

2

Fractions and Decimals

- 2.1** Multiplying Fractions
- 2.2** Dividing Fractions
- 2.3** Dividing Mixed Numbers
- 2.4** Adding and Subtracting Decimals
- 2.5** Multiplying Decimals
- 2.6** Dividing Whole Numbers
- 2.7** Dividing Decimals

Chapter Learning Target:

Understand fractions and decimals.

Chapter Success Criteria:

- I can identify a fraction and a decimal.
- I can add, subtract, multiply, and divide fractions and decimals.
- I can evaluate expressions involving fractions and decimals using the order of operations.
- I can solve a problem using fractions and decimals.



STEAM Video: "Space is Big"

STEAM Video



Space is Big

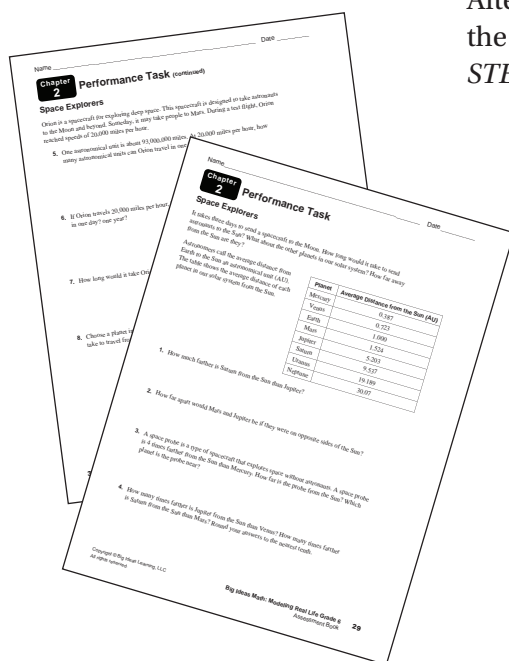
An astronomical unit (AU) is the average distance between Earth and the Sun, about 93 million miles. Why do astronomers use astronomical units to measure distances in space? In what different ways can you compare the distances between objects and the locations of objects using the four mathematical operations?

Watch the STEAM Video “Space is Big.” Then answer the following questions.

1. You know the distances between the Sun and each planet. How can you find the minimum and maximum distances between two planets as they rotate around the Sun?
2. The table shows the distances of three celestial bodies from Earth. It takes about three days to travel from Earth to the Moon. How can you estimate the amount of time it would take to travel from Earth to the Sun or to Venus?

Celestial body	Sun	Moon	Venus
Distance from Earth (AU)	1	0.00256	0.277

Performance Task



Space Explorers

After completing this chapter, you will be able to use the concepts you learned to answer the questions in the *STEAM Video Performance Task*.

You will use a table that shows the average distances between the Sun and each planet in our solar system to find several distances in space. Then you will use the speed of the Orion spacecraft to answer questions about time and distance.

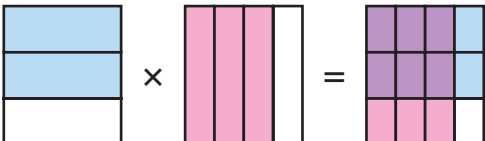
Is it realistic for a manned spacecraft to travel to each planet in our solar system? Explain why or why not.

Getting Ready for Chapter 2

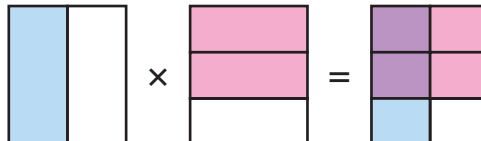
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Chapter Exploration

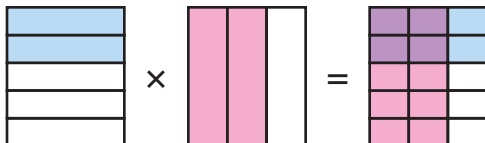
Work with a partner. The area model represents the multiplication of two fractions. Copy and complete the statement.

1. 

$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$

2. 

$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$

3. 

$\frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$

4. 

$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$

Work with a partner. Use an area model to find the product.

5. $\frac{1}{2} \times \frac{1}{3}$

6. $\frac{4}{5} \times \frac{1}{4}$

7. $\frac{1}{6} \times \frac{3}{4}$

8. $\frac{3}{5} \times \frac{1}{4}$

9. **MODELING REAL LIFE** You have a recipe that serves 6 people. The recipe uses three-fourths of a cup of milk.

- How can you use the recipe to serve *more* people? How much milk would you need? Give 2 examples.
- How can you use the recipe to serve *fewer* people? How much milk would you need? Give 2 examples.



Vocabulary

The following vocabulary terms are defined in this chapter. Think about what each term might mean and record your thoughts.

reciprocals

multiplicative inverses

2.1 Multiplying Fractions

Learning Target: Find products involving fractions and mixed numbers.

- Success Criteria:**
- I can draw a model to explain fraction multiplication.
 - I can multiply fractions.
 - I can find products involving mixed numbers.
 - I can interpret products involving fractions and mixed numbers to solve real-life problems.

EXPLORATION 1

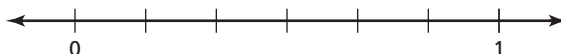
Using Models to Solve a Problem



Work with a partner. A bottle of water is $\frac{1}{2}$ full. You drink $\frac{2}{3}$ of the water.

Use one of the models to find the portion of the bottle of water that you drink. Explain your steps.

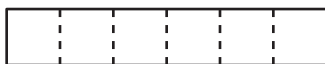
- number line



- area model



- tape diagram

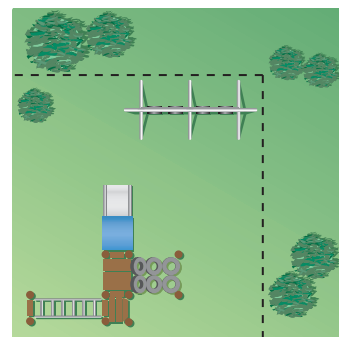


EXPLORATION 2

Solving a Problem Involving Fractions

Work with a partner. A park has a playground that is $\frac{3}{4}$ of its width and $\frac{4}{5}$ of its length.

- Use a model to find the portion of the park that is covered by the playground. Explain your steps.
- How can you find the solution of part (a) without using a model?



Math Practice

Find General Methods

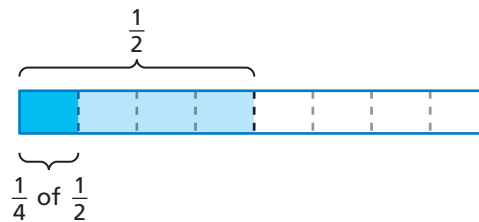
How can you use your answer to find a method for multiplying fractions?

2.1 Lesson

EXAMPLE 1 Multiplying Fractions

Find $\frac{1}{4} \times \frac{1}{2}$.

Use a model to find $\frac{1}{4}$ of $\frac{1}{2}$.



So, the product is $\frac{1}{8}$.

Try It Multiply.

1. $\frac{1}{3} \times \frac{1}{5}$

2. $\frac{2}{3} \times \frac{3}{4}$

3. $\frac{1}{2} \cdot \frac{5}{6}$

Think: What is one-fourth of one-half?

Key Idea

Multiplying Fractions

Words Multiply the numerators and multiply the denominators.

Numbers $\frac{3}{7} \times \frac{1}{2} = \frac{3 \times 1}{7 \times 2} = \frac{3}{14}$

Algebra $\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$, where $b, d \neq 0$

EXAMPLE 2 Multiplying Fractions

Find $\frac{8}{9} \cdot \frac{3}{4}$.

Estimate $1 \cdot \frac{3}{4} = \frac{3}{4}$

Remember



To simplify a fraction, write an equivalent fraction whose numerator and denominator have no common factors other than 1.

$$\frac{24}{36} = \frac{24 \div 12}{36 \div 12} = \frac{2}{3}$$

$$\begin{aligned} \frac{8}{9} \cdot \frac{3}{4} &= \frac{8 \cdot 3}{9 \cdot 4} \\ &= \frac{24}{36}, \text{ or } \frac{2}{3} \end{aligned}$$

Multiply the numerators and the denominators.

Simplify.

The product is $\frac{2}{3}$.

Reasonable? $\frac{2}{3} \approx \frac{3}{4}$ ✓

The symbol \approx means is approximately equal to.

Try It Multiply. Write the answer in simplest form.

4. $\frac{3}{7} \times \frac{2}{3}$

5. $\frac{4}{9} \cdot \frac{3}{10}$

6. $\frac{6}{5} \cdot \frac{5}{8}$

EXAMPLE 3 Solving a Problem Involving Fractions

You have $\frac{2}{3}$ of a bag of flour. You use $\frac{3}{4}$ of the flour to make empanada dough. How much of the entire bag do you use to make the dough?

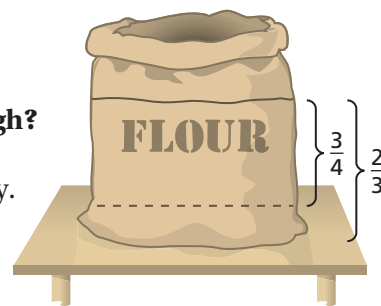
You use $\frac{3}{4}$ of $\frac{2}{3}$ of the bag. To find $\frac{3}{4}$ of $\frac{2}{3}$, multiply.

$$\frac{3}{4} \times \frac{2}{3} = \frac{3 \times 2}{4 \times 3}$$

Multiply the numerators and the denominators.

$$= \frac{6}{12}, \text{ or } \frac{1}{2}$$

Simplify.



► So, you use $\frac{1}{2}$ of the entire bag.

Try It

7. **WHAT IF?** You use $\frac{1}{4}$ of the flour to make the dough. How much of the entire bag do you use to make the dough?

Key Idea

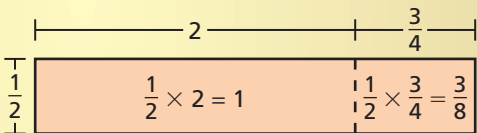
Multiplying Mixed Numbers

Write each mixed number as an improper fraction. Then multiply as you would with fractions.

EXAMPLE 4 Multiplying a Fraction and a Mixed Number

Another Method

Use a model.



So, $\frac{1}{2} \times 2\frac{3}{4} = 1 + \frac{3}{8} = 1\frac{3}{8}$. ✓

Find $\frac{1}{2} \times 2\frac{3}{4}$.

Estimate $\frac{1}{2} \times 3 = 1\frac{1}{2}$

$$\frac{1}{2} \times 2\frac{3}{4} = \frac{1}{2} \times \frac{11}{4}$$

Write $2\frac{3}{4}$ as the improper fraction $\frac{11}{4}$.

$$= \frac{1 \times 11}{2 \times 4}$$

Multiply the numerators and the denominators.

$$= \frac{11}{8}, \text{ or } 1\frac{3}{8}$$

Simplify.

► The product is $1\frac{3}{8}$.

Reasonable? $1\frac{3}{8} \approx 1\frac{1}{2}$ ✓

Try It Multiply. Write the answer in simplest form.

8. $\frac{1}{3} \times 1\frac{1}{6}$

9. $3\frac{1}{2} \times \frac{4}{9}$

10. $4\frac{2}{3} \cdot \frac{3}{4}$

EXAMPLE 5 Multiplying Mixed Numbers

Find $1\frac{4}{5} \times 3\frac{2}{3}$.

Estimate $2 \times 4 = 8$

$$\begin{aligned}1\frac{4}{5} \times 3\frac{2}{3} &= \frac{9}{5} \times \frac{11}{3} \\ &= \frac{9 \times 11}{5 \times 3} \\ &= \frac{99}{15}, \text{ or } 6\frac{3}{5}\end{aligned}$$

Write $1\frac{4}{5}$ and $3\frac{2}{3}$ as improper fractions.

Multiply the numerators and the denominators.

Simplify.

▶ The product is $6\frac{3}{5}$.

Reasonable? $6\frac{3}{5} \approx 8$ ✓

Try It Multiply. Write the answer in simplest form.

11. $1\frac{7}{8} \cdot 2\frac{2}{5}$

12. $5\frac{5}{7} \times 2\frac{1}{10}$

13. $2\frac{1}{3} \cdot 7\frac{2}{3}$



Self-Assessment for Concepts & Skills

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

MULTIPLYING FRACTIONS AND MIXED NUMBERS Multiply. Write the answer in simplest form.

14. $\frac{1}{8} \times \frac{1}{6}$

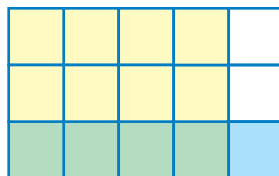
15. $\frac{3}{8} \cdot \frac{2}{3}$

16. $2\frac{1}{6} \cdot 4\frac{2}{5}$

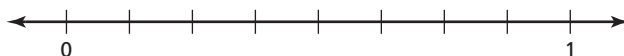
17. **MP REASONING** What is the missing denominator?

$$\frac{3}{7} \times \frac{1}{\square} = \frac{3}{28}$$

18. **USING TOOLS** Write a multiplication problem involving fractions that is represented by the model. Explain your reasoning.



19. **USING TOOLS** Use the number line to find $\frac{3}{4} \times \frac{1}{2}$. Explain your reasoning.



EXAMPLE 6**Modeling Real Life**

Understand the problem.

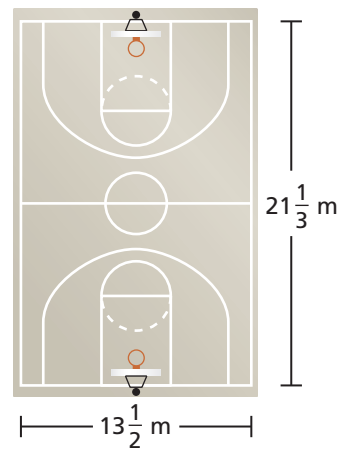
Make a plan.

Solve and check.

A city is resurfacing a basketball court. Find the area of the court.

You are given the dimensions of a basketball court. You are asked to find the area of the court.

Use the formula for the area of a rectangle. Find the product of the length and the width of the court.

**Check Reasonableness**

Find an underestimate and an overestimate.

Underestimate:
 $13 \cdot 21 = 273$

Overestimate:
 $14 \cdot 22 = 308$

The answer is reasonable because $273 < 288 < 308$. ✓

$$A = \ell w$$

Write the formula.

$$= 21\frac{1}{3} \cdot 13\frac{1}{2}$$

Substitute for ℓ and w .

$$= \frac{64}{3} \cdot \frac{27}{2}$$

Write $21\frac{1}{3}$ and $13\frac{1}{2}$ as improper fractions.

$$= \frac{64 \cdot 27}{3 \cdot 2}$$

Multiply the numerators and the denominators.

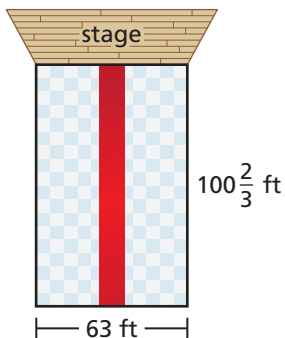
$$= \frac{1728}{6}, \text{ or } 288$$

Simplify.

► So, the area of the court is 288 square meters.

**Self-Assessment for Problem Solving**

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



20. You spend $\frac{5}{12}$ of a day at an amusement park. You spend $\frac{2}{5}$ of that time riding waterslides. How many hours do you spend riding waterslides? Draw a model to show why your answer makes sense.
21. A venue is preparing for a concert on the floor shown. The width of the red carpet is $\frac{1}{6}$ of the width of the floor. What is the area of the red carpet?
22. You travel $9\frac{3}{8}$ miles from your house to a shopping mall. You travel $\frac{2}{3}$ of that distance on an interstate. The only road construction you encounter is on the first $\frac{2}{5}$ of the interstate. On how many miles of your trip do you encounter construction?

2.1 Practice



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

► Review & Refresh

Find the LCM of the numbers.

1. 8, 10

2. 5, 7

3. 2, 5, 7

4. 6, 7, 10

Divide. Use a diagram to justify your answer.

5. $6 \div \frac{1}{2}$

6. $\frac{1}{4} \div 8$

7. $4 \div \frac{1}{3}$

8. $\frac{1}{5} \div 4$

Write the product as a power.

9. $10 \times 10 \times 10$

10. $5 \times 5 \times 5 \times 5$

11. How many inches are in $5\frac{1}{2}$ yards?

A. $15\frac{1}{2}$

B. $16\frac{1}{2}$

C. 66

D. 198

► Concepts, Skills, & Problem Solving

MP CHOOSE TOOLS A bottle of water is $\frac{2}{3}$ full. You drink the given portion of the water. Use a model to find the portion of the bottle of water that you drink. (See Exploration 1, p. 45.)

12. $\frac{1}{2}$

13. $\frac{1}{4}$

14. $\frac{3}{4}$

MULTIPLYING FRACTIONS Multiply. Write the answer in simplest form.

