

Percents

MODULE



8



ESSENTIAL QUESTION

How can you use percents to solve real-world problems?

LESSON 8.1

Understanding Percent

COMMON CORE 6.RP.3c

LESSON 8.2

Percents, Fractions, and Decimals

COMMON CORE 6.RP.3

LESSON 8.3

Solving Percent Problems

COMMON CORE 6.RP.3, 6.RP.3c



Real-World Video

When you eat at a restaurant, your bill will include sales tax for most items. It is customary to add a tip for your server in many restaurants. Both taxes and tips are calculated as a percent of the bill.

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Write Equivalent Fractions

EXAMPLE $\frac{9}{12} = \frac{9 \times 4}{12 \times 4} = \frac{36}{48}$ Multiply the numerator and denominator by the same number to find an equivalent fraction.
 $\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$ Divide the numerator and denominator by the same number to find an equivalent fraction.

Write the equivalent fraction.

1. $\frac{9}{18} = \frac{\square}{6}$

2. $\frac{4}{6} = \frac{\square}{18}$

3. $\frac{25}{30} = \frac{5}{\square}$

4. $\frac{12}{15} = \frac{36}{\square}$

5. $\frac{15}{24} = \frac{\square}{8}$

6. $\frac{24}{32} = \frac{\square}{8}$

7. $\frac{50}{60} = \frac{10}{\square}$

8. $\frac{5}{9} = \frac{20}{\square}$

Multiply Fractions

EXAMPLE $\frac{5}{12} \times \frac{3}{10} = \frac{1\cancel{5}}{12\cancel{4}} \times \frac{1\cancel{3}}{\cancel{10}_2} = \frac{1}{8}$ Divide by the common factors.
Simplify.

Multiply. Write each product in simplest form.

9. $\frac{3}{8} \times \frac{4}{11} =$ _____ 10. $\frac{8}{15} \times \frac{5}{6} =$ _____ 11. $\frac{7}{12} \times \frac{3}{14} =$ _____

12. $\frac{9}{20} \times \frac{4}{5} =$ _____ 13. $\frac{7}{10} \times \frac{20}{21} =$ _____ 14. $\frac{8}{18} \times \frac{9}{20} =$ _____

Decimal Operations (Multiplication)

EXAMPLE $\begin{array}{r} 1.6 \\ \times 0.3 \\ \hline 0.48 \end{array}$ Multiply as you would with whole numbers.
Count the total number of decimal places in the factors.
Place the decimal point that number of places in the product.

Multiply.

15. 20×0.25 _____ 16. 0.3×16.99 _____ 17. 0.2×75 _____

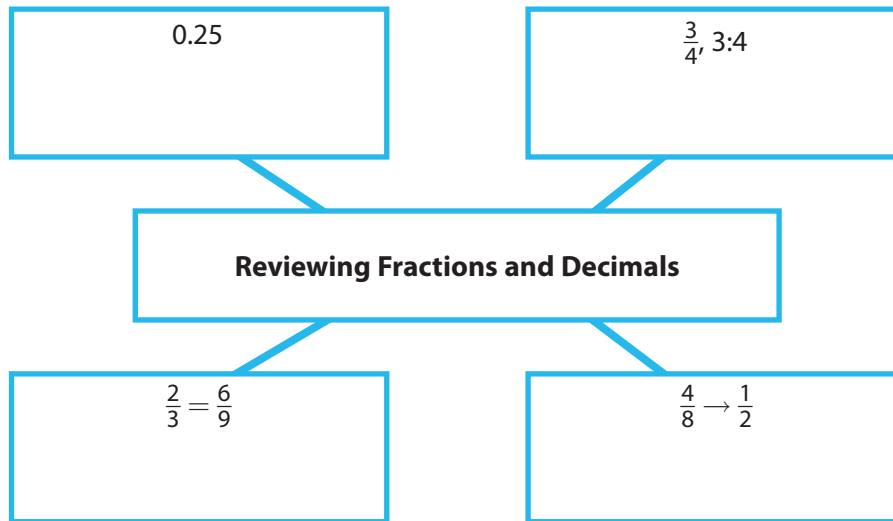
18. 5.5×1.1 _____ 19. 11.99×0.8 _____ 20. 7.25×0.5 _____

21. 4×0.75 _____ 22. 0.15×12.50 _____ 23. 6.5×0.7 _____

Reading Start-Up

Visualize Vocabulary

Use the ✓ words to complete the graphic. You may put more than one word in each box.



Understand Vocabulary

Match the term on the left to the correct expression on the right.

- | | |
|------------------------|---|
| 1. percent | A. A ratio that compares a number to 100. |
| 2. model | B. Decimals that name the same amount. |
| 3. equivalent decimals | C. Something that represents another thing. |

Vocabulary

Review Words

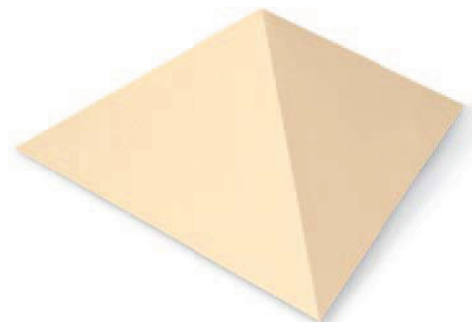
- ✓ decimal (*decimal*)
- ✓ equivalent fractions (*fracciones equivalentes*)
- denominator (*denominador*)
- ✓ fraction (*fracción*)
- mixed number (*número mixto*)
- numerator (*numerador*)
- ✓ ratio (*razón*)
- ✓ simplest form (*mínima expresión*)

Preview Words

- equivalent decimals (*decimales equivalentes*)
- model (*modelo*)
- percent (*porcentaje*)
- proportional reasoning (*razonamiento proporcional*)

Active Reading

Pyramid Before beginning the module, create a pyramid to help you organize what you learn. Label one side "Decimals," one side "Fractions," and the other side "Percents." As you study the module, write important vocabulary and other notes on the appropriate side.





Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.

COMMON CORE 6.RP.3c

Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percent.

Key Vocabulary**Percent** (*porcentaje*)

A ratio comparing a number to 100.

What It Means to You

You will learn to write numbers in various forms, including fractions, decimals, and percents.

UNPACKING EXAMPLE 6.RP.3c

Little brown bats flap their wings about $\frac{3}{4}$ as fast as pipistrelle bats do. How fast does the little brown bat flap its wings as a percent of the pipistrelle bat's wing flap rate?



$$\frac{3}{4} = 3 \div 4 = 0.75$$

$$0.75 = 75\%$$

Divide the numerator by the denominator.

Move the decimal point 2 places to the right.

COMMON CORE 6.RP.3c

Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percent.

What It Means to You

You will solve problems involving percent.

UNPACKING EXAMPLE 6.RP.3c

About 67% of a person's total (100%) body weight is water. If Cameron weighs 90 pounds, about how much of his weight is water?

67% of 90

$$\frac{67}{100} \cdot 90$$

$$= \frac{67}{100} \cdot \frac{90}{1}$$

$$= 60.3$$

About 60.3 pounds of Cameron's weight is water.



Visit my.hrw.com to see all the **Common Core Standards** unpacked.

8.1 Understanding Percent

Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); ...



ESSENTIAL QUESTION

How can you write a ratio as a percent?

EXPLORE ACTIVITY 1



COMMON CORE 6.RP.3c

Using a Grid to Model Percents

A **percent** is a ratio that compares a number to 100. The symbol % is used to show a percent.

17% is equivalent to

• $\frac{17}{100}$

• 17 to 100

• 17:100



The free-throw ratios for three basketball players are shown.

Player 1: $\frac{17}{25}$

Player 2: $\frac{33}{50}$

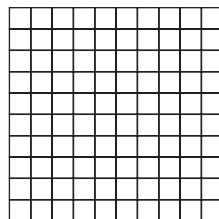
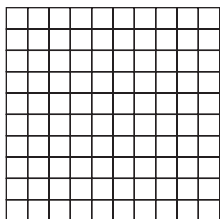
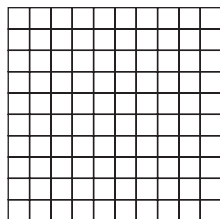
Player 3: $\frac{14}{20}$

- A** Rewrite each ratio as a number compared to 100. Then shade the grid to represent the free-throw ratio.

Player 1: $\frac{17}{25} = \frac{\square}{100}$

Player 2: $\frac{33}{50} = \frac{\square}{100}$

Player 3: $\frac{14}{20} = \frac{\square}{100}$



- B** Which player has the greatest free-throw ratio? _____

How is this shown on the grids? _____

- C** Use a percent to describe each player's free-throw ratio. Write the percents in order from least to greatest.

- D** How did you determine how many squares to shade on each grid?

EXPLORE ACTIVITY 2

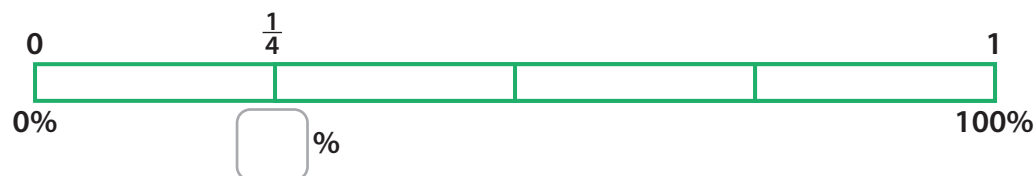
COMMON CORE 6.RP.3c

Connecting Fractions and Percents

You can use a percent bar model to model a ratio expressed as a fraction and to find an equivalent percent.

- A** Use a percent bar model to find an equivalent percent for $\frac{1}{4}$.

Draw a model to represent 100 and divide it into fourths. Shade $\frac{1}{4}$.



$\frac{1}{4}$ of 100 = 25, so $\frac{1}{4}$ of 100% = _____

Tell which operation you can use to find $\frac{1}{4}$ of 100.

Then find $\frac{1}{4}$ of 100%. _____

- B** Use a percent bar model to find an equivalent percent for $\frac{1}{3}$.

Draw a model and divide it into thirds. Shade $\frac{1}{3}$.



$\frac{1}{3}$ of 100 = $33\frac{1}{3}$, so $\frac{1}{3}$ of 100% = _____%

Tell which operation you can use to find $\frac{1}{3}$ of 100.

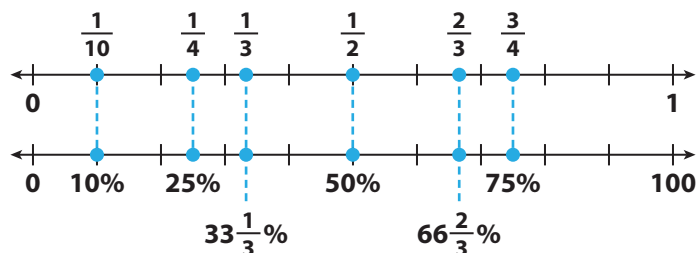
Then find $\frac{1}{3}$ of 100%. _____

Reflect

1. **Critique Reasoning** Jo says she can find the percent equivalent of $\frac{3}{4}$ by multiplying the percent equivalent of $\frac{1}{4}$ by 3. How can you use a percent bar model to support this claim?

Using Benchmarks and Proportional Reasoning

You can use certain *benchmark* percents to write other percents and to estimate fractions.



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EXAMPLE 1



COMMON CORE

6.RP.3c

- A** Find an equivalent percent for $\frac{3}{10}$.

