CHAPTER 6

Applying Fractions

"What do Ferris wheels have to do with math?"

A Ferris wheel follows a circular path. To find the distance that you travel when you go one time around a Ferris wheel, you can use the formula $C = \pi d$, where π is approximately $\frac{22}{7}$, or 3.14. In geometry, you will use formulas to solve many real-life problems.

You will solve problems about Ferris wheels in Lesson 6-9.

Roy Ooms/Masterfile

CONTENTS

GETTING STARTED

Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 6. Refer to the lesson or page number in parentheses for review.

Vocabulary Review

Choose the correct term to complete each sentence.

1. The Division (Identity, Property) of Equality states that if you divide each side of an equation by the same nonzero number, the two sides remain equal. (Lesson 4-3)
2. The (GCF, LCD) of 12 and 16 is 4. (Lessons 5-2 and 5-7)

Prerequisite Skills

Find the LCD of each pair of fractions. (Lesson 5-8)

3. $\frac{5}{7}, \frac{3}{5}$
4. $\frac{1}{2}, \frac{4}{9}$
5. $\frac{8}{15}, \frac{1}{6}$
6. $\frac{3}{4}, \frac{7}{10}$

Multiply or divide. (Pages 560, 562)

7. 1.8×12
8. $99 \div 12$
9. $83 \div 100$
10. 4.6×0.3

Complete to show equivalent mixed numbers. (Page 563)

11. $3\frac{1}{5} = 2\frac{\square}{5}$
12. $9\frac{2}{3} = \square\frac{5}{3}$
13. $6\frac{1}{4} = 5\frac{\square}{4}$
14. $8\frac{6}{7} = 7\frac{\square}{7}$

Write each mixed number as an improper fraction. (Page 563)

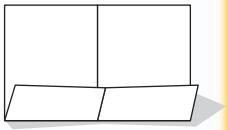
15. $10\frac{3}{4}$
16. $1\frac{7}{8}$
17. $4\frac{2}{5}$
18. $7\frac{2}{9}$

FOLDABLES Study Organizer

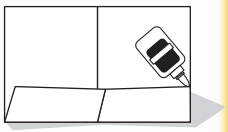
Fractions Make this Foldable to help you organize your notes. Begin with a sheet of $8\frac{1}{2}''$ by 11″ paper, four index cards, and glue.

STEP 1 **Fold**
Fold the paper in half widthwise.

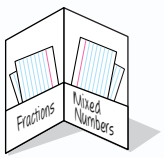
STEP 2 **Open and Fold Again**
Open and fold along the length about $2\frac{1}{2}''$ from the bottom.



STEP 3 **Glue**
Glue the edges on either side to form two pockets.



STEP 4 **Label**
Label the pockets *Fractions* and *Mixed Numbers*, respectively. Place two index cards in each pocket.



Noteables™

Chapter Notes Each time you find this logo throughout the chapter, use your *Noteables™: Interactive Study Notebook with Foldables™* or your own notebook to take notes. Begin your chapter notes with this Foldable activity.

MathOnline

Readiness To prepare yourself for this chapter with another quiz, visit **msmath2.net/chapter_readiness**

6-1 Estimating with Fractions

What You'll LEARN

Estimate sums, differences, products, and quotients of fractions and mixed numbers.

NEW Vocabulary

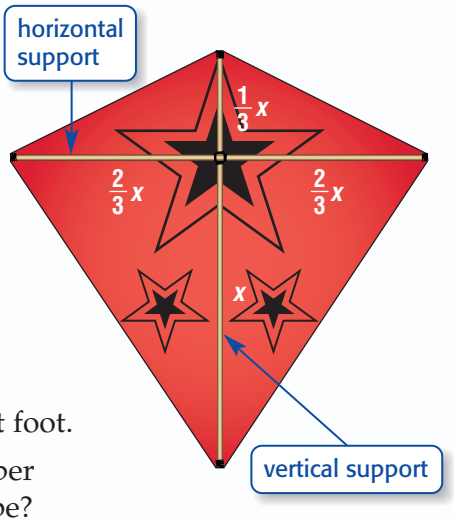
compatible numbers

MATH Symbols

≈ is approximately equal to

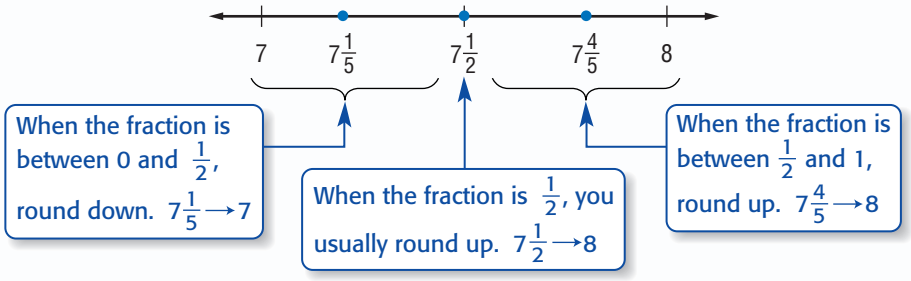
WHEN am I ever going to use this?

KITES For a kite to have balance while flying, the left and right sides of the horizontal support must each be $\frac{2}{3}$ as long as the bottom of the vertical support. Also, the top must be $\frac{1}{3}$ as long as the bottom portion.



1. Suppose the bottom portion of the vertical support is $2\frac{3}{4}$ feet. Round this length to the nearest foot.
2. About how long should the upper portion of the vertical support be?
3. About how long should the left and right sides of the horizontal support be?

To estimate the sum, difference, product, or quotient of mixed numbers, round the mixed numbers to the nearest whole number.



STUDY TIP

Front-End Estimation Add the integers, estimate the sum of the fractions, and find the total sum.

$3\frac{2}{3} + 5\frac{1}{6}$
$\approx 8 + 1$
≈ 9

EXAMPLES Estimate with Mixed Numbers

Estimate.

1 $3\frac{2}{3} + 5\frac{1}{6}$

$3\frac{2}{3} + 5\frac{1}{6} \rightarrow 4 + 5 = 9$

The sum is *about* 9.

2 $6\frac{2}{5} \times 1\frac{7}{8}$

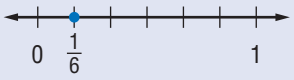
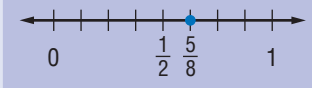
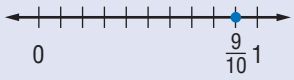
$6\frac{2}{5} \times 1\frac{7}{8} \rightarrow 6 \times 2 = 12$

The product is *about* 12.

Your Turn **Estimate.**

a. $2\frac{1}{5} + 3\frac{1}{2}$ b. $4\frac{3}{8} \times 5\frac{1}{4}$ c. $8\frac{7}{9} \div 2\frac{3}{4}$

To estimate the sum, difference, product, or quotient of fractions, round each fraction to 0, $\frac{1}{2}$, or 1, whichever is closest. Number lines and fraction models can help you decide how to round.

Fractions Close to 0	Fractions Close to $\frac{1}{2}$	Fractions Close to 1
		
 1/7	 4/9	 5/6

EXAMPLES Estimate with Fractions

Estimate.

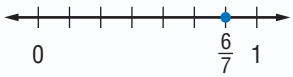
3 $\frac{1}{8} + \frac{2}{3}$

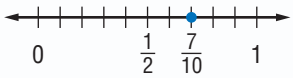
 $\frac{1}{8}$ is about 0.

 $\frac{2}{3}$ is about $\frac{1}{2}$.

$\frac{1}{8} + \frac{2}{3} \rightarrow 0 + \frac{1}{2} = \frac{1}{2}$ The sum is *about* $\frac{1}{2}$.

4 $\frac{6}{7} - \frac{7}{10}$

 $\frac{6}{7}$ is about 1.

 $\frac{7}{10}$ is about $\frac{1}{2}$.

$\frac{6}{7} - \frac{7}{10} \rightarrow 1 - \frac{1}{2} = \frac{1}{2}$ The difference is *about* $\frac{1}{2}$.

5 $\frac{8}{9} \div \frac{5}{6}$

$\frac{8}{9} \div \frac{5}{6} \rightarrow 1 \div 1 = 1$ $\frac{8}{9}$ is about 1, and $\frac{5}{6}$ is about 1.

The quotient is *about* 1.

Your Turn **Estimate.**

d. $\frac{4}{5} + \frac{2}{7}$ **e.** $\frac{5}{8} - \frac{3}{7}$ **f.** $\frac{3}{5} \times \frac{11}{12}$

STUDY TIP

Fractions When the numerator and the denominator of a fraction are very close in value, such as $\frac{6}{7}$ or $\frac{8}{9}$, the fraction is close to 1.

Sometimes it makes sense to round fractions to the nearest $\frac{1}{2}$, or mixed numbers to the nearest integer. Other times, it is useful to use **compatible numbers**, or numbers that are easy to compute mentally.

EXAMPLES Use Compatible Numbers

Estimate.

6 $\frac{1}{3} \times 14$ **THINK** What is $\frac{1}{3}$ of 14?

$\frac{1}{3} \times 14 \rightarrow \frac{1}{3} \times 15 = 5$ Round 14 to 15, since 15 is divisible by 3.

The product is *about* 5.

7 $9\frac{7}{8} \div 4\frac{1}{5}$

$9\frac{7}{8} \div 4\frac{1}{5} \rightarrow 10 \div 4\frac{1}{5}$ Round $9\frac{7}{8}$ to 10.

$\rightarrow 10 \div 5 = 2$ Round $4\frac{1}{5}$ to 5, since 10 is divisible by 5.

The quotient is *about* 2.

Your Turn **Estimate.**

g. $\frac{1}{4} \cdot 21$ h. $\frac{1}{2} \times 17$ i. $12 \div 6\frac{2}{3}$

STUDY TIP

Compatible Numbers When dividing mixed numbers, round so that the dividend is a multiple of the divisor.

Skill and Concept Check

1. **Writing Math** Explain how models are useful when estimating with fractions.

2. **OPEN ENDED** Describe when estimation is a better method for solving a problem rather than using pencil and paper, a calculator, or a computer. Then give a real-life example.