15. $\frac{1}{7} \times \frac{2}{3}$

16. $\frac{5}{8} \cdot \frac{1}{2}$

17. $\frac{1}{4} \times \frac{2}{5}$

18. $\frac{3}{7} \times \frac{1}{4}$

19. $\frac{2}{3} \times \frac{4}{7}$

20. $\frac{5}{7} \times \frac{7}{8}$

21. $\frac{3}{8} \cdot \frac{1}{9}$

22. $\frac{5}{6} \cdot \frac{2}{5}$

23. $\frac{5}{12} \times 10$

24. $6 \cdot \frac{7}{8}$

25. $\frac{3}{4} \times \frac{8}{15}$

26. $\frac{4}{9} \times \frac{4}{5}$

27. $\frac{3}{7} \cdot \frac{3}{7}$

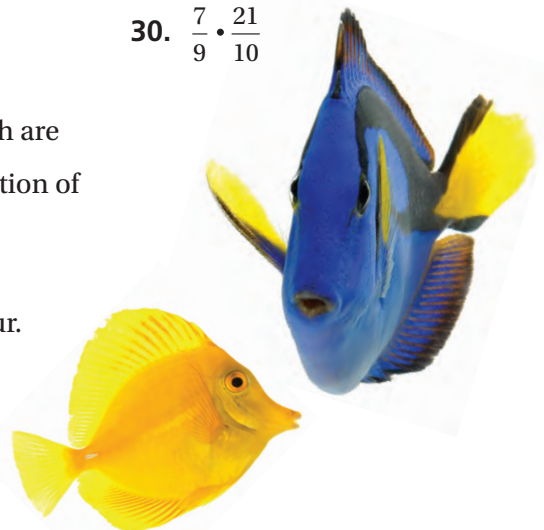
28. $\frac{5}{6} \times \frac{2}{9}$

29. $\frac{13}{18} \times \frac{6}{7}$

30. $\frac{7}{9} \cdot \frac{21}{10}$

31. **MODELING REAL LIFE** In an aquarium, $\frac{2}{5}$ of the fish are surgeonfish. Of these, $\frac{3}{4}$ are yellow tangs. What portion of all fish in the aquarium are yellow tangs?

32. **MODELING REAL LIFE** You exercise for $\frac{3}{4}$ of an hour. You jump rope for $\frac{1}{3}$ of that time. What portion of the hour do you spend jumping rope?



MP REASONING Without finding the product, copy and complete the statement using $<$, $>$, or $=$. Explain your reasoning.

33. $\frac{4}{7}$ $\frac{9}{10} \cdot \frac{4}{7}$

34. $\frac{5}{8} \times \frac{22}{15}$ $\frac{5}{8}$

35. $\frac{5}{6}$ $\frac{5}{6} \times \frac{7}{7}$

MULTIPLYING FRACTIONS AND MIXED NUMBERS Multiply. Write the answer in simplest form.

36. $1\frac{1}{3} \cdot \frac{2}{3}$

37. $6\frac{2}{3} \times \frac{3}{10}$

38. $2\frac{1}{2} \cdot \frac{4}{5}$

39. $\frac{3}{5} \cdot 3\frac{1}{3}$

40. $7\frac{1}{2} \times \frac{2}{3}$

41. $\frac{5}{9} \times 3\frac{3}{5}$

42. $\frac{3}{4} \cdot 1\frac{1}{3}$

43. $3\frac{3}{4} \times \frac{2}{5}$

44. $4\frac{3}{8} \cdot \frac{4}{5}$

45. $\frac{3}{7} \times 2\frac{5}{6}$

46. $1\frac{3}{10} \times 18$

47. $15 \cdot 2\frac{4}{9}$

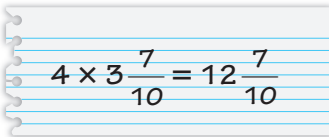
48. $1\frac{1}{6} \times 6\frac{3}{4}$

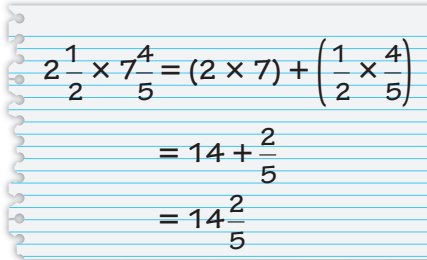
49. $2\frac{5}{12} \cdot 2\frac{2}{3}$

50. $5\frac{5}{7} \cdot 3\frac{1}{8}$

51. $2\frac{4}{5} \times 4\frac{1}{16}$

YOU BE THE TEACHER Your friend finds the product. Is your friend correct? Explain your reasoning.

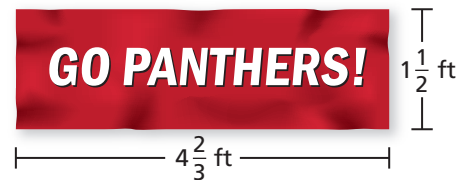
52. 

53. 

54. **MODELING REAL LIFE** A vitamin C tablet contains $\frac{1}{4}$ of a gram of vitamin C. You take $1\frac{1}{2}$ tablets every day. How many grams of vitamin C do you take every day?

55. **MP PROBLEM SOLVING** You make a banner for a football rally.

- What is the area of the banner?
- You add a $\frac{1}{4}$ -foot border on each side. What is the area of the new banner?



MULTIPLYING FRACTIONS AND MIXED NUMBERS Multiply. Write the answer in simplest form.

56. $\frac{1}{2} \times \frac{3}{5} \times \frac{4}{9}$

57. $\frac{4}{7} \cdot 4\frac{3}{8} \cdot \frac{5}{6}$

58. $1\frac{1}{15} \times 5\frac{2}{5} \times 4\frac{7}{12}$

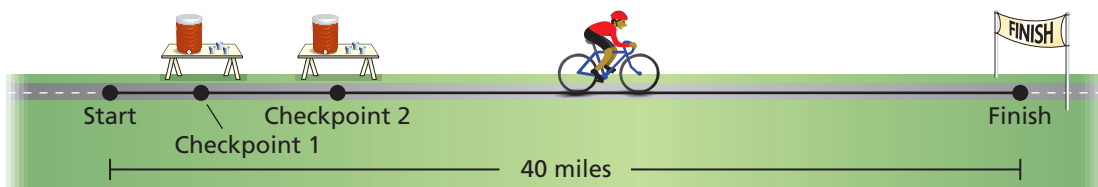
59. $\left(\frac{3}{5}\right)^3$

60. $\left(\frac{4}{5}\right)^2 \times \left(\frac{3}{4}\right)^2$

61. $\left(\frac{5}{6}\right)^2 \cdot \left(1\frac{1}{10}\right)^2$

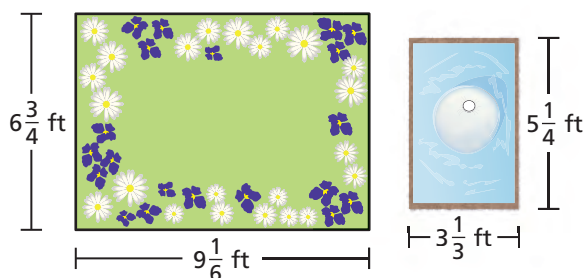
62. **OPEN-ENDED** Find a fraction that, when multiplied by $\frac{1}{2}$, is less than $\frac{1}{4}$.

63. **MP LOGIC** You are in a bike race. When you get to the first checkpoint, you are $\frac{2}{5}$ of the distance to the second checkpoint. When you get to the second checkpoint, you are $\frac{1}{4}$ of the distance to the finish. What is the distance from the start to the first checkpoint?



64. **MP NUMBER SENSE** Is the product of two positive mixed numbers ever less than 1? Explain.

65. **MP REASONING** You plan to add a fountain to your garden.



- Draw a diagram of the fountain in the garden. Label the dimensions.
- Describe two methods for finding the area of the garden that surrounds the fountain.
- Find the area. Which method did you use, and why?

66. **MP PROBLEM SOLVING** The cooking time for a ham is $\frac{2}{5}$ of an hour for each pound. What time should you start cooking a ham that weighs $12\frac{3}{4}$ pounds so that it is done at 4:45 P.M.?

67. **MP PRECISION** Complete the Four Square for $\frac{7}{8} \times \frac{1}{3}$.

68. **DIG DEEPER!** You ask 150 people about their pets. The results show that $\frac{9}{25}$ of the people own a dog. Of the people who own a dog, $\frac{1}{6}$ of them also own a cat.

- What portion of the people own a dog and a cat?
- How many people own a dog but not a cat? Explain.

Answer	Meaning
Model	Application

$\frac{7}{8} \times \frac{1}{3}$

69. **MP NUMBER SENSE** Use each of the numbers from 1 to 9 exactly once to create three mixed numbers with the greatest possible product. Then use each of the numbers exactly once to create three mixed numbers with the least possible product. Find each product. Explain your reasoning. The fraction portion of each mixed number should be proper.

$$\square \frac{\square}{\square} \times \square \frac{\square}{\square} \times \square \frac{\square}{\square}$$

2.2 Dividing Fractions

Learning Target: Compute quotients of fractions and solve problems involving division by fractions.

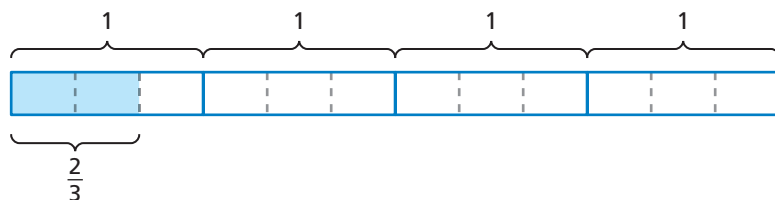
- Success Criteria:**
- I can draw a model to explain division of fractions.
 - I can find reciprocals of numbers.
 - I can divide fractions by fractions.
 - I can divide fractions and whole numbers.

EXPLORATION 1 Dividing by Fractions

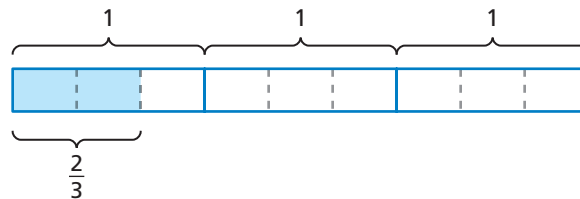
It may help to create a context for each question in Exploration 1. In part (a), suppose you want to cut 4 yards of string into pieces that are $\frac{2}{3}$ of a yard. How many pieces can you cut?

Work with a partner. Answer each question using a model.

- a. How many two-thirds are in four?



- b. How many three-fourths are in three?
 c. How many two-fifths are in four-fifths?
 d. How many two-thirds are in three?



- e. How many one-thirds are in five-sixths?

EXPLORATION 2 Finding a Pattern

Math Practice

Look for Structure

Can the pattern you found be applied to division by a whole number? Why or why not?

Work with a partner. The table shows the division expressions from Exploration 1. Complete each multiplication expression so that it has the same value as the division expression above it. What can you conclude about dividing by fractions?

Division Expression	$4 \div \frac{2}{3}$	$3 \div \frac{3}{4}$	$\frac{4}{5} \div \frac{2}{5}$	$3 \div \frac{2}{3}$	$\frac{5}{6} \div \frac{1}{3}$
Multiplication Expression	$4 \times ?$	$3 \times ?$	$\frac{4}{5} \times ?$	$3 \times ?$	$\frac{5}{6} \times ?$

2.2 Lesson

Key Vocabulary

reciprocals, p. 54
multiplicative inverses,
p. 54

Two numbers whose product is 1 are **reciprocals**, or **multiplicative inverses**. To write the reciprocal of a number, first write the number as a fraction. Then invert the fraction. So, the reciprocal of a fraction $\frac{a}{b}$ is $\frac{b}{a}$, where $a \neq 0$ and $b \neq 0$.

The Meaning of a Word Invert

When you **invert** a glass, you turn it over.



EXAMPLE 1 Writing Reciprocals

When any number is multiplied by 0, the product is 0. So, the number 0 does not have a reciprocal.

	Original Number	Fraction	Reciprocal	Check
a.	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{5}{3}$	$\frac{3}{5} \times \frac{5}{3} = 1$
b.	$\frac{9}{5}$	$\frac{9}{5}$	$\frac{5}{9}$	$\frac{9}{5} \times \frac{5}{9} = 1$
c.	2	$\frac{2}{1}$	$\frac{1}{2}$	$\frac{2}{1} \times \frac{1}{2} = 1$

Try It Write the reciprocal of the number.

1. $\frac{3}{4}$

2. 5

3. $\frac{7}{2}$

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

Key Idea

Dividing Fractions

Words To divide a number by a fraction, multiply the number by the reciprocal of the fraction.

Numbers $\frac{1}{5} \div \frac{3}{4} = \frac{1}{5} \times \frac{4}{3} = \frac{1 \times 4}{5 \times 3}$

Algebra $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{a \cdot d}{b \cdot c}$, where $b, c,$ and $d \neq 0$

EXAMPLE 2**Dividing a Fraction by a Fraction**

a. Find $\frac{3}{4} \div \frac{5}{12}$.

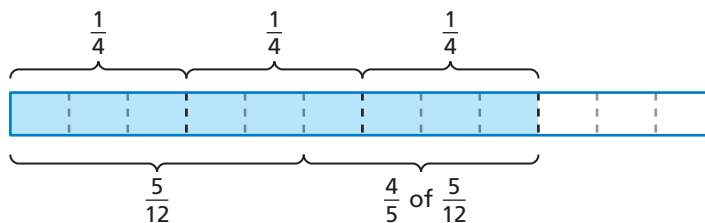
$$\begin{aligned} \frac{3}{4} \div \frac{5}{12} &= \frac{3}{4} \cdot \frac{12}{5} \\ &= \frac{3 \cdot 12}{4 \cdot 5} \\ &= \frac{36}{20}, \text{ or } 1\frac{4}{5} \end{aligned}$$

Multiply by the reciprocal of $\frac{5}{12}$, which is $\frac{12}{5}$.

Multiply fractions.

Simplify.

Think: How many five-twelfths are in three-fourths?



b. Find $\frac{1}{6} \div \frac{2}{3}$.

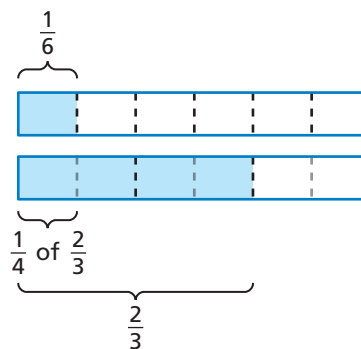
$$\begin{aligned} \frac{1}{6} \div \frac{2}{3} &= \frac{1}{6} \times \frac{3}{2} \\ &= \frac{1 \times 3}{6 \times 2} \\ &= \frac{3}{12}, \text{ or } \frac{1}{4} \end{aligned}$$

Multiply by the reciprocal of $\frac{2}{3}$, which is $\frac{3}{2}$.

Multiply fractions.

Simplify.

Example 2(b) is asking you to find how many $\frac{2}{3}$ are in $\frac{1}{6}$. Because the divisor is greater than the dividend, it can be helpful to model each number with a tape diagram.



Try It Divide. Write the answer in simplest form. Use a model to justify your answer.

5. $\frac{1}{2} \div \frac{1}{8}$

6. $\frac{2}{5} \div \frac{3}{10}$

7. $\frac{3}{8} \div \frac{3}{4}$

8. $\frac{2}{7} \div \frac{9}{14}$

EXAMPLE 3**Dividing a Fraction by a Whole Number**Find $\frac{4}{5} \div 2$.

$$\frac{4}{5} \div 2 = \frac{4}{5} \div \frac{2}{1}$$

Write 2 as an improper fraction.

$$= \frac{4}{5} \times \frac{1}{2}$$

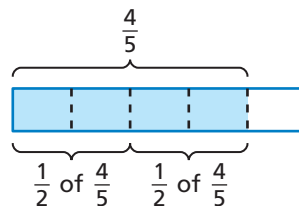
Multiply by the reciprocal of $\frac{2}{1}$, which is $\frac{1}{2}$.

$$= \frac{4 \times 1}{5 \times 2}$$

Multiply fractions.

$$= \frac{4}{10}, \text{ or } \frac{2}{5}$$

Simplify.

**Remember**

When dividing unit fractions by whole numbers, remember that dividing by a number n is equivalent to multiplying by $\frac{1}{n}$.

Try It Divide. Write the answer in simplest form.

9. $\frac{1}{3} \div 3$

10. $\frac{2}{3} \div 10$

11. $\frac{5}{8} \div 4$

12. $\frac{6}{7} \div 4$

**Self-Assessment for Concepts & Skills**

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

DIVIDING FRACTIONS Divide. Write the answer in simplest form.

Draw a model to justify your answer.

