

3.3 Using Ratio Tables

Learning Target: Use ratio tables to represent equivalent ratios and solve ratio problems.

- Success Criteria:**
- I can use various operations to create tables of equivalent ratios.
 - I can use ratio tables to solve ratio problems.
 - I can use ratio tables to compare ratios.

EXPLORATION 1

Making a Table of Equivalent Ratios

Work with a partner. You buy milk that contains 180 calories per 2 cups.

- You measure 2 cups of the milk for a recipe and pour it into a pitcher. You repeat this four more times. Make a table to show the numbers of calories and cups in the pitcher as you add the milk.
- Describe any relationships you see in your table.
- Describe ways that you can find equivalent ratios using different operations.

Math Practice

Compare Arguments

Compare your explanations in part (c) with another group. If they are different, are they both correct?

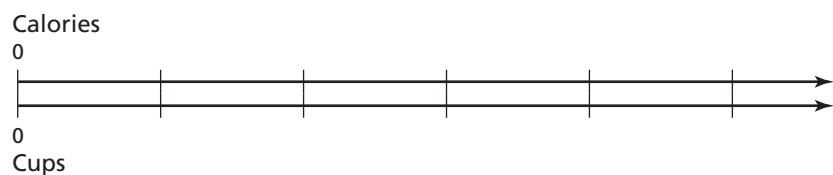


EXPLORATION 2

Creating a Double Number Line


Work with a partner.

- Represent the ratio in Exploration 1 by labeling the increments on the *double number line* below. Can you label the increments in more than one way?



- How can you use the double number line to find the number of calories in 3 cups of milk? 3.5 cups of milk?

3.3 Lesson

Key Vocabulary 
ratio table, p. 122

You can find and organize equivalent ratios in a **ratio table**. You can generate a ratio table by using repeated addition or multiplication.

EXAMPLE 1 Completing Ratio Tables

Find the missing values in each ratio table. Then write the equivalent ratios.

a.

Triangles	1	2		4
Sides	3		9	

b.

Frogs	4	20		
Toads	6		90	180

- a. Because the original ratio is 1 triangle to 3 sides, you can repeatedly add 1 to the first row and repeatedly add 3 to the second row.

Triangles	1	2	3	4
Sides	3	6	9	12

▶ The equivalent ratios are 1 : 3, 2 : 6, 3 : 9, and 4 : 12.

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

Frogs	4	20	60	120
Toads	6	30	90	180

▶ The equivalent ratios are 4 : 6, 20 : 30, 60 : 90, and 120 : 180.

Try It Find the missing values in the ratio table. Then write the equivalent ratios.

1.

Hands	4		12	16
People	2	4		

2.

Miles	4		24	96
Hours	3	6		

You can also generate a ratio table by using subtraction or division. In summary, 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.

EXAMPLE 2 Completing Ratio Tables

Find the missing values in each ratio table. Then write the equivalent ratios.

a.

Dollars	1			8
Cents	100	300	900	

b.

Meters	3		2	
Minutes	1	2		$\frac{5}{3}$

In Example 2(a), notice that you obtain the fourth column by subtracting the values in the first column from the values in the third column.

$9 - 1 = 8$
 $900 - 100 = 800$

- a. You can use a combination of operations to find the missing values.

Dollars	1	3	9	8
Cents	100	300	900	800

Operations shown: $\times 3$, $\times 3$, -1 (top row); $\times 3$, $\times 3$, -100 (bottom row)

▶ The equivalent ratios are 1 : 100, 3 : 300, 9 : 900, and 8 : 800.

- b. You can use a combination of operations to find the missing values.

Meters	3	6	2	5
Minutes	1	2	$\frac{2}{3}$	$\frac{5}{3}$

Operations shown: $\times 2$, $\div 3$, $+3$ (top row); $\times 2$, $\div 3$, $+1$ (bottom row)

▶ The equivalent ratios are 3 : 1, 6 : 2, $2 : \frac{2}{3}$, and $5 : \frac{5}{3}$.

Try It Find the missing values in the ratio table. Then write the equivalent ratios.

3.

Flowers	1	2	4	
Petals	5			15

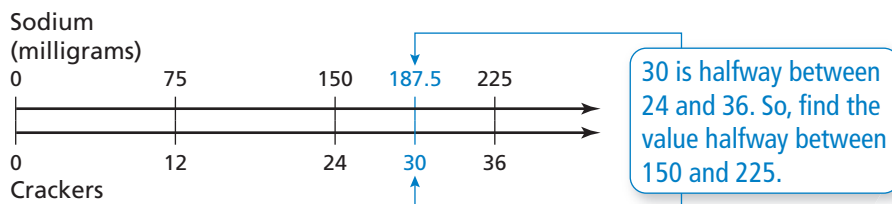
4.

