English Spanish

5.1 Ratios

Essential Question How can you tell whether two recipes make the same mixture?

A **ratio** is a comparison of two quantities using division.

Ratios

$\frac{4 \text{ ft}}{2 \text{ ft}}$ $\frac{3 \text{ c}}{5 \text{ c}}$ $\frac{20 \text{ sec}}{45 \text{ sec}}$ $\frac{120 \text{ mi}}{80 \text{ mi}}$

1 ACTIVITY: Comparing Recipes

Work with a partner.

You are making some homemade hand lotion. You find three recipes.

Do the recipes make the same lotion? How can you tell?

Recipe 1

Melt these ingredients over low heat:
2/3 cup of apricot oil
1/3 cup of cocoa butter
1 teaspoon of lanolin
1/2 ounce of grated beeswax

When cool, add the following:
2/3 cup of rosewater
1/3 cup of aloe vera gel
2 drops of rose oil
1 Vitamin E capsule

Whip together until the mixture resembles lotion.

Recipe 2

Melt these ingredients over low heat:
1 cup of apricot oil
1/2 cup of cocoa butter
1 1/2 teaspoons of lanolin
3/4 ounce of grated beeswax

When cool, add the following:
1 cup of rosewater
1/2 cup of aloe vera gel
3 drops of rose oil
1 1/2 Vitamin E capsules

Whip together until the mixture resembles lotion.

Recipe 3

Melt these ingredients over low heat:
1 1/2 cups of apricot oil
2/3 cup of cocoa butter
2 teaspoons of lanolin
1 ounce of grated beeswax

When cool, add the following:
1 1/2 cups of rosewater
2/3 cup of aloe vera gel
4 drops of rose oil
2 Vitamin E capsules

Whip together until the mixture resembles lotion.

2 ACTIVITY: Finding Equivalent Ratios

Work with a partner.

a. The ratios $\frac{1}{3}, \frac{2}{6}, \frac{3}{9}, \frac{4}{12}, \frac{5}{15}, \frac{6}{18}$ are all equivalent. Explain how you can use the multiplication table to show this.

b. Use the multiplication table to find 11 ratios that are equivalent to $\frac{2}{7}$.

c. Use the multiplication table to find 11 ratios that are equivalent to $\frac{8}{3}$.

d. Explain why the strategy in parts (a), (b), and (c) works to produce equivalent ratios.

	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
5	5	10	15	20	**25**	30	35	40	45	50	55	60
6	6	12	18	24	30	**36**	42	48	54	60	66	72
7	7	14	21	28	35	42	**49**	56	63	70	77	84
8	8	16	24	32	40	48	56	**64**	72	80	88	96
9	9	18	27	36	45	54	63	72	**81**	90	99	108
10	10	20	30	40	50	60	70	80	90	**100**	110	120
11	11	22	33	44	55	66	77	88	99	110	**121**	132
12	12	24	36	48	60	72	84	96	108	120	132	**144**

What Is Your Answer?

3. You and two friends are making cookies. You make the original recipe amount. One of your friends makes a "half batch." Your other friend makes a "double batch." If you taste a spoonful of cookie dough from each batch, will they all taste the same? Explain your reasoning.

4. **IN YOUR OWN WORDS** How can you tell whether two recipes make the same mixture? Give an example.

Practice Use what you learned about writing equivalent ratios to complete Exercises 12–15 on page 194.

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5.1 Lesson

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Key Vocabulary
ratio, *p. 192*
equivalent ratios, *p. 193*

Key Idea

Ratio

Words A **ratio** is a comparison of two quantities using division.

Numbers A ratio of 2 red crayons to 5 blue crayons can be written in three ways.

$\frac{2}{5}$, 2 to 5, or 2 : 5

EXAMPLE 1 Writing a Ratio

Write the ratio of pennies to quarters in three ways.

pennies → 5
quarters → 8

∴ The ratio of pennies to quarters is $\frac{5}{8}$, 5 to 8, or 5 : 8.

