

# Representing Ratios and Rates

MODULE



# 6



## ESSENTIAL QUESTION

How can you use ratios and rates to solve real-world problems?



LESSON 6.1

### Ratios



6.RP.1, 6.RP.3,  
6.RP.3a

LESSON 6.2

### Rates



6.RP.2, 6.RP.3,  
6.RP.3b

LESSON 6.3

### Using Ratios and Rates to Solve Problems



6.RP.3, 6.RP.3a



### Real-World Video

Scientists studying sand structures determined that the perfect sand and water mixture is equal to 1 bucket of water for every 100 buckets of sand. This recipe can be written as the ratio  $\frac{1}{100}$ .

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# Are YOU Ready?

Complete these exercises to review skills you will need for this module.



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## Simplify Fractions

**EXAMPLE** Simplify  $\frac{15}{24}$ .

15: 1, ③, 5, 15  
24: 1, 2, ③, 4, 6, 8, 12, 24

$$\frac{15 \div 3}{24 \div 3} = \frac{5}{8}$$

List all the factors of the numerator and denominator.

Circle the greatest common factor (GCF).

Divide the numerator and denominator by the GCF.

Write each fraction in simplest form.

1.  $\frac{6}{9}$  \_\_\_\_\_

2.  $\frac{4}{10}$  \_\_\_\_\_

3.  $\frac{15}{20}$  \_\_\_\_\_

4.  $\frac{20}{24}$  \_\_\_\_\_

5.  $\frac{16}{56}$  \_\_\_\_\_

6.  $\frac{45}{72}$  \_\_\_\_\_

7.  $\frac{18}{60}$  \_\_\_\_\_

8.  $\frac{32}{72}$  \_\_\_\_\_

## Write Equivalent Fractions

**EXAMPLE**  $\frac{6}{8} = \frac{6 \times 2}{8 \times 2}$   
 $= \frac{12}{16}$

$\frac{6}{8} = \frac{6 \div 2}{8 \div 2}$   
 $= \frac{3}{4}$

Multiply the numerator and denominator by the same number to find an equivalent fraction.

Divide the numerator and denominator by the same number to find an equivalent fraction.

Write the equivalent fraction.

9.  $\frac{12}{15} = \frac{\square}{5}$

10.  $\frac{5}{6} = \frac{\square}{30}$

11.  $\frac{16}{24} = \frac{4}{\square}$

12.  $\frac{3}{9} = \frac{21}{\square}$

13.  $\frac{15}{40} = \frac{\square}{8}$

14.  $\frac{18}{30} = \frac{\square}{10}$

15.  $\frac{48}{64} = \frac{12}{\square}$

16.  $\frac{2}{7} = \frac{18}{\square}$

# Reading Start-Up

## Visualize Vocabulary

Use the ✓ words to complete the chart. Choose the review words that describe multiplication and division.

Understanding Multiplication and Division		
Symbol	Operation	Term for the answer
×		
÷		

## Understand Vocabulary

Match the term on the left to the definition on the right.

- |                      |   |
|----------------------|---|
| 1. rate              | A. Rate in which the second quantity is one unit.     |
| 2. ratio             | B. Comparison of two quantities by division.          |
| 3. unit rate         | C. Ratios that name the same comparison.              |
| 4. equivalent ratios | D. Ratio of two quantities that have different units. |

## Vocabulary

### Review Words

- colon (*dos puntos*)
- denominator (*denominador*)
- ✓ divide (*dividir*)
- fraction bar (*barra de fracciones*)
- ✓ multiply (*multiplicar*)
- numerator (*numerador*)
- ✓ product (*producto*)
- quantity (*cantidad*)
- ✓ quotient (*cociente*)
- term (*término*)

### Preview Words

- equivalent ratios (*razones equivalentes*)
- rate (*tasa*)
- ratio (*razón*)
- unit rate (*tasa unitaria*)

## Active Reading

**Two-Panel Flip Chart** Create a two-panel flip chart, to help you understand the concepts in this module. Label one flap "Ratios" and the other flap "Rates." As you study each lesson, write important ideas under the appropriate flap. Include information about unit rates and any sample equations that will help you remember the concepts when you look back at your notes.





# 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.3

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

**Key Vocabulary****ratio** (*razón*)

A comparison of two quantities by division.

**rate** (*tasa*)

A ratio that compares two quantities measured in different units.

**equivalent ratios** (*razones equivalentes*)

Ratios that name the same comparison.

## What It Means to You

You will use equivalent ratios to solve real-world problems involving ratios and rates.

**UNPACKING EXAMPLE 6.RP.3**

A group of 10 friends is in line to see a movie. The table shows how much different groups will pay in all. Predict how much the group of 10 will pay.

<b>Number in group</b>	3	5	6	12
<b>Amount paid (\$)</b>	15	25	30	60

The ratios are all the same.

$$\frac{3}{15} = \frac{1}{5} \quad \frac{6}{30} = \frac{1}{5} \quad \frac{5}{25} = \frac{1}{5} \quad \frac{12}{60} = \frac{1}{5}$$

Find the denominator that gives a ratio equivalent to  $\frac{1}{5}$  for a group of 10.

$$\frac{10}{?} = \frac{1}{5} \quad \rightarrow \quad \frac{10 \div 10}{50 \div 10} = \frac{1}{5} \quad \rightarrow \quad \frac{10}{50} = \frac{1}{5}$$

A group of 10 will pay \$50.