Students	24	12		36
Teachers	2		4	

EXAMPLE 3**Solving a Ratio Problem**

A nutrition label shows that there are 75 milligrams of sodium in every 12 crackers. You eat 30 crackers. How much sodium do you consume?

Method 1: Use a double number line. Increment the number lines using the original ratio of 75 to 12.



► So, you consume 187.5 milligrams of sodium in 30 crackers.

Method 2: Use a ratio table. The ratio of milligrams of sodium to crackers is 75 to 12. Find an equivalent ratio with 30 crackers.

		$\div 2$	$\times 5$
Sodium (milligrams)	75	37.5	187.5
Crackers	12	6	30
		$\div 2$	$\times 5$

► So, you consume 187.5 milligrams of sodium in 30 crackers.

Try It

5. **WHAT IF?** You eat 21 crackers. How much sodium do you consume?

**Self-Assessment for Concepts & Skills**

Solve each exercise. Then rate your understanding of the success criteria in your journal.

COMPLETING A RATIO TABLE Find the missing values in the ratio table. Then write the equivalent ratios.

6.

Fruit	2		6
Vegetables	6	12	

7.

Gnats	2	14		5
Flies	8		28	

8. **WRITING** Explain how creating a ratio table using repeated addition is similar to creating a ratio table using multiplication.

EXAMPLE 4**Modeling Real Life**

You and your teacher make colored frosting. You add 3 drops of red food coloring for every 1 drop of blue food coloring. Your teacher adds 5 drops of red for every 3 drops of blue. Whose frosting is redder?

Understand the problem.

You are given the numbers of drops of food coloring that you and your teacher use to make frosting. You are asked to determine whose frosting is redder.

Make a plan.

Use ratio tables to compare the frostings. Find ratios in which the number of drops of red, the number of drops of blue, or the total number of drops is the same. Then compare the quantities to determine which is redder.

Solve and check.

Create ratio tables for $3 : 1$ and $5 : 3$ using repeated addition. Include a column for the total number of drops in each frosting.

**Look Back**

The tables show that when both frostings have a total of 16 drops, your frosting has 2 more drops of red and 2 fewer drops of blue. So, your frosting is redder. ✓

Your Frosting		
Drops of Red	Drops of Blue	Total Drops
3	1	4
6	2	8
9	3	12
12	4	16
15	5	20

Your Teacher's Frosting		
Drops of Red	Drops of Blue	Total Drops
5	3	8
10	6	16
15	9	24
20	12	32
25	15	40

When both frostings have 3 drops of blue, your frosting has $9 - 5 = 4$ more drops of red than your teacher's frosting.

▶ So, your frosting is redder than your teacher's frosting.

**Self-Assessment for Problem Solving**

Solve each exercise. Then rate your understanding of the success criteria in your journal.



- You mix 7 tablespoons of vinegar for every 4 tablespoons of baking soda to produce a chemical reaction. You use 15 tablespoons of baking soda. How much vinegar do you use?
- You make a carbonated beverage by adding 7 ounces of soda water for every 3 ounces of regular water. Your friend uses 11 ounces of soda water for every 4 ounces of regular water. Whose beverage is more carbonated?

3.3 Practice



Go to BigIdeasMath.com to get HELP with solving the exercises.

► Review & Refresh

A bag contains green tokens and black tokens. You are given the number of green tokens in the bag and the ratio of green tokens to black tokens. Find the number of black tokens in the bag.

- 8 green tokens; 4 for every 1
- 6 green tokens; 2 : 7
- 24 green tokens; 8 to 5
- 36 green tokens; 3 for every 4

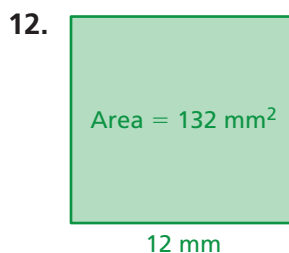
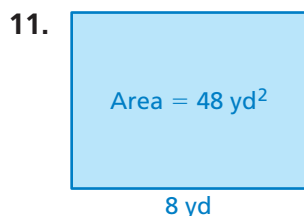
Find the GCF of the numbers.

- 8, 16
- 48, 80
- 15, 45, 100

Evaluate the expression.

- $35 - 2 \times 4^2$
- $12 \div (1 + 3^3 - 2^4)$
- $8^2 \div [(11 - 3) \cdot 2]$

Find the perimeter of the rectangle.



► Concepts, Skills, & Problem Solving

USING A RATIO TABLE Use a ratio table to find the number of calories in the indicated number of cups of milk from Exploration 1. Explain your method. (See Exploration 1, p. 121.)

- 16 cups
- 18 cups
- 5.5 cups

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

16.