EXAMPLE 2 Writing and Simplifying Ratios

a. Write the ratio of boys to girls at Oak Grove.

Oak Grove Middle School	
Boys	**Girls**
600	540

boys → $\frac{600}{540} = \frac{10}{9}$ Write in simplest form.
girls →

∴ The ratio of boys to girls is $\frac{10}{9}$.

b. Write the ratio of girls to the total number of students at Oak Grove.

girls → $\frac{540}{1140} = \frac{9}{19}$ Write in simplest form.
total number of students →

∴ The ratio of girls to the total number of students is $\frac{9}{19}$.

On Your Own

Now You're Ready
Exercises 4–11

1. In Example 1, write the ratio of quarters to the total number of coins in three ways.
2. Write the ratio of boys to the total number of students at Oak Grove in simplest form.

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Two ratios that describe the same relationship are **equivalent ratios**.

EXAMPLE 3 Writing Equivalent Ratios

Write two equivalent ratios for triangles to squares.

Reading

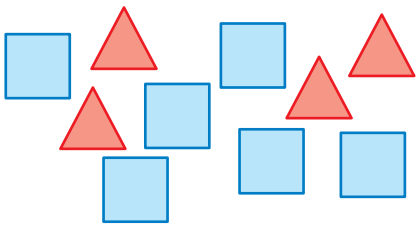
The ratio $\frac{2}{3}$ means that for every 2 triangles, there are 3 squares.

triangles → $\frac{4}{6}$

squares → $\frac{4}{6}$

triangles → $\frac{4}{6} = \frac{2}{3}$ (÷ 2)

squares → $\frac{4}{6} = \frac{2}{3}$ (÷ 2)



∴ Two equivalent ratios are $\frac{4}{6}$ and $\frac{2}{3}$.

EXAMPLE 4 Comparing Ratios

You answer 24 out of 30 questions correctly on a quiz. Your friend answers 35 out of 40 questions correctly on a different quiz. Who has the better score?

You: number correct → $\frac{24}{30} = \frac{4}{5}$ ← number of questions — Write in simplest form.

Your friend: number correct → $\frac{35}{40} = \frac{7}{8}$ ← number of questions — Write in simplest form.

Use percents to compare the scores.

You: $\frac{4}{5} = 0.8 = 80\%$

Your friend: $\frac{7}{8} = 0.875 = 87.5\%$

∴ Your friend has the better score.

On Your Own

Now You're Ready
Exercises 12–19

Write two equivalent ratios for the given ratio.

3. 4 : 8 **4.** $\frac{3}{7}$ **5.** 5 to 20

6. You catch 18 out of 25 passes. Your teammate catches 23 out of 30 passes. Who has the greater catch ratio? Explain.

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5.1 Exercises

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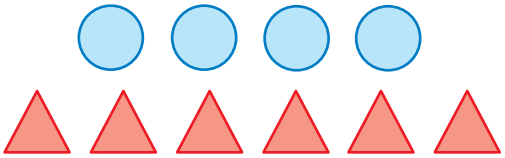
Vocabulary and Concept Check

1. **VOCABULARY** Write the ratio $\frac{3}{7}$ in two other ways.

2. **OPEN-ENDED** Describe the circles and triangles using four different ratios.

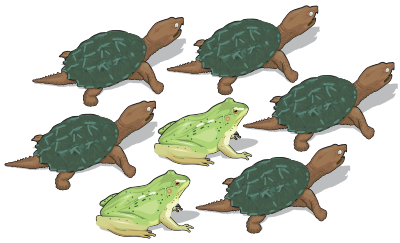


3. **OPEN-ENDED** Write the ratio of vowels to consonants in your last name.

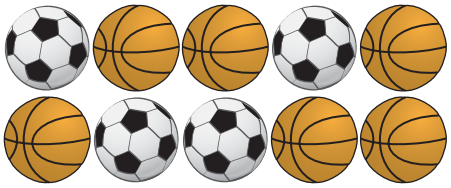
Practice and Problem Solving

Write the ratio in three ways. Explain what the ratio means.