**COMMON CORE** 6.RP.3b

Solve unit rate problems including those involving unit pricing and constant speed.

**Key Vocabulary****unit rate** (*tasa unitaria*)

A rate in which the second quantity in the comparison is one unit.

## What It Means to You

You will solve problems involving unit rates by division.

**UNPACKING EXAMPLE 6.RP.3b**

A 2-liter bottle of spring water costs \$2.02. A 3-liter bottle of the same water costs \$2.79. Which is the better deal?

**2-liter bottle**

$$\frac{\$2.02}{2 \text{ liters}}$$

$$\frac{\$2.02 \div 2}{2 \text{ liters} \div 2}$$

$$\frac{\$1.01}{1 \text{ liter}}$$

**3-liter bottle**

$$\frac{\$2.79}{3 \text{ liters}}$$

$$\frac{\$2.79 \div 3}{3 \text{ liters} \div 3}$$

$$\frac{\$0.93}{1 \text{ liter}}$$

The 3-liter bottle is the better deal.



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# 6.1 Ratios

Understand the concept of a ratio and use ratio language to describe a relationship between two quantities. Also 6.RP.3, 6.RP.3a



ESSENTIAL QUESTION

How do you use ratios to compare two quantities?

EXPLORE ACTIVITY



## Representing Ratios with Models

A **ratio** is a comparison of two quantities. It shows how many times as great one quantity is than another.



For example, the ratio of star-shaped beads to moon-shaped beads in a bracelet is 3 to 1.

- A** Write the ratio of moon beads to star beads.
- B** Write the ratio of moon beads to all the beads.
- C** If the bracelet has 2 moon beads, how many star beads does it have?
- D** If the bracelet has 9 star beads, how many moon beads does it have? How do you know?

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**Reflect**

- 1. Make a Prediction** Write a rule that you can use to find the number of star beads in a bracelet when you know the number of moon beads. Then write a rule that you can use to find the number of moon beads when you know the number of star beads.
- 2. Make a Prediction** Write a rule that you can use to find the total number of beads in a bracelet when you know the number of moon beads.

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# Writing Ratios

The numbers in a ratio are called *terms*. A ratio can be written in several different ways.

5 dogs to 3 cats

5 to 3

5:3

$\frac{5}{3}$

A ratio can compare a part to a part, a part to the whole, or the whole to a part.

## EXAMPLE 1



COMMON CORE

6.RP.1

### Math Talk

#### Mathematical Practices

What is the ratio of videos that are dramas to videos that are not dramas? Is this a part to part or part to whole ratio?

- A** Write the ratio of comedies to dramas in three different ways.

part to part

8:3      $\frac{8}{3}$      8 comedies to 3 dramas

- B** Write the ratio of dramas to total videos in three different ways.

part to whole

3:14      $\frac{3}{14}$      3 dramas to 14 total videos

	Comedies	8
	Dramas	3
	Cartoons	2
	Science Fiction	1

The total number of videos is  $8 + 3 + 2 + 1 = 14$ .

### Reflect

3. **Analyze Relationships** Describe the relationship between the drama videos and the science fiction videos.

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4. **Analyze Relationships** The ratio of floor seats to balcony seats in a theater is 20:1. Does this theater have more floor seats or more balcony seats? How do you know?

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### YOUR TURN

Write each ratio in three different ways.

5. bagel chips to peanuts \_\_\_\_\_

6. total party mix to pretzels \_\_\_\_\_

7. cheese crackers to peanuts \_\_\_\_\_

#### Party Mix Makes 8 cups

3 cups pretzels

3 cups bagel chips

1 cup cheese crackers

1 cup peanuts



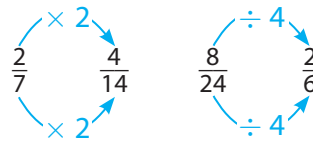
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# Equivalent Ratios

**Equivalent ratios** are ratios that name the same comparison. You can find equivalent ratios by using a table or by multiplying or dividing both terms of a ratio by the same number. So, equivalent ratios have a multiplicative relationship.



A ratio with terms that have no common factors is said to be in simplest form.

## EXAMPLE 2



COMMON CORE

6.RP.3, 6.RP.3a

My Notes

**You make 5 cups of punch by mixing 3 cups of cranberry juice with 2 cups of apple juice. How much cranberry juice and how much apple juice do you need to make four times the original recipe?**

**Method 1** Use a table.

**STEP 1** Make a table comparing the number of cups of cranberry juice and apple juice needed to make two times, three times, and four times the original recipe.

Multiply both terms of the original ratio by the same number to find an equivalent ratio.

		$3 \times 2$	$3 \times 3$	$3 \times 4$
		↓	↓	↓
<b>Cranberry Juice</b>	3	6	9	12
<b>Apple Juice</b>	2	4	6	8
		↑	↑	↑
		$2 \times 2$	$2 \times 3$	$2 \times 4$

**STEP 2** Write the original ratio and the ratio that shows the amount of cranberry juice and apple juice needed to make four times the original recipe.

$$\frac{3}{2} = \frac{12}{8}$$

You will need 12 cups of cranberry juice and 8 cups of apple juice.

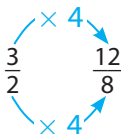
**Method 2** Multiply both terms of the ratio by the same number.

**STEP 1** Write the original ratio in fraction form.

$$\frac{3}{2}$$

**STEP 2** Multiply the numerator and denominator by the same number.

To make four times the original recipe, multiply by 4.



