

TOPIC
4

Review What You Know!

Vocabulary
Choose the best term from the box. Write it on the blank.

percent
proportion
rate
ratio

- A _____ is a ratio in which the first term is compared to 100.
- A ratio that relates two quantities with different units of measure is a _____.
- A statement that two ratios are equal is called a _____.
- The relationship "3 students out of 5 students" is an example of a _____.

Fractions, Decimals, and Percents

Write each number in two equivalent forms as a fraction, decimal, or percent.

5. 0.29 6. 35% 7. $\frac{2}{5}$

Proportions

Find the unknown number in each proportion.

8. $\frac{x \text{ days}}{4 \text{ years}} = \frac{365.25 \text{ days}}{1 \text{ year}}$ 9. $\frac{33,264 \text{ feet}}{x \text{ miles}} = \frac{5,280 \text{ feet}}{1 \text{ mile}}$

10. A cooking magazine shows a photo of a main dish on the front cover of 5 out of the 12 issues it publishes each year. Write and solve a proportion to determine how many times a photo of a main dish will be on the front cover during the next 5 years.

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Topic 4 Analyze and Solve Percent Problems 213

Solve & Discuss It!

ACTIVITY

Jaime's older brother and his three friends want to split the cost of lunch. They also want to leave a 15%–20% tip. How much should each person pay?

Reasoning Which line on the receipt will you use to calculate the tip?

Lesson 4-1

Analyze Percents of Numbers

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I can...
understand, find, and analyze percents of numbers.

Focus on math practices

Reasoning How would the amount each person pays change if the tip is determined before or after the bill is split?

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Essential Question How do percents show the relationship between quantities?

EXAMPLE 1 Find Percents of Numbers

Diego starts a 12-hour road trip with his phone's battery charge at 75%. Given his normal usage, will his phone last the whole trip? Explain.

Look for Relationships How many hours will the phone last when the battery charge is at 75%?

STEP 1 Draw a bar diagram and write equivalent ratios to represent the hours remaining and the battery charge.

$\frac{75}{100} = \frac{x}{15}$

STEP 2 Use the equivalent ratios to find 75% of 15.

$\frac{75}{100} = \frac{x}{15}$ Solve for x .

$\frac{75}{100} \cdot 15 = \frac{x}{15} \cdot 15$
 $11.25 = x$
 75% of 15 is 11.25 hours.
 The remaining battery life is 11.25 hours, so the phone will not last the whole 12-hour trip.

Try It!

Kita's phone had a fully charged battery. With normal usage, her phone will last 18 hours. How much time is left on Kita's phone battery with 12% charge remaining?

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

$\frac{\square}{100} \cdot \square = \frac{x}{\square} \cdot \square$

$\square = x$

Kita's phone battery has \square hours remaining.

Convince Me! Why is 51% of a number more than half of the number?

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EXAMPLE 2 Use Percents Greater than 100%

A full set of adult teeth includes 160% as many teeth as a full set of baby teeth. How many teeth are there in a full set of adult teeth?

Use the bar diagram to write equivalent ratios. Then solve for t to find the number of adult teeth.

$\frac{160}{100} = \frac{t}{20}$

$\frac{160}{100} \cdot 20 = \frac{t}{20} \cdot 20$
 $32 = t$

A full set of adult teeth includes 32 teeth.

20 BABY TEETH

Types of Baby Teeth

- 4 central incisors (A and F)
- 4 lateral incisors (B and G)
- 4 cuspids (C and H)
- 4 first molars (D and I)
- 4 second molars (E and J)

Adults have 160% as many teeth as babies.

EXAMPLE 3 Use Percents Less than 1%

What is the approximate distance in miles from Earth to the Moon?

STEP 1 Draw a bar diagram and write equivalent ratios.

$\frac{0.27}{100} = \frac{x}{93,000,000}$

STEP 2 Solve for x .

$\frac{0.27}{100} \cdot 93,000,000 = \frac{x}{93,000,000} \cdot 93,000,000$
 $251,100 = x$

The distance from Earth to the Moon is about 251,100 miles.

Check Your Answer Use compatible numbers to estimate the solution. 93,000,000 is approximately 100,000,000. 1% of 100,000,000 miles is 1,000,000 miles. 0.27% is about $\frac{1}{4}$ of 1%, so the distance is about $\frac{1}{4}$ of 1,000,000, or 250,000 miles.

Reasoning The exact distance is close to the estimated distance, so the answer is reasonable.

Try It!

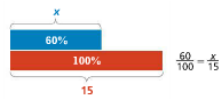
a. Find 0.08% of 720. b. Find 162.5% of 200. c. Find 0.3% of 60.

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KEY CONCEPT

A percent is one way to represent the relationship between two quantities, generally that of a part to the whole.



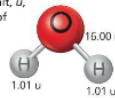
$$n\% = \frac{n}{100}$$

Do You Understand?