13. $\frac{2}{3} \div \frac{5}{6}$

14. $\frac{6}{7} \div 3$

15. **WHICH ONE DOESN'T BELONG?** Which of the following does *not* belong with the other three? Explain your reasoning.

$$\frac{2}{3} \div \frac{4}{5}$$

$$\frac{3}{2} \cdot \frac{4}{5}$$

$$\frac{5}{4} \times \frac{2}{3}$$

$$\frac{5}{4} \div \frac{3}{2}$$

MATCHING Match the expression with its value.

16. $\frac{2}{5} \div \frac{8}{15}$

17. $\frac{8}{15} \div \frac{2}{5}$

18. $\frac{2}{15} \div \frac{8}{5}$

19. $\frac{8}{5} \div \frac{2}{15}$

A. $\frac{1}{12}$

B. $\frac{3}{4}$

C. 12

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

EXAMPLE 4

Modeling Real Life



A piece of wood is 4 feet long. How many $\frac{3}{4}$ -foot pieces can you cut from the piece of wood? How much wood is left over?

Divide the length of the entire piece of wood by the length of a smaller piece.

So, divide 4 by $\frac{3}{4}$. The quotient can be used to answer both questions.

$$4 \div \frac{3}{4} = 4 \times \frac{4}{3}$$

Multiply by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.

$$= \frac{4 \times 4}{3}$$

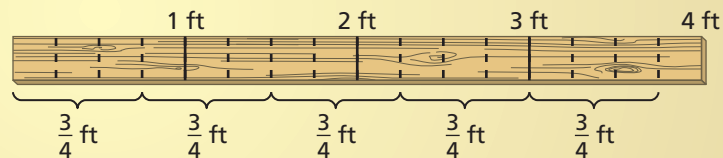
Multiply.

$$= \frac{16}{3}, \text{ or } 5\frac{1}{3}$$

Simplify.

- ▶ You can cut five $\frac{3}{4}$ -foot pieces from the piece of wood. The remaining piece is $\frac{1}{3}$ of a $\frac{3}{4}$ -foot section. So, $\frac{1}{3} \cdot \frac{3}{4} = \frac{3}{12} = \frac{1}{4}$ foot of wood is left over.

Another Method Use a diagram.



One-fourth of a foot is left over after cutting 5 pieces. ✓



Self-Assessment for Problem Solving

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



20. You have 5 cups of rice to make *bibimbap*, a popular Korean meal. The recipe calls for $\frac{4}{5}$ cup of rice per serving. How many full servings of *bibimbap* can you make? How much rice is left over?
21. A band earns $\frac{2}{3}$ of their profit from selling concert tickets and $\frac{1}{5}$ of their profit from selling merchandise. The band earns a profit of \$1500 from selling concert tickets. How much profit does the band earn from selling merchandise?

2.2 Practice



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

► Review & Refresh

Multiply. Write the answer in simplest form.

1. $\frac{7}{10} \cdot \frac{3}{4}$

2. $\frac{5}{6} \times 2\frac{1}{3}$

3. $\frac{4}{9} \times \frac{3}{8}$

4. $2\frac{2}{5} \cdot 6\frac{2}{3}$

Match the expression with its value.

5. $3 + 2 \times 4^2$

6. $(3 + 2) \times 4^2$

7. $2 + 3 \times 4^2$

8. $4^2 + 2 \times 3$

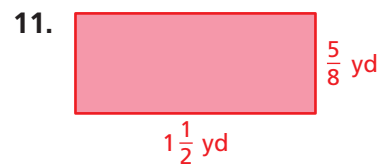
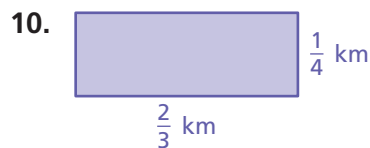
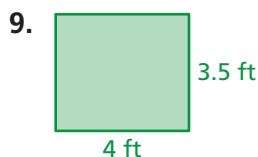
A. 22

B. 35

C. 50

D. 80

Find the area of the rectangle.



► Concepts, Skills, & Problem Solving

MP CHOOSE TOOLS Answer the question using a model. (See Exploration 1, p. 53.)

12. How many three-fifths are in three?
13. How many two-ninths are in eight-ninths?
14. How many three-fourths are in seven-eighths?

WRITING RECIPROCAL Write the reciprocal of the number.

15. 8 16. $\frac{6}{7}$ 17. $\frac{2}{5}$ 18. $\frac{11}{8}$

DIVIDING FRACTIONS Divide. Write the answer in simplest form.

19. $\frac{1}{3} \div \frac{1}{2}$ 20. $\frac{1}{8} \div \frac{1}{4}$ 21. $\frac{2}{7} \div 2$ 22. $\frac{6}{5} \div 3$
23. $\frac{2}{3} \div \frac{4}{9}$ 24. $\frac{5}{6} \div \frac{2}{7}$ 25. $12 \div \frac{3}{4}$ 26. $8 \div \frac{2}{5}$
27. $\frac{3}{7} \div 6$ 28. $\frac{12}{25} \div 4$ 29. $\frac{2}{9} \div \frac{2}{3}$ 30. $\frac{8}{15} \div \frac{4}{5}$
31. $\frac{1}{3} \div \frac{1}{9}$ 32. $\frac{7}{10} \div \frac{3}{8}$ 33. $\frac{14}{27} \div 7$ 34. $\frac{5}{8} \div 15$
35. $\frac{27}{32} \div \frac{7}{8}$ 36. $\frac{4}{15} \div \frac{10}{13}$ 37. $9 \div \frac{4}{9}$ 38. $10 \div \frac{5}{12}$

YOU BE THE TEACHER Your friend finds the quotient. Is your friend correct?

Explain your reasoning.

39.

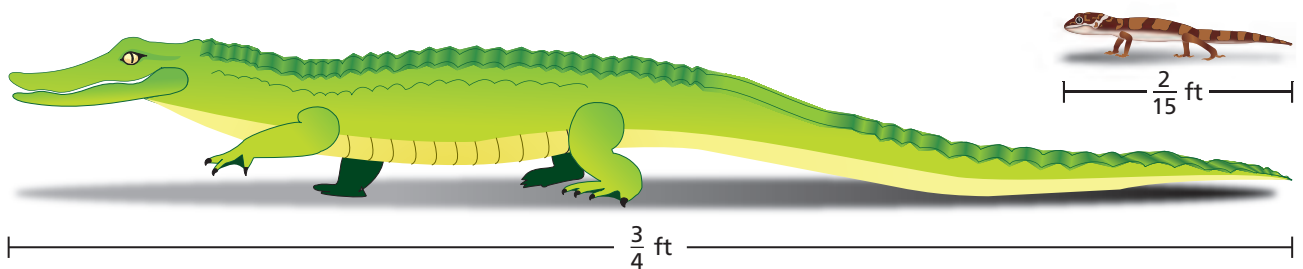
$$\begin{aligned} \frac{4}{7} \div \frac{13}{28} &= \frac{4}{7} \times \frac{28}{13} \\ &= \frac{4 \times 28}{7 \times 13} \\ &= \frac{112}{91}, \text{ or } 1\frac{3}{13} \end{aligned}$$

40.

$$\begin{aligned} \frac{2}{5} \div \frac{8}{9} &= \frac{5}{2} \times \frac{8}{9} \\ &= \frac{5 \times 8}{2 \times 9} \\ &= \frac{40}{18}, \text{ or } 2\frac{2}{9} \end{aligned}$$

41. **MP REASONING** You have $\frac{3}{5}$ of an apple pie. You divide the remaining pie into 5 equal slices. What portion of the original pie is each slice?

42. **MP PROBLEM SOLVING** How many times longer is the baby alligator than the baby gecko?



OPEN-ENDED Write a real-life problem for the expression. Then solve the problem.

43. $\frac{5}{6} \div 4$

44. $\frac{2}{5} \div \frac{3}{8}$

45. $10 \div \frac{2}{3}$

46. $\frac{2}{7} \div \frac{4}{9}$

MP NUMBER SENSE Copy and complete the statement.

47. $\frac{5}{12} \times \square = 1$

48. $3 \times \square = 1$

49. $7 \div \square = 56$

MP REASONING Without finding the quotient, copy and complete the statement using $<$, $>$, or $=$. Explain your reasoning.

50. $\frac{7}{9} \div 5 \square \frac{7}{9}$

51. $\frac{3}{7} \div 1 \square \frac{3}{7}$

52. $8 \div \frac{3}{4} \square 8$

53. $\frac{5}{6} \div \frac{7}{8} \square \frac{5}{6}$

ORDER OF OPERATIONS Evaluate the expression. Write the answer in simplest form.

54. $\frac{1}{6} \div 6 \div 6$

55. $\frac{7}{12} \div 14 \div 6$

56. $\frac{3}{5} \div \frac{4}{7} \div \frac{9}{10}$

57. $4 \div \frac{8}{9} - \frac{1}{2}$

58. $\frac{3}{4} + \frac{5}{6} \div \frac{2}{3}$

59. $\frac{7}{8} - \frac{3}{8} \div 9$

60. $\frac{9}{16} \div \frac{3}{4} \cdot \frac{2}{13}$

61. $\frac{3}{14} \cdot \frac{2}{5} \div \frac{6}{7}$

62. $\frac{10}{27} \cdot \left(\frac{3}{8} \div \frac{5}{24} \right)$

63. **MP NUMBER SENSE** When is the reciprocal of a fraction a whole number? Explain.

64. **MODELING REAL LIFE** You use $\frac{1}{8}$ of your battery for every $\frac{2}{5}$ of an hour that you video chat. You use $\frac{3}{4}$ of your battery video chatting. How long did you video chat?

65. **MP PROBLEM SOLVING** The table shows the portions of a family budget that are spent on several expenses.

Expense	Portion of Budget
Housing	$\frac{2}{5}$
Food	$\frac{4}{9}$
Automobiles	$\frac{1}{15}$
Recreation	$\frac{1}{40}$

- How many times more is the expense for housing than for automobiles?
- How many times more is the expense for food than for recreation?
- The expense for automobile fuel is $\frac{1}{60}$ of the total expenses. What portion of the automobile expense is spent on fuel?

66. **CRITICAL THINKING** A bottle of juice is $\frac{2}{3}$ full. The bottle contains $\frac{4}{5}$ of a cup of juice.

How many cups of juice?



- Write a division expression that represents the capacity of the bottle.
- Write a related multiplication expression that represents the capacity of the bottle.
- Explain how you can use the diagram to verify the expression in part (b).
- Find the capacity of the bottle.

67. **DIG DEEPER!** You have 6 pints of glaze. It takes $\frac{7}{8}$ of a pint to glaze a bowl and $\frac{9}{16}$ of a pint to glaze a plate.



- How many bowls can you completely glaze? How many plates can you completely glaze?
- You want to glaze 5 bowls, and then use the rest for plates. How many plates can you completely glaze? How much glaze will be left over?
- How many of each object can you completely glaze so that there is no glaze left over? Explain how you found your answer.

68. **MP REASONING** A water tank is $\frac{1}{8}$ full. The tank is $\frac{3}{4}$ full when 42 gallons of water are added to the tank.

- How much water can the tank hold?
- How much water was originally in the tank?
- How much water is in the tank when it is $\frac{1}{2}$ full?



2.3 Dividing Mixed Numbers

Learning Target: Compute quotients with mixed numbers and solve problems involving division with mixed numbers.

- Success Criteria:**
- I can draw a model to explain division of mixed numbers.
 - I can write a mixed number as an improper fraction.
 - I can divide with mixed numbers.
 - I can evaluate expressions involving mixed numbers using the order of operations.

EXPLORATION 1

Dividing Mixed Numbers

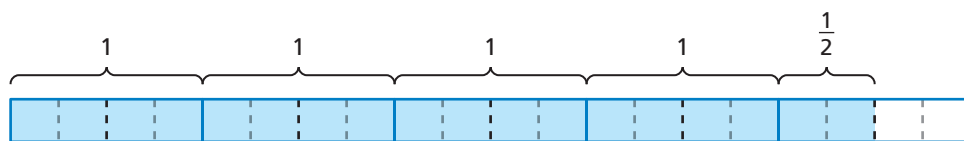
Work with a partner. Write a real-life problem that represents each division expression described. Then solve each problem using a model. Check your answers.

Math Practice

Make Sense of Quantities

What values do the parts of the model represent?

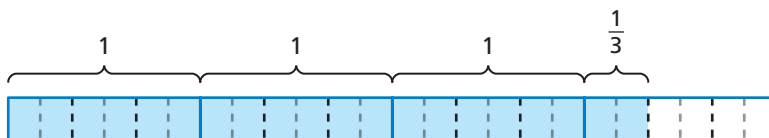
- a. How many three-fourths are in four and one-half?



- b. How many three-eighths are in two and one-fourth?

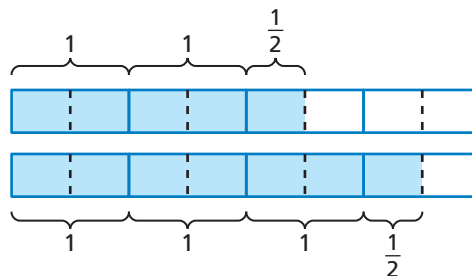
- c. How many one and one-halves are in six?

- d. How many seven-sixths are in three and one-third?



- e. How many one and one-fifths are in five?

- f. How many three and one-halves are in two and one-half?



- g. How many four and one-halves are in one and one-half?

2.3 Lesson

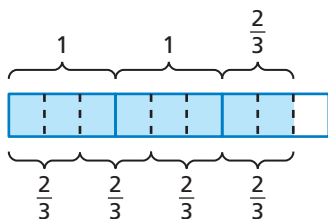
Key Idea

Dividing Mixed Numbers

Write each mixed number as an improper fraction. Then divide as you would with proper fractions.

EXAMPLE 1 Dividing with Mixed Numbers

Think: How many two-thirds are in two and two-thirds?



a. Find $2\frac{2}{3} \div \frac{2}{3}$.

$$\begin{aligned} 2\frac{2}{3} \div \frac{2}{3} &= \frac{8}{3} \div \frac{2}{3} \\ &= \frac{8}{3} \times \frac{3}{2} \\ &= \frac{8 \times 3}{3 \times 2} \\ &= \frac{24}{6}, \text{ or } 4 \end{aligned}$$

So, the quotient is 4.

Write $2\frac{2}{3}$ as the improper fraction $\frac{8}{3}$.

Multiply by the reciprocal of $\frac{2}{3}$, which is $\frac{3}{2}$.

Multiply fractions.

Simplify.

b. Find $3\frac{5}{6} \div 1\frac{2}{3}$.

$$\begin{aligned} 3\frac{5}{6} \div 1\frac{2}{3} &= \frac{23}{6} \div \frac{5}{3} \\ &= \frac{23}{6} \times \frac{3}{5} \\ &= \frac{23 \times 3}{6 \times 5} \\ &= \frac{69}{30}, \text{ or } 2\frac{3}{10} \end{aligned}$$

So, the quotient is $2\frac{3}{10}$.

Estimate $4 \div 2 = 2$

Write each mixed number as an improper fraction.

Multiply by the reciprocal of $\frac{5}{3}$, which is $\frac{3}{5}$.

Multiply fractions.

Simplify.

Reasonable? $2\frac{3}{10} \approx 2$ ✓

Try It Divide. Write the answer in simplest form.

1. $3\frac{2}{3} \div \frac{1}{3}$

2. $1\frac{3}{7} \div \frac{2}{3}$

3. $2\frac{1}{6} \div \frac{3}{4}$

4. $6\frac{1}{2} \div 2$

5. $10\frac{2}{3} \div 2\frac{2}{3}$

6. $8\frac{1}{4} \div 1\frac{1}{2}$

7. $3 \div 1\frac{3}{4}$

8. $\frac{3}{4} \div 2\frac{1}{2}$

EXAMPLE 2 Using Order of Operations

Remember



Be sure to check your answers whenever possible. In Example 2, you can use estimation to check that your answer is reasonable.

$$\begin{aligned}5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3} \\ \approx 5 \div 1 - 1 \\ = 5 - 1 \\ = 4 \quad \checkmark\end{aligned}$$

Evaluate $5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3}$.

$$\begin{aligned}5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3} &= \frac{21}{4} \div \frac{9}{8} - \frac{2}{3} \\ &= \frac{21}{4} \times \frac{8}{9} - \frac{2}{3} \\ &= \frac{21 \times 8}{4 \times 9} - \frac{2}{3} \\ &= \frac{168}{36} - \frac{2}{3} \\ &= \frac{14}{3} - \frac{2}{3} \\ &= \frac{12}{3}, \text{ or } 4\end{aligned}$$

Write each mixed number as an improper fraction.

Multiply by the reciprocal of $\frac{9}{8}$, which is $\frac{8}{9}$.

Multiply fractions.

Multiply.

Simplify.

Subtract.

Try It Evaluate the expression. Write the answer in simplest form.