To make four times the original recipe, you will need 12 cups of cranberry juice and 8 cups of apple juice.

### Math Talk

#### Mathematical Practices

The ratio of apple juice to grape juice in a recipe is 8 cups to 10 cups. What is this ratio in simplest form? Explain.

## YOUR TURN

Write three ratios equivalent to the given ratio.

8.  $\frac{8}{10}$  \_\_\_\_\_

9.  $\frac{5}{2}$  \_\_\_\_\_

## Guided Practice

The number of dogs compared to the number of cats in an apartment complex is represented by the model shown. (Explore Activity)

1. Write a ratio that compares the number of dogs to the number of cats. \_\_\_\_\_



2. If there are 15 cats in the apartment complex, how many dogs are there?



$15 \div$  \_\_\_\_\_  $=$  \_\_\_\_\_ dogs

3. How many cats are there if there are 5 dogs in the apartment complex?

$5 \times$  \_\_\_\_\_  $=$  \_\_\_\_\_ cats

4. The only pets in the apartment complex are cats and dogs. If there are 10 dogs, how many *pets* are there? \_\_\_\_\_

The contents of Dana's box of muffins are shown. Write each ratio in three different ways. (Example 1)

5. banana nut muffins to corn muffins \_\_\_\_\_

6. corn muffins to total muffins \_\_\_\_\_

### Dana's Dozen Muffins

5 corn

4 bran

2 banana nut

1 blueberry

**Vocabulary** Write three equivalent ratios for the given ratio.

Circle the simplest form of the ratio. (Example 2)

7.  $\frac{10}{12}$  \_\_\_\_\_

8.  $\frac{14}{2}$  \_\_\_\_\_

9.  $\frac{4}{7}$  \_\_\_\_\_



## ESSENTIAL QUESTION CHECK-IN

10. Use an example to describe the multiplicative relationship between two equivalent ratios.


\_\_\_\_\_

\_\_\_\_\_



# 6.1 Independent Practice

**COMMON CORE** 6.RP.1, 6.RP.3, 6.RP.3a



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**Write three ratios equivalent to the ratio described in each situation.**

**11.** The ratio of cups of water to cups of milk in a recipe is 1 to 3.

\_\_\_\_\_

**12.** The ratio of boys to girls on the bus is  $\frac{20}{15}$ .

\_\_\_\_\_

**13.** In each bouquet of flowers, there are 4 roses and 6 white carnations. Complete the table to find how many roses and carnations there are in 4 bouquets of flowers.

<b>Roses</b>	4				
<b>Carnations</b>	6				

\_\_\_\_\_

**14.** Ed is using the recipe shown to make fruit salad. He wants to use 30 diced strawberries in his fruit salad. How many bananas, apples, and pears should Ed use in his fruit salad?

\_\_\_\_\_

<b>Fruit Salad Recipe</b>
4 bananas, diced
3 apples, diced
6 pears, diced
10 strawberries, diced

**15.** A collector has 120 movie posters and 100 band posters. She wants to sell 24 movie posters but still have her poster collection maintain the same ratio of 120:100. If she sells 24 movie posters, how many band posters should she sell? Explain.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**16.** Bob needs to mix 2 cups of orange juice concentrate with 3.5 cups of water to make orange juice. Bob has 6 cups of concentrate. How much orange juice can he make?

\_\_\_\_\_

**17. Multistep** The ratio of North American butterflies to South American butterflies at a butterfly park is 5:3. The ratio of South American butterflies to European butterflies is 3:2. There are 30 North American butterflies at the butterfly park.

**a.** How many South American butterflies are there?

\_\_\_\_\_

**b.** How many European butterflies are there?

\_\_\_\_\_

18. Sinea and Ren are going to the carnival next week. The table shows the amount that each person spent on snacks, games, and souvenirs the last time they went to the carnival.

	Snacks	Games	Souvenirs
Sinea	\$5	\$8	\$12
Ren	\$10	\$8	\$20

- a. Sinea wants to spend money using the same ratios as on her last trip to the carnival. If she spends \$26 on games, how much will she spend on souvenirs? \_\_\_\_\_
- b. Ren wants to spend money using the same ratios as on his last trip to the carnival. If he spends \$5 on souvenirs, how much will he spend on snacks? \_\_\_\_\_
- c. **What If?** Suppose Sinea and Ren each spend \$40 on snacks, and each person spends money using the same ratios as on their last trip. Who spends more on souvenirs? Explain.

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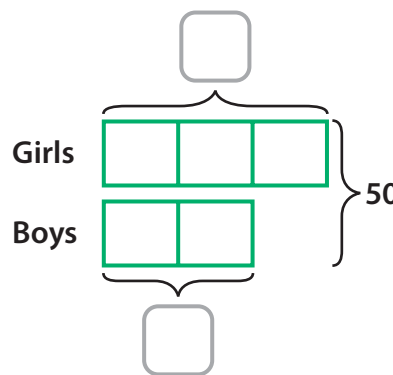


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**FOCUS ON HIGHER ORDER THINKING**

19. **Multiple Representations** The diagram compares the ratio of girls in the chorus to boys in the chorus. What is the ratio of girls to boys? If there are 50 students in the chorus, how many are girls and how many are boys?



20. **Analyze Relationships** How is the process of finding equivalent ratios like the process of finding equivalent fractions?