Boys	1	
Girls	5	10

17.

Burgers	3		9
Hot Dogs	5	10	

18.

People	6		18
Benches	3	12	

19.

Adults	2	1		18
Children	14		21	

20.

Pies	5		$\frac{10}{3}$	
Cakes	3	12		5

21.

Plums	14	42		
Grapes	7		3	24

22. **YOU BE THE TEACHER** Your friend creates a ratio table for the ratio 5 : 3. Is your friend correct? Explain your reasoning.

A	5	25	125
B	3	9	27

COMPLETING RATIO TABLES Complete the ratio table to solve the problem.

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

You	3			12
Friend	4			

24. 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

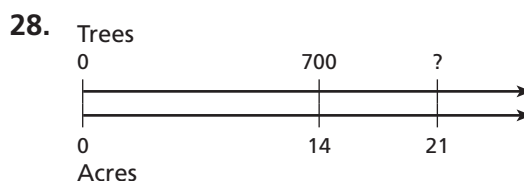
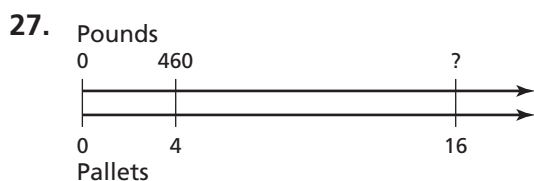
25. First and second place in a contest use a ratio to share a cash prize. When first place pays \$100, second place pays \$60. How much does first place pay when second place pays \$36?

First	100		
Second	60		36

26. 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

USING A DOUBLE NUMBER LINE Find the missing quantity in the double number line.



29. **MP PROBLEM SOLVING** A company sets sales goals for employees each month.

- At her current pace, how many items will Kristina sell in 28 days? Is she on track to meet the goal? Explain.
- At his current pace, how many dollars worth of product will Jim sell in 28 days? Is he on track to meet the goal? Explain.

Monthly Goals			
Sell 400 items in 28 days.			
Sell \$16,800 worth of items in 28 days.			
Weekly Report			
Date: February 7, 8:37 P.M.			
Employee	Dollars	Items	Transactions
Jim	\$4100.00	105	30
Kristina	\$4250.00	98	35



30. **MODELING REAL LIFE** A gold alloy contains 15 milligrams of gold for every 4 milligrams of copper. A jeweler uses 48 milligrams of copper to make the alloy. How much gold does the jeweler use to make the alloy?

31. **MODELING REAL LIFE** You make candles by adding 2 fluid ounces of scented oil for every 22 fluid ounces of wax. Your friend makes candles by adding 3 fluid ounces of the same scented oil for every 37 fluid ounces of wax. Whose candles are more fragrant? Explain your reasoning.
32. **MODELING REAL LIFE** A mint milk shake contains 1.25 fluid ounces of milk for every 4 ounces of ice cream. A strawberry milk shake contains 1.75 fluid ounces of milk for every 5 ounces of ice cream. Which milk shake is thicker? Explain.

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

33. $A + B = 30$
 $A : B$ is equivalent to $2 : 3$.
34. $A + B = 44$
 $A : B$ is equivalent to $4 : 7$.
35. $A - B = 18$
 $A : B$ is equivalent to $11 : 5$.
36. $A - B = 25$
 $A : B$ is equivalent to $13 : 8$.

Nutrition Facts	
8 servings per container	
Serving size	1 ounce (28g)
Amount per serving	
Calories	161
% Daily Value*	
Total Fat 13g	20%
Saturated Fat 3g	13%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 4mg	0%
Total Carbohydrate 9g	3%
Dietary Fiber 1g	3%
Total Sugars 1g	
Includes 0g Added Sugars	0%
Protein 4g	
Vitamin D 0mcg	0%
Calcium 14.8mg	1%
Iron 2.67mg	15%
Potassium 264mg	8%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

37. **MODELING REAL LIFE** A nutrition label shows that there are 161 calories in 28 grams of dry roasted cashews. You eat 9 cashews totaling 12 grams.
- Do you think it is possible to find the number of calories you consume? Explain your reasoning.
 - How many cashews are in one serving?
38. **MP REASONING** The ratio of three numbers is $4 : 5 : 3$. The sum of the numbers is 54. What are the three numbers?
39. **CRITICAL THINKING** Seven out of every 8 students surveyed own 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?

40. **MP LOGIC** 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?

41. **MP PROBLEM SOLVING** You earn \$72 for every 8 hours you spend shoveling snow. You earn \$60 for every 5 hours you spend babysitting. For every 3 hours you spend babysitting, you spend 2 hours shoveling snow. You babysit for 15 hours in January. How much money do you earn in January?

42. **DIG DEEPER!** 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?

