

# 4-1

# Ratios

© CONTENT STANDARDS

Essential for understanding  
7.RP.1

## What You'll Learn

To write ratios and use them to compare quantities

🔊 **New Vocabulary** ratio, equivalent ratios

## Why Learn This?

The keys on a music keyboard have a repeating pattern of five black keys and seven white keys. You can use ratios to describe patterns.

The ratio of black keys to white keys in the pattern is 5 to 7. What is the ratio of black keys to all keys in the pattern?



5	7
12	

## KEY CONCEPTS Ratio

A **ratio** is a comparison of two quantities by division. You can write a ratio in three ways.

**Arithmetic**  
5 to 7    5 : 7     $\frac{5}{7}$

**Algebra**  
 $a$  to  $b$      $a : b$      $\frac{a}{b}$   
where  $b \neq 0$

## EXAMPLE Writing Ratios



- 1 **Music** Using the pattern shown above, write the ratio of black keys to all keys in three ways.

black keys → 5 to 12 ← all keys

black keys → 5 : 12 ← all keys

$\frac{5}{12}$  ← black keys  
← all keys

5	7
12	

## Example

- 1 **Writing Ratios** There are 7 red stripes and 6 white stripes on the flag of the United States. Write the ratio of red stripes to white stripes in three ways.

red stripes →  $\boxed{7 \text{ to } 6}$  ← white stripes

red stripes →  $\boxed{7 : 6}$  ← white stripes

$\boxed{7}$  ← red stripes

$\boxed{6}$  ← white stripes

## Quick Check

1. Write each ratio in three ways. Use the pattern of piano keys shown at the right.

a. white keys to all keys

$$7 \text{ to } 12, 7 : 12, \frac{7}{12}$$

b. white keys to black keys

$$7 \text{ to } 5, 7 : 5, \frac{7}{5}$$



Two ratios that name the same number are **equivalent ratios**. In a previous course, you learned to write equivalent fractions. You can find equivalent ratios by writing a ratio as a fraction and finding an equivalent fraction.

## EXAMPLES Writing Equivalent Ratios

2 Find a ratio equivalent to  $\frac{4}{5}$ .

$$\frac{4 \times 2}{5 \times 2} = \frac{8}{10} \quad \leftarrow \text{Multiply the numerator and denominator by 2.}$$

3 Write the ratio 2 yd to 20 ft as a fraction in simplest form.

$$\frac{2 \text{ yd}}{20 \text{ ft}} = \frac{2 \times 3 \text{ ft}}{20 \text{ ft}} \quad \leftarrow \text{There are 3 ft in each yard.}$$

$$= \frac{6 \text{ ft}}{20 \text{ ft}} \quad \leftarrow \text{Multiply.}$$

$$= \frac{6 \text{ ft} \div 2}{20 \text{ ft} \div 2} \quad \leftarrow \text{Divide by the GCF, 2.}$$

$$= \frac{3}{10} \quad \leftarrow \text{Simplify.}$$

## Examples

- ② **Writing Equivalent Ratios** Find a ratio equivalent to  $\frac{14}{4}$ .

$$\frac{14 \div \boxed{2}}{4 \div \boxed{2}} = \frac{\boxed{7}}{\boxed{2}}$$

← Divide the numerator and denominator by 2.

- ③ **Writing Equivalent Ratios** Write the ratio 2 lb to 56 oz as a fraction in simplest form.

$$\frac{2 \text{ lb}}{56 \text{ oz}} = \frac{2 \times 16 \text{ oz}}{56 \text{ oz}}$$

← There are 16 oz in each pound.

$$= \frac{\boxed{32} \text{ oz}}{56 \text{ oz}}$$

← Multiply.

$$= \frac{\boxed{32} \div \boxed{8} \text{ oz}}{56 \div \boxed{8} \text{ oz}}$$

← Divide by the GCF,  $\boxed{8}$  oz.

$$= \frac{\boxed{4}}{\boxed{7}}$$

← Simplify.

