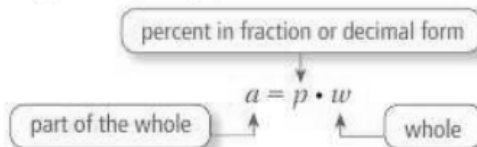7. Twenty percent of the tornadoes occurred in central Alabama on April 27. How many tornadoes does this represent?

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Lesson Tutorials
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Key Idea

The Percent Equation

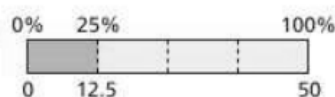**Words** To represent "a is p percent of w," use an equation.

percent in fraction or decimal form

$$a = p \cdot w$$

part of the whole

whole

Numbers $15 = 0.5 \cdot 30$

EXAMPLE 1 Finding a Part of a Number

What number is 24% of 50?   Estimate

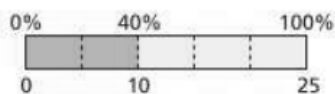| 0%	25%		100%
0	12.5		50

Common Error

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

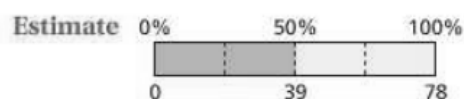**EXAMPLE 2** Finding a Percent

9.5 is what percent of 25?   Estimate

0%	40%		100%
0	10		25

EXAMPLE **3** **Finding a Whole**

39 is 52% of what number?   Estimate

0%	50%	100%

0   39   78

On Your Own

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**

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

8th Street Cafe

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

Food Total	27.50
Tax	1.65
Subtotal	29.15

TIP: _____

TOTAL: _____

Thank You

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

On Your Own

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

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.
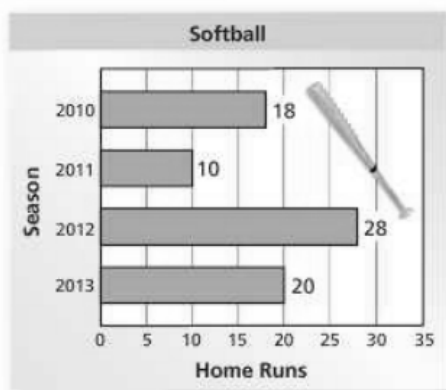
On Your Own

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

1. 10 inches to 25 inches

2. 57 people to 65 people

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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?

Softball

Key Idea

Percent Error

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

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

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.

On Your Own

Now You're Ready
Exercises 8–15
and 18

3. In Example 2, what was the percent of change from 2010 to 2011?

4. **WHAT IF?** In Example 3, your friend estimates that the length of the classroom is 23 feet. Who has the greater percent error? Explain.

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.

Study Tip

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

∴ So, the sale pr

On Your Own

Now You're Ready
Exercises 4–8

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

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EXAMPLE **2** **Finding an Original Price**

What is the original price
of the shoes?

40% OFF
NOW $33

EXAMPLE **3** **Finding a Selling Price**

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

SALE

On Your Own

2. The discount on a DVD is 50%. It is on sale for $10. What
is the original price of the DVD?

3. A store pays $75 for an aquarium. The markup is 20%.
What is the selling price?

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

Simple interest		Annual interest rate (in decimal form)

$$I = Prt$$

Principal		Time (in years)
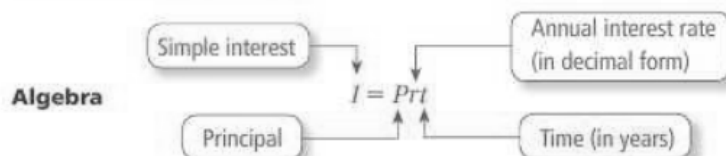
EXAMPLE 1 Finding Interest Earned

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?

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?

1. In Example 1, what is the balance of the account after 9 months?

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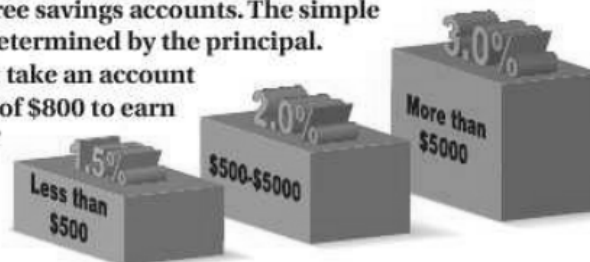
The pictogram shows that the interest rate for a principal of $800 is 2%.

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?

On Your Own

3. In Example 3, how long does it take an account with a principal of $10,000 to earn $750 in interest?

4. **WHAT IF?** In Example 4, you pay off the loan after 2 years. How much money do you save?