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21. **Explain the Error** Tina says that 6:8 is equivalent to 36:64. What did Tina do wrong?

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Work Area

Understand the concept of a unit rate  $a/b$  associated with a ratio  $a:b$  with  $b \neq 0$ , and use rate language. ... Also 6.RP.3, 6.RP.3b



ESSENTIAL QUESTION

How do you use rates to compare quantities?

EXPLORE ACTIVITY



## Using Rates to Compare Prices

A **rate** is a comparison of two quantities that have different units.

Chris drove 107 miles in two hours. This can be expressed as the rate shown at the right. Notice that the units are different: **miles** and **hours**.

The rate is  $\frac{107 \text{ miles}}{2 \text{ hours}}$ .

**Shana is at the grocery store comparing two brands of juice. Brand A costs \$3.84 for a 16-ounce bottle. Brand B costs \$4.50 for a 25-ounce bottle.**

To compare the costs, Shana must compare prices for equal amounts of juice. How can she do this?

**A** Complete the tables.

Brand A	
Ounces	Price (\$)
16	3.84
8	1.92
4	
2	
1	

Brand B	
Ounces	Price (\$)
25	4.50
5	
1	

**B** Brand A costs \$ \_\_\_\_\_ per ounce. Brand B costs \$ \_\_\_\_\_ per ounce.

**C** Which brand is the better buy? Why? \_\_\_\_\_

### Reflect

1. **Analyze Relationships** Describe another method to compare the costs.

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# Calculating Unit Rates

A **unit rate** is a rate in which the second quantity is one unit. When the first quantity in a unit rate is an amount of money, the unit rate is sometimes called a *unit price* or *unit cost*.

## EXAMPLE 1



COMMON CORE

6.RP.2

### Yoga Classes

This month's special:

6 classes for \$90



The first quantity in a unit rate can be less than 1.

- A** Gerald pays \$90 for 6 yoga classes. What is the cost per class?

Use the information in the problem to write a rate:  $\frac{\$90}{6 \text{ classes}}$

To find the unit rate, divide both quantities in the rate by the same number so that the second quantity is 1.

Gerald's yoga classes cost \$15 per class.

$$\frac{\$90}{6 \text{ classes}} = \frac{\$15}{1 \text{ class}}$$

- B** The cost of 2 cartons of milk is \$5.50. What is the unit price?

The unit price is \$2.75 per carton of milk.

$$\frac{\$5.50}{2 \text{ cartons}} = \frac{\$2.75}{1 \text{ carton}}$$

- C** A cruise ship travels 20 miles in 50 minutes. How far does the ship travel per minute?

The ship travels 0.4 mile per minute.

$$\frac{20 \text{ miles}}{50 \text{ minutes}} = \frac{0.4 \text{ mile}}{1 \text{ minute}}$$

### Reflect

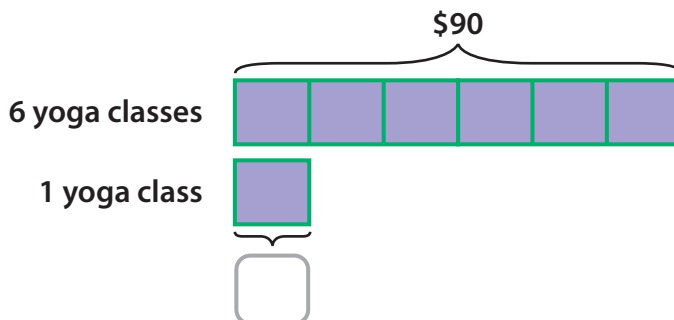
2. **Multiple Representations** Explain how you could use a diagram like the one shown below to find the unit rate in **A**. Then complete the diagram to find the unit rate.

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## YOUR TURN

3. There are 156 players on 13 teams. How many players are on each team? \_\_\_\_\_ players per team

## Problem Solving with Unit Rates

You can solve rate problems by using a unit rate or by using equivalent rates.

### EXAMPLE 2



COMMON CORE

6.RP.3, 6.RP.3b

**At a summer camp, the campers are divided into groups. Each group has 16 campers and 2 cabins. How many cabins are needed for 112 campers?**

**Method 1** Find the unit rate. How many campers per cabin?

$$\frac{16 \text{ campers}}{2 \text{ cabins}} = \frac{8 \text{ campers}}{1 \text{ cabin}}$$

Divide to find the unit rate.

There are 8 campers per cabin.

$$\frac{112 \text{ campers}}{8 \text{ campers per cabin}} = 14 \text{ cabins}$$

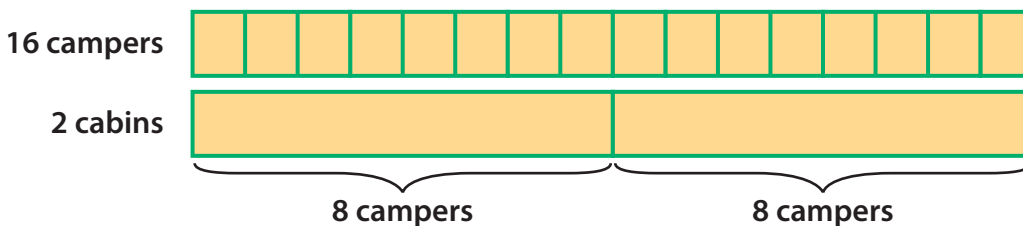
Divide to find the number of cabins.