**EXAMPLE****Comparing Ratios**

- 4 **Social Studies** An official U.S. flag has a length-to-width ratio of 19 : 10. The largest U.S. flag measures 505 ft by 255 ft. Is this an official U.S. flag?

official flag ↓		largest flag ↓
$\frac{19}{10}$	← length → ← width →	$\frac{505}{255}$
$\frac{19}{10} = 1.9$	← Write as a decimal. Round if necessary. →	$\frac{505}{255} \approx 1.98$

Since 1.98 is not equal to 1.9, the largest flag is *not* an official U.S. flag.



- 4 **Comparing Ratios** The ratio of girls to boys enrolled at King Middle School is 15 : 16. There are 195 girls and 208 boys in Grade 8. Is the ratio of girls to boys in Grade 8 equivalent to the ratio of girls to boys in the entire school?

<b>Entire School</b>		<b>Grade 8</b>
$\frac{15}{16}$	← girls →	$\frac{195}{208}$
	← boys →	
$\frac{15}{16} = 0.9375$	← Write as a decimal. →	$\frac{195}{208} = 0.9375$

Since the two decimals are **equal**, the ratio of girls to boys in Grade 8 is **equivalent** to the ratio of girls to boys in the entire school.

## Quick Check

2. Find a ratio equivalent to  $\frac{7}{9}$ .

Answers may vary. Sample answer:  $\frac{14}{18}$ .

3. Write the ratio 3 gal to 10 qt as a fraction in simplest form.

$\frac{6}{5}$

4. Tell whether the ratios below are *equivalent* or *not equivalent*.

a. 7 : 3, 128 : 54

not equivalent

b.  $\frac{180}{240}$ ,  $\frac{25}{34}$

not equivalent

c. 6.1 to 7, 30.5 to 35

equivalent



## Check Your Understanding

1. **Vocabulary** How are equivalent ratios like equivalent fractions?

2. **Number Sense** Do all ratios compare a part to a whole? Explain.

Find an equivalent ratio for each ratio.

3.  $\frac{1}{8}$

4. 2 to 7

5. 10 : 9

Write each ratio as a fraction in simplest form.

6. 2 gal to 14 qt

7. 34 in. to 4 ft

8.  $\frac{4 \text{ min}}{90 \text{ s}}$

Tell whether the ratios are *equivalent* or *not equivalent*.

9.  $\frac{12}{24}$ ,  $\frac{50}{100}$

10. 1 to 3, 2 to 9

11. 2 : 3, 24 : 36

You have an assignment worksheet, and time to begin working on it now.

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

### Practice 4-1

Ratios

Write a ratio for each situation in three ways.

1. Ten years ago in Louisiana, schools averaged 182 pupils for every 10 teachers.  
\_\_\_\_\_
2. Between 1899 and 1900, 284 out of 1,000 people in the United States were 5–17 years old.  
\_\_\_\_\_

Use the chart below for Exercises 3–4.

Three seventh-grade classes were asked whether they wanted chicken or pasta served at their awards banquet.

Room Number	Chicken	Pasta
201	10	12
202	8	17
203	16	10

3. In room 201, what is the ratio of students who prefer chicken to students who prefer pasta?  
\_\_\_\_\_
4. Combine the totals for all three rooms. What is the ratio of the number of students who prefer pasta to the number of students who prefer chicken?  
\_\_\_\_\_

Write each ratio as a fraction in simplest form.

5. 12 to 18 \_\_\_\_\_
6. 81 : 27 \_\_\_\_\_
7.  $\frac{6}{28}$  \_\_\_\_\_

Tell whether the ratios are equivalent or not equivalent.

8. 12 : 24, 50 : 100 \_\_\_\_\_
9.  $\frac{22}{1}$ ,  $\frac{1}{22}$  \_\_\_\_\_
10. 2 to 3, 24 to 36 \_\_\_\_\_
11. A bag contains green, yellow, and orange marbles. The ratio of green marbles to yellow marbles is 2 : 5. The ratio of yellow marbles to orange marbles is 3 : 4. What is the ratio of green marbles to orange marbles?  
\_\_\_\_\_