STEP 1 Write $\frac{3}{10}$ as a multiple of a benchmark fraction.

$$\frac{3}{10} = 3 \cdot \frac{1}{10} \quad \text{Think: } \frac{3}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10}$$

STEP 2 Find an equivalent percent for $\frac{1}{10}$.

$$\frac{1}{10} = 10\% \quad \text{Use the number lines to find the equivalent percent for } \frac{1}{10}.$$

STEP 3 Multiply.

$$\frac{3}{10} = 3 \cdot \frac{1}{10} = 3 \cdot 10\% = 30\%$$

- B** 76% of the students at a middle school bring their own lunch. About what fraction of the students bring their own lunch?

STEP 1 Note that 76% is close to the benchmark 75%.

STEP 2 Find a fraction equivalent for 75%:

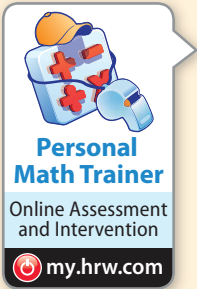
$$75\% = \frac{3}{4}$$

About $\frac{3}{4}$ of the students bring their own lunch.

Math Talk

Mathematical Practices

Explain how you could use equivalent ratios to write $\frac{3}{10}$ as a percent.



YOUR TURN

Use a benchmark to find an equivalent percent for each fraction.

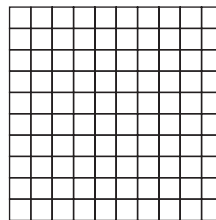
2. $\frac{9}{10}$ _____ 3. $\frac{2}{5}$ _____

4. 64% of the animals at an animal shelter are dogs. About what fraction of the animals at the shelter are dogs?

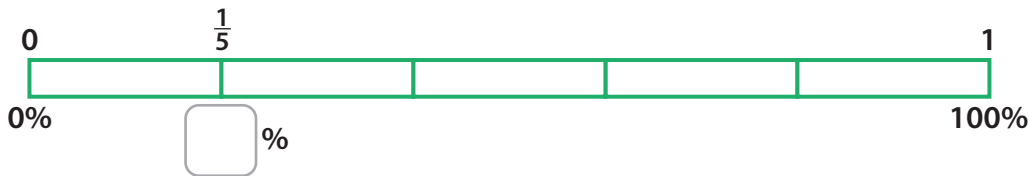
Guided Practice

1. Shade the grid to represent the ratio $\frac{9}{25}$. Then find a percent equivalent to the given ratio. (Explore Activity 1)

$$\frac{9 \times \square}{25 \times \square} = \frac{\square}{100} = \underline{\hspace{2cm}}$$



2. Use the percent bar model to find the missing percent. (Explore Activity 2)



Identify a benchmark you can use to find an equivalent percent for each ratio. Then find the equivalent percent. (Example 1)

3. $\frac{6}{10}$ Benchmark: $\frac{1}{\square}$

4. $\frac{2}{4}$ Benchmark: $\frac{\square}{4}$

5. $\frac{4}{5}$ Benchmark: $\frac{\square}{5}$

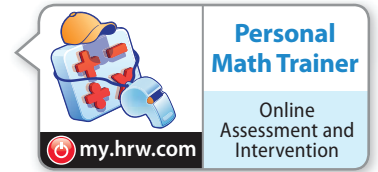
6. 41% of the students at an art college want to be graphic designers. About what fraction of the students want to be graphic designers? (Example 1)

ESSENTIAL QUESTION CHECK-IN

7. How do you write a ratio as a percent?

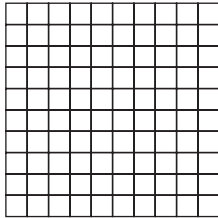
8.1 Independent Practice

COMMON CORE 6.RP.3c

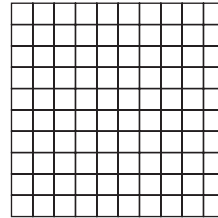


Shade the grid to represent the ratio. Then find the missing number.

8. $\frac{23}{50} = \frac{\square}{100}$



9. $\frac{11}{20} = \frac{\square}{100}$



10. Mark wants to use a grid like the ones in Exercises 1 and 2 to model the percent equivalent of the fraction $\frac{2}{3}$. How many grid squares should he shade? What percent would his model show?

11. The ratios of saves for a baseball pitcher to the number of save opportunities are given for three relief pitchers: $\frac{9}{10}$, $\frac{4}{5}$, $\frac{17}{20}$. Write each ratio as a percent. Order the percents from least to greatest.

Circle the greater quantity.

12. $\frac{1}{3}$ of a box of Corn Krinkles

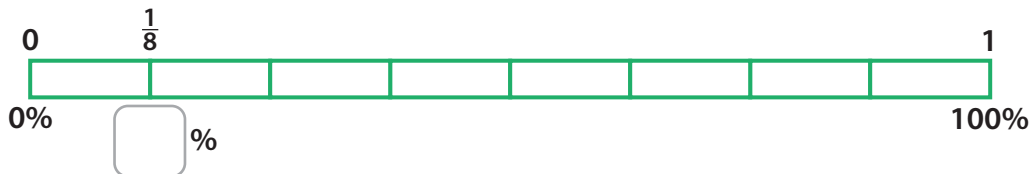
50% of a box of Corn Krinkles

13. 30% of your minutes are used up

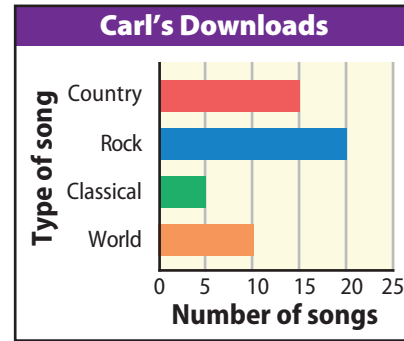
$\frac{1}{4}$ of your minutes are used up

14. **Multiple Representations** Explain how you could write 35% as the sum of two benchmark percents or as a multiple of a percent.

