

### Solve & Discuss It!

Fran is shopping for a new pair of shoes. She did some research and has narrowed the options to the two pairs she likes the most. Based on buyers' reviews, which pair do you recommend that she buy? Explain your thinking.

Compare Styles



**19** OUT OF **25**  
positive reviews

Add to Cart



**99** OUT OF **132**  
positive reviews

Add to Cart

**Model with Math** How can you use what you know about ratios to compare the reviews?

#### Lesson 4-3

### Represent and Use the Percent Equation

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**I can...**  
represent and solve percent problems using equations.

**Focus on math practices**

**Model with Math** Describe another situation in which you could use ratios to make a decision.


### Essential Question

How are percent problems related to proportional reasoning?

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#### EXAMPLE 1 Find the Percent


In science class, students compared their vertical reach and height to see if they are proportional. Maria is 60 inches tall and can reach 75 inches high. What percent of her total vertical reach is her height?



Vertical Reach  
75 in.

Height  
60 in.

Use proportional reasoning to develop the **percent equation**.



$$\frac{\text{part}}{\text{whole}} = \frac{p}{100}$$

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

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

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

**Use Structure** The percent is a constant of proportionality that relates a part to the whole. The equation has the same form as  $y = mx$ .

The percent equation is **part = percent · whole**.

$$\text{height} = \text{percent} \cdot \text{vertical reach}$$

$$60 = p \cdot 75$$

$$\frac{60}{75} = \frac{p \cdot 75}{75}$$

$$0.80 = p$$

To represent a decimal as a percent, multiply by 100 and add the percent symbol.

Maria's height is 80% of her total vertical reach.

#### Try It!

An elephant weighs 15,000 pounds on Earth and 2,500 pounds on the Moon. Assuming the weights are proportional, what percent of its weight on Earth is its weight on the Moon?

**Convince Me!** How does the percent describe how the weights are related?

$$\square = p \cdot 15,000$$

$$\square = p \cdot 15,000$$

$$\square = \square$$

$$\square = p$$

The elephant's weight on the Moon is about  % of its weight on Earth.

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**EXAMPLE 2** Find the Part

Many states have a meal tax that is proportional to the total spent on food and beverages. In one state, the meal tax is 8.44%. How much tax will a customer pay if the food and beverages total \$54?

Tax (\$) **8.44%**

100%

Total food and beverage (\$) **54**

part = percent • whole  
 tax = percent • bill  
 $t = 8.44\% \cdot b$   
 $t = 0.0844 \cdot 54$   
 $t = 4.5576$

Use  $t$  for the tax and  $b$  for the food and beverages bill.

Express the percent as a decimal.

**Reasoning** What does 4.5576 mean in this situation?

The customer will pay \$4.56 in tax.

**EXAMPLE 3** Find the Whole

Jane earns a 5.5% commission on the selling price of each home she sells. She earned \$9,020 in commission on the sale of a home. What was the selling price of the home?

Commission (\$) **5.5%**

100%

Selling price (\$) **164,000**

part = percent • whole  
 $c = 5.5\% \cdot h$   
 $9,020 = 0.055h$   
 $\frac{9,020}{0.055} = \frac{0.055h}{0.055}$   
 $164,000 = h$


Use  $c$  for the commission and  $h$  for the selling price of the home.

**Be Precise** Instead of a salary, some workers earn a percent of the value of a transaction, called a *commission*.

Jane sold the home for \$164,000.

**Try It!**

To make a profit, a clothing store sells jeans at 15% of the amount they paid for them. How much did the store pay for the jeans shown?



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**KEY CONCEPT**

The percent equation shows how a percent relates proportional quantities. The percent is a constant of proportionality and the equation has the same form as  $y = mx$ .

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

part P% 100% whole

**"Part is % of Whole"**  
 $A = d \cdot W$   
 (Base) (Total)

**Do You Understand?**

- Essential Question** How are percent problems related to proportional reasoning?
- Reasoning** A waiter at a restaurant receives \$11 as a tip on a \$47.20 bill. He usually receives tips that are 20% of the total bill. Is the tip amount what the waiter typically receives? Explain.  
 $1.5 \times \frac{A}{1.5} = \frac{30}{100} \times \frac{1.5}{1}$
- Construct Arguments** Sara used an equation to solve the problem below. Justify each step of her work.  
 About 11% of people are left-handed. How many people would you expect to be left-handed in a class of 30 students?  
 $t = 0.11 \cdot 30$   
 $t = 3.3$   
 about 3 students

**Do You Know How?**

- An auto insurance company pays 12% commission to its agents for each new insurance policy they sell. How much commission does an agent make on a \$1,000 policy?  
 earnings = 12% of \$1,000  
 $= 12\% \times 1000 \rightarrow 12000$   
 $\$120$
- Curt and Melanie are mixing blue and yellow paint to make seafoam green paint. Use the percent equation to find how much yellow paint they should use.  
 $A = \% \cdot W$   
 $A = 30\% \cdot 1.5$   
 $A = 0.3 \cdot 1.5$   
 $\begin{array}{r} 1.5 \\ \times 0.3 \\ \hline 45 \end{array}$
- Bill paid \$35.99 in tax on a laptop that cost \$449.99. About what percent sales tax did Bill pay?  
 $A = 45$   
 $A = 0.45 \text{ qt}$

