

# Ratios and Rates



## Getting the Idea

A **ratio** is a comparison of two numbers. Ratios can be written to compare a part to a part, a part to the whole, or the whole to a part. Each number in a ratio is called a **term**.

You can write a ratio in three ways:

1. in words                      5 to 6
2. as a fraction                 $\frac{5}{6}$
3. using a colon                5:6

## Example 1

For a certain shade of green paint, the paint store mixes 3 parts blue paint to 2 parts yellow paint. What is the ratio of blue paint to yellow paint?

**Strategy**      **Compare the number of blue parts to the number of yellow parts.**

**Step 1**      Break down the paint mix.

$$\text{blue} = 3$$

$$\text{yellow} = 2$$

**Step 2**      Write the ratio of blue to yellow three ways.

$$\text{In words} \quad 3 \text{ to } 2$$

$$\text{As a fraction} \quad \frac{3}{2}$$

$$\text{With a colon} \quad 3:2$$

**Solution**      **The ratio of blue paint to yellow paint is 3 to 2,  $\frac{3}{2}$ , or 3:2.**

A **rate** is a ratio that compares two quantities that have different units of measure.

A **unit rate** is a rate in which the second quantity in the comparison is 1 unit.

## Example 2

Lazlo built 30 toy airplanes in 5 hours. What was his unit rate for building the airplanes?

**Strategy**      **Divide to find the unit rate.**

**Step 1**      Write the rate as a fraction.

$$\frac{30 \text{ airplanes}}{5 \text{ hours}}$$

**Step 2**

Divide to find the unit rate.

$$30 \div 5 = 6$$

**Solution** Lazlo's unit rate was 6 toy airplanes per hour.**Example 3**

Jen works for a florist. She worked 15 hours last week and earned \$112.50. At that rate, how much will she earn if she works for 10 hours?

**Strategy** Find the unit rate. Then multiply.**Step 1**

Write the rate as a fraction.

$$\frac{\$112.50}{15 \text{ hours}}$$

**Step 2**

Divide to find the unit rate.

$$112.50 \div 15 = 7.5$$

Jen earns \$7.50 per hour.

**Step 3**

Multiply the unit rate by 10 hours.

$$\$7.50 \text{ per hour} \times 10 \text{ hours} = \$75.00$$

**Solution** Jen will earn \$75.00 if she works 10 hours.**Example 4**

One lap around the path in a park is  $\frac{1}{3}$  mile. It takes Andy  $\frac{1}{9}$  hour to walk one lap. What is Andy's unit rate around the park?

**Strategy** Find the unit rate.**Step 1**

Write the rate as a fraction.

In this case, it will be a complex fraction.

$$\frac{\frac{1}{3} \text{ mi}}{\frac{1}{9} \text{ hr}}$$

**Step 2**

Simplify the complex fraction.

Rewrite the fraction as division.

$$\frac{\frac{1}{3}}{\frac{1}{9}} = \frac{1}{3} \div \frac{1}{9}$$

**Step 3**

Divide to find the unit rate.

Multiply by the reciprocal and simplify.

$$\frac{1}{3} \div \frac{1}{9} = \frac{1}{3} \times \frac{9}{1} = \frac{1 \times 9}{3 \times 1} = \frac{9}{3} = 3$$

**Solution** Andy's unit rate is 3 miles per hour.

## Example 5

Holly's room is 12 feet long by 9 feet wide. The carpet she wants to put in the room costs \$4.50 per square foot. How much will it cost to carpet Holly's room?

**Strategy**     **Multiply the area by the unit rate.**

**Step 1**

Find the area of the room.

Use the formula for the area of a rectangle:  $\text{Area} = \text{length} \times \text{width}$ .

$$A = \text{length} \times \text{width}$$

$$= 12 \text{ ft} \times 9 \text{ ft} = 108 \text{ sq ft}$$

**Step 2**

Multiply the area by the unit rate.

$$108 \times \$4.50 = \$486.00$$

**Solution**     **It will cost \$486.00 to carpet Holly's room.**



### Coached Example

**If 5 tomatoes cost \$2.00, what is the unit price of the tomatoes? How much will a dozen tomatoes cost?**

Write a ratio that compares the total cost to the number of tomatoes. \_\_\_\_\_

Divide to find the unit price. \_\_\_\_\_

To find the cost of a dozen tomatoes, multiply the unit price by \_\_\_\_\_.

$$\text{_____} \times \text{_____} = \text{_____}$$

**The unit price of the tomatoes is \_\_\_\_\_ per tomato.**

**One dozen tomatoes will cost \$\_\_\_\_\_.**



## Lesson Practice

Choose the correct answer.