**Method 2** Use equivalent rates.

$$\frac{16 \text{ campers}}{2 \text{ cabins}} = \frac{112 \text{ campers}}{14 \text{ cabins}}$$

The camp needs 14 cabins.

**Check** Use a diagram to check the unit rate if there are 16 campers in 2 cabins. Then, use the unit rate to check if 14 cabins is a reasonable number for 112 campers.



The unit rate of 8 campers per cabin is reasonable. You can multiply 14 cabins by 8 campers per cabin to find that there would be enough room for 112 campers.



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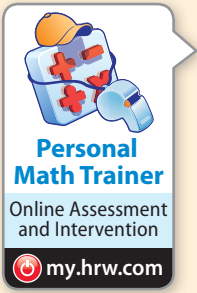
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**YOUR TURN**

4. Petra jogs 3 miles in 27 minutes. At this rate, how long would it take her to jog 5 miles? Show your work.

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**Guided Practice**

Mason's favorite brand of peanut butter is available in two sizes. Each size and its price are shown in the table. Use the table for 1 and 2. (Explore Activity)

1. What is the unit rate for each size of peanut butter?

Regular: \$ \_\_\_\_\_ per ounce

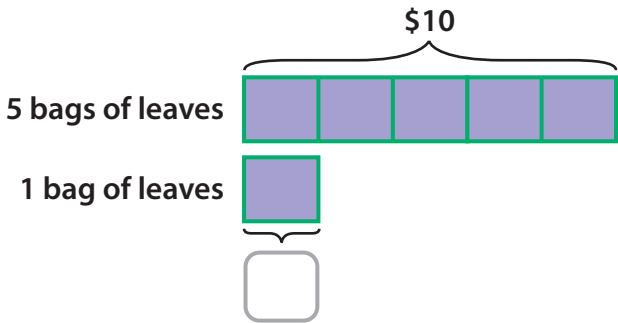
Family size: \$ \_\_\_\_\_ per ounce

	Size (oz)	Price (\$)
Regular	16	3.36
Family Size	40	7.60

2. Which size is the better buy? \_\_\_\_\_

3. Martin charges \$10 for every 5 bags of leaves he rakes. Last weekend, he raked 24 bags of leaves. How much money did he earn? (Example 1)

\_\_\_\_\_ for 24 bags of leaves



Find the unit rate. (Example 1)

4. Lisa walked 48 blocks in 3 hours.

\_\_\_\_\_ blocks per hour

5. Gordon types 1,800 words in 25 minutes.

\_\_\_\_\_ words per minute

6. A particular frozen yogurt has 75 calories in 2 ounces. How many calories are in 8 ounces of the yogurt? (Example 2)

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7. The cost of 10 oranges is \$1. What is the cost of 5 dozen oranges? (Example 2)

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**ESSENTIAL QUESTION CHECK-IN**

8. How can you use a rate to compare the costs of two boxes of cereal that are different sizes?

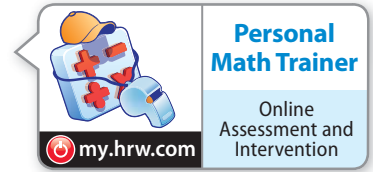
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# 6.2 Independent Practice

**COMMON CORE** 6.RP.2, 6.RP.3, 6.RP.3b



Taryn and Alastair both mow lawns. Each charges a flat fee to mow a lawn. The table shows the number of lawns mowed in the past week, the time spent mowing lawns, and the money earned.

	Number of Lawns Mowed	Time Spent Mowing Lawns (in hours)	Money Earned
Taryn	9	7.5	\$112.50
Alastair	7	5	\$122.50

9. How much does Taryn charge to mow a lawn? \_\_\_\_\_
10. How much does Alastair charge to mow a lawn? \_\_\_\_\_
11. Who earns more per hour, Taryn or Alastair? \_\_\_\_\_
12. **What If?** If Taryn and Alastair want to earn an additional \$735 each, how many additional hours will each spend mowing lawns? Explain.

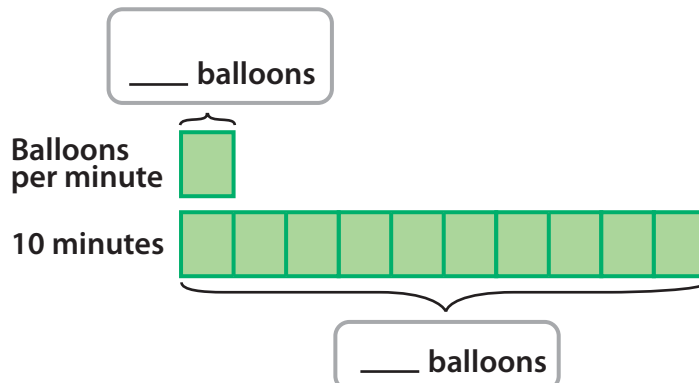
\_\_\_\_\_

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\_\_\_\_\_

13. **Multistep** Tomas makes balloon sculptures at a circus. In 180 minutes, he uses 252 balloons to make 36 identical balloon sculptures.

- a. How many minutes does it take to make one balloon sculpture? How many balloons are used in one sculpture? \_\_\_\_\_
- b. What is Tomas's unit rate for balloons used per minute? \_\_\_\_\_
- c. Complete the diagram to find out how many balloons he will use in 10 minutes. \_\_\_\_\_



14. Abby can buy an 8-pound bag of dog food for \$7.40 or a 4-pound bag of the same dog food for \$5.38. Which is the better buy? \_\_\_\_\_
15. A bakery offers a sale price of \$3.50 for 4 muffins. What is the price per dozen? \_\_\_\_\_
16. Mrs. Jacobsen wants to order toy instruments to give as prizes to her music students. The table shows the prices for various order sizes.

