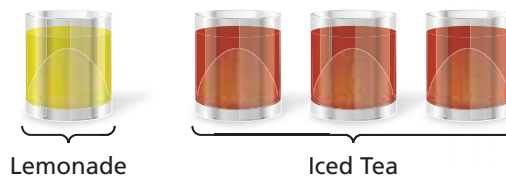


5.2 Ratio Tables

Essential Question How can you find two ratios that describe the same relationship?

1 ACTIVITY: Making a Mixture

Work with a partner. A mixture calls for 1 cup of lemonade and 3 cups of iced tea.



- a. How many total cups does the mixture contain? cups

For every cup of lemonade, there are cups of iced tea.

- b. How do you make a larger batch of this mixture? Describe your procedure and use the table below to organize your results. Add more columns to the table if needed.

Cups of Lemonade						
Cups of Iced Tea						
Total Cups						

- c. Which operations did you use to complete your table? Do you think there is more than one way to complete the table? Explain.
- d. How many total cups are in your final mixture? How many of those cups are lemonade? How many are iced tea? Compare your results with those of other groups in your class.
- e. Suppose you take a sip from every group's final mixture. Do you think all the mixtures should taste the same? Do you think the color of all the mixtures should be the same? Explain your reasoning.
- f. Why do you think it is useful to use a table when organizing your results in this activity? Explain.



Ratios

In this lesson, you will

- use ratio tables to find equivalent ratios.
- solve real-life problems.

Learning Standards

MACC.6.RP.1.1

MACC.6.RP.1.3a

2 ACTIVITY: Using a Multiplication Table

Math Practice 2

Use Operations

For each part of this problem, how do you know which operation to use?

Work with a partner. Use the information in Activity 1 and the multiplication table below.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48

- A mixture contains 8 cups of lemonade. How many cups of iced tea are in the mixture?
- A mixture contains 21 cups of iced tea. How many cups of lemonade are in the mixture?
- A mixture has a total of 40 cups. How many cups are lemonade? How many are iced tea?
- REPEATED REASONING** Explain how a multiplication table may have helped you in Activity 1.

3 ACTIVITY: Using More than One Ratio to Describe a Quantity

Work with a partner.

- Find the ratio of pitchers of lemonade to pitchers of iced tea.



- How can you divide the pitchers into equal groups? Is there more than one way? Use your results to describe the entire collection of pitchers.
- Three more pitchers of lemonade are added. Is there more than one way to divide the pitchers into equal groups? Explain.
- The number of pitchers of lemonade and iced tea are doubled. Can you use the ratio in part (b) to describe the entire collection of pitchers? Explain.

What Is Your Answer?

- IN YOUR OWN WORDS** How can you find two ratios that describe the same relationship? Give examples to support your explanation.

Practice

Use what you learned about ratios to complete Exercises 4 and 5 on page 201.

Key Vocabulary

equivalent ratios,
p. 198
ratio table, p. 198

Two ratios that describe the same relationship are **equivalent ratios**. You can find equivalent ratios by:

- adding or subtracting quantities in equivalent ratios.
- multiplying or dividing each quantity in a ratio by the same number.

You can find and organize equivalent ratios in a **ratio table**.

EXAMPLE 1 Completing Ratio Tables

Find the missing value(s) in each ratio table. Then write the equivalent ratios.

a.

Pens	1	2	
Pencils	3		9

b.

Dogs	4		24
Cats	6	12	

- a. You can use repeated addition with the original ratio to find the missing values.

Pens	1	2	3
Pencils	3	6	9

∴ The equivalent ratios are 1 : 3, 2 : 6, and 3 : 9.

- b. You can use multiplication to find the missing values.

Dogs	4	8	24
Cats	6	12	36

∴ The equivalent ratios are 4 : 6, 8 : 12, and 24 : 36.

On Your Own

 Now You're Ready
Exercises 6–11

Find the missing value(s) in the ratio table. Then write the equivalent ratios.

1.

Plantains	4		12
Bananas	3	6	

2.

Euros	5	10	
Dollars	4		32


EXAMPLE 2 Making a Ratio Table

You are making sugar water for your hummingbird feeder. A website indicates to use 4 parts of water for every 1 part of sugar. You use 20 cups of water. How much sugar do you need?

You can solve this problem by using equivalent ratios. The ratio of water to sugar is 4 parts to 1 part. So, for every 4 cups of water, you need 1 cup of sugar. Find an equivalent ratio with 20 parts water.

Method 1: Use a ratio table and addition.

You can think of making a larger batch of sugar water as combining several batches of 4 to 1 mixtures. Use addition to obtain 20 in the water column.



