# 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
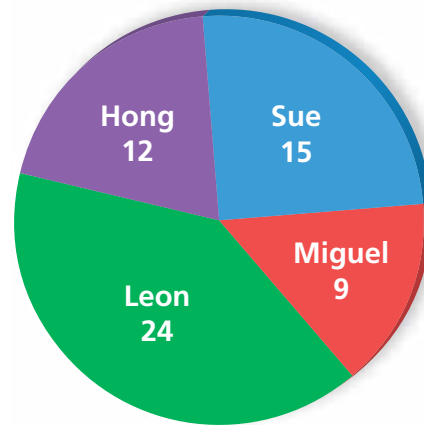
a. Complete the table.

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.
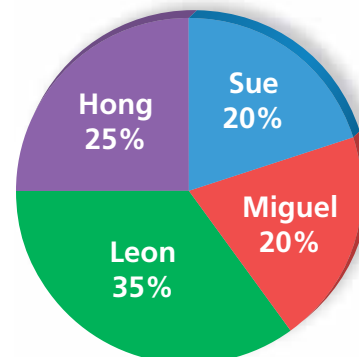
2 ACTIVITY: Finding Parts Using Different Methods

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.

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.

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

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

$$\text{part} = \boxed{} \cdot \boxed{}$$ Divide out common factors. This is the percent equation.

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?

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

Math Practice

Justify Conclusions

How can you justify the equations that you chose?

a. What number is 55% of 80?

$$a = 0.55 \cdot 80 \qquad a = \frac{11}{20} \cdot 80 \qquad 80a = 0.55 \qquad \frac{a}{80} = \frac{55}{100}$$

b. 24 is 60% of what number?

$$\frac{24}{w} = \frac{60}{100} \qquad 24 = 0.6 \cdot w \qquad \frac{24}{60} = w \qquad 24 = \frac{3}{5} \cdot w$$

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.
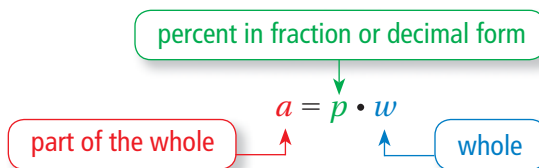
16 is what percent of 250?

Practice

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

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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
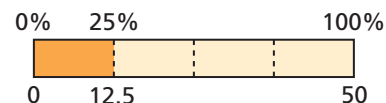
Common Error

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

$a = p \cdot w$ Write percent equation.

$= \dfrac{24}{100} \cdot 50$ Substitute $\dfrac{24}{100}$ for p and 50 for w.
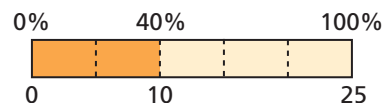
$= 12$ Simplify.

So, 12 is 24% of 50.   **Reasonable?** $12 \approx 12.5$ ✔

EXAMPLE 2   Finding a Percent

9.5 is what percent of 25?

Estimate   0%   40%   100%

0   10   25

$a = p \cdot w$ Write percent equation.

$9.5 = p \cdot 25$ Substitute 9.5 for a and 25 for w.

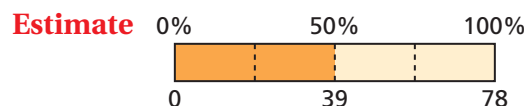$\dfrac{9.5}{25} = \dfrac{p \cdot 25}{25}$ Division Property of Equality

$0.38 = p$ 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?   **Estimate**

0%   50%   100%

0   39   78

$$a = p \cdot w$$ 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
Subtotal   29.15

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.
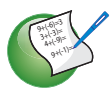
✓ Vocabulary and Concept Check

1. **VOCABULARY** Write the percent equation in words.

2. **REASONING** A number n is 150% of number m. Is n *greater than*, *less than*, or *equal to m*? Explain your reasoning.

3. **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.

4. What number is 24% of 80?

5. 15 is what percent of 40?

6. 15 is 30% of what number?

7. What number is 120% of 70?

8. 20 is what percent of 52?

9. 48 is 75% of what number?

Write and solve an equation to answer the question.

① 10. 20% of 150 is what number?

11. 45 is what percent of 60?

② 12. 35% of what number is 35?

13. 0.8% of 150 is what number?

③ 14. 29 is what percent of 20?

15. 0.5% of what number is 12?

16. What percent of 300 is 51?

17. 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?

✗
$a = p \cdot w$
$= 35 \cdot 20$
$= 700$

19. 30 is 60% of what number?

✗
$a = p \cdot w$
$= 0.6 \cdot 30$
$= 18$

20. **COMMISSION** A salesperson receives a 2.5% commission on sales. What commission does the salesperson receive for $8000 in sales?

21. **FUNDRAISING** Your school raised 125% of its fundraising goal. The school raised $6750. What was the goal?

22. **SURFBOARD** The sales tax on a surfboard is $12. What is the percent of sales tax?

SALE
$240

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

Other

40.0%

37.5%
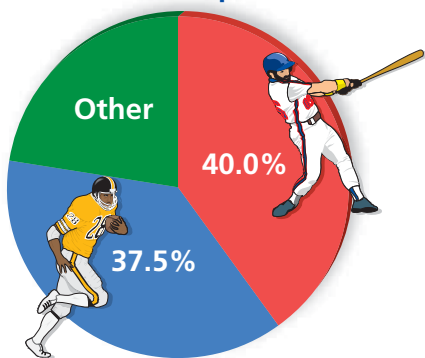
27. LOGIC How can you tell whether the percent of a number will be *greater than*, *less than*, or *equal to* the number? Give examples to support your answer.

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. $\dfrac{10 - 4}{10}$

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

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

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

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)*

Ⓐ $\dfrac{3}{8} = \dfrac{x}{160}$　　　Ⓑ $\dfrac{3}{5} = \dfrac{x}{160}$　　　Ⓒ $\dfrac{5}{8} = \dfrac{x}{160}$　　　Ⓓ $\dfrac{3}{5} = \dfrac{160}{x}$