- The cost of a tent rental is \$160 for 5 days. At this rate, how much does it cost to rent the tent for one day?
  - \$25
  - \$30
  - \$32
  - \$35
- There are 3 counselors for every 45 students enrolled in a camp. What is the maximum number of students allowed if there are 10 counselors?
  - 15
  - 135
  - 150
  - 300
- A recipe for rice pudding calls for  $2\frac{1}{2}$  cups of milk. The recipe makes 5 servings. How many cups of milk are needed to make 8 servings?
  - $3\frac{1}{2}$  cups
  - 4 cups
  - $4\frac{1}{2}$  cups
  - $7\frac{1}{2}$  cups
- Camille bought 3 pounds of nuts for \$10.35. What is the unit price per pound?
  - \$3.45
  - \$4.65
  - \$6.65
  - \$7.35
- Derek's car averages 30 miles per gallon. Which is closest to the amount of gas he will use traveling 454.5 miles?
  - 10 gallons
  - 12 gallons
  - 13 gallons
  - 15 gallons
- Ms. Carson drove 96 miles in 1.5 hours. What was her speed in miles per hour?
  - 48 miles per hour
  - 54 miles per hour
  - 64 miles per hour
  - 144 miles per hour

7. Which of the following shows the least expensive unit price?

- A. 3 oranges for \$1.02
- B. 4 oranges for \$1.52
- C. 5 oranges for \$1.75
- D. 6 oranges for \$2.46

8. It takes Eduardo  $\frac{1}{20}$  hour to run  $\frac{1}{4}$  mile. What is Eduardo's unit rate, in miles per hour, when he runs?

- A. 3 miles per hour
- B. 4 miles per hour
- C. 5 miles per hour
- D. 6 miles per hour

9. Whitney earns \$206.25 for 25 hours of work.

A. How much does Whitney earn per hour? Show your work.

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B. At this rate, how much will Whitney earn in 30 hours? Show your work.

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10. It rained 15 millimeters in 12 hours. Select True or False for each statement.

- A. The unit rate is  $1\frac{1}{4}$  millimeters of rain per hour.  True  False
- B. The ratio of millimeters of rain to hours of rain is 5:4.  True  False
- C. At the same rate, it would take 8 hours to rain 10 millimeters.  True  False
- D. At the same rate, it would rain 36 millimeters in 45 hours.  True  False

11. Eighty people can ride on a certain Ferris wheel in 20 minutes. Circle the number that makes the statement true.

At that rate, 

160
240
320

 people can ride the Ferris wheel in 1 hour.

12. A recipe uses  $\frac{1}{2}$  cup of flour for every  $\frac{1}{4}$  cup of sugar. Which is a true statement? Circle all that apply.
- A. The unit rate of flour to sugar is 1 to 2.
  - B. The unit rate of flour to sugar is 2 to 1.
  - C. If you used 12 cups of flour, you used 24 cups of sugar.
  - D. If you used 6 cups of sugar, you used 12 cups of flour.
  - E. If you had 6 cups of sugar and used 20 cups of flour, you would need 4 more cups of sugar.

13. A bakery makes 500 bagels in 3 hours. Write each number in the correct box.

1,000	1,200	1,400	835	900	1,150
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Number of Bagels Made in Less Than 7 Hours	Number of Bagels Made in More Than 7 Hours

14. At the grocery store, 5 pounds of apples costs \$4.60. At the same rate, could you buy each given number of pounds of apples for the stated price? Select Yes or No.

- A. 6 pounds for \$5.52      Yes    No
- B. 3 pounds for \$2.76      Yes    No
- C. 8 pounds for \$7.39      Yes    No
- D. 2 pounds for \$1.80      Yes    No
- E. 9 pounds for \$8.28      Yes    No

15. Edward drove 434 miles in 7 hours. Use numbers from the box to complete each statement.

At the same rate, Edward would drive \_\_\_\_\_ miles in 3 hours.

At the same rate, Edward would drive 558 miles in \_\_\_\_\_ hours.

At the same rate, Edward would drive \_\_\_\_\_ miles in \_\_\_\_\_ hours.

4	186
8	248
9	310

16. Draw a line from each sentence to its unit rate.

- A. Darlene ran  $\frac{1}{2}$  mile in  $\frac{1}{10}$  hour.     ●     ● 5.5 to 1
- B. Hector made 22 necklaces in 4 hours.     ●     ● 5 to 1
- C. Lucas paid \$82.50 for 5 shirts.     ●     ● 15.5 to 1
- D. Karen drove 403 miles using 26 gallons of gas.     ●     ● 16.5 to 1