3. **NUMBER SENSE** Determine which of the following has a sum that is greater than 1. Write *yes* or *no* and explain.

   a. $\frac{1}{2} + \frac{4}{7}$ b. $\frac{3}{4} + \frac{5}{8}$ c. $\frac{2}{5} + \frac{1}{6}$

GUIDED PRACTICE

Estimate.

4. $8\frac{3}{8} + 1\frac{4}{5}$ 5. $5\frac{5}{7} \times 2\frac{7}{8}$ 6. $\frac{1}{6} + \frac{2}{5}$

7. $\frac{6}{7} - \frac{1}{5}$ 8. $\frac{1}{4} \cdot 15$ 9. $21\frac{5}{6} \div 9\frac{3}{4}$

10. **CONSTRUCTION** About how many bookcase shelves shown at the right can a carpenter cut from a board that is 1 foot wide and 12 feet long?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
11–16, 37–38	1, 2
17–24	3–5
25–28	6–7

Extra Practice
See pages 577, 601.

Estimate.

11. $3\frac{3}{4} + 4\frac{5}{6}$
12. $1\frac{1}{8} + 5\frac{11}{12}$
13. $5\frac{1}{3} - 3\frac{1}{6}$
14. $4\frac{2}{5} - 1\frac{1}{2}$
15. $2\frac{2}{3} \cdot 6\frac{1}{3}$
16. $6\frac{1}{8} \div 1\frac{2}{3}$
17. $\frac{3}{4} + \frac{3}{8}$
18. $\frac{5}{8} + \frac{3}{7}$
19. $\frac{5}{9} - \frac{1}{6}$
20. $\frac{3}{4} - \frac{3}{5}$
21. $\frac{1}{8} \times \frac{3}{4}$
22. $\frac{4}{9} \cdot \frac{11}{12}$
23. $\frac{4}{5} \div \frac{7}{8}$
24. $\frac{1}{10} \div \frac{5}{6}$
25. $\frac{1}{2} \times 13$
26. $\frac{1}{4} \times 39$
27. $25\frac{3}{10} \div 5\frac{2}{3}$
28. $27\frac{5}{8} \div 6\frac{1}{5}$
29. $12\frac{2}{7} \div 4\frac{1}{3}$
30. $5\frac{9}{10} \cdot 4\frac{1}{6}$

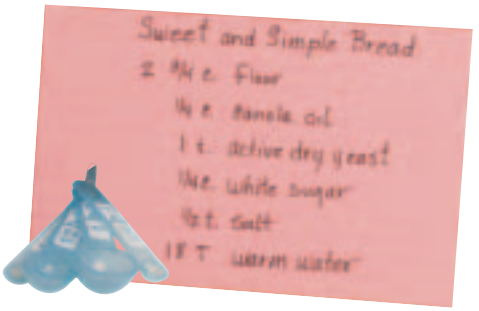
31. Estimate $23\frac{2}{9}$ divided by 3.

32. Estimate the sum of $4\frac{1}{8}$, $1\frac{5}{6}$, and $\frac{7}{9}$.

Estimate.

33. $-3\frac{2}{7} \times 8\frac{3}{4}$
34. $\frac{4}{5}\left(-\frac{5}{8}\right)$
35. $-\frac{1}{6} \times (-65)$
36. $12\frac{1}{4} \cdot 2\frac{7}{9}$

37. **BAKING** Kayla wants to make the bread recipe shown at the right, but she has only $1\frac{1}{3}$ cups of flour. About how much more flour does she need?



38. **SEWING** A skirt that is $15\frac{7}{8}$ inches long has a hem of $1\frac{1}{8}$ inches. Approximately how long will the skirt be if the hem is let down?

39. **CRITICAL THINKING** If a number being divided is rounded up and the divisor is rounded down, what is the effect on the quotient?

Spiral Review with Standardized Test Practice

40. **MULTIPLE CHOICE** Choose the best estimate for $2\frac{1}{5} + 3\frac{3}{4}$.

(A) 6 (B) 5 (C) 4 (D) 2

41. **MULTIPLE CHOICE** If Lucas's car gets $23\frac{1}{3}$ miles per gallon, about how many miles can he drive on $1\frac{3}{4}$ gallons?

(F) 0.46 mi (G) 4.6 mi (H) 46 mi (I) 460 mi

Replace each ● with <, >, or = to make a true sentence. (Lesson 5-8)

42. $\frac{7}{8}$ ● 0.75
43. $\frac{4}{5}$ ● $\frac{5}{7}$
44. $2\frac{1}{3}$ ● $\frac{7}{3}$
45. $\frac{6}{11}$ ● $\frac{9}{14}$

46. Find the LCM of 9 and 12. (Lesson 5-7)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Find the LCD of each pair of fractions.** (Lesson 5-8)

47. $\frac{3}{4}, \frac{5}{12}$
48. $\frac{1}{2}, \frac{7}{10}$
49. $\frac{1}{6}, \frac{1}{8}$
50. $\frac{4}{5}, \frac{2}{3}$

6-2 Adding and Subtracting Fractions

What You'll LEARN

Add and subtract fractions.

REVIEW Vocabulary

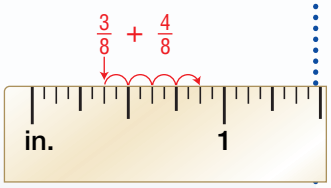
LCD: the least common multiple of the denominators of two or more fractions (Lesson 5-8)

HANDS-ON Mini Lab

Materials
- ruler

Work with a partner.

1. Find $\frac{3}{8}$ inch on a ruler. From that point, add $\frac{4}{8}$ inch. What is the result?
2. Use a ruler to add $\frac{1}{4}$ inch and $\frac{2}{4}$ inch.
3. **Make a conjecture** about how to find each sum. Check using a ruler.
   a. $\frac{5}{8} + \frac{7}{8}$ b. $\frac{3}{16} + \frac{1}{16}$ c. $\frac{1}{2} + \frac{3}{4}$



Fractions that have the same denominators are called *like fractions.*

Noteables — Key Concept: Add and Subtract Like Fractions

Words To add or subtract like fractions, add or subtract the numerators and write the result over the denominator. Simplify if necessary.

Symbols

Arithmetic	Algebra
$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$	$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$, where $c \neq 0$
$\frac{11}{12} - \frac{7}{12} = \frac{4}{12}$ or $\frac{1}{3}$	$\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$, where $c \neq 0$

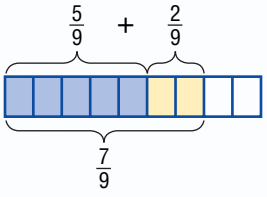
EXAMPLES Add and Subtract Like Fractions

Add or subtract. Write in simplest form.

1 $\frac{5}{9} + \frac{2}{9}$

$\frac{5}{9} + \frac{2}{9} = \frac{5+2}{9}$ Add the numerators.

$= \frac{7}{9}$ Write the sum over the denominator.

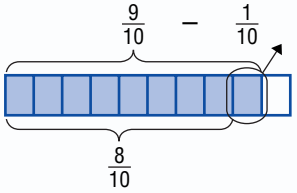


2 $\frac{9}{10} - \frac{1}{10}$

$\frac{9}{10} - \frac{1}{10} = \frac{9-1}{10}$ Subtract the numerators.

$= \frac{8}{10}$ Write the difference over the denominator.

$= \frac{4}{5}$ Simplify.



READING in the Content Area

For strategies in reading this lesson, visit msmath2.net/reading.

CONTENTS

To add or subtract *unlike fractions*, or fractions with different denominators, rename the fractions using the LCD. Then add or subtract as with like fractions.

EXAMPLES Add and Subtract Unlike Fractions

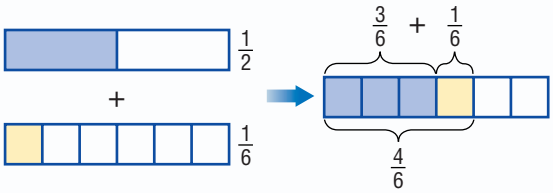
Add or subtract. Write in simplest form.

3 $\frac{1}{2} + \frac{1}{6}$ **Estimate** $\frac{1}{2} + 0 = \frac{1}{2}$

The least common denominator of 2 and 6 is 6.

$\frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$ Rename $\frac{1}{2}$ using the LCD.

$$\begin{array}{r} \frac{1}{2} \rightarrow \frac{3}{6} \\ +\frac{1}{6} \rightarrow +\frac{1}{6} \\ \hline \frac{4}{6} \text{ or } \frac{2}{3} \end{array}$$



$\frac{2}{3}$ is close to the estimate. So, $\frac{1}{2} + \frac{1}{6} = \frac{2}{3}$.

4 $-\frac{5}{6} + \frac{7}{8}$ **Estimate** $-1 + 1 = 0$

The LCD of 6 and 8 is 24.

$$\begin{array}{r} -\frac{5}{6} \rightarrow -\frac{5 \times 4}{6 \times 4} \rightarrow -\frac{20}{24} \\ +\frac{7}{8} \rightarrow \frac{7 \times 3}{8 \times 3} \rightarrow +\frac{21}{24} \\ \hline \frac{1}{24} \end{array}$$

So, $-\frac{5}{6} + \frac{7}{8} = \frac{1}{24}$. Compare to the estimate.

REAL-LIFE MATH

WEATHER The average precipitation for November and December in Seattle, Washington, is $5\frac{7}{10}$ inches and 6 inches, respectively.

Source: *The World Almanac*

5 **WEATHER** **The average precipitation for November and December in Grand Junction, Colorado, is $\frac{7}{10}$ inch and $\frac{3}{5}$ inch, respectively. What is the difference of the average precipitation for these two months?**

Estimate $\frac{1}{2} - \frac{1}{2} = 0$

$\frac{7}{10} - \frac{3}{5} = \frac{7}{10} - \frac{3 \times 2}{5 \times 2}$ The LCD of 10 and 5 is 10.

$= \frac{7}{10} - \frac{6}{10}$ Rename the fractions with the LCD.

$= \frac{1}{10}$ Subtract the numerators.

The difference in the precipitation is $\frac{1}{10}$ inch.

Your Turn **Add or subtract. Write in simplest form.**

a. $\frac{8}{9} - \frac{2}{9}$ b. $-\frac{3}{8} + \frac{5}{6}$ c. $\frac{7}{8} + \frac{3}{4}$ d. $\frac{2}{3} - \frac{1}{6}$

Skill and Concept Check

1. **Draw** a model to show $\frac{3}{8} + \frac{1}{4}$.