	25 items	50 items	80 items
Whistles	\$21.25	\$36.00	\$60.00
Kazoos	\$10.00	\$18.50	\$27.20

- a. What is the difference between the highest unit price for whistles and the lowest unit price for whistles? \_\_\_\_\_
- b. What is the highest unit price per kazoo? \_\_\_\_\_
- c. **Persevere in Problem Solving** If Mrs. Jacobsen wants to buy the item with the lowest unit price, what item should she order and how many of that item should she order? \_\_\_\_\_

**H.O.T.** FOCUS ON HIGHER ORDER THINKING

17. **Draw Conclusions** There are 2.54 centimeters in 1 inch. How many centimeters are there in 1 foot? in 1 yard? Explain your reasoning.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

18. **Critique Reasoning** A 2-pound box of spaghetti costs \$2.50. Philip says that the unit cost is  $\frac{2}{2.50} = \$0.80$  per pound. Explain his error.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

19. **Look for a Pattern** A grocery store sells three different quantities of sugar. A 1-pound bag costs \$1.10, a 2-pound bag costs \$1.98, and a 3-pound bag costs \$2.85. Describe how the unit cost changes as the quantity of sugar increases.

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Work Area



# LESSON 6.3 Using Ratios and Rates to Solve Problems

COMMON CORE 6.RP.3

Use ratio and rate reasoning to solve... problems, e.g., by reasoning about tables... double number line diagrams... Also 6.RP.3a



## ESSENTIAL QUESTION

How can you use ratios and rates to make comparisons and predictions?

### EXPLORE ACTIVITY 1



COMMON CORE 6.RP.3a

## Using Tables to Compare Ratios

Anna's recipe for lemonade calls for 2 cups of lemonade concentrate and 3 cups of water. Bailey's recipe calls for 3 cups of lemonade concentrate and 5 cups of water.

- A** In Anna's recipe, the ratio of concentrate to water is \_\_\_\_\_.  
Use equivalent ratios to complete the table.

$$2 \times 2 \quad 2 \times \square \quad 2 \times \square$$

Concentrate (c)	2	4		
Water (c)	3		9	15

$$3 \times 2 \quad 3 \times 3 \quad 3 \times 5$$

- B** In Bailey's recipe, the ratio of concentrate to water is \_\_\_\_\_.  
Use equivalent ratios to complete the table.

$$3 \times 3 \quad 3 \times 4 \quad 3 \times \square$$

Concentrate (c)	3	9	12	
Water (c)	5			25

$$5 \times 3 \quad 5 \times \square \quad 5 \times \square$$

- C** Find two columns, one in each table, in which the amount of water is the same. Circle these two columns.
- D** Whose recipe makes stronger lemonade? How do you know?

\_\_\_\_\_

\_\_\_\_\_

- E** Compare the ratios:  $\frac{10}{15}$    $\frac{9}{15}$   $\frac{2}{3}$    $\frac{3}{5}$

**Reflect**

- Analyze Relationships** Suppose each person pours herself one cup of the lemonade she made. How much concentrate is in each person's cup? How do you know?

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Math On the Spot

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## Comparing Ratios

You can use equivalent ratios to solve real-world problems.

### EXAMPLE 1



COMMON CORE

6.RP.3

A fruit and nut bar recipe calls for 4 cups of chopped nuts and 6 cups of dried fruit. When Tonya made a batch of these bars, she used 6 cups of chopped nuts and 9 cups of dried fruit. Did Tonya use the correct ratio of nuts to fruit?

- STEP 1** Find the ratio of nuts to fruit in the recipe.

$$\frac{4}{6} \quad \text{4 cups of nuts to 6 cups of fruit}$$

- STEP 2** Find the ratio of nuts to fruit that Tonya used.

$$\frac{6}{9} \quad \text{6 cups of nuts to 9 cups of fruit}$$

- STEP 3** Find equivalent ratios that have the same second term.

$$\frac{4}{6} = \frac{12}{18} \quad \frac{6}{9} = \frac{12}{18}$$

$\begin{matrix} \nearrow \times 3 \\ \searrow \times 3 \end{matrix}$ 
 $\begin{matrix} \nearrow \times 2 \\ \searrow \times 2 \end{matrix}$

18 is a multiple of 6 and 9, so find equivalent ratios with 18 in the second term.

$$\frac{12}{18} = \frac{12}{18}$$

The ratios  $\frac{4}{6}$  and  $\frac{6}{9}$  are equivalent. So, Tonya used the same ratio of nuts to fruit that was given in the recipe.

### Math Talk

#### Mathematical Practices

Explain how you compare two ratios to check if they are equivalent.

### YOUR TURN

- In the science club, there are 2 sixth-graders for every 3 seventh-graders. At this year's science fair, there were 7 projects by sixth-graders for every 12 projects by seventh-graders. Is the ratio of sixth-graders to seventh-graders in the science club equivalent to the ratio of science fair projects by sixth-graders to projects by seventh-graders? Explain.