Water (cups)	4	8	12	16	20
Sugar (cups)	1	2	3	4	5

Diagram showing the construction of the ratio table. Red arrows above the water column indicate adding 4 cups repeatedly: 4 to 8 (+4), 8 to 12 (+4), 12 to 16 (+4), and 16 to 20 (+4). Red arrows below the sugar column indicate adding 1 cup repeatedly: 1 to 2 (+1), 2 to 3 (+1), 3 to 4 (+1), and 4 to 5 (+1).

The ratio 20 to 5 is equivalent to 4 to 1.

∴ So, you need 5 cups of sugar.

Method 2: Use a ratio table and multiplication.

You multiplied the amount of water in the recipe by 5 because $20 \div 4 = 5$. So, you need to multiply the amount of sugar by 5. Multiply each part of the ratio in the original recipe by 5.

Water (cups)	4	20
Sugar (cups)	1	5

Diagram showing the multiplication step. A red arrow above the water column points from 4 to 20 with $\times 5$ written above it. A red arrow below the sugar column points from 1 to 5 with $\times 5$ written below it.

The ratio 20 to 5 is equivalent to 4 to 1.

∴ So, you need 5 cups of sugar.

Study Tip

In Example 2, Method 1, notice that you can eliminate a step by adding columns 2 and 3 to obtain $8 + 12 = 20$ cups of water for $2 + 3 = 5$ cups of sugar.

On Your Own

Now You're Ready
Exercises 13
and 14

- WHAT IF?** You use 24 cups of water. How much sugar do you need?
- You make a sweeter mixture of sugar water for your hummingbird feeder using 3 parts of water for every 1 part of sugar. You use 9 quarts of water. How much sugar do you need?

EXAMPLE 3 Using a Ratio Table

The nutrition facts label on a box of crackers shows that there are 240 milligrams of sodium in every 36 crackers.

a. You eat 15 crackers. How much sodium do you consume?

The ratio of sodium to crackers is 240 to 36. Use a ratio table to find an equivalent ratio with 15 crackers.

Sodium (milligrams)	240	120	20	100
Crackers	36	18	3	15

$\div 2$ $\div 6$ $\times 5$
 $\div 2$ $\div 6$ $\times 5$



The ratio 100 to 15 is equivalent to 240 to 36.

So, you consume 100 milligrams of sodium.

b. You eat 21 crackers. How much sodium do you consume?

Notice that you can add the two middle columns in the table above.

So, you consume $120 + 20 = 140$ milligrams of sodium in $18 + 3 = 21$ crackers.

Study Tip

In Example 3, notice that you could use one step in the ratio table: multiply by

$$\frac{1}{2} \cdot \frac{1}{6} \cdot 5 = \frac{5}{12}$$

EXAMPLE 4 Using a Ratio Table

You mix 3 pints of yellow paint for every 4 pints of blue paint to make green paint. You use 10 pints of blue paint. How much green paint do you make?

The ratio of yellow paint to blue paint is 3 to 4. Use a ratio table to find an equivalent ratio with 10 parts blue paint.

Yellow (pints)	3	$\frac{3}{2}$	$7\frac{1}{2}$
Blue (pints)	4	2	10

$\div 2$ $\times 5$
 $\div 2$ $\times 5$

You use $7\frac{1}{2}$ pints of yellow paint and 10 pints of blue paint.

So, you make $7\frac{1}{2} + 10 = 17\frac{1}{2}$ pints of green paint.

Study Tip

In Example 4, notice that you could use one step in the ratio table: multiply by

$$\frac{1}{2} \cdot 5 = \frac{5}{2}$$

On Your Own

- WHAT IF?** In Example 3, you eat 24 crackers. How much sodium do you consume?
- WHAT IF?** In Example 4, you mix 2 pints of yellow paint for every 3 pints of blue paint. You use 5 pints of yellow paint. How much green paint do you make?

Now You're Ready
Exercises 15
and 16

Vocabulary and Concept Check

- VOCABULARY** How can you tell whether two ratios are equivalent?
- NUMBER SENSE** Consider the ratio 3 : 5. Can you create an equivalent ratio by adding the same number to each quantity in the ratio? Explain.
- WHICH ONE DOESN'T BELONG?** Which ratio does *not* belong with the other three? Explain your reasoning.

3 : 4

9 : 12

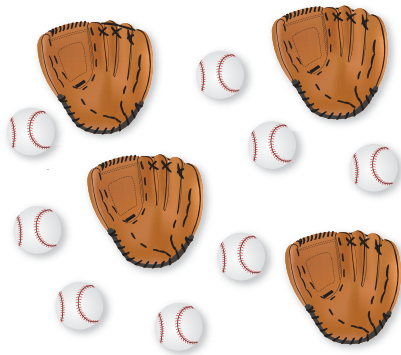
12 : 15

12 : 16

Practice and Problem Solving

Write several ratios that describe the collection.

4. baseballs to gloves



5. ladybugs to bees



Find the missing value(s) in the ratio table. Then write the equivalent ratios.