2. **OPEN ENDED** Write a subtraction problem with fractions in which the difference is $\frac{2}{7}$.

3. **FIND THE ERROR** Marissa and Jacinta are finding $\frac{5}{9} + \frac{1}{6}$. Who is correct? Explain.

Marissa
$\frac{5}{9} + \frac{1}{6} = \frac{5+9}{9+6}$

Jacinta
$\frac{5}{9} + \frac{1}{6} = \frac{5 \times 2}{9 \times 2} + \frac{1 \times 3}{6 \times 3}$

GUIDED PRACTICE

Add or subtract. Write in simplest form.

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

5. $\frac{6}{7} + \frac{3}{7}$

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

7. $\frac{5}{6} - \frac{7}{12}$

8. $\frac{4}{9} + \frac{2}{9}$

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

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

11. $\frac{5}{6} + \frac{4}{9}$

12. $-\frac{1}{3} + \frac{3}{4}$

13. $-\frac{1}{6} + \frac{7}{10}$

14. **PRESIDENTS** Of the United States presidents, $\frac{5}{14}$ were born in either Virginia or Ohio, and $\frac{1}{6}$ were born in either Massachusetts or New York. What fraction were born in one of these four states?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
15–18, 23–26	1, 2
19–22, 27–41	3–5

Extra Practice
See pages 577, 601.

Add or subtract. Write in simplest form.

15. $\frac{3}{7} + \frac{1}{7}$

16. $\frac{5}{8} + \frac{7}{8}$

17. $\frac{5}{6} - \frac{1}{6}$

18. $\frac{7}{10} - \frac{3}{10}$

19. $-\frac{1}{15} + \frac{3}{5}$

20. $-\frac{7}{9} - \frac{1}{3}$

21. $\frac{4}{5} - \frac{1}{6}$

22. $\frac{7}{12} + \frac{7}{10}$

23. $\frac{4}{5} - \frac{3}{5}$

24. $\frac{8}{9} - \frac{5}{9}$

25. $\frac{3}{8} + \frac{7}{8}$

26. $\frac{5}{6} + \frac{5}{6}$

27. $\frac{5}{8} - \frac{7}{12}$

28. $\frac{2}{15} + \frac{4}{9}$

29. $-\frac{5}{8} + \frac{11}{12}$

30. $-\frac{3}{8} - \frac{1}{12}$

31. $\frac{3}{10} - \frac{1}{4}$

32. $\frac{9}{10} + \frac{4}{15}$

33. $-\frac{9}{10} - \frac{1}{6}$

34. $-\frac{7}{9} + \left(-\frac{5}{6}\right)$

ALGEBRA **Evaluate each expression if $a = \frac{3}{4}$ and $b = \frac{5}{6}$.**

35. $\frac{1}{12} + a$

36. $b - \frac{7}{10}$

37. $b - a$

38. $-a + b$

39. **MULTI STEP** After 1 hour, Jon had finished $\frac{5}{6}$ of a long-distance race, and Ling had finished $\frac{7}{9}$ of it. At that time, who had finished a greater fraction of the race, and by how much?

MONEY For Exercises 40 and 41, use the following information and the table at the right.
Sierra and Jacob each receive an equal allowance. The table shows the fraction of their allowance that they each deposit into their savings account and the fraction they each spend at the mall.

Where Money Goes	Fraction of Allowance	
	Sierra	Jacob
savings account	$\frac{1}{2}$	$\frac{1}{3}$
spend at mall	$\frac{1}{4}$	$\frac{3}{5}$
left over	?	?

40. What fraction of Jacob's allowance goes into his savings account or is spent at the mall?

41. Who has more money left over? Explain.

42. **CRITICAL THINKING** Does $\frac{1}{3} + \frac{5}{9} - \frac{5}{12} = \frac{5}{9} + \frac{5}{12} - \frac{1}{3}$? Explain.

Spiral Review with Standardized Test Practice

43. **MULTIPLE CHOICE** Makayla uses $\frac{1}{5}$ pound of ham and $\frac{1}{8}$ pound of turkey for her sandwich. How much meat does she use in all?

(A) $\frac{1}{13}$ lb (B) $\frac{2}{13}$ lb (C) $\frac{13}{40}$ lb (D) $\frac{7}{20}$ lb

44. **MULTIPLE CHOICE** Jamal used a bucket that was $\frac{7}{9}$ full with soapy water to wash his mother's car. After washing the car, the bucket was only $\frac{1}{6}$ full. What part of the bucket of soapy water did Jamal use?

(F) $\frac{1}{9}$ (G) $\frac{8}{15}$ (H) $\frac{11}{18}$ (I) $\frac{17}{18}$

Estimate. (Lesson 6-1)

45. $\frac{6}{7} - \frac{5}{12}$ 46. $4\frac{1}{9} + 3\frac{3}{4}$ 47. $16\frac{2}{3} \div 8\frac{1}{5}$ 48. $5\frac{4}{5} \cdot 3\frac{1}{3}$

PETS For Exercises 49 and 50, refer to the table at the right. It shows where pet owners get their pets. (Lesson 5-8)

49. Where do the greatest number of people get their pets?

50. Of the sources listed, where do the fewest people get their pets?

Pet Source	Portion of Pet Owners
animal shelter	$\frac{3}{20}$
friend/family	$\frac{21}{50}$
pet store	0.07
find as stray	0.14

Source: Yankelovich Partners

GETTING READY FOR THE NEXT LESSON

BASIC SKILL **Complete.**

Example: $8\frac{1}{2} = 7\frac{3}{2}$

51. $5\frac{2}{3} = 4\frac{\square}{3}$ 52. $7\frac{8}{9} = 6\frac{\square}{9}$ 53. $12\frac{1}{5} = \square\frac{6}{5}$ 54. $4\frac{3}{8} = \square\frac{11}{8}$

6-3 Adding and Subtracting Mixed Numbers

What You'll LEARN

Add and subtract mixed numbers.

WHEN am I ever going to use this?

ASTRONOMY Astronomers use *astronomical units* (AU) to represent large distances in space. One AU is the average distance from Earth to the Sun. Mercury is about $\frac{2}{5}$ AU from the Sun.

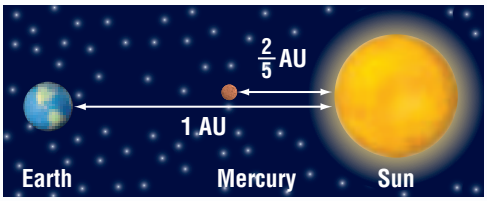


Diagram is not drawn to scale.

1. Jupiter is $5\frac{2}{5}$ AU from the Sun and Saturn's distance is $9\frac{1}{2}$ AU. Write an expression to find how much closer to the Sun Jupiter is than Saturn.
2. Find the difference of the fractional parts of the mixed numbers.
3. Find the difference of the whole numbers.
4. **Make a conjecture** about how to find $9\frac{1}{2} - 5\frac{2}{5}$. Then use your conjecture to find the difference.

To add or subtract mixed numbers, first add or subtract the fractions. If necessary, rename them using the LCD. Then add or subtract the whole numbers and simplify if necessary.

EXAMPLES Add and Subtract Mixed Numbers

Add or subtract. Write in simplest form.

1 $7\frac{4}{9} + 10\frac{2}{9}$

Estimate $7 + 10 = 17$

$$\begin{array}{r} 7\frac{4}{9} \\ +\ 10\frac{2}{9} \\ \hline 17\frac{6}{9} \text{ or } 17\frac{2}{3} \end{array}$$

Add the whole numbers and fractions separately.

Simplify.

Compare each sum to its estimate.

2 $8\frac{5}{6} - 2\frac{1}{3}$

Estimate $9 - 2 = 7$

$$\begin{array}{rcl} 8\frac{5}{6} & \rightarrow & 8\frac{5}{6} \\ -\ 2\frac{1}{3} & \rightarrow & -\ 2\frac{2}{6} \\ \hline & & 6\frac{3}{6} \text{ or } 6\frac{1}{2} \end{array}$$

Rename the fraction using the LCD.

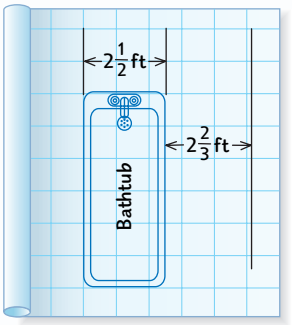
Simplify.

Your Turn **Add or subtract. Write in simplest form.**

a. $6\frac{1}{8} + 2\frac{5}{8}$ b. $13\frac{7}{8} - 9\frac{3}{4}$ c. $1\frac{5}{9} + 4\frac{1}{6}$

EXAMPLE Use Mixed Numbers to Solve a Problem

3 **BUILDING** There should be $2\frac{2}{3}$ feet of clearance space in front of a bathtub. What is the total width of the bathtub and clearance space shown at the right?



$2\frac{1}{2} + 2\frac{2}{3} = 2\frac{3}{6} + 2\frac{4}{6}$ Rename the fractions.

$= 4 + \frac{7}{6}$ Add the whole numbers and add the fractions.

$= 4 + 1\frac{1}{6}$ Rename $\frac{7}{6}$ as $1\frac{1}{6}$.

$= 5\frac{1}{6}$ Simplify.

The total width is $5\frac{1}{6}$ feet.

REAL-LIFE CAREERS

How Does a Plumber Use Math?

Plumbers add and subtract mixed numbers when calculating the dimensions for installing house fixtures such as shower stalls and sinks.

Research

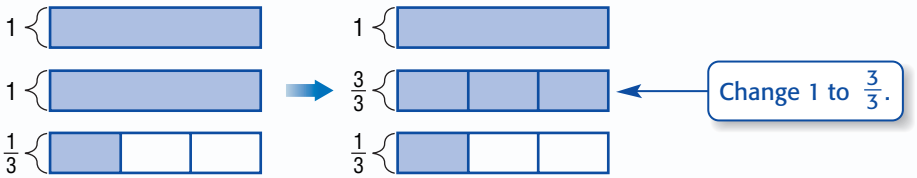
For information about a career as a plumber, visit: msmath2.net/careers

Sometimes when you subtract mixed numbers, the fraction in the first mixed number is less than the fraction in the second.