Name: \_\_\_\_\_

### Practice & Problem Solving

**Leveled Practice** In 7 and 8, solve each percent problem.

7. In a survey of 500 voters, 430 said they would vote for the same candidate again. What percent of the voters would vote the same way again?

part = percent · whole

$$\frac{430}{500} = \frac{P}{100}$$

$$\frac{430 \times 2}{500 \times 2} = \frac{P}{100}$$

$$\frac{860}{500} = \frac{P}{100}$$

$$1.72 = \frac{P}{100}$$

$$172\% = P$$

8. The local newspaper has letters to the editor from 40 people. If this number represents 5% of all of the newspaper's readers, how many readers,  $r$ , does the newspaper have?

part = percent · whole

$$40 = 5\% \cdot r$$

$$40 = 0.05 \cdot r$$

$$\frac{40}{0.05} = \frac{0.05 \cdot r}{0.05}$$

$$800 = r$$

9. **Make Sense and Persevere** What percent of the 16-gigabyte hard drive shown is used for photos?

Music	3.32 GB	Photos	Apps	Other	Free Space
16 GB					

$A = d \cdot w$

$$\frac{3.32}{16} = \frac{d}{100}$$

$$0.2075 = \frac{d}{100}$$

$$20.75\% = d$$

10. A shirt that normally costs \$30 is on sale for \$21.75. What percent of the regular price is the sale price?

11. Complete the table.

Earning Commission		
Sales	Commission Rate	Commission
\$768	4%	

12. Complete the table.

Sales Tax		
Selling Price	Tax Rate	Sales Tax
\$39.98	4.5%	

13. A restaurant automatically charges a 20% gratuity if a party has 6 or more people. How much gratuity is added to a party of 6 on a \$141 bill?

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14. **Make Sense and Persevere** A large university accepts 70% of the students who apply. Of the students the university accepts, 25% actually enroll. If 20,000 students apply, how many enroll?

15. **Model with Math** There are 4,000 books in the town's library. Of these, 2,600 are fiction. Write a percent equation that you can use to find the percent of the books that are fiction. Then solve your equation.

16. A salesperson earns 4% commission on furnace sales.

a. What is the commission that the salesperson earns on the sale of \$33,000 worth of furnaces?

b. Suppose the salesperson doubles his sales of furnaces. What would be true about the commission? Explain without using any calculations.

17. Heidi earns 3% commission on the jewelry she sells each week. Last week, she sold the pieces of jewelry shown.

a. How much did she make in commission?

b. **Reasoning** How much did the jewelry store take in from her sales? How do you know?

18. **Higher Order Thinking** In a company, 60% of the workers are men. If 1,380 women work for the company, how many workers are there in all? Show two different ways that you can solve this problem.

**Assessment Practice**

19. A salesperson works 40 hours per week at a job where he has two options for being paid. Option A is an hourly wage of \$19. Option B is a commission rate of 8% on weekly sales. How much does he need to sell in a given week to earn the same amount with each option?

20. At a real estate agency, an agent sold a house for \$382,000. The commission rate is 5.5% for the real estate agency. The commission for the agent is 30% of the amount the real estate agency gets.

**PART A**  
How much did the agency make on the house? Show your work.

**PART B**  
How much did the agent earn in commission? Explain.

**Handwritten Notes:**

For problem 14:  $A = d \cdot w$   
 $2600 = d \cdot \frac{4000}{100}$   
 $2600 = d \cdot 40$   
 $\frac{2600}{40} = \frac{d \cdot 40}{40}$   
 $65 = d$   
 65% of the library books are fiction.

For problem 16a:  $A = 4\% \times 33,000$   
 $A = 0.04 \times 33,000$   
 $A = 1,320$

For problem 18:  $A = d \cdot w$   
 $1380 = 40\% \cdot W$   
 $1380 = 0.4 \cdot W$   
 $\frac{1380}{0.4} = \frac{0.4 \cdot W}{0.4}$   
 $3450 = W$   
 The company employs a total of 3,450 people.

For problem 17:  $110 + 275 + 200 + 145 = 730$  total

$$17) \text{ Heidi's earnings} = 3\% \text{ of } \$730$$

$$A = d \cdot w$$

$\underbrace{0.03}$

$$A = 0.03 \cdot 730$$

$$A = \frac{730 \cdot 0.03}{1}$$
$$A = \$21.90$$

a) Heidi earns \$21.90 in commission selling \$730 in jewelry.

$$b) \begin{array}{r} \$730.00 \\ \quad 21.90 \\ \hline \$708.10 \end{array}$$