9. $1\frac{1}{2} \div \frac{1}{6} - \frac{7}{8}$

10. $3\frac{1}{3} \div \frac{5}{6} + \frac{8}{9}$

11. $\frac{2}{5} + 2\frac{4}{5} \div 2$

12. $\frac{2}{3} - 1\frac{4}{7} \div 4\frac{5}{7}$



Self-Assessment for Concepts & Skills

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

EVALUATING EXPRESSIONS Evaluate the expression. Write the answer in simplest form.

13. $4\frac{4}{7} \div \frac{4}{7}$

14. $\frac{1}{2} \div 5\frac{1}{4}$

15. $\frac{3}{4} + 6\frac{2}{5} \div 1\frac{3}{5}$

16. **MP NUMBER SENSE** Is $2\frac{1}{2} \div 1\frac{1}{4}$ the same as $1\frac{1}{4} \div 2\frac{1}{2}$? Use models to justify your answer.

17. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find “both” answers.

What is $5\frac{1}{2}$ divided by $\frac{1}{8}$?

What is the quotient of $5\frac{1}{2}$ and $\frac{1}{8}$?

What is $5\frac{1}{2}$ times 8?

What is $\frac{1}{8}$ of $5\frac{1}{2}$?

EXAMPLE 3**Modeling Real Life**

One serving of tortilla soup is $1\frac{2}{3}$ cups. A restaurant cook makes 50 cups of soup. Is there enough to serve 35 people? Explain.

Divide the total amount of soup by the amount per serving to find the number of available servings. So, divide 50 by $1\frac{2}{3}$.

$$50 \div 1\frac{2}{3} = 50 \div \frac{5}{3}$$

Write $1\frac{2}{3}$ as the improper fraction $\frac{5}{3}$.

$$= 50 \cdot \frac{3}{5}$$

Multiply by the reciprocal of $\frac{5}{3}$, which is $\frac{3}{5}$.

$$= \frac{50 \cdot 3}{5}$$

Multiply.

$$= \frac{150}{5}, \text{ or } 30$$

Simplify.

▶ No. Because 30 is less than 35, there is not enough soup to serve 35 people.

Another Method Multiply the amount in one serving, $1\frac{2}{3}$ cups, by 35 to see how much soup is needed for 35 people.

$$1\frac{2}{3} \cdot 35 = \frac{5}{3} \cdot 35 = \frac{175}{3} = 58\frac{1}{3}$$

Because $58\frac{1}{3}$ is greater than 50, there is not enough soup to serve 35 people. ✓

**Self-Assessment for Problem Solving**

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



18. A watercooler contains 160 cups of water. During practice, each person on a team fills a water bottle with $3\frac{1}{3}$ cups of water from the cooler. Is there enough water for all 45 people on the team to fill their water bottles? Explain.
19. A cyclist is $7\frac{3}{4}$ kilometers from the finish line of a race. The cyclist rides at a rate of $25\frac{5}{6}$ kilometers per hour. How many minutes will it take the cyclist to finish the race?

2.3 Practice



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

► Review & Refresh

Divide. Write the answer in simplest form.

1. $\frac{1}{8} \div \frac{1}{7}$

2. $\frac{7}{9} \div \frac{2}{3}$

3. $\frac{5}{6} \div 10$

4. $12 \div \frac{3}{8}$

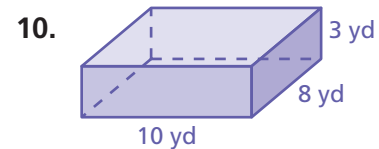
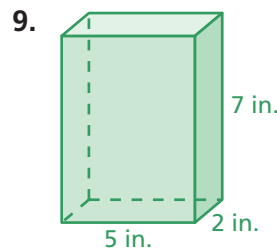
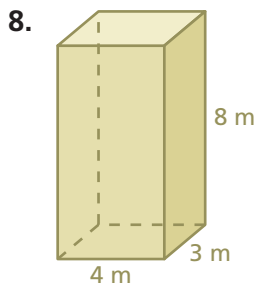
Find the LCM of the numbers.

5. 8, 14

6. 9, 11, 12

7. 12, 27, 30

Find the volume of the rectangular prism.



11. Which number is *not* a prime factor of 286?

A. 2

B. 7

C. 11

D. 13

► Concepts, Skills, & Problem Solving

MP CHOOSE TOOLS Write a real-life problem that represents the division expression described. Then solve the problem using a model. Check your answer algebraically. (See Exploration 1, p. 61.)

12. How many two-thirds are in three and one-third?

13. How many one and one-sixths are in five and five-sixths?

14. How many two and one-halves are in eight and three-fourths?

DIVIDING WITH MIXED NUMBERS Divide. Write the answer in simplest form.

15. $2\frac{1}{4} \div \frac{3}{4}$

16. $3\frac{4}{5} \div \frac{2}{5}$

17. $8\frac{1}{8} \div \frac{5}{6}$

18. $7\frac{5}{9} \div \frac{4}{7}$

19. $7\frac{1}{2} \div 1\frac{9}{10}$

20. $3\frac{3}{4} \div 2\frac{1}{12}$

21. $7\frac{1}{5} \div 8$

22. $8\frac{4}{7} \div 15$

23. $8\frac{1}{3} \div \frac{2}{3}$

24. $9\frac{1}{6} \div \frac{5}{6}$

25. $13 \div 10\frac{5}{6}$

26. $12 \div 5\frac{9}{11}$

27. $\frac{7}{8} \div 3\frac{1}{16}$

28. $\frac{4}{9} \div 1\frac{7}{15}$

29. $4\frac{5}{16} \div 3\frac{3}{8}$

30. $6\frac{2}{9} \div 5\frac{5}{6}$

31. **YOU BE THE TEACHER** Your friend finds the quotient of $3\frac{1}{2}$ and $1\frac{2}{3}$. Is your friend correct? Explain your reasoning.

$$3\frac{1}{2} \div 1\frac{2}{3} = 3\frac{1}{2} \times 1\frac{3}{2} = \frac{7}{2} \times \frac{5}{2} = \frac{7 \times 5}{2 \times 2} = \frac{35}{4}, \text{ or } 8\frac{3}{4}$$

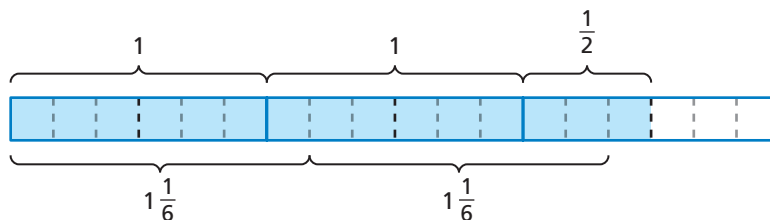


32. **MP PROBLEM SOLVING** A platinum nugget weighs $3\frac{1}{2}$ ounces. How many $\frac{1}{4}$ -ounce pieces can be cut from the nugget?

ORDER OF OPERATIONS Evaluate the expression. Write the answer in simplest form.

33. $3 \div 1\frac{1}{5} + \frac{1}{2}$ 34. $4\frac{2}{3} - 1\frac{1}{3} \div 2$ 35. $\frac{2}{5} + 2\frac{1}{6} \div \frac{5}{6}$
 36. $5\frac{5}{6} \div 3\frac{3}{4} - \frac{2}{9}$ 37. $6\frac{1}{2} - \frac{7}{8} \div 5\frac{11}{16}$ 38. $9\frac{1}{6} \div 5 + 3\frac{1}{3}$
 39. $3\frac{3}{5} + 4\frac{4}{15} \div \frac{4}{9}$ 40. $\frac{3}{5} \times \frac{7}{12} \div 2\frac{7}{10}$ 41. $4\frac{3}{8} \div \frac{3}{4} \cdot \frac{4}{7}$
 42. $1\frac{9}{11} \times 4\frac{7}{12} \div \frac{2}{3}$ 43. $3\frac{4}{15} \div (8 \cdot 6\frac{3}{10})$ 44. $2\frac{5}{14} \div (2\frac{5}{8} \times 1\frac{3}{7})$

45. **MP LOGIC** Your friend uses the model shown to state that $2\frac{1}{2} \div 1\frac{1}{6} = 2\frac{1}{6}$. Is your friend correct? Justify your answer using the model.



46. **MODELING REAL LIFE** A bag contains 42 cups of dog food. Your dog eats $2\frac{1}{3}$ cups of dog food each day. Is there enough food to last 3 weeks? Explain.

47. **DIG DEEPER!** You have 12 cups of granola and $8\frac{1}{2}$ cups of peanuts to make trail mix. What is the greatest number of full batches of trail mix you can make? Explain how you found your answer.

Trail Mix
$2\frac{3}{4}$ cups granola
$1\frac{1}{3}$ cups peanuts



48. **MP REASONING** At a track and field meet, the longest shot-put throw by a boy is 25 feet 8 inches. The longest shot-put throw by a girl is 19 feet 3 inches. How many times greater is the longest shot-put throw by the boy than by the girl?

2.4 Adding and Subtracting Decimals

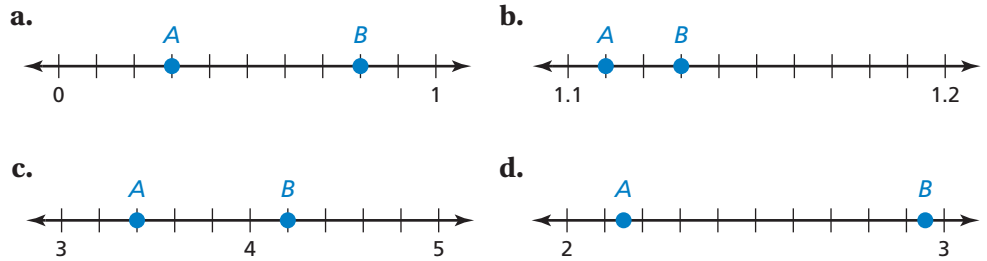
Learning Target: Add and subtract decimals and solve problems involving addition and subtraction of decimals.

- Success Criteria:**
- I can explain why it is necessary to line up the decimal points when adding and subtracting decimals.
 - I can add decimals.
 - I can subtract decimals.
 - I can evaluate expressions involving addition and subtraction of decimals.

EXPLORATION 1

Using Number Lines

Work with a partner. Use each number line to find $A + B$ and $B - A$. Explain how you know you are correct.



EXPLORATION 2

Extending the Place Value Chart

Work with a partner. Explain how you can use the place value chart below to add and subtract decimals beyond hundredths. Then find each sum or difference.

Place Value Chart											
millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones	and	tenths	hundredths		
							.				
							.				
							.				

Math Practice

Recognize Usefulness of Tools

How does the place value chart help you perform the operations? How can you perform the operations without the chart?

- | | |
|----------------------|----------------------------|
| a. $16.05 + 2.945$ | b. $7.421 + 8.058$ |
| c. $38.72 - 8.618$ | d. $64.968 - 51.167$ |
| e. $225.1 + 85.0465$ | f. $1107.20592 - 102.3056$ |

2.4 Lesson

Key Idea

Adding and Subtracting Decimals

To add or subtract decimals, write the numbers vertically and line up the decimal points. Then bring down the decimal point and add or subtract as you would with whole numbers.

EXAMPLE 1 Adding Decimals

Line up the decimal points.

a. Add $8.13 + 2.76$.

$$\begin{array}{r} 8.13 \\ + 2.76 \\ \hline 10.89 \end{array}$$

Estimate $8 + 3 = 11$

Add as you would with whole numbers.

Reasonable? $10.89 \approx 11$ ✓

b. Add $1.459 + 23.7$.

$$\begin{array}{r} 1 \\ 1.459 \\ + 23.700 \\ \hline 25.159 \end{array}$$

Insert zeros so that both numbers have the same number of decimal places.

Be sure to add or subtract only digits that have the same place value.

Try It Add.

1. $4.206 + 10.85$

2. $15.5 + 8.229$

3. $78.41 + 90.99$

EXAMPLE 2 Subtracting Decimals

Line up the decimal points.

a. Subtract $5.508 - 3.174$.

$$\begin{array}{r} 4 \text{ } 10 \\ 5.\cancel{5}\cancel{0}8 \\ - 3.174 \\ \hline 2.334 \end{array}$$

Estimate $6 - 3 = 3$

Subtract as you would with whole numbers.

Reasonable? $2.334 \approx 3$ ✓

b. Subtract $21.9 - 1.605$.

$$\begin{array}{r} 9 \\ 8 \text{ } 10 \\ 21.\cancel{9}\cancel{0}\cancel{0} \\ - 1.605 \\ \hline 20.295 \end{array}$$

Insert zeros so that both numbers have the same number of decimal places.

Try It Subtract.

4. $6.34 - 5.33$

5. $27.9 - 0.905$

6. $18.626 - 13.88$

EXAMPLE 3**Adding and Subtracting Decimals**

Difficulty score	6.9
Execution score	
deductions	1.534
Penalties	0.3

A gymnast's score for a routine is calculated by finding the sum of a difficulty score and an execution score, minus any penalties. The execution score starts at 10 and is reduced by deductions. The gymnast's score can be represented by

$$6.9 + (10 - 1.534) - 0.3.$$

What is the gymnast's score?

Evaluate the expression to solve the problem.

$$\begin{aligned} 6.9 + (10 - 1.534) - 0.3 & \\ &= 6.9 + 8.466 - 0.3 && \text{Subtract inside parentheses.} \\ &= 15.366 - 0.3 && \text{Add.} \\ &= 15.066 && \text{Subtract.} \end{aligned}$$

► So, the gymnast's score is 15.066.

Try It

7. **WHAT IF?** The execution score is adjusted and has 1.467 in deductions. What is the gymnast's score?

**Self-Assessment for Concepts & Skills**

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

ADDING AND SUBTRACTING DECIMALS Evaluate the expression.

8. $23.557 - 17.601 + 5.216$ 9. $16.5263 + 12.404 - 11.73$

10. **(MP) CHOOSE TOOLS** Why is it helpful to estimate the answer before adding or subtracting decimals?
11. **WRITING** When adding or subtracting decimals, how can you be sure to add or subtract only digits that have the same place value?
12. **OPEN-ENDED** Describe two real-life examples of when you would need to add and subtract decimals.

13. **(MP) STRUCTURE** You add $3.841 + 29.999$ as shown. Describe a method for adding the numbers using mental math. Which method do you prefer? Explain.

$$\begin{array}{r} 1111 \\ 3.841 \\ + 29.999 \\ \hline 33.840 \end{array}$$

14. **OPEN-ENDED** Write three decimals that have a sum of 27.905.

EXAMPLE 4

Modeling Real Life

The Lincoln Memorial Reflecting Pool is approximately rectangular. Its width is 50.9 meters, and its length is 618.44 meters. You walk the perimeter of the pool. About how many meters do you walk?

Understand the problem.

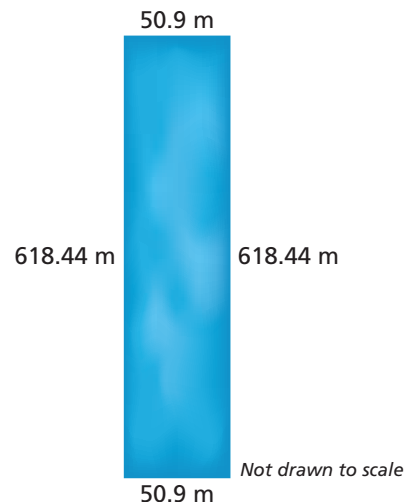
Make a plan.

Solve and check.

You are given the dimensions of a rectangular pool. You are asked to find the number of meters you walk around the perimeter of the pool.

Draw a diagram and label the dimensions. Write the side lengths vertically and line up the decimal points to find the sum.

$$\begin{array}{r} 112 \\ 618.44 \\ 50.90 \\ 618.44 \\ + 50.90 \\ \hline 1338.68 \end{array}$$



So, you walk about 1339 meters.

Check Reasonableness Estimate the distance by finding the sum of the side lengths rounded to the nearest ten.

$$620 + 50 + 620 + 50 = 1340 \text{ meters}$$

The answer is reasonable because $1340 \approx 1338.68$. ✓



Self-Assessment for Problem Solving

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

- A field hockey field is rectangular. Its width is 54.88 meters, and its perimeter is 289.76 meters. Find the length of the field.
- DIG DEEPER!** You mix 23.385 grams of sugar and 12.873 grams of baking soda in a glass container for an experiment. You place the container on a scale to find that the total mass is 104.2 grams. What is the mass of the container?
- One molecule of water is made of two hydrogen atoms and one oxygen atom. The masses (in atomic mass units) for one atom of hydrogen and oxygen are shown. What is the mass (in atomic mass units) of one molecule of water?

hydrogen

H

1.0079

oxygen

O

15.999

2.4 Practice



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

► Review & Refresh

Divide. Write the answer in simplest form.

1. $3\frac{1}{4} \div \frac{3}{4}$

2. $4\frac{1}{6} \div 5$

3. $6\frac{2}{3} \div 3\frac{1}{5}$

Find the GCF of the numbers.

4. 16, 28, 40

5. 39, 54, 63

6. 24, 72, 132

Find the value of the power.