EXAMPLES Rename Numbers to Subtract

4 **Find $2\frac{1}{3} - 1\frac{2}{3}$.**

Rename $2\frac{1}{3}$ before subtracting.



$2\frac{1}{3} = 1\frac{3}{3} + \frac{1}{3}$ or $1\frac{4}{3}$

$2\frac{1}{3} \rightarrow 1\frac{4}{3}$ Rename $2\frac{1}{3}$ as $1\frac{4}{3}$.

$-\,1\frac{2}{3} \rightarrow -\,1\frac{2}{3}$ First subtract the whole numbers and then the fractions.

$\frac{2}{3}$ So, $2\frac{1}{3} - 1\frac{2}{3} = \frac{2}{3}$.

5 **Find $8 - 3\frac{3}{4}$.** **Estimate** $8 - 4 = 4$

$8 \rightarrow 7\frac{4}{4}$ $7 + \frac{4}{4} = 8$, so rename 8 as $7\frac{4}{4}$.

$-\,3\frac{3}{4} \rightarrow -\,3\frac{3}{4}$ Subtract.

$4\frac{1}{4}$ The difference is close to the estimate.

Your Turn **Subtract. Write in simplest form.**

d. $11\frac{2}{5} - 2\frac{3}{5}$ **e.** $5\frac{3}{8} - 4\frac{11}{12}$ **f.** $7 - 1\frac{1}{2}$

Aaron Haupt

Skill and Concept Check

1. **OPEN ENDED** Write a problem that can be solved by finding $8\frac{1}{2} + 2\frac{1}{3}$. Explain what the numbers represent and find the sum.

2. **FIND THE ERROR** Evan and José are finding $3\frac{3}{4} - 1\frac{7}{8}$. Who is correct? Explain.

Evan

$3\frac{3}{4} - 1\frac{7}{8} = 3\frac{6}{8} - 1\frac{7}{8}$

$= 2\frac{1}{8}$

José

$3\frac{3}{4} - 1\frac{7}{8} = 3\frac{6}{8} - 1\frac{7}{8}$

$= 2\frac{14}{8} - 1\frac{7}{8}$ or $1\frac{7}{8}$

3. **NUMBER SENSE** Use estimation to determine whether $6\frac{3}{4} + \frac{4}{5}$ is *greater than*, *less than*, or *equal to* $2\frac{1}{9} + 6\frac{7}{8}$. Explain.

GUIDED PRACTICE

Add or subtract. Write in simplest form.

4. $1\frac{5}{7} + 8\frac{1}{7}$

5. $7\frac{5}{6} - 3\frac{1}{6}$

6. $8\frac{1}{2} + 3\frac{4}{5}$

7. $6\frac{3}{4} + 2\frac{9}{10}$

8. $9\frac{4}{5} - 2\frac{3}{5}$

9. $2\frac{3}{8} + 5\frac{7}{8}$

10. $4\frac{3}{10} + 4\frac{9}{10}$

11. $7\frac{5}{6} + 9\frac{3}{8}$

12. $3\frac{1}{4} - 1\frac{3}{4}$

13. $11 - 6\frac{3}{8}$

14. **AQUARIUMS** A fish tank that holds $18\frac{2}{3}$ gallons of water has $10\frac{1}{2}$ gallons so far. How much more water can be added?

Practice and Applications

Add or subtract. Write in simplest form.

15. $2\frac{1}{9} + 7\frac{4}{9}$

16. $10\frac{4}{5} - 2\frac{1}{5}$

17. $3\frac{1}{6} + 5\frac{1}{6}$

18. $6\frac{5}{7} + 8\frac{6}{7}$

19. $11\frac{3}{4} - 4\frac{1}{3}$

20. $4\frac{3}{8} + 10\frac{5}{12}$

21. $9\frac{4}{5} - 2\frac{3}{10}$

22. $6\frac{5}{6} - 2\frac{1}{3}$

23. $2\frac{3}{8} + 5\frac{7}{8}$

24. $8\frac{3}{7} + 1\frac{4}{7}$

25. $6\frac{2}{3} - 1\frac{3}{5}$

26. $4\frac{3}{10} - 1\frac{3}{4}$

27. $14\frac{1}{6} - 7\frac{1}{3}$

28. $3\frac{7}{9} + 3\frac{5}{9}$

29. $8\frac{5}{12} + 11\frac{1}{4}$

30. $7\frac{7}{8} + 10\frac{5}{6}$

31. $9\frac{1}{5} - 2\frac{3}{5}$

32. $12\frac{1}{2} - 6\frac{5}{8}$

33. $8 - 3\frac{2}{3}$

34. $13 - 5\frac{5}{6}$

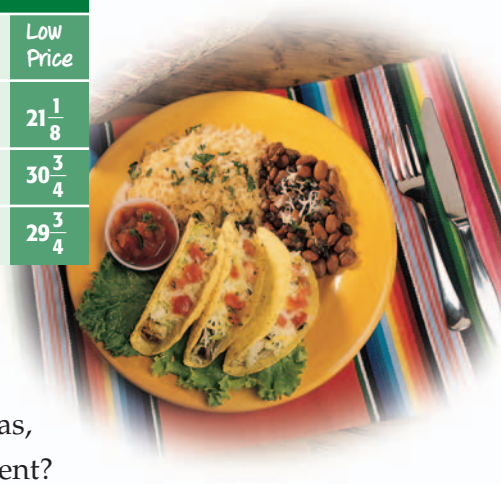
HOMEWORK HELP

For Exercises	See Examples
15–25, 28–30	1, 2
35–38	3
26–27, 31–34	4, 5

Extra Practice
See pages 577, 601.

STOCK MARKET **For Exercises 35–37, use the following information.**
Until several years ago, stock prices were listed as mixed numbers. Find the difference between the high and low price of each restaurant chain stock shown in the table.

Stock Prices		
Company	High Price	Low Price
Restaurant A	$52\frac{5}{16}$	$21\frac{1}{8}$
Restaurant B	$42\frac{1}{4}$	$30\frac{3}{4}$
Restaurant C	$68\frac{3}{8}$	$29\frac{3}{4}$



35. Restaurant A

36. Restaurant B

37. Restaurant C

38. **MONUMENTS** The Washington Monument is 555 feet $5\frac{1}{8}$ inches tall. The San Jacinto Monument near Houston, Texas, is 14 feet $6\frac{7}{8}$ inches taller. How tall is the San Jacinto Monument?

Add or subtract. Write in simplest form.

39. $10 - 3\frac{5}{11}$

40. $24 - 8\frac{3}{4}$

41. $6\frac{1}{6} + 1\frac{2}{3} + 5\frac{5}{9}$

42. $3\frac{1}{4} + 2\frac{5}{6} - 4\frac{1}{3}$

43. **CRITICAL THINKING** A string is cut in half, and one of the halves is used to bundle newspapers. Then one fifth of the remaining string is cut off. The piece left is 8 feet long. How long was the string originally?

Spiral Review with Standardized Test Practice

44. **MULTIPLE CHOICE** What is the sum of $7\frac{1}{2}$ and $2\frac{1}{6}$?

(A) $5\frac{1}{3}$ (B) $9\frac{1}{2}$ (C) $9\frac{2}{3}$ (D) $10\frac{2}{3}$

45. **MULTIPLE CHOICE** Melanie had $4\frac{2}{3}$ pounds of chopped walnuts. She used $1\frac{1}{4}$ pounds in a recipe. How many pounds of chopped walnuts did she have left?

(F) $2\frac{1}{3}$ lb (G) $2\frac{5}{12}$ lb (H) $3\frac{5}{12}$ lb (I) $3\frac{1}{2}$ lb

46. Find $\frac{7}{10} - \frac{1}{3}$. Write in simplest form. (Lesson 6-2)

Estimate. (Lesson 6-1)

47. $\frac{8}{9} \div \frac{9}{10}$

48. $3\frac{1}{2} + 6\frac{2}{3}$

49. $8\frac{4}{5} \times 7\frac{1}{9}$

50. $4\frac{2}{9} - 1\frac{1}{4}$

Replace each ● with $<$, $>$, or $=$ to make a true sentence. (Lesson 5-8)

51. $\frac{4}{5}$ ● $\frac{7}{9}$

52. $\frac{2}{3}$ ● $\frac{5}{6}$

53. $\frac{1}{8}$ ● 0.15

54. $\frac{3}{7}$ ● 0.4

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Write each mixed number as an improper fraction.** (Page 563)

55. $2\frac{3}{8}$

56. $1\frac{2}{7}$

57. $5\frac{1}{10}$

58. $6\frac{4}{5}$

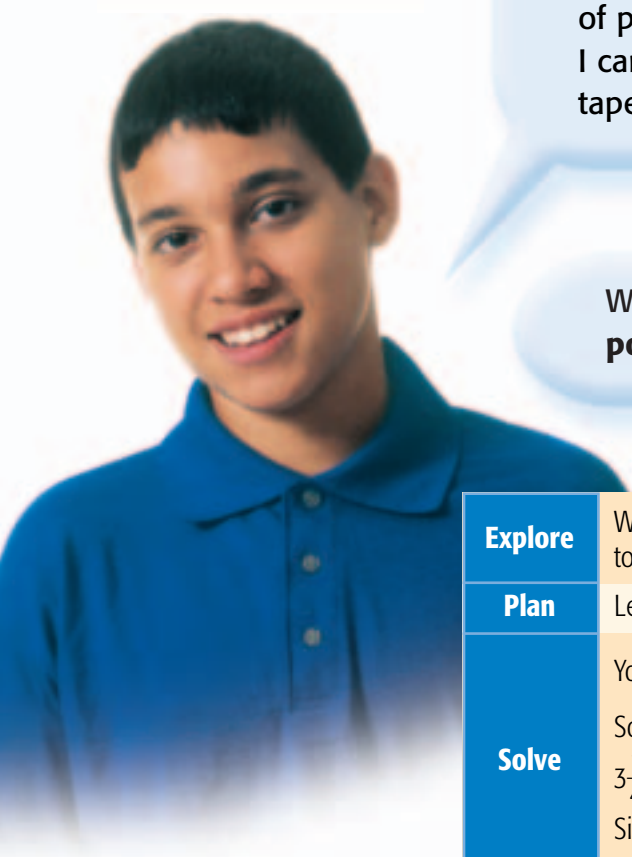
6-3b Problem-Solving Strategy

A Follow-Up of Lesson 6-3

Eliminate Possibilities

What You'll LEARN

Solve problems by eliminating possibilities.