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Personal Math Trainer

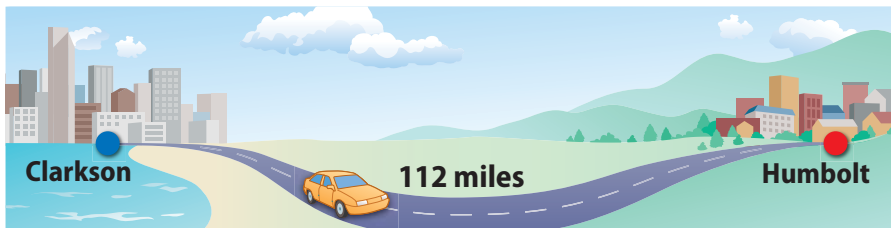
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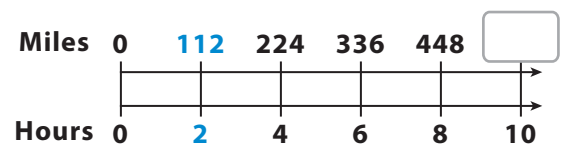
# Using Rates to Make Predictions

You can represent rates on a double number line to make predictions.

**Janet drives from Clarkson to Humbolt in 2 hours. Suppose Janet drives for 10 hours. If she maintains the same driving rate, can she drive more than 600 miles? Justify your answer.**



The double number line shows the number of miles Janet drives in various amounts of time.



- A** Explain how Janet’s rate for two hours is represented on the double number line.  


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- B** Describe the relationship between Janet’s rate for two hours and the other rates shown on the double number line.  


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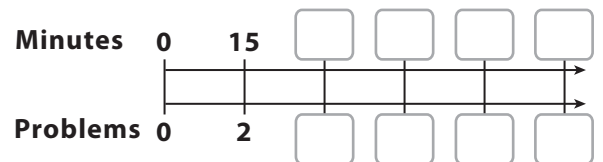
  


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- C** Complete the number line.
- D** At this rate, can Janet drive more than 600 miles in 10 hours? Explain.  


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## Reflect

- 3.** In fifteen minutes, Lena can finish 2 math homework problems. How many math problems can she finish in 75 minutes? Use a double number line to find the answer.



- 4.** How is using a double number line similar to finding equivalent ratios?

## Guided Practice

1. Celeste is making fruit baskets for her service club to take to a local hospital. The directions say to fill the boxes using 5 apples for every 6 oranges. Celeste is filling her baskets with 2 apples for every 3 oranges. [\(Explore Activity 1\)](#)

- a. Complete the tables to find equivalent ratios.

<b>Apples</b>	5			
<b>Oranges</b>	6			

<b>Apples</b>	2			
<b>Oranges</b>	3			

- b. Compare the ratios. Is Celeste using the correct ratio of apples to oranges?

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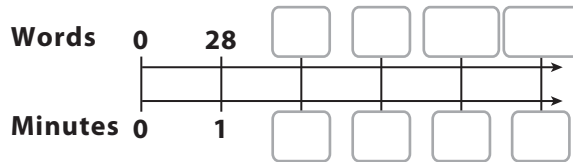
2. Neha used 4 bananas and 5 oranges in her fruit salad. Daniel used 7 bananas and 9 oranges. Did Neha and Daniel use the same ratio of bananas to oranges? If not, who used the greater ratio of bananas to oranges? [\(Example 1\)](#)

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3. Tim is a first grader and reads 28 words per minute. Assuming he maintains the same rate, use the double number line to find how many words he can read in 5 minutes. [\(Explore Activity 2\)](#)



4. A cafeteria sells 30 drinks every 15 minutes. Predict how many drinks the cafeteria sells every hour. [\(Explore Activity 2\)](#)

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### ESSENTIAL QUESTION CHECK-IN

5. Explain how to compare two ratios.

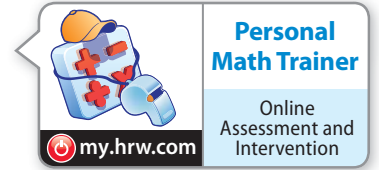
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# 6.3 Independent Practice

**COMMON CORE** 6.RP.3, 6.RP.3a



6. Gina’s art teacher mixes 9 pints of yellow paint with 6 pints of blue paint to create green paint. Gina mixes 4 pints of yellow paint with 3 pints of blue paint. Did Gina use the same ratio of yellow paint to blue paint instructed by her teacher? Explain.

\_\_\_\_\_

\_\_\_\_\_

7. The Suarez family paid \$15.75 for 3 movie tickets. How much would they have paid for 12 tickets?

\_\_\_\_\_

8. A grocery store sells snacks by weight. A six-ounce bag of mixed nuts costs \$3.60. Predict the cost of a two-ounce bag.

\_\_\_\_\_

9. The Martin family’s truck gets an average of 25 miles per gallon. Predict how many miles they can drive using 7 gallons of gas.

\_\_\_\_\_

10. **Multistep** The table shows two cell phone plans that offer free minutes for each given number of paid minutes used. Pablo has Plan A and Sam has Plan B.

- a. What is Pablo’s ratio of free to paid minutes?

\_\_\_\_\_

- b. What is Sam’s ratio of free to paid minutes?

\_\_\_\_\_

	Cell Phone Plans	
	Plan A	Plan B
Free minutes	2	8
Paid minutes	10	25

- c. Does Pablo’s cell phone plan offer the same ratio of free to paid minutes as Sam’s? Explain.