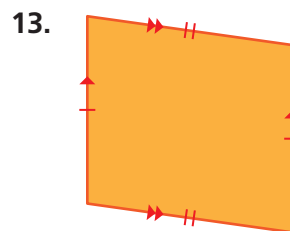
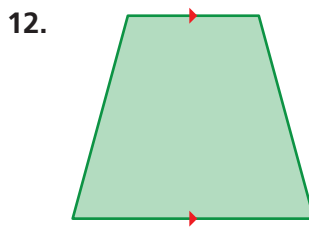
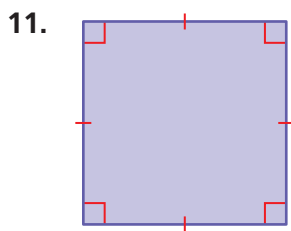
7. 1^{12}

8. 2^4

9. 3^6

10. 5^4

Classify the quadrilateral.



► Concepts, Skills, & Problem Solving

USING TOOLS Use a place value chart to find the sum or difference.

(See Exploration 2, p. 67.)

14. $4.63 + 8.547$

15. $3.6257 - 2.98$

16. $14.065 + 13.8542$

ADDING DECIMALS Add.

17. $7.82 + 3.209$

18. $3.7 + 2.774$

19. $12.829 + 10.07$

20. $20.35 + 13.748$

21. $11.212 + 7.36$

22. $14.91 + 2.095$

23. $31.994 + 8.006$

24. $3.946 + 6.052$

25. $41.226 + 102.774$

26. $122.781 + 19.228$

27. $17.440 + 12.497$

28. $15.255 + 19.058$

SUBTRACTING DECIMALS Subtract.

29. $4.58 - 3.12$

30. $8.629 - 5.309$

31. $6.98 - 2.614$

32. $15.131 - 11.57$

33. $13.5 - 10.856$

34. $25.82 - 22.936$

35. $17.651 - 12.04$

36. $19.255 - 6.194$

37. $56.217 - 35.8$

38. $62.486 - 18.549$

39. $152.883 - 35.6247$

40. $129.343 - 125.0372$

YOU BE THE TEACHER Your friend finds the sum or difference. Is your friend correct? Explain your reasoning.

41.

$$\begin{array}{r} 6.058 \\ + 3.95 \\ \hline 10.008 \end{array}$$

42.

$$\begin{array}{r} 9.5 \\ - 7.18 \\ \hline 2.48 \end{array}$$

43. **MP PROBLEM SOLVING** Vehicles must weigh no more than 10.75 tons to cross a bridge. A truck weighs 11.638 tons. By how many tons does the truck exceed the weight limit?

ADDING AND SUBTRACTING DECIMALS Evaluate the expression.

44. $6.105 + 10.4 + 3.075$

45. $22.6 - 12.286 - 3.542$

46. $15.35 + 7.604 - 12.954$

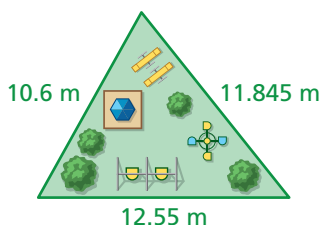
47. $16.5 - 13.45 + 7.293$

48. $25.92 - 18.478 + 8.164$

49. $23.45 + 17.75 - 19.618$

50. $14.549 - (8.131 + 3.7024)$

51. $41.563 - (18.65 + 15.9214) + 9.6$

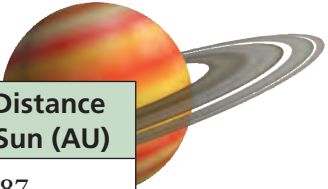


52. **MODELING REAL LIFE** A day-care center is building a new outdoor play area. The diagram shows the dimensions in meters. How much fencing is needed to enclose the play area?

53. **MP PROBLEM SOLVING** On a fantasy football team, a tight end scores 11.15 points and a running back scores 11.75 points. A wide receiver scores 1.05 points less than the running back. How many total points do the three players score?

MODELING REAL LIFE An astronomical unit (AU) is the average distance between Earth and the Sun. In Exercises 54–57, use the table that shows the average distance of each planet in our solar system from the Sun.

54. How much farther is Jupiter from the Sun than Mercury?
55. How much farther is Neptune from the Sun than Mars?
56. Estimate the greatest distance between Earth and Uranus.
57. Estimate the greatest distance between Venus and Saturn.
58. **MP STRUCTURE** When is the sum of two decimals equal to a whole number? When is the difference of two decimals equal to a whole number? Explain.



Planet	Average Distance from the Sun (AU)
Mercury	0.387
Venus	0.723
Earth	1.000
Mars	1.524
Jupiter	5.203
Saturn	9.537
Uranus	19.189
Neptune	30.07

2.5 Multiplying Decimals

Learning Target: Multiply decimals and solve problems involving multiplication of decimals.

- Success Criteria:**
- I can multiply decimals by whole numbers.
 - I can multiply decimals by decimals.
 - I can evaluate expressions involving multiplication of decimals.

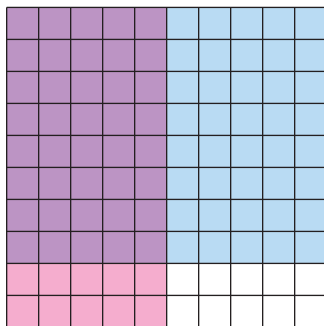
EXPLORATION 1

Multiplying Decimals

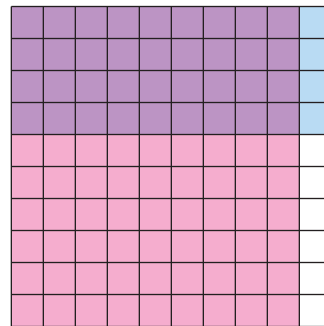
Work with a partner.

- a. Write the multiplication expression represented by each area model. Then find the product. Explain how you found your answer.

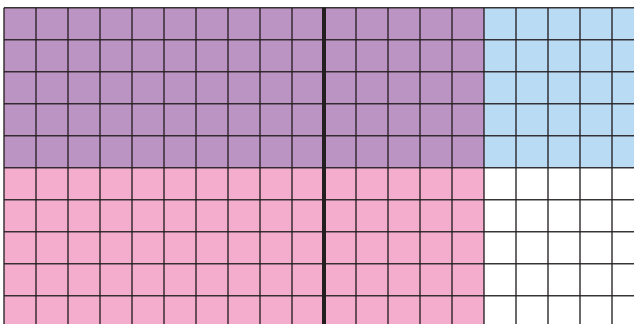
i.



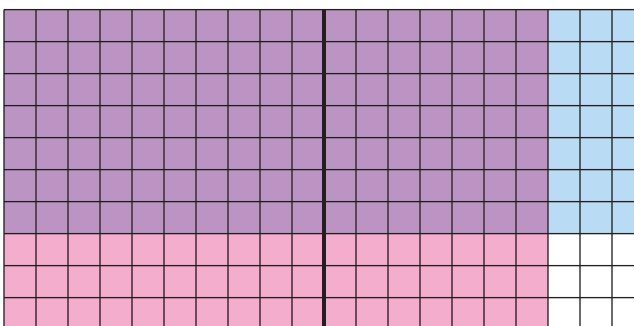
ii.



iii.



iv.



Math Practice

View as Components

How can you use an area model to find the product?

- b. How can you find the products in part (a) without using a model? How do you know where to place the decimal points in the answers?
- c. Find the product of 0.55 and 0.45. Explain how you found your answer.

2.5 Lesson

Key Idea

Multiplying Decimals by Whole Numbers

Words Multiply as you would with whole numbers. Then count the number of decimal places in the decimal factor. The product has the same number of decimal places.

Numbers

$$\begin{array}{r} 13.91 \\ \times 7 \\ \hline 97.37 \end{array} \quad \leftarrow \begin{array}{l} 2 \text{ decimal places} \end{array}$$
$$\begin{array}{r} 6.218 \\ \times 4 \\ \hline 24.872 \end{array} \quad \leftarrow \begin{array}{l} 3 \text{ decimal places} \end{array}$$

EXAMPLE 1 Multiplying Decimals and Whole Numbers

- a. Find 6×3.91 . **Estimate** $6 \times 4 = 24$

$$\begin{array}{r} 3.91 \\ \times 6 \\ \hline 23.46 \end{array}$$

← 2 decimal places

← Count 2 decimal places from right to left.

▶ So, $6 \times 3.91 = 23.46$. **Reasonable?** $23.46 \approx 24$ ✓

- b. Find 3×0.016 . **Estimate** $3 \times 0 = 0$

$$\begin{array}{r} 0.016 \\ \times 3 \\ \hline 0.048 \end{array}$$

← 3 decimal places

← To have 3 decimal places, insert zeros to the left of 48.

▶ So, $3 \times 0.016 = 0.048$. **Reasonable?** $0.048 \approx 0$ ✓

- c. Find $5.1024 \cdot 12$. **Estimate** $5 \cdot 12 = 60$

$$\begin{array}{r} 5.1024 \\ \times 12 \\ \hline 102048 \\ 51024 \\ \hline 61.2288 \end{array}$$

← 4 decimal places

← Count 4 decimal places from right to left.

▶ So, $5.1024 \cdot 12 = 61.2288$. **Reasonable?** $61.2288 \approx 60$ ✓

Try It Multiply. Use estimation to check your answer.

1. 12.3×8 2. 5×14.51 3. $20 \cdot 0.008$ 4. $2.3275 \cdot 90$

The rule for multiplying two decimals is similar to the rule for multiplying a decimal by a whole number.

Key Idea

Multiplying Decimals by Decimals

Words Multiply as you would with whole numbers. Then add the number of decimal places in the factors. The sum is the number of decimal places in the product.

Numbers

$$\begin{array}{r} 4.716 \leftarrow 3 \text{ decimal places} \\ \times 0.2 \leftarrow + 1 \text{ decimal place} \\ \hline 0.9432 \leftarrow 4 \text{ decimal places} \end{array}$$

EXAMPLE 2 Multiplying Decimals

a. Multiply 4.8×7.2 .

Estimate $5 \times 7 = 35$

$$\begin{array}{r} 4.8 \leftarrow 1 \text{ decimal place} \\ \times 7.2 \leftarrow + 1 \text{ decimal place} \\ \hline 96 \\ 336 \\ \hline 34.56 \leftarrow 2 \text{ decimal places} \end{array}$$

▶ So, $4.8 \times 7.2 = 34.56$.

Reasonable? $34.56 \approx 35$ ✓

b. Multiply 3.1×0.005 .

Estimate $3 \times 0 = 0$

$$\begin{array}{r} 3.1 \leftarrow 1 \text{ decimal place} \\ \times 0.005 \leftarrow + 3 \text{ decimal places} \\ \hline 0.0155 \leftarrow 4 \text{ decimal places} \end{array}$$

▶ So, $3.1 \times 0.005 = 0.0155$.

Reasonable? $0.0155 \approx 0$ ✓

c. Multiply $4.25 \cdot 1.75$.

Estimate $4 \times 2 = 8$

$$\begin{array}{r} 4.25 \leftarrow 2 \text{ decimal places} \\ \times 1.75 \leftarrow + 2 \text{ decimal places} \\ \hline 2125 \\ 2975 \\ 425 \\ \hline 7.4375 \leftarrow 4 \text{ decimal places} \end{array}$$

▶ So, $4.25 \cdot 1.75 = 7.4375$.

Reasonable? $7.4375 \approx 8$ ✓

Try It Multiply. Use estimation to check your answer.

5. 8.1×5.6

6. 2.7×9.04

7. 6.32×0.09

8. 1.785×0.2

EXAMPLE 3**Evaluating an Expression**

What is the value of $2.44(4.5 - 3.175)$?

- A. 3.233 B. 3.599 C. 7.805 D. 32.33

Step 1: Evaluate the expression in parentheses first.

$$\begin{array}{r} \cancel{1} \cancel{0} \\ 4.5 \cancel{0} \cancel{0} \\ - 3.175 \\ \hline 1.325 \end{array}$$

So, $2.44(4.5 - 3.175) = 2.44(1.325)$.

Step 2: Multiply the result from Step 1 by 2.44.

$$\begin{array}{r} 1.325 \leftarrow 3 \text{ decimal places} \\ \times 2.44 \leftarrow + 2 \text{ decimal places} \\ \hline 5300 \\ 5300 \\ 2650 \\ \hline 3.23300 \leftarrow 5 \text{ decimal places} \end{array}$$

▶ The correct answer is **A**.

Try It Evaluate the expression.

9. $12.67 + 8.2 \cdot 1.9$ 10. $6.4(1.8 \cdot 7.5)$



Self-Assessment for Concepts & Skills

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

EVALUATING AN EXPRESSION Evaluate the expression.

11. 8×11.215 12. $9.42 \cdot 6.83$ 13. $0.15(4.3 - 2.417)$

14. **MP NUMBER SENSE** If you know $12 \times 24 = 288$, how can you find 0.12×0.24 ?
15. **MP NUMBER SENSE** Is the product 1.23×8 greater than or less than 8? Explain.
16. **MP REASONING** Copy the problem and place the decimal point in the product.

$$\begin{array}{r} 1.78 \\ \times 4.9 \\ \hline 8722 \end{array}$$

EXAMPLE 4

Modeling Real Life



Zinc: \$2.41 per ounce

A science teacher buys 3.25 ounces of zinc for an experiment. The teacher pays with a \$10 bill. How much change does the teacher receive?

Find the cost of 3.25 ounces of zinc at \$2.41 per ounce. Then subtract that amount from \$10.

Step 1: Multiply 2.41 by 3.25 to find the cost of the zinc.

$$\begin{array}{r} 2.41 \quad \leftarrow 2 \text{ decimal places} \\ \times 3.25 \quad \leftarrow + 2 \text{ decimal places} \\ \hline 1205 \\ 482 \\ 723 \\ \hline 7.8325 \quad \leftarrow 4 \text{ decimal places} \end{array}$$

The cost of 3.25 ounces of zinc is \$7.83.

Step 2: Subtract the cost of the zinc from the amount of money the teacher uses to buy the zinc.

$$10.00 - 7.83 = 2.17$$

▶ So, the teacher receives \$2.17 in change.



Self-Assessment for Problem Solving

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



17. You earn \$9.15 per hour painting a fence. It takes 6.75 hours to paint the fence. Did you earn enough money to buy the jersey shown? If so, how much money do you have left? If not, how much money do you need to earn?
18. A sand volleyball court is a rectangle that has a length of 52.5 feet and a width that is half of the length. In case of rain, the court is covered with a tarp. How many square feet of tarp are needed to cover the court?
19. **DIG DEEPER!** You buy 4 cases of bottled water and 5 bottles of fruit punch for a birthday party. Each case of bottled water costs \$2.75, and each bottle of fruit punch costs \$1.35. You hand the cashier a \$20 bill. How much change will you receive?

2.5 Practice



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

► Review & Refresh

Add or subtract.

1. $12.29 - 6.15$ 2. $4.6 + 11.81$ 3. $9.34 + 17.009$ 4. $18.247 - 16.262$

Divide.

5. $78 \div 3$ 6. $65 \div 13$ 7. $57 \div 19$ 8. $84 \div 12$

9. What is $4\frac{1}{3} \times \frac{4}{5}$?

- A. $2\frac{1}{8}$ B. $3\frac{7}{15}$ C. $4\frac{4}{15}$ D. $5\frac{5}{12}$

Evaluate the expression.

10. $4 + 6^2 \div 2$ 11. $(35 + 9) \div 4 - 3^2$ 12. $8^2 \div [(14 - 12) \times 2^3]$

► Concepts, Skills, & Problem Solving

USING TOOLS Use an area model to find the product. (See Exploration 1, p. 73.)

13. 2.1×1.5 14. 0.6×0.4 15. 0.7×0.3 16. 2.7×2.3

MULTIPLYING DECIMALS AND WHOLE NUMBERS Multiply. Use estimation to check your answer.

17.
$$\begin{array}{r} 4.8 \\ \times 7 \\ \hline \end{array}$$
 18.
$$\begin{array}{r} 6.3 \\ \times 5 \\ \hline \end{array}$$
 19.
$$\begin{array}{r} 7.19 \\ \times 16 \\ \hline \end{array}$$
 20.
$$\begin{array}{r} 0.87 \\ \times 21 \\ \hline \end{array}$$
21.
$$\begin{array}{r} 1.95 \\ \times 11 \\ \hline \end{array}$$
 22.
$$\begin{array}{r} 5.89 \\ \times 5 \\ \hline \end{array}$$
 23.
$$\begin{array}{r} 3.472 \\ \times 4 \\ \hline \end{array}$$
 24.
$$\begin{array}{r} 8.188 \\ \times 12 \\ \hline \end{array}$$

25. 100×0.024 26. 19×0.004 27. 3.27×14 28. $46 \cdot 5.448$
29. 50×12.21 30. $104 \cdot 4.786$ 31. 0.0038×9 32. 10×0.0093

YOU BE THE TEACHER Your friend finds the product. Is your friend correct? Explain your reasoning.