I recorded $3\frac{1}{4}$ hours of a miniseries on a videotape that can record 6 hours of programming. What is the most that I can record on the rest of the same tape—2 hours, $2\frac{1}{2}$ hours, or 3 hours?

Well, we can **eliminate** some **possibilities** by estimating.

Explore	We know the combined hours of programming must be less than or equal to 6 hours.
Plan	Let's eliminate answers that are not reasonable.
Solve	You couldn't record 3 more hours on the tape because $3\frac{1}{4} + 3 = 6\frac{1}{4}$. So, we can eliminate that choice. Now let's check the choice of $2\frac{1}{2}$ hours. $3\frac{1}{4} + 2\frac{1}{2} = 5\frac{3}{4}$ Since this is less than 6 hours, this choice is correct. You could record $2\frac{1}{2}$ more hours on the tape.
Examine	Recording 2 more hours would give $3\frac{1}{4} + 2$ or $5\frac{1}{4}$ hours. This is less than the 6-hour maximum, but not the most that you could record.

Analyze the Strategy

1. **Describe** different ways that you can eliminate possibilities when solving problems.
2. **Explain** how the strategy of eliminating possibilities is useful for taking multiple choice tests.
3. **Write** a problem that could be solved by eliminating the possibilities. Explain your answer.

John Evans

CONTENTS

Apply the Strategy

Solve. Use the eliminate possibilities strategy.

4. **JUICE** Lauren has a 3-gallon cooler with $1\frac{3}{4}$ gallons of juice in it. If she wants the cooler full for her soccer game, how much juice does she need to add?

   (A) 4 gal (B) $3\frac{1}{4}$ gal
   (C) $1\frac{1}{4}$ gal (D) $\frac{1}{4}$ gal

5. **ELEPHANTS** An elephant in a zoo eats 58 cabbages in a week. About how many cabbages does an elephant eat in one year?

   (F) 7 (G) 700
   (H) 1,500 (I) 3,000

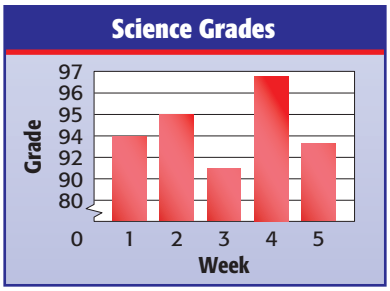
Mixed Problem Solving

Solve. Use any strategy.

6. **RAIN FOREST** In some areas of the rain forest, 325 inches of rain may fall in a year. Which is the *best* estimate for the average rainfall per day in such an area?

   (A) $\frac{1}{3}$ in. (B) 1 in.
   (C) 5 in. (D) 33 in.

7. **GRADES** Explain why the graph showing a student's science grades is misleading.



8. **ELEVATORS** An elevator can hold a maximum weight of 3,500 pounds. Which is the *best* estimate for the number of adults that the elevator can hold?

   (F) 10 adults (G) 20 adults
   (H) 35 adults (I) 80 adults

9. **SUPPLIES** Vanessa has $55 to buy school supplies. She bought a backpack that costs $23.50, a combination lock that costs $6.25, and 4 binders that are $3.99 each. If mechanical pencils are $2.50 per pack, how many packs can she buy?

10. **SHOPPING** Abby bought the items at the right for a party. Which is the *best* estimate of the total cost of the items, not including tax?

Item	Price
balloons	$2.95
cups and plates	$9.30
streamers	$4.50

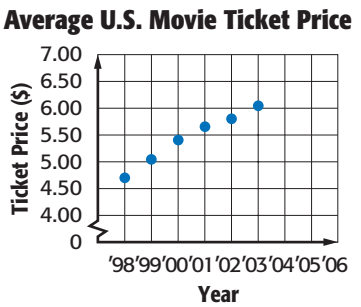
   (A) less than $15
   (B) between $15 and $25
   (C) between $25 and $35
   (D) more than $35

11. **TRAVEL** Mr. Rollins drove 780 miles on a five-day trip. He rented a car for $23 per day plus $0.15 per mile after 500 free miles. About how much did the rental car cost?

   (F) $100 (G) $130 (H) $160 (I) $180

12. **STANDARDIZED TEST PRACTICE**
   If the trend in the graph continued, which is the best estimate for the average movie ticket price in the United States in 2006?

   (A) $5.50
   (B) $6.00
   (C) $6.25
   (D) $6.75



6-4 Multiplying Fractions and Mixed Numbers

What You'll LEARN

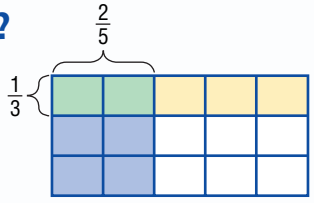
Multiply fractions and mixed numbers.

REVIEW Vocabulary

GCF: the greatest of the common factors of two or more numbers (Lesson 5-2)

WHEN am I ever going to use this?

EARTH SCIENCE About $\frac{1}{3}$ of the land in the United States is forests. About $\frac{2}{5}$ of U.S. forests are publicly owned.



1. What part of the rectangle represents $\frac{1}{3}$?
2. What part of the rectangle represents $\frac{2}{5}$ of $\frac{1}{3}$?
3. **Make a conjecture** about what fraction of U.S. land is publicly owned forests.

You can multiply fractions by using the rule below.

Noteables **Key Concept: Multiply Fractions**

Words To multiply fractions, multiply the numerators and multiply the denominators.

Symbols

Arithmetic	Algebra
$\frac{1}{3} \times \frac{2}{5} = \frac{1 \times 2}{3 \times 5} = \frac{2}{15}$	$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d} = \frac{ac}{bd}$

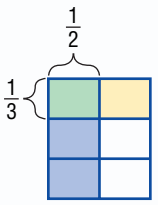
EXAMPLES Multiply Fractions

Multiply. Write in simplest form.

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

$\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3}$ ← Multiply the numerators. ← Multiply the denominators.

$= \frac{1}{6}$ Simplify.

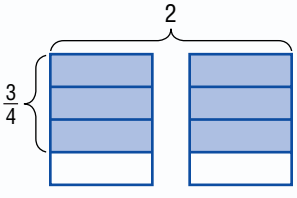


2 $2 \times \frac{3}{4}$

$2 \times \frac{3}{4} = \frac{2}{1} \times \frac{3}{4}$ Write 2 as $\frac{2}{1}$.

$= \frac{2 \times 3}{1 \times 4}$ Multiply the numerators and multiply the denominators.

$= \frac{6}{4}$ or $1\frac{1}{2}$ Simplify.



Your Turn **Multiply. Write in simplest form.**

a. $\frac{3}{5} \times \frac{1}{2}$ b. $\frac{1}{3} \times \frac{3}{4}$ c. $\frac{2}{3} \times 4$

Richard Hamilton Smith/CORBIS

CONTENTS

If the numerator and denominator of either fraction have common factors, you can simplify before multiplying.

STUDY TIP

Simplifying You can simplify by dividing a numerator and a denominator by the same factor. Doing this step before you multiply is easier than doing it after you multiply.

EXAMPLE Simplify Before Multiplying

1 **Find $-\frac{2}{7} \times \frac{3}{8}$. Write in simplest form.**

$-\frac{2}{7} \times \frac{3}{8} = -\frac{\cancel{2}^{1}}{7} \times \frac{3}{\cancel{8}_{4}}$ Divide 2 and 8 by their GCF, 2.

$= -\frac{1 \times 3}{7 \times 4}$ Multiply the numerators and multiply the denominators.

$= -\frac{3}{28}$ Simplify.

Your Turn **Multiply. Write in simplest form.**

d. $\frac{1}{3} \times \frac{3}{7}$ **e.** $-\frac{4}{9} \times \frac{1}{8}$ **f.** $\frac{5}{6} \times \frac{3}{5}$

EXAMPLE Multiply Mixed Numbers

4 **Find $\frac{1}{2} \times 4\frac{2}{5}$. Write in simplest form.** **Estimate** $\frac{1}{2} \times 4 = 2$

Method 1 Rename the mixed number.

$\frac{1}{2} \times 4\frac{2}{5} = \frac{1}{\cancel{2}_{1}} \times \frac{\cancel{22}^{11}}{5}$ Rename $4\frac{2}{5}$ as an improper fraction, $\frac{22}{5}$.

$= \frac{1 \times 11}{1 \times 5}$ Multiply.

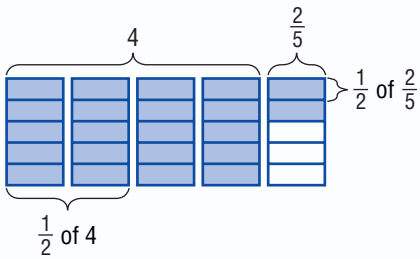
$= \frac{11}{5}$ or $2\frac{1}{5}$ Simplify.

The product is close to the estimate.

STUDY TIP

Mental Math When you see a problem like $\frac{1}{2} \times 4\frac{2}{5}$, you can use the Distributive Property. Think, "What is $\frac{1}{2}$ of 4 and what is $\frac{1}{2}$ of $\frac{2}{5}$?" This is equal to $\frac{1}{2}\left(4 + \frac{2}{5}\right)$.

Method 2 Use mental math.



$\frac{1}{2} \times 4\frac{2}{5} = \frac{1}{2} \times \left(4 + \frac{2}{5}\right)$ Write $4\frac{2}{5}$ as a sum of its parts.

$= \left(\frac{1}{2} \times 4\right) + \left(\frac{1}{2} \times \frac{2}{5}\right)$ Distributive Property

$= 2 + \frac{1}{5}$ or $2\frac{1}{5}$ Multiply.

Compare this product to the model shown above.

Your Turn **Multiply. Write in simplest form.**

g. $\frac{1}{4} \times 8\frac{4}{9}$ **h.** $3 \times 5\frac{1}{3}$ **i.** $-1\frac{7}{8} \times \left(-2\frac{2}{5}\right)$

Skill and Concept Check

1. **OPEN ENDED** Write a pair of fractions whose product is $\frac{8}{15}$.

2. **Which One Doesn't Belong?** Identify the expression that does not have the same value as the other three. Explain your reasoning.