15. Use the percent bar model to find the missing percent.



16. Multistep Carl buys songs and downloads them to his computer. The bar graph shows the numbers of each type of song he downloaded last year.



- What is the total number of songs Carl downloaded last year?

- What fraction of the songs were country? Find the fraction for each type of song. Write each fraction in simplest form and give its percent equivalent.

H.O.T. FOCUS ON HIGHER ORDER THINKING

17. Critique Reasoning Marcus bought a booklet of tickets to use at the amusement park. He used 50% of the tickets on rides, $\frac{1}{3}$ of the tickets on video games, and the rest of the tickets in the batting cage. Marcus says he used 10% of the tickets in the batting cage. Do you agree? Explain.

18. Look for a Pattern Complete the table.

Fraction	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{5}{5}$	$\frac{6}{5}$
Percent	20%					

- Analyze Relationships** What is true when the numerator and denominator of the fraction are equal? What is true when the numerator is greater than the denominator?

- Justify Reasoning** What is the percent equivalent of $\frac{3}{2}$? Use a pattern like the one in the table to support your answer.

Work Area

LESSON 8.2 Percents, Fractions, and Decimals

COMMON CORE 6.RP.3

Use ratio and rate reasoning to solve real-world and mathematical problems...



ESSENTIAL QUESTION

How can you write equivalent percents, fractions, and decimals?

Writing Percents as Decimals and Fractions

You can write a percent as an equivalent fraction or as an equivalent decimal. Equivalent percents, decimals, and fractions all represent equal parts of the same whole.



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EXAMPLE 1



COMMON CORE 6.RP.3

Lorenzo spends 35% of his budget on rent for his apartment. Write this percent as a fraction and as a decimal.

STEP 1 Write the percent as a fraction.

$$35\% = \frac{35}{100} \quad \text{Percent means per 100.}$$

STEP 2 Write the fraction in simplest form.

$$\frac{35}{100} = \frac{35 \div 5}{100 \div 5} = \frac{7}{20}$$

STEP 3 Write the percent as a decimal.

$$35\% = \frac{35}{100} \quad \text{Write the fraction equivalent of 35\%.}$$

$$= 0.35 \quad \text{Write the decimal equivalent of } \frac{35}{100}.$$

So, 35% written as a fraction is $\frac{7}{20}$ and written as a decimal is 0.35.

Math Talk

Mathematical Practices

Explain why both the numerator and denominator in Step 2 are divided by 5.

YOUR TURN

Write each percent as a fraction and as a decimal.

- | | |
|--------------|--------------|
| 1. 15% _____ | 2. 48% _____ |
| 3. 80% _____ | 4. 75% _____ |
| 5. 36% _____ | 6. 40% _____ |



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EXPLORE ACTIVITY

COMMON CORE 6.RP.3

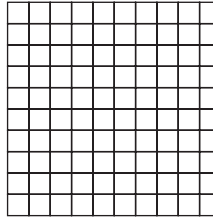
Modeling Decimal, Fraction, and Percent Equivalencies

Using models can help you understand how decimals, fractions, and percents are related.

- A** Model 0.78 by shading a 10-by-10 grid.

$$0.78 = \frac{\square}{100}$$

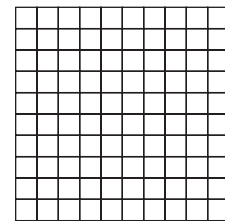
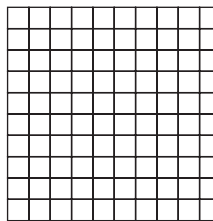
_____ out of a hundred, or _____%.



- B** Model 1.42 by shading 10-by-10 grids.

$$1.42 = \frac{\square}{100} + \frac{\square}{100} = \frac{\square}{100} = 1\frac{\square}{100}$$

1.42 = 100% + _____% = _____%

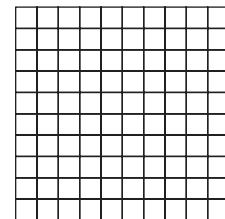
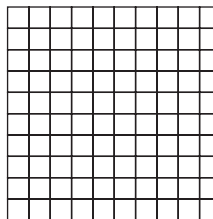


- C** Model 125% by shading 10-by-10 grids.

The model shows 100% + _____% = 125%.

125% = the decimal _____.

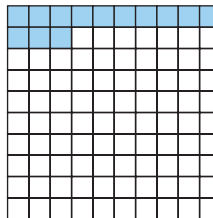
$$125\% = \frac{\square}{100} + \frac{\square}{100} = \frac{\square}{100} = 1\frac{\square}{100} = 1\frac{\square}{\square}$$



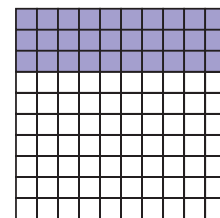
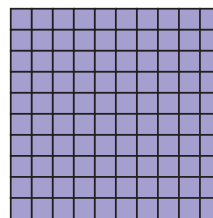
Reflect

- 7. Multiple Representations** What decimal, fraction, and percent equivalencies are shown in each model? Explain.

- a. _____



- b. _____



Writing Fractions as Decimals and Percents

You can write some fractions as percents by writing an equivalent fraction with a denominator of 100. This method is useful when the fraction has a denominator that is a factor or a multiple of 100. If a fraction does not have a denominator that is a factor or multiple of 100, you can use long division.



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EXAMPLE 2



COMMON CORE 6.RP.3

- A** 96 out of 200 animals treated by a veterinarian are horses. Write $\frac{96}{200}$ as a decimal and as a percent.