33.
$$\begin{array}{r} 0.0045 \\ \times 9 \\ \hline 0.0405 \end{array}$$

34.
$$\begin{array}{r} 0.32 \\ \times 5 \\ \hline 0.160 \end{array}$$

35. **MODELING REAL LIFE** The weight of an object on the Moon is about 0.167 of its weight on Earth. How much does a 180-pound astronaut weigh on the Moon?



MULTIPLYING DECIMALS Multiply.

$$\begin{array}{r} 36. \quad 0.7 \\ \times 0.2 \\ \hline \end{array}$$

$$\begin{array}{r} 37. \quad 0.08 \\ \times 0.3 \\ \hline \end{array}$$

$$\begin{array}{r} 38. \quad 0.007 \\ \times 0.03 \\ \hline \end{array}$$

$$\begin{array}{r} 39. \quad 0.0008 \\ \times 0.09 \\ \hline \end{array}$$

$$\begin{array}{r} 40. \quad 0.004 \\ \times 0.9 \\ \hline \end{array}$$

$$\begin{array}{r} 41. \quad 0.06 \\ \times 0.5 \\ \hline \end{array}$$

$$\begin{array}{r} 42. \quad 0.0008 \\ \times 0.004 \\ \hline \end{array}$$

$$\begin{array}{r} 43. \quad 0.0002 \\ \times 0.06 \\ \hline \end{array}$$

$$44. \quad 12.4 \times 0.2$$

$$45. \quad 18.6 \cdot 5.9$$

$$46. \quad 7.91 \times 0.72$$

$$47. \quad 1.16 \times 3.35$$

$$48. \quad 6.478 \times 18.21$$

$$49. \quad 1.9 \times 7.216$$

$$50. \quad 0.0021 \times 18.2$$

$$51. \quad 6.109 \cdot 8.4$$

52. **YOU BE THE TEACHER** Your friend finds the product of 4.9 and 3.8. Is your friend correct? Explain your reasoning.

$$\begin{array}{r} 4.9 \\ \times 3.8 \\ \hline 186.2 \end{array}$$

53. **MP PROBLEM SOLVING** A Chinese restaurant offers buffet takeout for \$4.99 per pound. How much does your takeout meal cost?

54. **MP PROBLEM SOLVING** On a tour of an old gold mine, you find a nugget containing 0.82 ounce of gold. Gold is worth \$1323.80 per ounce. How much is your nugget worth?

55. **MP PRECISION** One meter is approximately 3.28 feet. Find the height of each building in feet.



Continent	Tallest Building	Height (meters)
Africa	Carlton Centre	223
Asia	Burj Khalifa	828
Australia	Q1	323
Europe	Federation Tower	374
North America	One World Trade Center	541
South America	Gran Torre Santiago	300

56. **MP REASONING** Show how to evaluate $(7.12 \times 8.22) \times 100$ without multiplying two decimals.

EVALUATING AN EXPRESSION Evaluate the expression.

$$57. \quad 2.4 \times 16 + 7$$

$$58. \quad 6.85 \times 2 \times 10$$

$$59. \quad 1.047 \times 5 - 0.88$$

$$60. \quad 4.32(3.7 + 1.65)$$

$$61. \quad 23.98 - 1.7^2 \cdot 7.6$$

$$62. \quad 12 \cdot 5.16 + 10.064$$

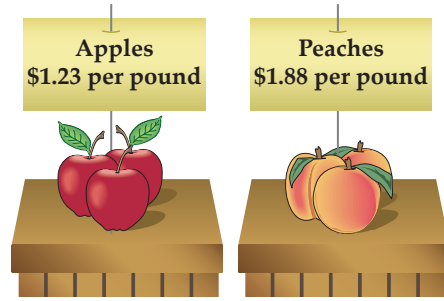
$$63. \quad 0.9(8.2 \cdot 20.35)$$

$$64. \quad 7.5^2(6.084 - 5.44)$$

$$65. \quad 0.629[81 \div (10 \times 2.7)]$$

66. **MP REASONING** Without multiplying, how many decimal places does 3.4^2 have? 3.4^3 ? 3.4^4 ? Explain your reasoning.

67. **MODELING REAL LIFE** You buy 2.6 pounds of apples and 1.475 pounds of peaches. You hand the cashier a \$20 bill. How much change will you receive?



- MP PATTERNS** Describe the pattern. Find the next three numbers.

68. 1, 0.6, 0.36, 0.216, ... 69. 15, 1.5, 0.15, 0.015, ...
70. 0.04, 0.02, 0.01, 0.005, ... 71. 5, 7.5, 11.25, 16.875, ...

72. **DIG DEEPER!** You are preparing for a trip to Canada. At the time of your trip, each U.S. dollar is worth 1.293 Canadian dollars and each Canadian dollar is worth 0.773 U.S. dollar.

- You exchange 150 U.S. dollars for Canadian dollars. How many Canadian dollars do you receive?
- You spend 120 Canadian dollars on the trip. Then you exchange the remaining Canadian dollars for U.S. dollars. How many U.S. dollars do you receive?

73. **OPEN-ENDED** You and four friends have dinner at a restaurant.

- Draw a restaurant menu that has main items, desserts, and beverages, with their prices.
- Write a guest check that shows what each of you ate. Find the subtotal.
- Multiply by 0.07 to find the tax. Then find the total.
- Round the total to the nearest whole number. Multiply by 0.20 to estimate a tip. Including the tip, how much did the dinner cost?



74. **GEOMETRY** A rectangular painting has an area of 9.52 square feet.



- Draw three different ways in which this can happen.
- The cost of a frame depends on the perimeter of the painting. Which of your drawings from part (a) is the least expensive to frame? Explain your reasoning.
- The thin, black framing costs \$1 per foot. The fancy framing costs \$5 per foot. Will the fancy framing cost five times as much as the black framing? Explain why or why not.
- Suppose the cost of a frame depends on the outside perimeter of the frame. Does this change your answer to part (c)? Explain why or why not.

2.6 Dividing Whole Numbers

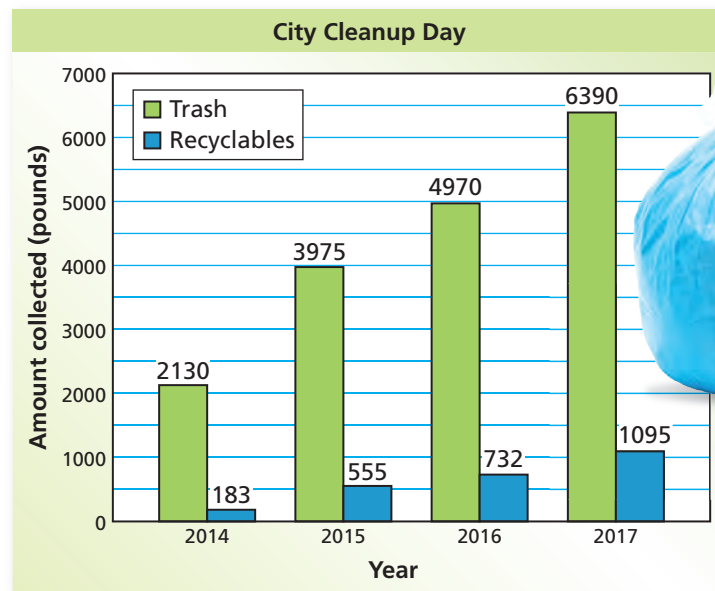
Learning Target: Divide whole numbers and solve problems involving division of whole numbers.

- Success Criteria:**
- I can use long division to divide whole numbers.
 - I can write a remainder as a fraction.
 - I can interpret quotients in real-life problems.

EXPLORATION 1

Using a Double Bar Graph

Work with a partner. The double bar graph shows the history of a citywide cleanup day.



Math Practice

Calculate Accurately

How can you extend what you know about long division to divide any pair of multi-digit whole numbers accurately?

- Make five conclusions from the graph.
- Compare the results of the city cleanup day in 2016 to the results in 2014.
- What is the average combined amount of trash and recyclables collected each year over the four-year period?
- Make a prediction about the amount of trash collected in a future year.



2.6 Lesson

You have used long division to divide whole numbers. When the *divisor* divides evenly into the *dividend*, the *quotient* is a whole number.

$$\begin{array}{r} 20 \leftarrow \text{Quotient} \\ \text{Divisor} \rightarrow 15 \overline{)300} \leftarrow \text{Dividend} \end{array}$$

When the divisor does not divide evenly into the dividend, you obtain a remainder. When this occurs, you can write the quotient as a mixed number.

EXAMPLE 1 Dividing Whole Numbers

- a. Find $672 \div 8$.

$$\begin{array}{r} 84 \\ 8 \overline{)672} \\ \underline{-64} \downarrow \\ 32 \\ \underline{-32} \\ 0 \end{array}$$

There are eight groups of 8 in 67.

There are four groups of 8 in 32.

There is no remainder.

▶ So, $672 \div 8 = 84$.

Remember



$$\frac{\text{dividend}}{\text{divisor}} = \text{quotient}$$

So,
 $\text{quotient} \times \text{divisor} = \text{dividend}.$

Check Find the product of the quotient and the divisor.

$$\begin{array}{r} 84 \quad \text{quotient} \\ \times 8 \quad \text{divisor} \\ \hline 672 \quad \text{dividend} \quad \checkmark \end{array}$$

- b. Find the quotient of 9216 and 150.

$$\begin{array}{r} 61 \text{ R}66 \\ 150 \overline{)9216} \\ \underline{-900} \downarrow \\ 216 \\ \underline{-150} \\ 66 \end{array}$$

There are six groups of 150 in 921.

There is one group of 150 in 216.

The remainder is 66.

▶ The quotient is $61\frac{66}{150}$, or $61\frac{11}{25}$.

Try It Divide. Use estimation to check your answer.

- $234 \div 9$
- $\frac{6096}{30}$
- $45,691 \div 28$
- Find the quotient of 9920 and 320.

EXAMPLE 2 Solving a Problem Using Division

You make 12 equal payments for a go-kart. You pay a total of \$1380. How much is each payment?

You want to find the number of groups of 12 in \$1380. So, find the quotient of 1380 and 12 using long division.



Check Find the product of the quotient and the divisor.

$$\begin{array}{r} 115 \text{ quotient} \\ \times 12 \text{ divisor} \\ \hline 230 \\ 115 \\ \hline 1380 \text{ dividend} \end{array}$$

$$\begin{array}{r} 115 \\ 12 \overline{)1380} \\ \underline{-12} \\ 18 \\ \underline{-12} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

There is one group of 12 in 13.
There is one group of 12 in 18.
There are five groups of 12 in 60.
There is no remainder.

The quotient of 1380 and 12 is 115.

▶ So, each payment is \$115.

Try It

5. **WHAT IF?** You make 30 equal payments for the go-kart. How much is each payment?



Self-Assessment for Concepts & Skills

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

DIVIDING WHOLE NUMBERS Divide. Use estimation to check your answer.

6. $876 \div 12$ 7. $3024 \div 7$ 8. $1043 \div 22$

9. **VOCABULARY** Use the division problem shown to tell whether the number is the divisor, dividend, or quotient.

a. 884 b. 26 c. 34

10. **MP NUMBER SENSE** Without calculating, decide which is greater: $3999 \div 129$ or $3834 \div 142$. Explain.

11. **MP REASONING** In a division problem, can the remainder be greater than the divisor? Explain.

$$\begin{array}{r} 26 \\ 34 \overline{)884} \end{array}$$

EXAMPLE 3**Modeling Real Life**

A 301-foot-high swing at an amusement park can take 64 people on each ride. A total of 10,250 people ride the swing today. All the rides are full except for the last ride. How many rides are given? How many people are on the last ride?

To find the number of rides given, first you need to find the number of groups of 64 people in 10,250 people. So, find the quotient of 10,250 and 64.

$$\begin{array}{r}
 160 \text{ R}10 \\
 64 \overline{)10,250} \\
 \underline{-64} \\
 385 \\
 \underline{-384} \\
 10 \\
 \underline{-0} \\
 10
 \end{array}$$

There is one group of 64 in 102.
 There are six groups of 64 in 385.
 There are no groups of 64 in 10.
 The remainder is 10.

Do not stop here. You must write a 0 in the ones place of the quotient.

The quotient is $160\frac{10}{64}$. This means there are 160 full rides, with 10 people remaining.

► So, 161 rides are given, with 10 people on the last ride.

Check Find the product of the quotient and the divisor.

$$64 \cdot 160\frac{10}{64} = 64\left(160 + \frac{10}{64}\right) = 64(160) + 64\left(\frac{10}{64}\right) = 10,240 + 10 = 10,250 \quad \checkmark$$

**Self-Assessment for Problem Solving**

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



- In a movie's opening weekend, 879,575 tickets are sold in 755 theaters. The average cost of a ticket is \$9.50. What is the average amount of money earned by each theater?
- A boat can carry 582 passengers to the base of a waterfall. A total of 13,105 people ride the boat today. All the rides are full except for the first ride. How many rides are given? How many people are on the first ride?
- DIG DEEPER!** A new year begins at 12:00 A.M. on January 1. What is the date and time 12,345 minutes after the start of a new year?

2.6 Practice



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

► Review & Refresh

Multiply.

1. 8×3.79

2. 12.1×2.42

3. 6.43×0.28

4. $9.526 \cdot 6.61$

List the factor pairs of the number.

5. 26

6. 72

7. 50

8. 98

Match the expression with its value.

9. $\frac{6}{7} \div \frac{3}{5}$

10. $\frac{3}{7} \div \frac{6}{5}$

11. $\frac{6}{5} \div \frac{3}{7}$

12. $\frac{3}{5} \div \frac{6}{7}$

A. $\frac{7}{10}$

B. $1\frac{3}{7}$

C. $\frac{5}{14}$

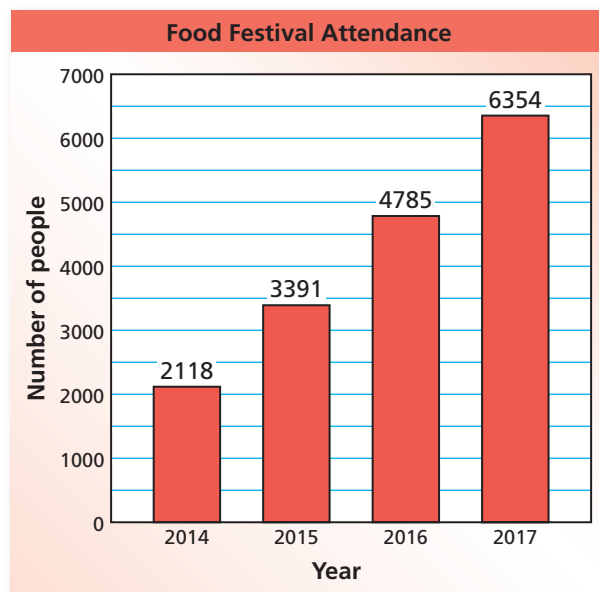
D. $2\frac{4}{5}$

► Concepts, Skills, & Problem Solving

OPERATIONS WITH WHOLE NUMBERS The bar graph shows the attendance at a food festival. Use the graph to answer the question.

(See Exploration 1, p. 81.)

- What is the total attendance at the food festival from 2014 to 2017?
- How many times more people attended the food festival in 2017 than in 2014?
- What is the average attendance at the festival each year over the four-year period?
- The festival projects that the attendance for 2018 will be twice the attendance in 2016. What is the projected attendance for 2018?



DIVIDING WHOLE NUMBERS Divide. Use estimation to check your answer.

17. $837 \div 27$

18. $1088 \div 34$

19. $903 \div 72$

20. $6409 \div 61$

21. $\frac{5986}{82}$

22. $6200 \div 163$

23. $6255 \div 118$

24. $\frac{588}{84}$

25. $7440 \div 124$

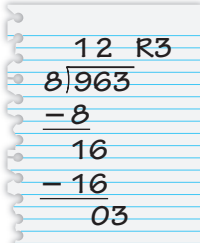
26. $26,862 \div 407$

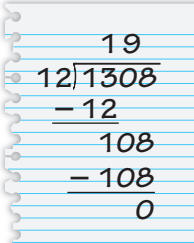
27. $8241 \div 173$

28. $\frac{33,505}{160}$

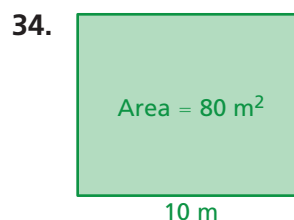
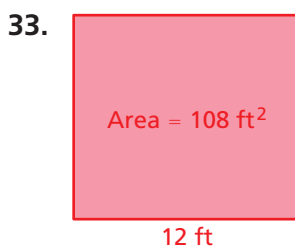
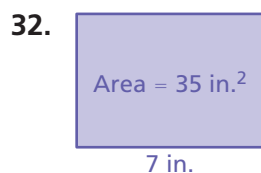
29. **MODELING REAL LIFE** A pharmacist divides 364 pills into prescription bottles. Each bottle contains 28 pills. How many bottles does the pharmacist fill?