$\frac{1}{5}$ of 25	$25 \times \frac{1}{5}$	$5 \div 25$	$\frac{1}{5} \cdot \frac{25}{1}$

3. **NUMBER SENSE** Is $18 \times \frac{4}{5}$ *greater than*, *less than*, or *equal to* 18? Explain.

GUIDED PRACTICE

Multiply. Write in simplest form.

4. $\frac{2}{3} \times \frac{1}{3}$
5. $\frac{1}{2} \times \frac{2}{5}$
6. $-\frac{2}{3} \times \frac{3}{8}$
7. $-\frac{1}{6} \times 4$
8. $2\frac{1}{4} \times \frac{2}{3}$
9. $1\frac{5}{6} \times 3\frac{3}{5}$

10. **FOOD** An average slice of American cheese is about $\frac{1}{8}$ inch thick. What is the height of a package containing 20 slices?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
11–12	1
21–24, 34	2
13–20, 33	3
25–32, 35–36	4

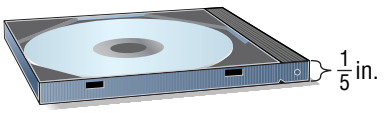
Extra Practice
See pages 578, 601.

Multiply. Write in simplest form.

11. $\frac{3}{4} \times \frac{1}{8}$
12. $\frac{2}{5} \times \frac{2}{3}$
13. $\frac{1}{5} \times \frac{5}{6}$
14. $\frac{4}{9} \times \frac{1}{4}$
15. $-\frac{2}{3} \times \frac{1}{4}$
16. $-\frac{1}{12} \times \frac{3}{5}$
17. $\frac{4}{7} \times \frac{7}{8}$
18. $\frac{2}{5} \times \frac{15}{16}$
19. $\frac{3}{8} \times \frac{10}{27}$
20. $\frac{9}{10} \times \frac{5}{6}$
21. $-9 \times \left(-\frac{1}{2}\right)$
22. $-\frac{4}{5} \times (-6)$

23. **ELECTIONS** In an election in which 4,500 votes were cast, one candidate received $\frac{3}{5}$ of the votes. How many votes did the candidate receive?

24. **PACKAGING** The plastic cases used to store compact disks and DVDs are about $\frac{1}{5}$-inch thick. A company wants to sell 10 of these cases in plastic wrapping. What is the height of 10 cases?



Multiply. Write in simplest form.

25. $4\frac{2}{3} \times \frac{4}{7}$
26. $\frac{5}{8} \times 2\frac{1}{2}$
27. $14 \times 1\frac{1}{7}$
28. $3\frac{3}{4} \times 8$
29. $-9 \times 4\frac{2}{3}$
30. $-4 \times 7\frac{5}{6}$
31. $3\frac{1}{4} \times 2\frac{2}{3}$
32. $5\frac{1}{3} \times 3\frac{3}{4}$

33. **TELEVISION** A media research survey showed that one evening, $\frac{2}{3}$ of all U.S. households had their TVs on, and $\frac{3}{8}$ of them were watching a World Series baseball game. What fraction of U.S. households was watching the game?

34. **ANIMALS** Komodo dragons are the largest lizards in the world. A 250-pound komodo dragon can eat enough at one time to increase its weight by $\frac{3}{4}$. Find $\frac{3}{4} \times 250$ to determine how much weight a 250-pound komodo dragon could gain after eating.

35. **TURTLES** A giant tortoise can travel about one tenth of a kilometer in an hour. At this rate, how far can it travel in $1\frac{3}{4}$ hours?

36. **FLAGS** By law, the length of an official United States flag must be $1\frac{9}{10}$ times its width. What is the length of the flag shown at the right?

37. **CRITICAL THINKING** Two positive fractions which are *not* improper are multiplied. Is the product *sometimes*, *always*, or *never* less than 1? Explain.

Spiral Review with Standardized Test Practice

38. **MULTIPLE CHOICE** A box of books weighs $8\frac{2}{3}$ pounds. How much do $4\frac{1}{2}$ boxes weigh?

Ⓐ 19 lb Ⓑ $27\frac{2}{3}$ lb Ⓒ $32\frac{1}{2}$ lb Ⓓ 39 lb

39. **GRID IN** Jeanette and Vanesa are each taking half of the leftover pizza shown at the right. What fraction of the whole pizza does each person take?

40. **LIFE SCIENCE** A female anglerfish is approximately $2\frac{1}{2}$ inches long, and a male is about $\frac{2}{5}$ inch long. How much longer is the female than the male? (Lesson 6-3)

Add or subtract. Write in simplest form. (Lesson 6-2)

41. $\frac{2}{7} + \frac{4}{7}$ 42. $\frac{1}{2} - \frac{1}{8}$ 43. $\frac{5}{9} + \frac{5}{6}$ 44. $\frac{3}{4} - \frac{1}{6}$

Find the greatest common factor of each set of numbers. (Lesson 5-2)

45. 44, 60 46. 25, 75 47. 6, 15, 27 48. 12, 30, 48

49. **ALGEBRA** On a January day in Buffalo, New York, the temperature dropped to −20.8°C. Find this temperature in degrees Fahrenheit by using the formula $C = 0.6F - 17.8$. (Lesson 4-4)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Multiply.** (Page 560)

50. $2.8 \cdot 5$ 51. $1.9 \cdot 33$ 52. $7 \cdot 12.5$ 53. $3.6 \cdot 0.8$

6-5 Algebra: Solving Equations

What You'll LEARN

Solve equations with rational number solutions.

NEW Vocabulary

multiplicative inverse
reciprocal

Link to READING

***Everyday Meaning of Inverse*:** opposite in order, as in an inverse statement in logic

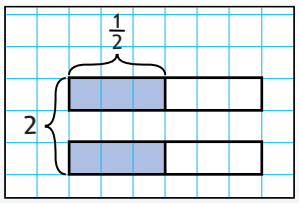
HANDS-ON Mini Lab

Materials
- grid paper
- colored pencils

Work with a partner.

The model below shows $\frac{1}{2} \cdot 2$.

1. What is the product?
2. Use grid paper to model $\frac{1}{3} \cdot 3$. What is the product?
3. Copy and complete the table below.



$\frac{1}{2} \cdot 2 = \underline{?}$	$\frac{2}{3} \cdot \frac{3}{2} = \underline{?}$	$\frac{5}{6} \cdot \underline{?} = 1$
$\frac{1}{3} \cdot 3 = \underline{?}$	$\frac{3}{5} \cdot \frac{5}{3} = \underline{?}$	$\frac{9}{20} \cdot \underline{?} = 1$
$\frac{1}{4} \cdot \frac{4}{1} = \underline{?}$	$\frac{11}{12} \cdot \frac{12}{11} = \underline{?}$	$\underline{?} \cdot \frac{17}{8} = 1$

Two numbers whose product is 1 are called **multiplicative inverses**, or **reciprocals**.

Noteables

Key Concept: Multiplicative Inverse Property

Words The product of a number and its multiplicative inverse is 1.

Symbols

Arithmetic	Algebra
$\frac{3}{4} \times \frac{4}{3} = 1$	$\frac{a}{b} \times \frac{b}{a} = 1$, for $a, b \neq 0$

EXAMPLES Find Multiplicative Inverses

Find the multiplicative inverse of each number.

1 $\frac{2}{5}$

$\frac{2}{5} \cdot \frac{5}{2} = 1$ Multiply $\frac{2}{5}$ by $\frac{5}{2}$ to get the product 1.

The multiplicative inverse of $\frac{2}{5}$ is $\frac{5}{2}$, or $2\frac{1}{2}$.

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

$2\frac{1}{3} = \frac{7}{3}$ Rename the mixed number as an improper fraction.

$\frac{7}{3} \cdot \frac{3}{7} = 1$ Multiply $\frac{7}{3}$ by $\frac{3}{7}$ to get the product 1.

The multiplicative inverse of $2\frac{1}{3}$ is $\frac{3}{7}$.

Your Turn **Find the multiplicative inverse of each number.**

a. $\frac{5}{6}$ b. $1\frac{1}{2}$ c. 8 d. $-\frac{4}{3}$

Study Tip

Look Back You can review the other **properties of equality** in Lessons 4-2 and 4-3.

In Chapter 4, you learned to solve equations using the Addition, Subtraction, and Division Properties of Equality. You can also solve equations by multiplying each side by the same number. This is called the **Multiplication Property of Equality**.

Noteables **Key Concept: Multiplication Property of Equality**

Words If you multiply each side of an equation by the same nonzero number, the two sides remain equal.

Symbols

Arithmetic	Algebra	
$5 = 5$	$\frac{x}{2} = -3$	$\frac{2}{3}x = 4$
$5 \cdot 2 = 5 \cdot 2$	$\frac{x}{2}(2) = -3(2)$	$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot 4$
$10 = 10$	$x = -6$	$x = 6$

EXAMPLE 3 Solve a Division Equation

Solve $7 = \frac{n}{4}$. Check your solution.

$7 = \frac{n}{4}$ Write the equation.

$7 \cdot 4 = \frac{n}{4} \cdot 4$ Multiply each side of the equation by 4.

$28 = n$ Simplify.

The solution is 28.

When the coefficient of x is a fraction, multiply each side of the equation by its reciprocal.

Standardized Test Practice

EXAMPLE 4 Use a Reciprocal to Solve an Equation

MULTIPLE-CHOICE TEST ITEM

What value of x makes $\frac{2}{3}x = -9$ a true sentence?

(A) $\frac{3}{2}$ (B) $-\frac{18}{27}$ (C) $-\frac{9}{1}$ (D) $-13\frac{1}{2}$

Test-Taking Tip

Backsolving
Sometimes it may be easier to substitute each of the choices into the given equation until you get a true sentence.

Read the Test Item To find the value of x, solve the equation.

Solve the Test Item

$\frac{2}{3}x = -9$ Write the equation.

$\left(\frac{3}{2}\right)\frac{2}{3}x = \left(\frac{3}{2}\right)(-9)$ Multiply each side by the reciprocal of $\frac{2}{3}$, $\frac{3}{2}$.

$x = -\frac{27}{2}$ or $-13\frac{1}{2}$ Simplify.

The answer is D.

Your Turn

e. What value of b makes $24 = \frac{3}{4}b$ a true sentence?

(A) 6 (B) 18 (C) 32 (D) 72

Skill and Concept Check

1. Writing Math Tell whether 8 is a solution of $\frac{n}{3} = 24$. Explain.

2. **OPEN ENDED** Write a division equation that can be solved by multiplying each side by $\frac{9}{4}$.