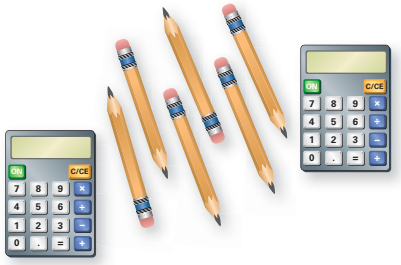
1 **4.** frogs to turtles



5. basketballs : soccer balls



6. $\frac{\text{calculators}}{\text{pencils}}$



7. $\frac{\text{shirts}}{\text{pants}}$

Write the ratio in simplest form.

2 **8.** $\frac{25}{30}$ **9.** $\frac{12}{16}$ **10.** $\frac{24}{8}$ **11.** $\frac{21}{15}$

Write two equivalent ratios for the given ratio.

3 **12.** $\frac{4}{12}$ **13.** $\frac{6}{18}$ **14.** $\frac{7}{14}$ **15.** $\frac{11}{33}$

16. $\frac{6}{27}$ **17.** $\frac{9}{10}$ **18.** $\frac{15}{35}$ **19.** $\frac{12}{8}$

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ERROR ANALYSIS **Describe and correct the error in writing an equivalent ratio.**

20. ✗ $\frac{2}{3} = \frac{2+4}{3+4} = \frac{6}{7}$

21. ✗ $\frac{2}{3} = \frac{2 \times 2}{3 \times 3} = \frac{4}{9}$

22. **PUPPY** One way to make puppy food is to soften three parts dog food with one part water. How much dog food can be softened with 16 cups of water?

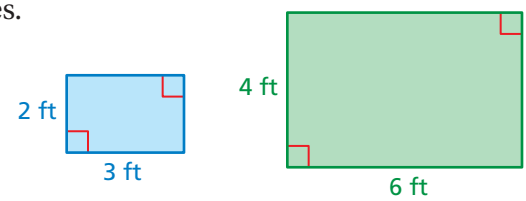
23. **CHECKERS** During a checkers game, there are 16 pieces left. The ratio of black to red is 3 : 5. How many black pieces are on the board? Explain how you found your answer.

24. **SCHOOL PLAY** There are 48 students in a school play. The ratio of boys to girls is 5 : 7. How many boys are in the school play? Explain how you found your answer.

25. **GEOMETRY** Use the blue and green rectangles.

a. Find the ratio of the length of the blue rectangle to the length of the green rectangle. Repeat this for width, perimeter, and area.

b. Compare and contrast your ratios in part (a).



Player	Hits	At Bats
1	30	48
2	16	40
3	20	32
4	36	60

26. **SOFTBALL** The table shows the number of hits and at bats for four softball players.

a. Write each player's batting average as a ratio of hits to at bats.

b. Did the player with the most hits have the best batting average? Explain.

27. **Reasoning** There are 12 boys and 10 girls in your gym class. If 6 boys joined the class, how many girls would need to join for the ratio to remain the same?

Fair Game Review What you learned in previous grades & lessons

Divide. SECTION 3.4

28. 13.8 ÷ 3 **29.** 16.45 ÷ 5 **30.** 53.13 ÷ 21 **31.** 19.214 ÷ 13

32. **MULTIPLE CHOICE** Which numbers are ordered from least to greatest? SECTION 4.3

(A) 0.83, $\frac{17}{20}$, 86%, $\frac{7}{8}$, 87.25%

(B) 0.83, $\frac{17}{20}$, 86%, 87.25%, $\frac{7}{8}$

(C) $\frac{17}{20}$, 0.83, 86%, 87.25%, $\frac{7}{8}$

(D) $\frac{7}{8}$, 87.25%, 86%, 0.83, $\frac{17}{20}$