YOU BE THE TEACHER Your friend finds the quotient. Is your friend correct? Explain your reasoning.

30. 

31. 

GEOMETRY Find the perimeter of the rectangle.



35. **MP REASONING** You borrow bookcases like the one shown to display 943 books at a book sale. You plan to put 22 books on each shelf. No books will be on top of the bookcases.
- How many bookcases must you borrow to display all the books?
 - You fill the shelves of each bookcase in order, starting with the top shelf. How many books are on each shelf of the last bookcase?

36. **DIG DEEPER!** The siding of a house is 2250 square feet. The siding needs two coats of paint.

- What is the minimum cost of the paint needed to complete the job?
- How much paint is left over when you spend the minimum amount?

Can Size	Cost	Coverage
1 quart	\$18	80 square feet
1 gallon	\$29	320 square feet

37. **CRITICAL THINKING** Use the digits 3, 4, 6, and 9 to complete the division problem. Use each digit once.

$$\square \square \square , 000 \div \square 00 = \square 0$$

2.7 Dividing Decimals

Learning Target: Divide decimals and solve problems involving division of decimals.

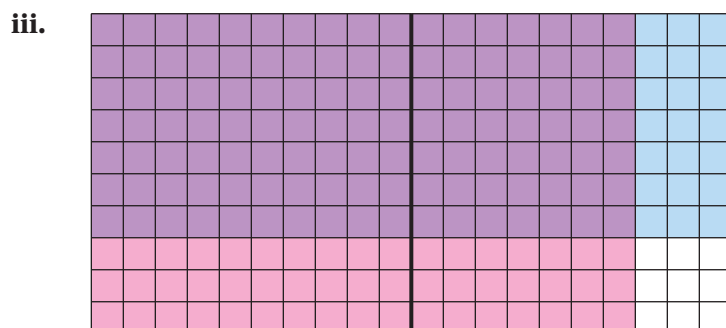
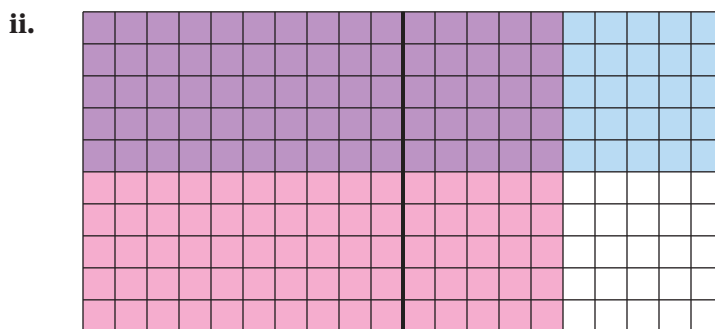
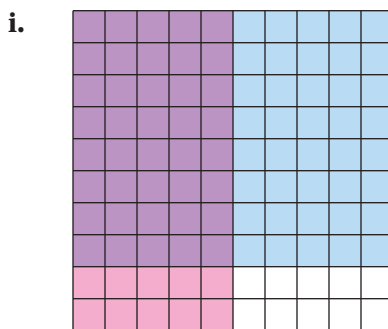
- Success Criteria:**
- I can divide decimals by whole numbers.
 - I can divide decimals by decimals.
 - I can divide whole numbers by decimals.

EXPLORATION 1

Dividing Decimals

Work with a partner.

- a. Write two division expressions represented by each area model. Then find the quotients. Explain how you found your answer.



Math Practice

Construct Arguments

Why do the quotients in part (b) have the relationship you observed?

- b. Use a calculator to find $119 \div 17$, $11.9 \div 1.7$, $1.19 \div 0.17$, and $0.119 \div 0.017$. What do you notice? Explain how you can use long division to divide any pair of multi-digit decimals.

2.7 Lesson

Key Idea

Dividing Decimals by Whole Numbers

Words Place the decimal point in the quotient above the decimal point in the dividend. Then divide as you would with whole numbers. Continue until there is no remainder.

Numbers

$$\begin{array}{r} 1.83 \\ 4 \overline{)7.32} \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

EXAMPLE 1 Dividing Decimals by Whole Numbers

a. Find $7.6 \div 4$.

Estimate $8 \div 4 = 2$

$$\begin{array}{r} 1.9 \\ 4 \overline{)7.6} \\ -4 \\ \hline 36 \\ -36 \\ \hline 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

▶ So, $7.6 \div 4 = 1.9$.

Reasonable? $1.9 \approx 2$ ✓

b. Find $4.374 \div 12$.

$$\begin{array}{r} 0.3645 \\ 12 \overline{)4.3740} \\ -36 \\ \hline 77 \\ -72 \\ \hline 54 \\ -48 \\ \hline 60 \\ -60 \\ \hline 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

Insert a zero and continue to divide.

▶ So, $4.374 \div 12 = 0.3645$.

Check $0.3645 \times 12 = 4.374$ ✓

Try It Divide. Use estimation to check your answer.

1. $36.4 \div 2$

2. $22.2 \div 6$

3. $59.64 \div 7$

4. $3.12 \div 16$

5. $6.224 \div 4$

6. $43.407 \div 14$

Key Idea

Dividing Decimals by Decimals

Words Multiply the divisor *and* the dividend by a power of 10 to make the divisor a whole number. Then place the decimal point in the quotient above the decimal point in the dividend and divide as you would with whole numbers. Continue until there is no remainder.

Numbers $1.2 \overline{)4.56}$

Multiply each number by 10.

$$\begin{array}{r} 3.8 \\ 12 \overline{)45.6} \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

EXAMPLE 2 Dividing Decimals

Multiplying the divisor and the dividend by a power of 10 does not change the quotient.

For example:

$$\begin{aligned} 18.2 \div 1.4 &= 13 \\ 182 \div 14 &= 13 \\ 1820 \div 140 &= 13 \end{aligned}$$

a. Find $18.2 \div 1.4$.

$$1.4 \overline{)18.2}$$

Multiply each number by 10.

$$\begin{array}{r} 13. \\ 14 \overline{)182.} \\ \underline{-14} \\ 42 \\ \underline{-42} \\ 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

▶ So, $18.2 \div 1.4 = 13$.

Check $13 \times 1.4 = 18.2$ ✓

b. Find $0.273 \div 0.39$.

$$0.39 \overline{)0.273}$$

Multiply each number by 100.

$$\begin{array}{r} 0.7 \\ 39 \overline{)273} \\ \underline{-273} \\ 0 \end{array}$$

▶ So, $0.273 \div 0.39 = 0.7$.

Check $0.7 \times 0.39 = 0.273$ ✓

Try It Divide. Check your answer.

7. $1.2 \overline{)9.6}$

8. $3.4 \overline{)57.8}$

9. $21.643 \div 2.3$

10. $0.459 \div 0.51$

EXAMPLE 3**Inserting Zeros in the Dividend and the Quotient**a. Find $2.45 \div 0.007$.

$$\begin{array}{r} 0.007 \overline{)2.450} \longrightarrow 7 \overline{)2450} \\ \underline{-21} \\ 35 \\ \underline{-35} \\ 00 \end{array}$$

Multiply each number by 1000. Insert a zero in the dividend.

Because $0 \div 7 = 0$, insert a zero in the quotient.

▶ So, $2.45 \div 0.007 = 350$.b. Find $32 \div 1.25$.

$$\begin{array}{r} 1.25 \overline{)32.00} \longrightarrow 125 \overline{)3200.0} \\ \underline{-250} \\ 700 \\ \underline{-625} \\ 750 \\ \underline{-750} \\ 0 \end{array}$$

Multiply each number by 100. Insert two zeros in the dividend.

Insert a zero and continue to divide.

▶ So, $32 \div 1.25 = 25.6$.**Try It** Divide. Check your answer.

11. $3.8 \div 0.16$

12. $15.6 \div 0.78$

13. $7.2 \div 0.048$

14. $42 \div 3.75$

**Self-Assessment for Concepts & Skills**

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

DIVIDING DECIMALS Divide. Check your answer.

15. $37.7 \div 13$

16. $33 \div 4.4$

17. $2.16 \div 0.009$

18. **MP NUMBER SENSE** Fix the one that is not correct.

$$\begin{array}{r} 6.1 \\ 4 \overline{)24.4} \end{array}$$

$$\begin{array}{r} 61 \\ 4 \overline{)244} \end{array}$$

$$\begin{array}{r} 6.1 \\ 4 \overline{)2.44} \end{array}$$

19. **MP NUMBER SENSE** Rewrite $2.16 \overline{)18.5}$ so that the divisor is a whole number.20. **MP STRUCTURE** Write $1.8 \div 6$ as a multiplication problem with a missing factor. Explain your reasoning.

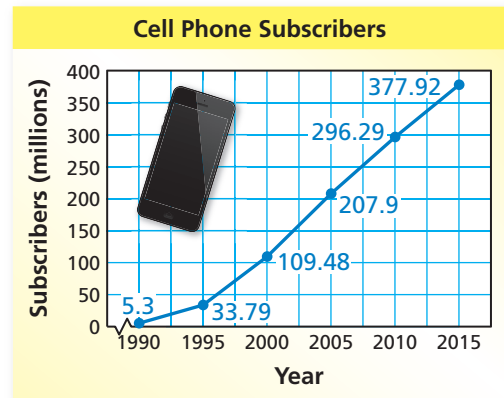
EXAMPLE 4

Modeling Real Life

How many times more cell phone subscribers were there in 2015 than in 1990? Round to the nearest whole number.

Divide the number of subscribers in 2015 by the number of subscribers in 1990.

From the graph, there were 377.92 million subscribers in 2015 and 5.3 million in 1990. So, divide 377.92 by 5.3.



Check Reasonableness

Find an underestimate and an overestimate.

Underestimate:

$$370 \div 6 = 61\frac{2}{3}$$

Overestimate:

$$380 \div 5 = 76$$

The answer is reasonable because

$$61\frac{2}{3} < 71 < 76. \quad \checkmark$$

$$5.3 \overline{)377.92} \longrightarrow 53 \overline{)3779.2}$$

$$\begin{array}{r} 71.3 \\ - 371 \\ \hline 69 \\ - 53 \\ \hline 162 \\ - 159 \\ \hline 3 \end{array}$$

Rounds to 71.

So, there were about 71 times more subscribers in 2015 than in 1990.



Self-Assessment for Problem Solving

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

- A magazine subscription costs \$29.88 for 12 issues or \$15.24 for 6 issues. Which subscription costs more per issue? How much more?
- The track of a roller coaster is 1.265 miles long. The ride lasts for 2.3 minutes. What is the average speed of the roller coaster in miles per hour?
- DIG DEEPER!** The table shows the number of visitors to a website each year for 4 years. Does the number of visitors increase more from Year 1 to Year 2 or from Year 3 to Year 4? How many times greater is the increase?

Year	Visitors (millions)
1	2.4
2	32.22
3	88.4
4	102.6

2.7 Practice



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

► Review & Refresh

Divide.

1. $84 \div 14$

2. $391 \div 23$

3. $1458 \div 54$

4. $\frac{68,134}{163}$

5. What is the value of $18 + 3^2 \div [3 \times (8 - 5)]$?

A. 3

B. 19

C. 27

D. 49

Add or subtract.

6. $7.635 - 5.046$

7. $12.177 + 3.09$

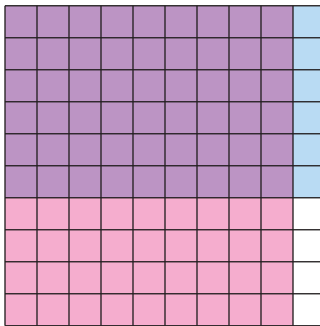
8. $14.008 - 9.433$

► Concepts, Skills, & Problem Solving

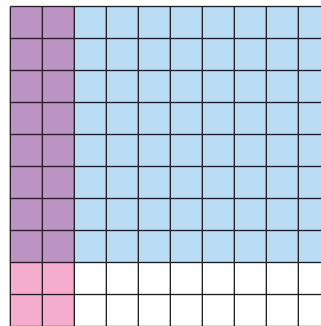
DIVIDING DECIMALS Write two division expressions represented by the area model. Then find the quotients. Explain how you found your answer.

(See Exploration 1, p. 87.)

9.



10.



DIVIDING DECIMALS BY WHOLE NUMBERS Divide. Use estimation to check your answer.

11. $6 \overline{)25.2}$

12. $5 \overline{)33.5}$

13. $7 \overline{)3.5}$

14. $8 \overline{)10.4}$

15. $38.79 \div 9$

16. $37.72 \div 4$

17. $43.4 \div 7$

18. $22.505 \div 7$

19. $44.64 \div 8$

20. $0.294 \div 3$

21. $3.6 \div 24$

22. $52.014 \div 20$

YOU BE THE TEACHER Your friend finds the quotient. Is your friend correct?

Explain your reasoning.

23.

$$\begin{array}{r} 3.12 \\ 9 \overline{)28.08} \\ \underline{-27} \\ 10 \\ \underline{-9} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

24.

$$\begin{array}{r} 0.86 \\ 6 \overline{)0.516} \\ \underline{-48} \\ 36 \\ \underline{-36} \\ 0 \end{array}$$



25. **MP PROBLEM SOLVING** You buy the same pair of pants in 3 different colors for \$89.85. How much does each pair of pants cost?

26. **MP REASONING** Which pack of fruit punch is the best buy? Explain.

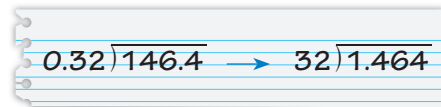
DIVIDING DECIMALS Divide. Check your answer.

- | | | | |
|-----------------------------|-------------------------------|---------------------------------|--------------------------------|
| 27. $2.1 \overline{)25.2}$ | 28. $3.8 \overline{)34.2}$ | 29. $36.47 \div 0.7$ | 30. $0.984 \div 12.3$ |
| 31. $6.64 \div 8.3$ | 32. $83.266 \div 13.43$ | 33. $0.09 \overline{)1.053}$ | 34. $35.903 \div 16.1$ |
| 35. $0.996 \div 0.12$ | 36. $4.63 \overline{)12.501}$ | 37. $0.005 \overline{)0.00115}$ | 38. $56.7175 \div 4.63$ |
| 39. $4.23 \div 0.012$ | 40. $0.52 \div 0.0013$ | 41. $95.04 \div 0.0132$ | 42. $32.2 \div 0.07$ |
| 43. $1.37 \overline{)54.8}$ | 44. $44.2 \div 3.25$ | 45. $4.04 \overline{)50.5}$ | 46. $250 \div 0.008$ |
| 47. $11.16 \div 0.062$ | 48. $12.5 \overline{)835}$ | 49. $597.6 \div 12.45$ | 50. $0.435 \overline{)118.32}$ |

DIVIDING DECIMALS Divide. Round to the nearest hundredth.

51. $80.89 \div 8.425$ 52. $0.8 \div 0.6$ 53. $38.9 \div 6.44$ 54. $11.6 \div 0.95$

55. **YOU BE THE TEACHER** Your friend rewrites the problem. Is your friend correct? Explain your reasoning.



ORDER OF OPERATIONS Evaluate the expression.

- | | | |
|----------------------------------|-------------------------------|---------------------------------------|
| 56. $7.68 + 3.18 \div 12$ | 57. $10.56 \div 3 - 1.9$ | 58. $19.6 \div 7 \times 9$ |
| 59. $5.5 \times 16.56 \div 9$ | 60. $35.25 \div 5 \div 3$ | 61. $13.41 \times (5.4 \div 9)$ |
| 62. $6.2 \cdot (5.16 \div 6.45)$ | 63. $132.06 \div (4^2 + 2.6)$ | 64. $4.8[23.9841 \div (1.16 + 1.27)]$ |

65. **MODELING REAL LIFE** A person's running stride is about 1.14 times the person's height. Your friend's stride is 5.472 feet. How tall is your friend?

66. **MP PROBLEM SOLVING** You have 3.4 gigabytes available on your tablet. A song is about 0.004 gigabyte. How many songs can you download onto your tablet?



MP REASONING Without finding the quotient, copy and complete the statement using $<$, $>$, or $=$. Explain your reasoning.

- | | | | |
|---|--------------------|--|------------------|
| 67. $6.66 \div 0.74$ <input type="checkbox"/> | $66.6 \div 7.4$ | 68. $32.2 \div 0.7$ <input type="checkbox"/> | $3.22 \div 7$ |
| 69. $160.72 \div 16.4$ <input type="checkbox"/> | $160.72 \div 1.64$ | 70. $75.6 \div 63$ <input type="checkbox"/> | $7.56 \div 0.63$ |

71. **DIG DEEPER!** The table shows the top three times in a swimming event at the Summer Olympics. The event consists of a team of four women swimming 100 meters each.