STEP 1 Write an equivalent fraction with a denominator of 100.

$$\frac{96}{200} = \frac{48}{100} \quad \text{Divide both the numerator and denominator by 2.}$$

STEP 2 Write the decimal equivalent.

$$\frac{48}{100} = 0.48$$

STEP 3 Write the percent equivalent.

$$\frac{48}{100} = 48\% \quad \text{Percent means per 100.}$$

Notice that the denominator is not a factor or multiple of 100.

- B** $\frac{1}{8}$ of the animals treated by the veterinarian are dogs. Write $\frac{1}{8}$ as a decimal and as a percent.

STEP 1 Use long division to divide the numerator by the denominator.

$$\begin{array}{r} 0.125 \\ 8 \overline{)1.000} \\ \underline{-8} \\ 20 \\ \underline{-16} \\ 40 \\ \underline{-40} \\ 0 \end{array} \quad \text{Add a decimal point and zeros to the right of the numerator as needed.}$$

The decimal equivalent of $\frac{1}{8}$ is 0.125.

STEP 2 Write the decimal as a percent.

$$0.125 = \frac{125}{1,000} \quad \text{Write the fraction equivalent of the decimal.}$$

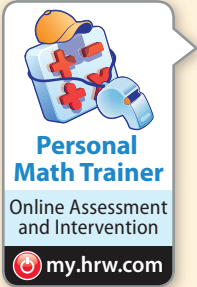
$$\frac{125}{1,000} = \frac{12.5}{100} \quad \text{Write an equivalent fraction with a denominator of 100.}$$

$$\frac{12.5}{100} = 12.5\% \quad \text{Write as a percent.}$$

The percent equivalent of $\frac{1}{8}$ is 12.5%.

Notice that the denominator is a multiple of 100.





YOUR TURN

Write each fraction as a decimal and as a percent.

8. $\frac{9}{25}$ _____

9. $\frac{7}{8}$ _____

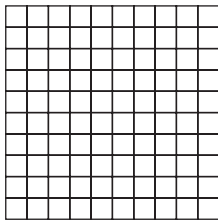
Guided Practice

1. Helene spends 12% of her budget on transportation expenses. Write this percent as a fraction and as a decimal. (Example 1)

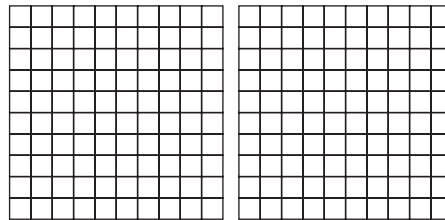
Model the decimal. Then write percent and fraction equivalents.

(Explore Activity)

2. 0.53



3. 1.07



Write each fraction as a decimal and as a percent. (Example 2)

4. $\frac{7}{20}$ of the packages _____

5. $\frac{3}{8}$ of a pie _____

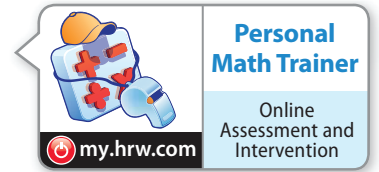


ESSENTIAL QUESTION CHECK-IN

6. How does the definition of *percent* help you write fraction and decimal equivalents?

8.2 Independent Practice

COMMON CORE 6.RP.3



Write each percent as a fraction and as a decimal.

7. 72% full

8. 25% successes

9. 500% increase

10. 5% tax

11. 37% profit

12. 165% improvement

Write each fraction as a decimal and as a percent.

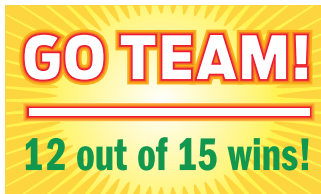
13. $\frac{5}{8}$ of an inch

14. $\frac{258}{300}$ of the contestants

15. $\frac{350}{100}$ of the revenue

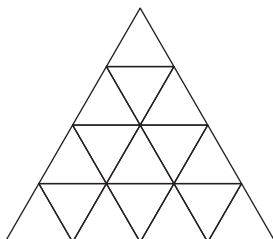
16. The poster shows how many of its games the football team has won so far. Express this information as a fraction, a percent, and as a decimal.

17. Justine answered 68 questions correctly on an 80-question test. Express this amount as a fraction, percent, and decimal.

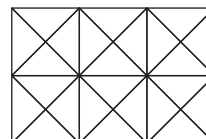


Each diagram is made of smaller, identical pieces. Tell how many pieces you would shade to model the given percent.

18. 75% _____



19. 25% _____



- 20. Multiple Representations** At Brian's Bookstore, 0.3 of the shelves hold mysteries, 25% of the shelves hold travel books, and $\frac{7}{20}$ of the shelves hold children's books. Which type of book covers the most shelf space in the store? Explain how you arrived at your answer.


FOCUS ON HIGHER ORDER THINKING

- 21. Critical Thinking** A newspaper article reports the results of an election between two candidates. The article says that Smith received 60% of the votes and that Murphy received $\frac{1}{3}$ of the votes. A reader writes in to complain that the article cannot be accurate. What reason might the reader have to say this?

- 22. Represent Real-World Problems** Evan budgets \$2,000 a month to spend on living expenses for his family. Complete the table to express the portion spent on each cost as a percent, fraction, and decimal.

	Food: \$500	Rent: \$1,200	Transportation: \$300
Fraction			
Percent			
Decimal			

- 23. Communicate Mathematical Ideas** Find the sum of each row in the table. Explain why these sums make sense.

- 24. Explain the Error** Your friend says that 14.5% is equivalent to the decimal 14.5. Explain why your friend is incorrect by comparing the fractional equivalents of 14.5% and 14.5.

LESSON 8.3 Solving Percent Problems

COMMON CORE 6.RP.3c

Find a percent of a quantity ...; solve problems involving finding the whole, given a part and the percent. *Also 6.RP.3*



ESSENTIAL QUESTION

How do you use percents to solve problems?