1 6.

Boys	1	
Girls	5	10

7.

Violins	8	24
Cellos	3	

8.

Taxis	6		36
Buses	5	15	

9.

Burgers	3		9
Hot Dogs	5	10	

10.

Towels	14	7	
Blankets	8		16

11.

Forks	16	8	
Spoons	10		30

12. **WORK** Your neighbor pays you \$17 for every 2 hours you work. You work for 8 hours on Saturday. How much does your neighbor owe you?

Complete the ratio table to solve the problem.

- 2 13. For every 3 tickets you sell, your friend sells 4. You sell a total of 12 tickets. How many does your friend sell?

You	3			12
Friend	4			

14. A store sells 2 printers for every 5 computers. The store sells 40 computers. How many printers does the store sell?

Printers	2		8	
Computers	5	10		40


- 3 15. First and second place in a contest use a ratio to share a cash prize. When first place pays \$100, second place pays \$60. How much does first place pay when second place pays \$36?

First	100		
Second	60		36


16. A grade has 81 girls and 72 boys. The grade is split into groups that have the same ratio of girls to boys as the whole grade. How many girls are in a group that has 16 boys?

Girls	81		
Boys	72		16

ERROR ANALYSIS Describe and correct the error in making the ratio table.

17. 

A	3	8	13
B	7	12	17

18. 

A	5	25	125
B	3	9	27

19. **DONATION** A sports store donates basketballs and soccer balls to the boys and girls club. The ratio of basketballs to soccer balls is 7 : 6. The store donates 24 soccer balls. How many basketballs does the store donate?

20. **DOWNLOAD** You are downloading songs to your MP3 player. The ratio of pop songs to rock songs is 5 : 4. You download 40 pop songs. How many rock songs do you download?



SCRAMBLED EGGS In Exercises 21–25, use the ratio table showing different batches of the same recipe for scrambled eggs.

Recipe	A	B	C	D	E	F
Servings	4	2	6	3	5	9
Eggs	8	4	12	6	10	18
Milk (cups)	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	$1\frac{1}{8}$

21. How can you use Recipes B and D to create Recipe E?
22. How can you use Recipes C and D to create Recipe F?
23. How can you use Recipes B and C to create Recipe A?

24. How can you use Recipes C and F to create Recipe D?

25. Describe one way to use the recipes to create a batch with 11 servings.

Two whole numbers A and B satisfy the following conditions. Find A and B .

26. $A + B = 30$
 $A : B$ is equivalent to $2 : 3$.
27. $A + B = 44$
 $A : B$ is equivalent to $4 : 7$.
28. $A - B = 18$
 $A : B$ is equivalent to $11 : 5$.
29. $A - B = 25$
 $A : B$ is equivalent to $13 : 8$.

Nutrition Facts	
Serving Size: 1 ounce (28g)	
Amount Per Serving	
Calories 161	Calories from Fat 109
% Daily Value*	
Total Fat 13g	20%
Saturated Fat 3g	13%
Trans Fat	
Cholesterol 0mg	0%
Sodium 4mg	0%
Total Carbohydrate 9g	3%
Dietary Fiber 1g	3%
Sugars 1g	
Protein 4g	
Vitamin A 0%	Vitamin C 0%
Calcium 1%	Iron 9%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

30. **CASHEWS** The nutrition facts label on a container of dry roasted cashews indicates there are 161 calories in 28 grams. You eat 9 cashews totaling 12 grams.
- How many calories do you consume?
 - How many cashews are in one serving?
31. **REASONING** The ratio of three numbers is $4 : 3 : 1$. The sum of the numbers is 64. What is the greatest number?
32. **SURVEY** Seven out of every 8 students surveyed owns a bike. The difference between the number of students who own a bike and those who do not is 72. How many students were surveyed?

33. **BUG COLLECTION** You and a classmate have a bug collection for science class. You find 5 out of every 9 bugs in the collection. You find 4 more bugs than your classmate. How many bugs are in the collection?

34. **Problem Solving** You and a friend each have a collection of tokens. Initially, for every 8 tokens you had, your friend had 3. After you give half of your tokens to your friend, your friend now has 18 more tokens than you. Initially, how many more tokens did you have than your friend?



Fair Game Review What you learned in previous grades & lessons

Factor the expression using the GCF. (Section 3.4)

35. $54 + 27$ 36. $60x - 84$ 37. $42x + 28y$

38. **MULTIPLE CHOICE** Which expression does *not* give the area of the shaded figure? (Section 4.3)

- (A) $2(6) + 2\left(\frac{1}{2}(6)(2)\right)$ (B) $2\left(\frac{1}{2}(3)(2 + 6)\right)$
- (C) $6(6) - 4\left(\frac{1}{2}(3)(2)\right)$ (D) $6(6) - \frac{1}{2}(6)(2)$