3. **Which One Doesn't Belong?** Identify the pair of numbers that does not have the same relationship as the other three. Explain your reasoning.

$\frac{7}{8}, \frac{8}{7}$	$5, \frac{1}{5}$	$\frac{2}{3}, 3$	$\frac{10}{3}, \frac{3}{10}$

GUIDED PRACTICE

Find the multiplicative inverse of each number.

4. $\frac{8}{5}$ 5. $\frac{2}{9}$ 6. -9 7. $5\frac{4}{5}$

Solve each equation. Check your solution.

8. $\frac{k}{16} = 2$ 9. $-4 = \frac{y}{3}$ 10. $6 = \frac{4}{7}u$

11. $\frac{1}{4}t = \frac{3}{8}$ 12. $\frac{5}{7}y = -1.5$ 13. $\frac{b}{8.2} = 2.5$

14. **MEASUREMENT** The weight in pounds p of an object with a mass m of 25 kilograms is given by the equation $\frac{p}{m} = 2.2$. How many pounds does the object weigh?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
15–22	1, 2
23–36	3, 4

Extra Practice
See pages 578, 601.

Find the multiplicative inverse of each number.

15. $\frac{11}{2}$ 16. $-\frac{9}{5}$ 17. $-\frac{3}{8}$ 18. $\frac{1}{6}$

19. 3 20. -14 21. $4\frac{2}{5}$ 22. $6\frac{2}{3}$

Solve each equation. Check your solution.

23. $\frac{x}{12} = 3$ 24. $\frac{d}{4} = 28$ 25. $-\frac{2}{5}t = -12$ 26. $-24 = \frac{3}{4}a$

27. $\frac{7}{8}k = -21$ 28. $14 = \frac{8}{3}b$ 29. $\frac{1}{2}z = -\frac{2}{5}$ 30. $\frac{3}{5} = \frac{3}{7}r$

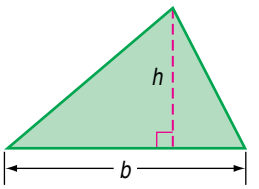
31. $35.1 = \frac{5}{6}m$ 32. $-\frac{a}{3.2} = 5$ 33. $0.8 = \frac{h}{3.6}$ 34. $\frac{m}{4.6} = 2.8$

35. **VACATION** The distance Katie travels in her car while driving 55 miles per hour for 2.5 hours is given by the equation $\frac{d}{2.5} = 55$. How far did she travel?

36. **MONEY** Based on recent exchange rates, the equation $d = \frac{31}{50}c$ shows the value in U.S. dollars d for an amount of Canadian dollars c. To the nearest cent, find the value in Canadian currency for \$250 in U.S. dollars.

Data Update What is the value in Canadian currency for \$250 in U.S. dollars today? Visit msmath2.net/data_update to learn more.

37. **CRITICAL THINKING** In Lesson 11-5, you will learn that the area of a triangle A is given by the equation $A = \frac{1}{2}bh$, where b is the base of the triangle and h is the height. Explain how you can use the properties of equality to find the value of b in terms of A and h. Then solve for b.



Spiral Review with Standardized Test Practice

38. **MULTIPLE CHOICE** What is the reciprocal of $2\frac{1}{5}$?

(A) $2\frac{5}{1}$ (B) $\frac{11}{5}$ (C) $\frac{5}{11}$ (D) $\frac{1}{10}$

39. **GRID IN** Aaron is serving a 12-pound turkey at a dinner party. As a rule, you should allow about $\frac{3}{4}$ of a pound of meat per person. Use $\frac{3}{4}p = 12$ to find the number of people p that can be served at the dinner party.

Multiply. Write in simplest form. (Lesson 6-4)

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

41. $1\frac{1}{2} \times 6$

42. $2\frac{2}{5} \times \frac{1}{6}$

43. $1\frac{1}{2} \times 1\frac{7}{9}$

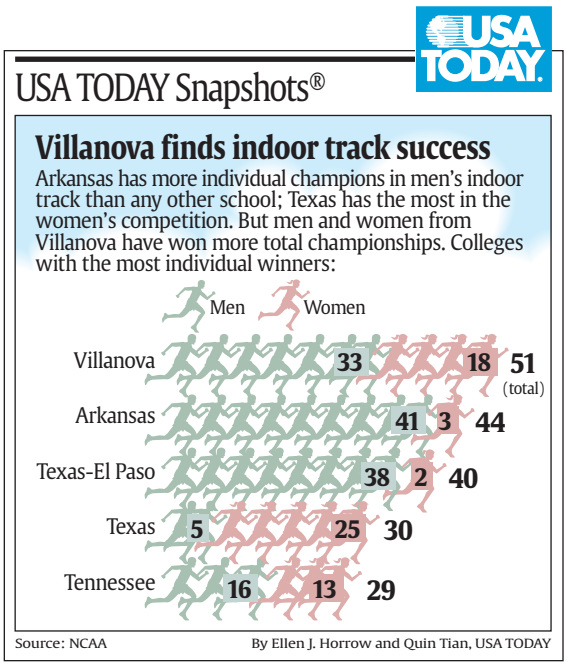
44. Find $7\frac{1}{3} - 3\frac{5}{9}$. (Lesson 6-3)

For Exercises 45–47, use the graphic at the right. Write a fraction that compares the number of women champions to the total number of champions for each college. Write in simplest form. (Lesson 5-3)

45. Villanova

46. Texas–El Paso

47. Texas



GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Estimate.** (Lesson 6-1)

48. $18\frac{1}{6} \div 3$

49. $24\frac{3}{8} \div 11\frac{7}{9}$

50. $\frac{2}{11} \div \frac{11}{12}$

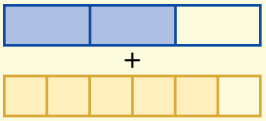
51. $\frac{9}{10} \div \frac{6}{7}$

CHAPTER 6

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **Write** an addition expression involving fractions shown by the model at the right. Then find the sum. Write in simplest form. (Lesson 6-2)



2. **Define** reciprocals. (Lesson 6-5)

Skills and Applications

Estimate. (Lesson 6-1)

3. $7\frac{1}{9} + 1\frac{1}{6}$
4. $13\frac{1}{2} \div 7\frac{2}{9}$
5. $\frac{11}{20} - \frac{5}{8}$

6. **SAVINGS** Jessica saves $\frac{1}{3}$ of the money she earns baby-sitting. If she earns $25 one evening, estimate the amount she saves. (Lesson 6-1)

Add, subtract, or multiply. Write in simplest form. (Lessons 6-2, 6-3, and 6-4)

7. $\frac{11}{15} - \frac{1}{15}$
8. $\frac{4}{7} + \left(-\frac{3}{14}\right)$
9. $\frac{5}{8} + \frac{3}{4}$
10. $5\frac{1}{6} - 1\frac{1}{3}$
11. $\frac{7}{12} \times \frac{4}{9}$
12. $2\frac{3}{5} + 6\frac{13}{15}$
13. $2\frac{3}{4} \times 12$
14. $4\frac{2}{7} \times 5\frac{5}{6}$

15. **AIRPLANES** The aircraft *Voyager* weighed 2,000 pounds. In 1986, it carried about $3\frac{1}{2}$ times its weight in fuel to fly nonstop around the world. How many pounds of fuel did *Voyager* carry? (Lesson 6-4)

Solve each equation. Check your solution. (Lesson 6-5)

16. $\frac{t}{5} = -11$
17. $2 = \frac{3}{8}y$
18. $16.2 = \frac{3}{4}k$

Standardized Test Practice

19. **MULTIPLE CHOICE** One batch of cookies uses $2\frac{1}{2}$ cups of flour and $1\frac{2}{3}$ cups of sugar. Which is the best estimate of the total amount of flour and sugar used in eight batches of cookies? (Lesson 6-1)

(A) less than 30 c

(B) between 30 c and 45 c

(C) between 45 c and 55 c

(D) more than 55 c

20. **MULTIPLE CHOICE** How much does a $12\frac{3}{4}$-pound package weigh after a $3\frac{5}{8}$-pound book is taken out of it? (Lesson 6-3)

(F) $8\frac{1}{8}$ lb

(G) 9 lb

(H) $9\frac{1}{8}$ lb

(I) 15 lb

The Game Zone

A Place To Practice Your Math Skills

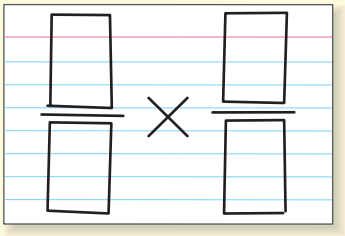
Totally Mental

GET READY!

Players: two
Materials: 2 index cards, spinner with the digits 1 through 9

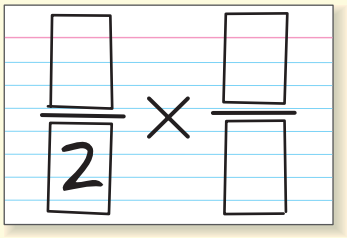
GET SET!

- Each player should make a game sheet on an index card like the one shown at the right.



GO!

- One player spins the spinner. The number that is spun should be written in one of the four boxes on his or her game sheet.



- The second player spins the spinner and writes the number from the spinner in one of the boxes on his or her game sheet.
- Continue until each person has spun the spinner four times.
- Find the product of the fractions on your game sheet.
- **Who Wins?** After four spins, the player with the greatest product is the winner.

6-6 Dividing Fractions and Mixed Numbers

What You'll LEARN

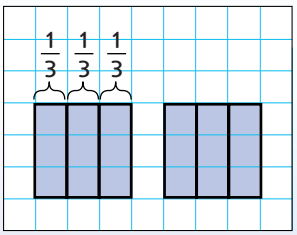
Divide fractions and mixed numbers.

HANDS-ON Mini Lab

Materials
- grid paper

Work with a partner.

The model at the right shows 2 units divided into thirds, or $2 \div \frac{1}{3}$.



1. How many thirds are in 2 units?
2. What is $2 \div \frac{1}{3}$?
3. Draw a model to show $3 \div \frac{1}{2}$.
4. What is $3 \div \frac{1}{2}$?