EXPLORE ACTIVITY



COMMON CORE 6.RP.3

Modeling a Percent Problem

You can use a model to solve a percent problem.

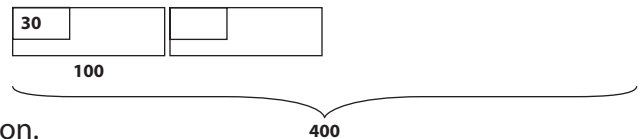
A sports store received a shipment of 400 baseball gloves. 30% were left-handed. How many left-handed gloves were in the shipment?



- A** Use the diagram to solve this problem.

30% means 30 out of _____.

There were _____ left-handed gloves for every 100 baseball gloves.

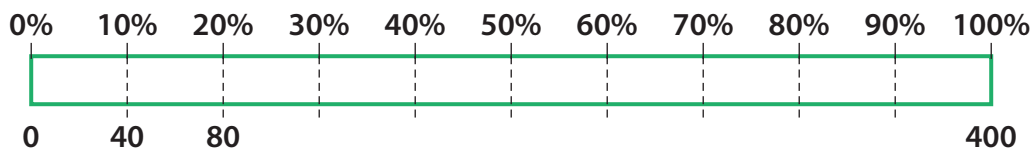


Complete the diagram to model this situation.

- B** Describe how the diagram models the shipment of gloves.

- C** Explain how you can use the diagram to find the total number of left-handed gloves in the shipment.

- D** Use a bar model to solve this problem. The bar represents 100%, or the entire shipment of 400 gloves. The bar is divided into 10 equal parts. Complete the labels along the bottom of the bar.



Reflect

- Justify Reasoning** How did you determine the labels along the bottom of the bar model in Step D?

- Communicate Mathematical Ideas** How can you use the bar model to find the number of left-handed gloves?



Finding a Percent of a Number

A percent is equivalent to the ratio of a part to a whole. To find a percent of a number, you can write a ratio to represent the percent, and find an equivalent ratio that compares the part to the whole.

The word *of* indicates multiplication.

To find 30% of 400, you can use:

Proportional Reasoning

$$\begin{array}{l} \begin{array}{c} \times 4 \\ \curvearrowright \\ \frac{30}{100} = \frac{?}{400} \\ \curvearrowleft \\ \times 4 \end{array} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array} \\ = \frac{120}{400} \end{array}$$

Multiplication

$$\begin{aligned} 30\% \text{ of } 400 &= \frac{30}{100} \text{ of } 400 \\ &= \frac{30}{100} \times 400 \\ &= 120 \end{aligned}$$

EXAMPLE 1

COMMON CORE 6.RP.3c

- A** Use proportional reasoning to find 28% of 25.

Math Talk

Mathematical Practices

Could you also use the proportion $\frac{28}{100} = \frac{?}{25}$ to find 28% of 25? Explain.

- STEP 1** Write a proportion comparing the percent to the ratio of part to whole.

$$\frac{?}{25} = \frac{28}{100}$$

Notice that 25 is a factor of 100.

- STEP 2** Find the multiplication factor.

$$\begin{array}{l} \text{part} \rightarrow \frac{?}{25} \\ \text{whole} \rightarrow \frac{28}{100} \end{array} \quad \begin{array}{c} \times 4 \\ \curvearrowright \\ \times 4 \end{array}$$

Since $25 \cdot 4 = 100$, find what number times 4 equals 28.

- STEP 3** Find the numerator.

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

Since $4 \cdot 7 = 28$, 28% of 25 = 7.

○ 28% of 25 is 7.

B Multiply by a fraction to find 35% of 60.

STEP 1 Write the percent as a fraction.

$$35\% \text{ of } 60 = \frac{35}{100} \text{ of } 60$$

STEP 2 Multiply.

$$\begin{aligned} \frac{35}{100} \text{ of } 60 &= \frac{35}{100} \times 60 \\ &= \frac{2,100}{100} \\ &= 21 \quad \text{Simplify.} \end{aligned}$$

○ 35% of 60 is 21.

C Multiply by a decimal to find 5% of 180.

STEP 1 Write the percent as a decimal.

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

STEP 2 Multiply.

$$180 \times 0.05 = 9$$

○ 5% of 180 is 9.

Reflect

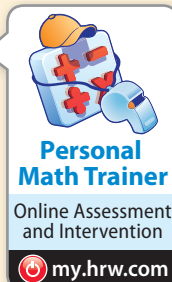
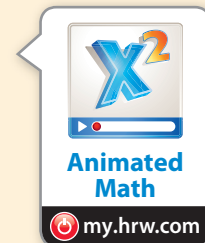
3. Analyze Relationships In **B**, the percent is 35%. What is the part and what is the whole?

4. Communicate Mathematical Ideas Explain how to use proportional reasoning to find 35% of 600.

YOUR TURN

Find the percent of each number.

- 5.** 38% of 50 _____ **6.** 27% of 300 _____ **7.** 60% of 75 _____





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Find a Percent Given a Part and a Whole

You can use proportional reasoning to solve problems in which you need to find a percent.

EXAMPLE 2



COMMON CORE

6.RP.3

The school principal spent \$2,000 to buy some new computer equipment. Of this money, \$120 was used to buy some new keyboards. What percent of the money was spent on keyboards?

STEP 1 Since you want to know the part of the money spent on keyboards, compare the part to the whole.

$$\begin{array}{l} \text{part} \rightarrow \$120 \\ \text{whole} \rightarrow \$2,000 \end{array}$$

STEP 2 Write a proportion comparing the percent to the ratio of part to whole.

$$\begin{array}{l} \text{part} \rightarrow ? \\ \text{whole} \rightarrow 100 \end{array} = \frac{120}{2,000} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

STEP 3 Find the multiplication factor.

$$\frac{?}{100} = \frac{120}{2,000}$$

Since $100 \times 20 = 2,000$, find what number times 20 equals 120.