\_\_\_\_\_

\_\_\_\_\_

11. **Consumer Math** A store has apples on sale for \$3.00 for 2 pounds. How many pounds of apples can you buy for \$9? If an apple is approximately 5 ounces, how many apples can you buy for \$9? Explain your reasoning.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**12. Science** Grass can grow up to six inches in a week depending on temperature, humidity, and time of year. At this rate, how tall will grass grow in 24 days?

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**13.** A town in east Texas received 10 inches of rain in two weeks. If it kept raining at this rate for a 31-day month, how much rain did the town receive?

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**14.** One patterned blue fabric sells for \$15.00 every two yards, and another sells for \$37.50 every 5 yards. Do these fabrics have the same unit cost? Explain.

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**FOCUS ON HIGHER ORDER THINKING**

**15. Problem Solving** Complete each ratio table.

	12	18	24
4.5			18

80.8	40.4		10.1
	512	256	

**16. Represent Real-World Problems** Write a real-world problem that compares the ratios 5 to 9 and 12 to 15.

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**17. Analyze Relationships** Explain how you can be sure that all the rates you have written on a double number line are correct.

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**18.** Paul can choose to be paid \$50 for a job, or he can be paid \$12.50 per hour. Under what circumstances should he choose the hourly wage? Explain.

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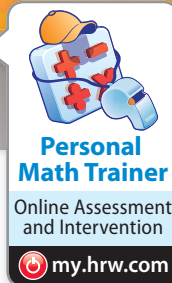
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Work Area

# Ready to Go On?



## 6.1 Ratios

Use the table to find each ratio.

1. white socks to brown socks \_\_\_\_\_

2. blue socks to nonblue socks \_\_\_\_\_

3. black socks to all of the socks \_\_\_\_\_

4. Find two ratios equivalent to the ratio in Exercise 1.

\_\_\_\_\_

<b>Color of socks</b>	white	black	blue	brown
<b>Number of socks</b>	8	6	4	5

## 6.2 Rates

Find each rate.

5. Earl runs 75 meters in 30 seconds. How many meters does Earl run per second? \_\_\_\_\_

6. The cost of 3 scarves is \$26.25. What is the unit price? \_\_\_\_\_

## 6.3 Using Ratios and Rates to Solve Problems

7. Danny charges \$35 for 3 hours of swimming lessons. Martin charges \$24 for 2 hours of swimming lessons. Who offers a better deal? \_\_\_\_\_

8. There are 32 female performers in a dance recital. The ratio of men to women is 3:8. How many men are in the dance recital? \_\_\_\_\_



### ESSENTIAL QUESTION

9. How can you use ratios and rates to solve problems?

\_\_\_\_\_

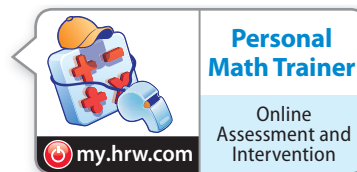
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# Assessment Readiness



## Selected Response

- Which ratio is **not** equivalent to the other three?  

(A) $\frac{2}{3}$	(C) $\frac{12}{15}$
(B) $\frac{6}{9}$	(D) $\frac{18}{27}$
- A lifeguard received 15 hours of first aid training and 10 hours of cardiopulmonary resuscitation (CPR) training. What is the ratio of hours of CPR training to hours of first aid training?  

(A) 15:10	(C) 10:15
(B) 15:25	(D) 25:15
- Jerry bought 4 DVDs for \$25.20. What was the unit rate?  

(A) \$3.15	(C) \$6.30
(B) \$4.20	(D) \$8.40
- There are 1,920 fence posts used in a 12-kilometer stretch of fence. How many fence posts are used in 1 kilometer of fence?  

(A) 150	(C) 155
(B) 160	(D) 180
- Sheila can ride her bicycle 6,000 meters in 15 minutes. How far can she ride her bicycle in 2 minutes?  

(A) 400 meters	(C) 800 meters
(B) 600 meters	(D) 1,000 meters
- Lennon has a checking account. He withdrew \$130 from an ATM Tuesday. Wednesday he deposited \$240. Friday he wrote a check for \$56. What was the total change in Lennon's account?  

(A) -\$74	(C) \$184
(B) \$54	(D) \$226

- Cheyenne is making a recipe that uses 5 cups of beans and 2 cups of carrots. Which combination below uses the same ratio of beans to carrots?  

(A) 10 cups of beans and 3 cups of carrots
(B) 10 cups of beans and 4 cups of carrots
(C) 12 cups of beans and 4 cups of carrots
(D) 12 cups of beans and 5 cups of carrots
- $\frac{5}{8}$  of the 64 musicians in a music contest are guitarists. Some of the guitarists play jazz solos, and the rest play classical solos. The ratio of the number of guitarists playing jazz solos to the total number of guitarists in the contest is 1:4. How many guitarists play classical solos in the contest?  

(A) 10	(C) 16
(B) 30	(D) 48

## Mini-Task

- Mikaela is competing in a race in which she both runs and rides a bicycle. She runs 5 kilometers in 0.5 hour and rides her bicycle 20 kilometers in 0.8 hour.
  - At the rate given, how many kilometers can Mikaela run in 1 hour?  
\_\_\_\_\_
  - At the rate given, how many kilometers can Mikaela bike in 1 hour?  
\_\_\_\_\_
  - If Mikaela runs for 1 hour and bikes for 1 hour at the rates given, how far will she travel?  
\_\_\_\_\_