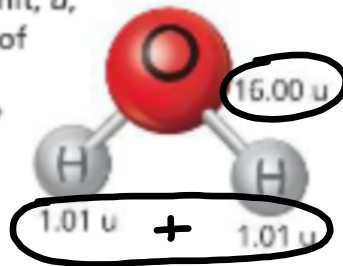
- Essential Question** How do percents show the relationship between quantities?
- Reasoning** How does a value that is greater than 100% of the original value or less than 1% of the original value compare to the original value?
- Construct Arguments** Gene stated that finding 25% of a number is the same as dividing the number by $\frac{1}{4}$. Is Gene correct? Explain.

Do You Know How?

- An 8-ounce serving of apples contains 8% of your daily vitamin C. How many ounces of apples would you need to get 100% of your daily vitamin C?
- Find the percent of each number.
 - 59% of 640
 - 0.20% of 3,542
 - 195% of 568
 - 74% of 920
- Water is 2 parts hydrogen and 1 part oxygen (H_2O). For one molecule of water, each atom has the atomic mass unit, u , shown. What percent of the mass of a water molecule is hydrogen?



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$$\frac{\text{hydrogen}}{\text{total (water)}} = \frac{1.01 + 1.01}{1.01 + 1.01 + 16} = \frac{2.02}{18.02}$$

$$= 0.1120976$$

$$\approx 11.2\%$$

$$\frac{\text{part}}{\text{total (whole)}} = \frac{\%}{100}$$

"part is % of whole"

Practice & Problem Solving

Leveled Practice In 7-8, fill in the boxes to solve.

7. A local Little League has 60 players, 80% of whom are right-handed. How many right-handed players are there?

$$\frac{x}{60} = \frac{80}{100}$$

$$x = \frac{4800}{100}$$

$$x = 48$$

right-handed players

8. Sandra's volleyball team has a total of 20 uniforms. 20% are medium-sized uniforms. How many uniforms are medium-sized?

$$\frac{x}{20} = \frac{20}{100}$$

$$x = \frac{400}{100}$$

$$x = 4$$

medium-sized uniforms

$$\frac{40}{10} = 4$$

9. Meg is a veterinarian. In a given week, 50% of the 16 dogs she saw were Boxers. Steve is also a veterinarian. In the same week, 7 of the 35 dogs he saw this week were Boxers. Each student record the part, the whole, and the percent.

a. Does Meg need to find the part, the whole, or the percent? **50%** **16**

b. Does Steve need to find the part, the whole, or the percent? **7** **35**

$$\frac{7}{35}$$

11. The registration fee for a used car is 0.8% of the sale price of \$5,700. How much is the fee?

12. The total cost of an item is the price plus the sales tax. Find the sales tax to complete the table. Then find the total cost of the item.

Sales Tax		
Selling Price	Rate of Sales Tax	Sales Tax
\$40.00	4%	

13. Is 700% of 5 less than 10, greater than 10 but less than 100, or greater than 100? Explain your reasoning.

14. Is 250% of 44 less than 100, greater than 100 but less than 150, or greater than 150? Explain your reasoning.

15. The seed and skin of a typical avocado is about 30%-40% of the avocado's weight. For an 8-ounce avocado, how many ounces of edible fruit does it have?

16. A new health drink has 130% of the recommended daily allowance (RDA) for a certain vitamin. The RDA for this vitamin is 45 mg. How many milligrams of the vitamin are in the drink?

$$75\% \text{ of } 125$$

$$75\% \times 125$$

$$93.75$$

17. Make Sense and Persevere 113 is 0.9% of what number? Tell which equivalent ratios you used to find the solution.

18. Without Arguments Brad says that if a second number is 125% of the first number then the first number must be $\frac{100}{125}$ of the second number. Is he correct? Justify your answer.

1st # $\rightarrow 100$

2nd # $\rightarrow 125\% \text{ of } 100$

$$125\% \times 100$$

$$125$$

19. Higher-Order Thinking Mark and Joe work as jewelers. Mark has an hourly wage of \$24 and gets overtime for every hour he works over 40 hours. The overtime pay rate is 150% of the normal rate. Joe makes 5% commission on all jewelry he sells. How much more money does Mark make in a week if Mark works 60 hours and Joe sells \$21,000 worth of jewelry? Explain.

Mark: Base pay = $\$24 \times 60 = \1440

OT (60-40=20) = $(\$24 \times 20) \times 150\% = \720

Assessment Practice

20. A forest covers 43,000 acres. A survey finds that 0.2% of the forest is old-growth trees. How many acres of old-growth trees are there?

$$\frac{150}{100} \times 1440$$

$$150 \times 14.4$$

$$2160$$

21. An Olympic-sized pool, which holds 660,000 gallons of water, is only 63% full. How many gallons of water are in the pool?

- 244,200
- 396,000
- 415,800
- 425,800

Joe

5% of \$21,000

$$5\% \times 21,000$$

$$\frac{5}{100} \times \frac{21000}{1}$$

$$\frac{1050}{1}$$

$$1050$$

$$\begin{array}{r} 2160 \\ - 1050 \\ \hline 1110 \end{array}$$

Mark makes \$1110 more during the week than Joe since he earns time and a half for the 20 hours of overtime.