STEP 4 Find the numerator.

$$\frac{6}{100} = \frac{120}{2,000} \quad \text{Since } 20 \times 6 = 120, \text{ the percent is } 6\%.$$

The principal spent 6% of the money on keyboards.

Reflect

8. **Communicate Mathematical Ideas** Write 57% as a ratio. Which part of the ratio represents the part and which part represents the whole? Explain.

YOUR TURN

9. Out of the 25 students in Mrs. Green's class, 19 have a pet. What percent of the students in Mrs. Green's class have a pet? _____



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Finding a Whole Given a Part and a Percent

You can use proportional reasoning to solve problems in which you know a part and a percent and need to find the whole.



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EXAMPLE 3



COMMON CORE

6.RP.3c

Twelve of the students in the school choir like to sing solos. These 12 students make up 24% of the choir. How many students are in the choir?

STEP 1 Since you want to know the total number of students in the choir, compare the part to the whole.

$$\begin{array}{l} \text{part} \rightarrow 12 \\ \text{whole} \rightarrow ? \end{array}$$

STEP 2 Write a proportion comparing the percent to the ratio of part to whole.

$$\begin{array}{l} \text{part} \rightarrow 12 \\ \text{whole} \rightarrow ? \end{array} = \frac{24}{100} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array} \quad \text{You know that 12 students represent 24\%.$$

STEP 3 Find the multiplication factor.

$$\frac{12}{?} = \frac{24}{100} \quad \begin{array}{l} \times 2 \\ \times 2 \end{array} \quad \text{Since } 12 \times 2 = 24, \text{ find what number times 2 equals 100.}$$

STEP 4 Find the denominator.

$$\frac{12}{50} = \frac{24}{100} \quad \text{Since } 50 \times 2 = 100, \text{ the denominator is 50.}$$

There are 50 students in the choir.



Math Talk

Mathematical Practices

Suppose 10 more students join the choir. None of them are soloists. What percent are soloists now?

Reflect

10. **Check for Reasonableness** In Example 3, 24% is close to 25%. How could you use this fact to check that 50 is a reasonable number for the total number of students in the choir?

YOUR TURN

11. 6 is 30% of _____.

12. 15% of _____ is 75.



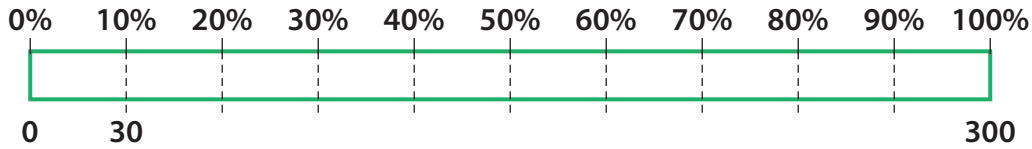
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Guided Practice

1. A store has 300 televisions on order, and 80% are high definition. How many televisions on order are high definition? Use the bar model and complete the bottom of the bar. (*Explore Activity*)



2. Use proportional reasoning to find 65% of 200. (*Example 1*)

$$\begin{array}{l} \text{part} \rightarrow \frac{\square}{100} = \frac{?}{\square} \\ \text{whole} \rightarrow \end{array} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

65% of 200 is _____.

4. Alana spent \$21 of her \$300 paycheck on a gift. What percent of her paycheck was spent on the gift? (*Example 2*)

$$\begin{array}{l} \text{part} \rightarrow \frac{?}{\square} = \frac{\$ \square}{\$ \square} \\ \text{whole} \rightarrow \end{array} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

Alana spent _____ of her paycheck on the gift.

3. Use multiplication to find 5% of 180. (*Example 1*)

$$\begin{aligned} \frac{5}{100} \text{ of } 180 &= \frac{5}{100} \square 180 \\ &= \frac{\square}{100} = \square \end{aligned}$$

5% of 180 is _____.

5. At Pizza Pi, 9% of the pizzas made last week had extra cheese. If 27 pizzas had extra cheese, how many pizzas in all were made last week? (*Example 3*)

$$\begin{array}{l} \text{part} \rightarrow \frac{\square}{100} = \frac{27}{?} \\ \text{whole} \rightarrow \end{array} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

There were _____ pizzas made last week.

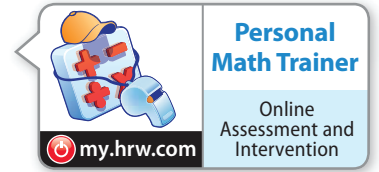


ESSENTIAL QUESTION CHECK-IN

6. How can you use proportional reasoning to solve problems involving percent?

8.3 Independent Practice

COMMON CORE 6.RP.3, 6.RP.3c



Find the percent of each number.

- | | | |
|--------------------------------|---------------------------------|------------------------------|
| 7. 64% of 75 tiles
_____ | 8. 20% of 70 plants
_____ | 9. 32% of 25 pages
_____ |
| 10. 85% of 40 e-mails
_____ | 11. 72% of 350 friends
_____ | 12. 5% of 220 files
_____ |

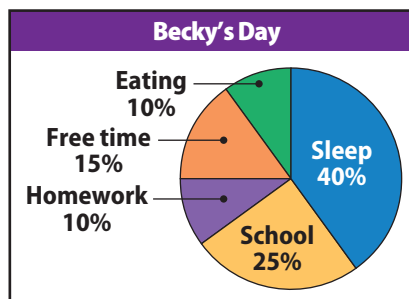
Complete each sentence.