Women's 4 × 100 Freestyle Relay		
Medal	Country	Time (seconds)
Gold	Australia	210.65
Silver	United States	211.89
Bronze	Canada	212.89

- a. Suppose the times of all four swimmers on each team were the same. For each team, how much time does it take a swimmer to swim 100 meters?
- b. Suppose each U.S. swimmer completed 100 meters a quarter second faster. Would the U.S. team have won the gold medal? Explain your reasoning.
72. **MP PROBLEM SOLVING** To approximate the number of bees in a hive, multiply the number of bees that leave the hive in one minute by 3 and divide by 0.014. You count 25 bees leaving a hive in one minute. How many bees are in the hive?



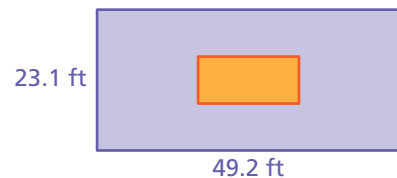
73. **MP PROBLEM SOLVING** You are saving money to buy a new bicycle that costs \$155.75. You have \$30 and plan to save \$5 each week. Your aunt decides to give you an additional \$10 each week.
- a. How many weeks will you have to save until you have enough money to buy the bicycle?
- b. How many more weeks would you have to save to buy a new bicycle that costs \$203.89? Explain how you found your answer.

74. **MP PRECISION** A store sells applesauce in two sizes.

Applesauce	
3.9-ounce bowl	\$0.52
24-ounce jar	\$2.63

- a. How many bowls of applesauce fit in a jar?
Round your answer to the nearest hundredth.
- b. Explain two ways to find the better buy.
- c. Which is the better buy?

75. **GEOMETRY** The large rectangle's dimensions are three times the dimensions of the small rectangle.



- a. How many times greater is the perimeter of the large rectangle than the perimeter of the small rectangle?
- b. How many times greater is the area of the large rectangle than the area of the small rectangle?
- c. Are the answers to parts (a) and (b) the same? Explain why or why not.
- d. What happens in parts (a) and (b) if the dimensions of the large rectangle are two times the dimensions of the small rectangle?

2

Connecting Concepts

► Using the Problem-Solving Plan

1. You change the water jug on the watercooler. How many glasses can be completely filled before you need to change the water jug again?

Understand the problem.

You know the capacities of the water jug and the glass. You are asked to determine how many glasses the water jug can fill.

Make a plan.

First, use what you know about converting measures to find the number of fluid ounces in 5 gallons. Then divide this amount by the capacity of the glass to find the number of glasses that can be filled.

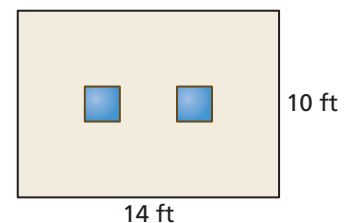
Solve and check.

Use the plan to solve the problem. Then check your solution.



2. Two ferries just departed from their docks at the same time. Ferry A departs from its dock every 1.2 hours. Ferry B departs from its dock every 1.8 hours. How long will it be until both ferries depart from their docks at the same time again?

3. You want to paint the ceiling of your bedroom. The ceiling has two square skylights as shown. Each skylight has a side length of $1\frac{7}{8}$ feet. How many square feet will you paint? Justify your answer.



Performance Task

Space Explorers

At the beginning of this chapter, you watched a STEAM video called "Space is Big." You are now ready to complete the performance task for this video, available at BigIdeasMath.com. Be sure to use the problem-solving plan as you work through the performance task.





▶ Review Vocabulary

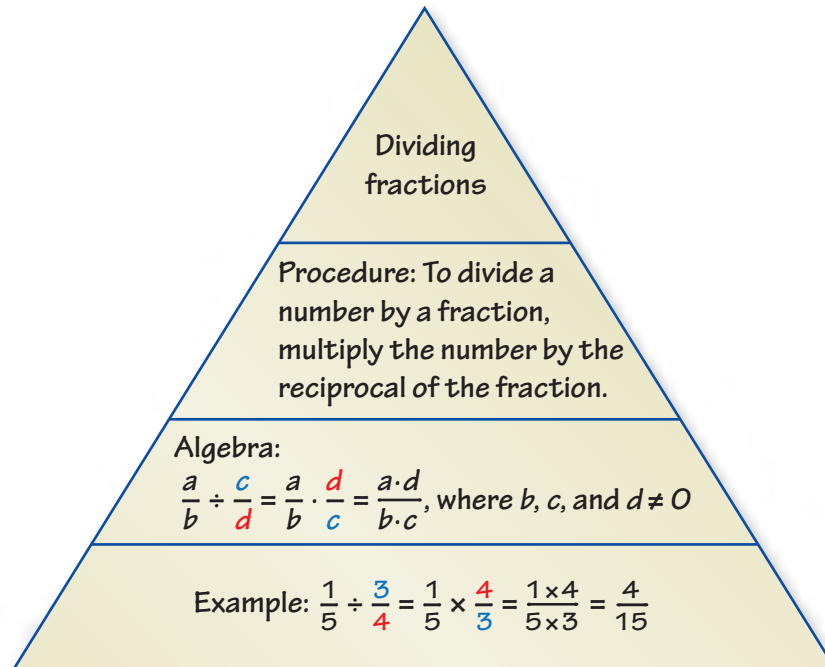
Write the definition and give an example of each vocabulary term.

reciprocals, p. 54

multiplicative inverses, p. 54

▶ Graphic Organizers

You can use a **Summary Triangle** to explain a concept. Here is an example of a Summary Triangle for *dividing fractions*.



Choose and complete a graphic organizer to help you study the concept.

1. multiplying fractions
2. multiplying mixed numbers
3. reciprocals
4. dividing mixed numbers
5. adding and subtracting decimals
6. multiplying decimals by decimals
7. dividing whole numbers
8. dividing decimals by decimals



"I finished my **Summary Triangle** about characteristics of igloos. I built one to use as my dog house. I'm calling it a dog-gloo."

▶ Chapter Self-Assessment

As you complete the exercises, use the scale below to rate your understanding of the success criteria in your journal.



2.1 Multiplying Fractions (pp. 45–52)

Learning Target: Find products involving fractions and mixed numbers.

Multiply. Write the answer in simplest form.

1. $\frac{2}{9} \times \frac{8}{11}$

2. $\frac{3}{10} \cdot \frac{4}{5}$

3. $2\frac{3}{10} \times 5\frac{1}{3}$

4. $\frac{2}{7} \times 4\frac{4}{9}$

5. Write two fractions whose product is $\frac{21}{32}$.

6. A costume designer needs to make 12 costumes for the school play. Each costume requires $2\frac{2}{3}$ yards of fabric. How many yards of fabric does the costume designer need to make all the costumes?

7. You spend $\frac{4}{5}$ of an hour on your homework. You spend $\frac{1}{2}$ of that time working on your science homework. How many minutes do you spend working on science homework?



2.2 Dividing Fractions (pp. 53–60)

Learning Target: Compute quotients of fractions and solve problems involving division by fractions.

Divide. Write the answer in simplest form.

8. $\frac{3}{4} \div \frac{5}{6}$

9. $\frac{2}{5} \div 8$

10. $5 \div \frac{1}{3}$

11. $\frac{8}{9} \div \frac{3}{10}$

12. A box contains 10 cups of pancake mix. You use $\frac{2}{3}$ cup each time you make pancakes. How many times can you make pancakes?

13. Write two fractions whose quotient is $\frac{28}{45}$.





2.3 Dividing Mixed Numbers (pp. 61–66)

Learning Target: Compute quotients with mixed numbers and solve problems involving division with mixed numbers.

Divide. Write the answer in simplest form.

14. $1\frac{2}{5} \div \frac{4}{7}$

15. $5\frac{5}{8} \div 3$

16. $5 \div 2\frac{6}{7}$

17. $4\frac{1}{8} \div 2\frac{1}{4}$

18. Evaluate $5\frac{5}{7} \div 1\frac{3}{5} \cdot 4\frac{2}{3}$. Write the answer in simplest form.



19. You have $23\frac{1}{2}$ pounds of blueberries to store in freezer bags. Each bag holds $3\frac{3}{4}$ pounds of blueberries. What is the minimum number of freezer bags needed to store all the blueberries?

20. A squirrel feeder holds $4\frac{1}{2}$ cups of seeds. Another squirrel feeder holds $6\frac{7}{8}$ cups of seeds. One scoop of seeds is $1\frac{5}{8}$ cups. How many scoops of seeds do you need to fill both squirrel feeders?



2.4 Adding and Subtracting Decimals (pp. 67–72)

Learning Target: Add and subtract decimals and solve problems involving addition and subtraction of decimals.

Add.

21. $3.78 + 8.94$

22. $19.89 + 4.372$

23. $24.916 + 17.385$

Subtract.

24. $7.638 - 2.365$

25. $14.21 - 4.103$

26. $5.467 - 2.736$

27. Write three decimals that have a sum of 10.806.

28. To make fuel for the main engines of a space shuttle, 102,619.377 kilograms of liquid hydrogen and 616,496.4409 kilograms of liquid oxygen are mixed together in the external tank. How much fuel is stored in the external tank?





2.5 Multiplying Decimals (pp. 73–80)

Learning Target: Multiply decimals and solve problems involving multiplication of decimals.

Multiply. Use estimation to check your answer.

29. 26.174×79

30. 9.475×8.03

31. 0.051×0.244

32. Evaluate $3.76(2.43 + 9.8)$.

33. Hair grows about 1.27 centimeters each month. How much does hair grow in 4 months?



2.6 Dividing Whole Numbers (pp. 81–86)

Learning Target: Divide whole numbers and solve problems involving division of whole numbers.

Divide. Use estimation to check your answer.

34. $7296 \div 38$

35. $5081 \div 203$

36. $\frac{17,264}{128}$

37. Your local varsity basketball team offers bus transportation for a playoff game. Each bus holds 56 people. A total of 328 people sign up. All buses are full except for the last bus. How many buses are used? How many people are in the last bus?

38. You have 600 elastic bands to make railroad bracelets. How many complete bracelets can you make?

Railroad Bracelet Supplies

- loom
- hook
- clip
- 28 elastic bands for outer rails
- 10 elastic bands for inner track



2.7 Dividing Decimals (pp. 87–94)

Learning Target: Divide decimals and solve problems involving division of decimals.

Divide. Check your answer.

39. $0.498 \div 6$

40. $8.9 \div 0.356$

41. $21.85 \div 3.8$

42. Evaluate $\frac{14.075 + 24.67}{3.15}$.

43. Your beginning balance on your lunch account is \$42. You buy lunch for \$1.80 every day and sometimes buy a snack for \$0.85. After 20 days, you have a balance of \$0.05. How many snacks did you buy?

2

Practice Test

Evaluate the expression. Write the answer in simplest form.

1. $5.138 + 2.624$

2. $\frac{5}{6} \div \frac{10}{21}$

3. $0.25 \overline{)5.46}$

4. $\frac{9}{16} \times \frac{2}{3}$

5. $8\frac{3}{4} \div 2\frac{7}{8}$

6. 4.87×7.23

7. $1875 \div 125$

8. $10 \div \frac{2}{5}$

9. $57.82 \div 0.784$

10. $5.316 - 1.942$

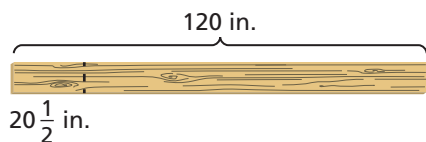
11. 6.729×8.3

12. $\frac{13,376}{248}$

13. On a road trip, you notice that the gas tank is $\frac{1}{4}$ full. The gas tank can hold 18 gallons, and the vehicle averages 22 miles per gallon. Will you make it to your destination 110 miles away before you run out of gas? Explain.
14. For a diving event, the highest and the lowest of seven scores are discarded. Next, the total of the remaining scores is multiplied by the degree of difficulty of the dive. That value is then multiplied by 0.6 to determine the final score. Find the final score for the dive.

Event	3-METER SPRINGBOARD						Difficulty
	JUDGE 1	JUDGE 2	JUDGE 3	JUDGE 4	JUDGE 5	JUDGE 6	JUDGE 7
SCORE	8.0	7.5	9.0	7.0	8.0	8.5	7.5

15. You are cutting as many $20\frac{1}{2}$ -inch pieces from the board to make ladder steps for a tree fort. How many steps can you make? How much wood is left over?



16. You spend $2\frac{1}{2}$ hours online. You spend $\frac{1}{5}$ of that time writing a blog. How long do you spend writing your blog?
17. You and a friend take pictures at a motocross event. Your camera can take 24 pictures in 3.75 seconds. Your friend's camera can take 36 pictures in 4.5 seconds. Evaluate the expression $(36 \div 4.5) \div (24 \div 3.75)$ to find how many times faster your friend's camera is than your camera.



2

Cumulative Practice

1. Which number is equivalent to the expression below?

$$6 \times 8 - 2 \times 3^2$$

- A. 12
B. 30
C. 324
D. 414

2. What is the greatest common factor of 48 and 120?



3. Which number is equivalent to $5.139 - 2.64$?

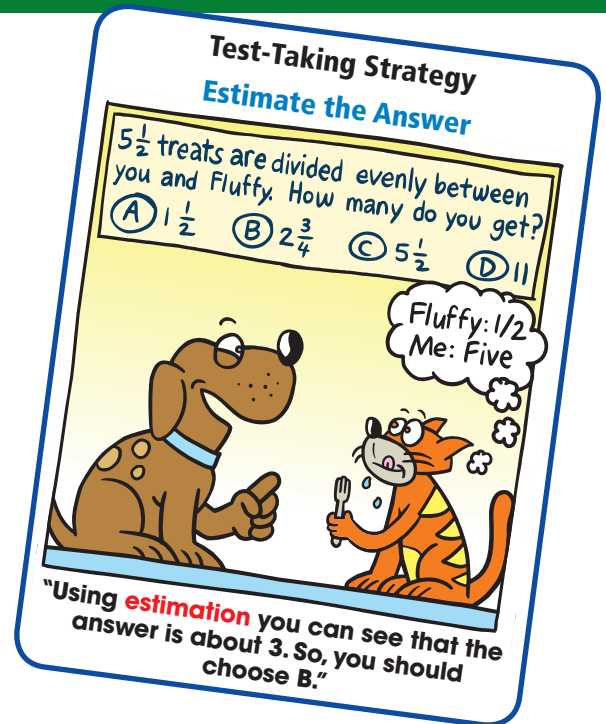
- F. 2.499
G. 2.599
H. 3.519
I. 3.599

4. Which number is equivalent to $\frac{4}{9} \div \frac{5}{7}$?

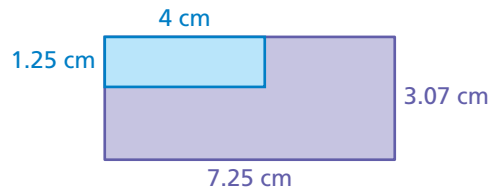
- A. $\frac{20}{63}$
B. $\frac{28}{45}$
C. $\frac{45}{28}$
D. $\frac{63}{20}$

5. You buy orange and black streamers for a party. The orange streamers are 9 feet long, and the black streamers are 12 feet long. What are the least numbers of streamers you should buy in order for the total length of the orange streamers to be the same as the total length of the black streamers?

- F. 36 orange streamers and 36 black streamers
G. 12 orange streamers and 9 black streamers
H. 3 orange streamers and 4 black streamers
I. 4 orange streamers and 3 black streamers



12. The area of the large rectangle is how many times the area of the small rectangle?

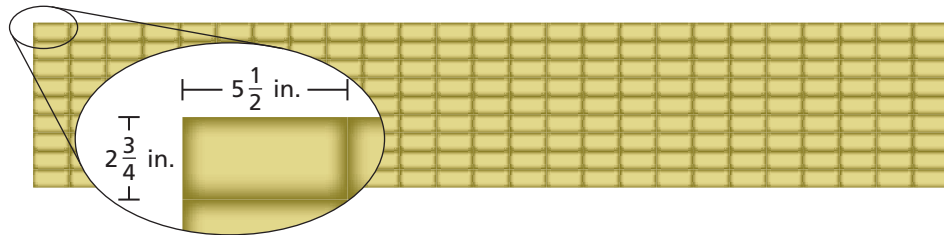


- F. 4.4515
 G. 5.915
 H. 17.2575
 I. 111.2875

13. Which expression is equivalent to $5 \times 5 \times 5 \times 5$?

- A. 5×4
 B. 4^5
 C. 5^4
 D. 5^5

14. A walkway is built using identical concrete blocks.



Part A How much longer, in inches, is the length of the walkway than the width of the walkway? Show your work and explain your reasoning.

Part B How many times longer is the length of the walkway than the width of the walkway? Show your work and explain your reasoning.

15. A meteoroid moving at a constant speed travels $6\frac{7}{8}$ miles in 30 seconds. How far does the meteoroid travel in 1 second?

- F. $\frac{1}{5}$ mile
 G. $\frac{11}{48}$ mile
 H. $2\frac{7}{24}$ miles
 I. $206\frac{1}{4}$ miles