- | | |
|--|--|
| 13. 4 students is _____ % of 20 students. | 14. 2 doctors is _____ % of 25 doctors. |
| 15. _____ % of 50 shirts is 35 shirts. | 16. _____ % of 200 miles is 150 miles. |
| 17. 4% of _____ days is 56 days. | 18. 60 minutes is 20% of _____ minutes. |
| 19. 80% of _____ games is 32 games. | 20. 360 kilometers is 24% of _____ kilometers. |
| 21. 75% of _____ peaches is 15 peaches. | 22. 9 stores is 3% of _____ stores. |
| 23. At a shelter, 15% of the dogs are puppies. There are 60 dogs at the shelter.

How many are puppies? _____ puppies | 24. Carl has 200 songs on his MP3 player. Of these songs, 24 are country songs. What percent of Carl's songs are country songs? _____ |
| 25. Consumer Math The sales tax in the town where Amanda lives is 7%. Amanda paid \$35 in sales tax on a new stereo. What was the price of the stereo? _____ | 26. Financial Literacy Ashton is saving money to buy a new bike. He needs \$120 but has only saved 60% so far. How much more money does Ashton need to buy the scooter? _____ |
| 27. Consumer Math Monica paid sales tax of \$1.50 when she bought a new bike helmet. If the sales tax rate was 5%, how much did the store charge for the helmet before tax? _____ | |

28. Use the circle graph to determine how many hours per day Becky spends on each activity.

- School: _____ hours
 Eating: _____ hours
 Sleep: _____ hours
 Homework: _____ hours
 Free time: _____ hours





29. Multistep Marc ordered a rug. He gave a deposit of 30% of the cost and will pay the rest when the rug is delivered. If the deposit was \$75, how much more does Marc owe? Explain how you found your answer.

30. Earth Science Your weight on different planets is affected by gravity. An object that weighs 150 pounds on Earth weighs only 56.55 pounds on Mars. The same object weighs only 24.9 pounds on the Moon.

a. What percent of an object's Earth weight is its weight on Mars and on the Moon?

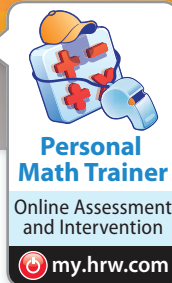
b. Suppose x represents an object's weight on Earth. Write two expressions: one that you can use to find the object's weight on Mars and another that you can use to write the object's weight on the Moon.

c. The space suit Neil Armstrong wore when he stepped on the Moon for the first time weighed about 180 pounds on Earth. How much did it weigh on the Moon?

d. What If? If you could travel to Jupiter, your weight would be 236.4% of your Earth weight. How much would Neil Armstrong's space suit weigh on Jupiter?

31. Explain the Error Your friend used the proportion $\frac{25}{100} = \frac{50}{?}$ to find 25% of 50 and says that the answer is 200. Explain why your friend is incorrect and find the correct answer.

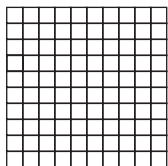
Ready to Go On?



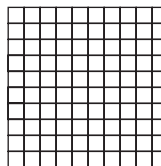
8.1 Understanding Percent

Shade the grid and write the equivalent percent for each fraction.

1. $\frac{19}{50}$ _____



2. $\frac{13}{20}$ _____



8.2 Percents, Fractions, and Decimals

Write each number in two equivalent forms.

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

4. 62.5% _____

5. 0.24 _____

6. $\frac{31}{50}$ _____

7. Selma spent $\frac{7}{10}$ of her allowance on a new backpack.
What percent of her allowance did she spend? _____

8.3 Solving Percent Problems

Complete each sentence.

8. 12 is 30% of _____.

9. 45% of 20 is _____.

10. 18 is _____ % of 30.

11. 56 is 80% of _____.

12. A pack of cinnamon-scented pencils sells for \$4.00. What is the sales tax rate if the total cost of the pencils is \$4.32? _____

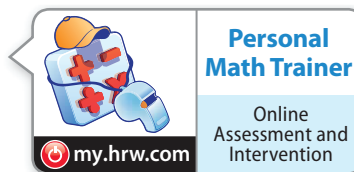


ESSENTIAL QUESTION

13. How can you solve problems involving percents?

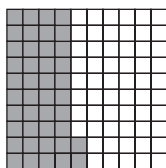


Assessment Readiness



Selected Response

1. What percent does this shaded grid represent?



- (A) 42%
(B) 48%
(C) 52%
(D) 58%
2. Which expression is **not** equal to one fourth of 52?
- (A) $0.25 \cdot 52$
(B) 4% of 52
(C) $52 \div 4$
(D) $\frac{52}{4}$
3. Approximately $\frac{4}{5}$ of U.S. homeowners have a cell phone. What percent of homeowners do **not** have a cell phone?
- (A) 20%
(B) 45%
(C) 55%
(D) 80%
4. The ratio of rock music to total CDs that Ella owns is $\frac{25}{40}$. Paolo has 50 rock music CDs. The ratio of rock music to total CDs in his collection is equivalent to the ratio of rock music to total CDs in Ella's collection. How many CDs do they own?
- (A) 65 (C) 120
(B) 80 (D) 130

5. Gabriel saves 40% of his monthly paycheck for college. He earned \$270 last month. How much money did Gabriel save for college?
- (A) \$96 (C) \$162
(B) \$108 (D) \$180
6. Forty children from an after-school club went to the matinee. This is 25% of the children in the club. How many children are in the club?
- (A) 10 (C) 200
(B) 160 (D) 900
7. Dominic answered 43 of the 50 questions on his spelling test correctly. Which decimal represents the fraction of problems he answered incorrectly?
- (A) 0.07 (C) 0.86
(B) 0.14 (D) 0.93

Mini-Task

8. Jen bought some sesame bagels and some plain bagels. The ratio of the number of sesame bagels to the number of plain bagels is 1 : 3.
- a. What fraction of the bagels are plain?
- _____
- b. What percent of the bagels are plain?
- _____
- c. If Jill bought 2 dozen bagels, how many of each type of bagel did she buy?
- _____