Dividing 8 by 2 gives the same result as multiplying 8 by the reciprocal of 2, or $\frac{1}{2}$.

reciprocals

$8 \div 2 = 4 \qquad 8 \cdot \frac{1}{2} = 4$

same result

In the same way, dividing 4 by $\frac{1}{3}$ is the same as multiplying 4 by the reciprocal of $\frac{1}{3}$, or 3. This pattern is true for any rational number.

Noteables™ Key Concept: Division by Fractions

Words To divide by a fraction, multiply by its multiplicative inverse, or reciprocal.

Symbols

Arithmetic	Algebra
$\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \cdot \frac{4}{3}$	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$, where $b, c, d \neq 0$

EXAMPLE 1 Divide by a Fraction

Find $\frac{3}{4} \div \frac{1}{2}$. Write in simplest form.

$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \cdot \frac{2}{1}$ Multiply by the reciprocal of $\frac{1}{2}$, which is $\frac{2}{1}$.

$= \frac{3}{\cancel{4}_{2}} \cdot \frac{\cancel{2}^{1}}{1}$ Divide by the GCF, 2.

$= \frac{3}{2}$ or $1\frac{1}{2}$ Multiply and simplify.

Your Turn **Divide. Write in simplest form.**

a. $\frac{3}{4} \div \frac{1}{4}$ b. $\frac{4}{5} \div \frac{8}{9}$ c. $\frac{5}{6} \div \frac{2}{3}$

To divide by a mixed number, rename the mixed number as an improper fraction.

EXAMPLES Divide by Mixed Numbers

2 **SURVEYING** **Fifteen acres of land are to be divided into $1\frac{1}{2}$-acre lots. How many lots will there be?**

Estimate $16 \div 2 = 8$

$$15 \div 1\frac{1}{2} = 15 \div \frac{3}{2}$$ Rename $1\frac{1}{2}$ as an improper fraction.

$$= 15 \cdot \frac{2}{3}$$ Multiply by the reciprocal of $\frac{3}{2}$, which is $\frac{2}{3}$.

$$= \frac{\overset{5}{\cancel{15}}}{1} \cdot \frac{2}{\underset{1}{\cancel{3}}}$$ Divide out common factors.

$$= 10$$ Multiply.

There will be 10 lots.

REAL-LIFE MATH

SURVEYING A surveyor can survey a line for nine miles before having to use spherical geometry and trigonometry to correct for Earth's curved surface.

Source: Kansas Society of Land Surveyors

3 **Find $\frac{2}{3} \div 3\frac{1}{3}$. Write in simplest form.**

Estimate $\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3}$ or $\frac{1}{6}$

$$\frac{2}{3} \div 3\frac{1}{3} = \frac{2}{3} \div \frac{10}{3}$$ Rename $3\frac{1}{3}$ as an improper fraction.

$$= \frac{2}{3} \cdot \frac{3}{10}$$ Multiply by the reciprocal of $\frac{10}{3}$, which is $\frac{3}{10}$.

$$= \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} \cdot \frac{\overset{1}{\cancel{3}}}{\underset{5}{\cancel{10}}}$$ Divide out common factors.

$$= \frac{1}{5}$$ Multiply.

The quotient is close to the estimate.

4 **Find $-6\frac{1}{2} \div 3\frac{5}{7}$.**

Estimate $-6 \div 3 = -2 \leftarrow$ compatible numbers

$$-6\frac{1}{2} \div 3\frac{5}{7} = -\frac{13}{2} \div \frac{26}{7}$$ Rename the mixed numbers as improper fractions.

$$= -\frac{13}{2} \cdot \frac{7}{26}$$ Multiply by the reciprocal of $\frac{26}{7}$, which is $\frac{7}{26}$.

$$= -\frac{\overset{1}{\cancel{13}}}{2} \cdot \frac{7}{\underset{2}{\cancel{26}}}$$ Divide out common factors.

$$= -\frac{7}{4}$$ Multiply.

$$= -1\frac{3}{4}$$ Simplify.

The quotient, $-1\frac{3}{4}$, is close to the estimate.

Your Turn **Divide. Write in simplest form.**

d. $5 \div 1\frac{1}{3}$ **e.** $-\frac{3}{4} \div 1\frac{1}{2}$ **f.** $2\frac{1}{3} \div 5\frac{5}{6}$

Aaron Haupt

Skill and Concept Check

1. **OPEN ENDED** Write a problem that is solved by finding $10 \div \frac{1}{4}$.

2. **Describe** the steps you would take to find *six divided by three-fourths.*

GUIDED PRACTICE

Divide. Write in simplest form.

3. $\frac{3}{5} \div \frac{1}{4}$ 4. $\frac{3}{4} \div 6$ 5. $\frac{1}{2} \div 7\frac{1}{2}$ 6. $5\frac{3}{5} \div 4\frac{2}{3}$

7. **FOOD** How many $\frac{1}{8}$-pound boxes of mints can be made with 3 pounds?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
8–14	1
15–17, 20	2, 3
18–19	4

Extra Practice
See pgs 579, 601.

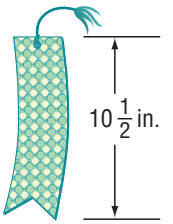
Divide. Write in simplest form.

8. $\frac{3}{8} \div \frac{6}{7}$ 9. $\frac{5}{9} \div \frac{5}{6}$ 10. $\frac{2}{3} \div \frac{1}{2}$ 11. $\frac{7}{8} \div \frac{3}{4}$

12. $6 \div \frac{1}{2}$ 13. $\frac{4}{9} \div 2$ 14. $2\frac{2}{3} \div 4$ 15. $5 \div 1\frac{1}{3}$

16. $-\frac{2}{3} \div 2\frac{1}{2}$ 17. $-\frac{8}{9} \div 5\frac{1}{3}$ 18. $4\frac{1}{2} \div 6\frac{3}{4}$ 19. $5\frac{2}{7} \div 2\frac{1}{7}$

20. **CRAFTS** Jared is making bookmarks like the one shown at the right. How many bookmarks can he make from a 15-yard spool of ribbon?



21. **CRITICAL THINKING** Will the quotient $7\frac{1}{6} \div 3\frac{2}{3}$ be a fraction less than 1 or greater than 1? Explain.

22. **EXTENDING THE LESSON** If you add any two rational numbers, the sum is always a rational number. So, the set of rational numbers is *closed* under addition. Is the set of rational numbers closed under subtraction, multiplication, and division also? Explain.

Spiral Review with Standardized Test Practice

23. **SHORT RESPONSE** Leticia is dividing $2\frac{3}{4}$ pounds of trail mix equally among each of her four friends. How much does each receive?

24. **GRID IN** What is $\frac{8}{9}$ divided by $\frac{2}{9}$?

Find the multiplicative inverse of each number. (Lesson 6-5)

25. $\frac{6}{7}$ 26. $\frac{4}{13}$ 27. 8 28. $5\frac{1}{4}$

29. Find $\frac{1}{10} \times \frac{5}{8}$. Write in simplest form. (Lesson 6-4)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Multiply or divide.** (Pages 560, 562)

30. 2.5×20 31. 3.5×4 32. $4{,}200 \div 2.1$ 33. $104 \div 6.5$

6-7 Measurement: Changing Customary Units

What You'll LEARN

Change units in the customary system.

NEW Vocabulary

pound
ounce
ton
cup
pint
quart
gallon

WHEN am I ever going to use this?

ANIMALS The largest creature that has ever lived on Earth is still alive today. This mighty creature is the blue whale. Some blue whales have been estimated to be as large as 150 tons.

1. There are 2,000 pounds in 1 ton. How many pounds are in 150 tons?
2. What operation did you use to find the weight in pounds? Explain.

The relationships among customary units of length, weight, and capacity are shown in the table at the right.

To change units, use the following rules.

- To convert from larger units to smaller units, multiply.
- To convert from smaller units to larger units, divide.

Customary Units of Length
1 foot (ft) = 12 inches (in.)
1 yard (yd) = 3 feet
1 mile (mi) = 5,280 feet
Customary Units of Weight
1 **pound** (lb) = 16 **ounces** (oz)
1 **ton** (T) = 2,000 pounds
Customary Units of Capacity
1 **cup** (c) = 8 fluid ounces (fl oz)
1 **pint** (pt) = 2 cups
1 **quart** (qt) = 2 pints
1 **gallon** (gal) = 4 quarts

larger units ↑ smaller units

EXAMPLES Convert Larger Units to Smaller Units

Complete.

1 **20 ft = ? in.**

Since 1 foot = 12 inches, multiply by 12.

$20 \times 12 = 240$

20 feet = 240 inches

2 **$3\frac{1}{2}$ lb = ? oz**

Since 1 pound = 16 ounces, multiply by 16.

$3\frac{1}{2} \times 16 = 56$

$3\frac{1}{2}$ pounds = 56 ounces

Your Turn **Complete.**

a. 36 yd = ? ft

b. $2\frac{3}{4}$ T = ? lb

c. $1\frac{1}{2}$ c = ? fl oz

EXAMPLE Convert Units to Solve a Problem

REAL-LIFE MATH

SKIING Ross Anderson is an American Indian speed skier. He has been clocked on skis going as fast as 137 miles per hour.

Source: *Native Peoples*

1 **SKIING** **Speed skiing takes place on a course that is about two thirds of a mile long. How many feet long is the course?**

$\frac{2}{3} \times 5{,}280 = 3{,}520$ Multiply by 5,280 since there are 5,280 feet in 1 mile.

So, the course is about 3,520 feet long.

To convert from smaller units to larger units, divide.

EXAMPLES Convert Smaller Units to Larger Units

Complete.

4 **750 lb = ? T**

Since 2,000 pounds are in 1 ton, divide by 2,000.

$750 \div 2{,}000 = \frac{3}{8}$

750 pounds = $\frac{3}{8}$ ton

5 **10 c = ? pt**

Since 2 cups are in 1 pint, divide by 2.

$10 \div 2 = 5$

10 cups = 5 pints

Your Turn **Complete.**

d. 2,640 ft = ? mi **e.** 100 oz = ? lb **f.** 14 pt = ? qt

Skill and Concept Check

1. **OPEN ENDED** Write a problem in which you would need to convert pints to cups.

2. **Which One Doesn't Belong?** Identify the unit of measure that does not have the same characteristic as the other three. Explain your reasoning.

gallon	pint	fluid ounce	pound

GUIDED PRACTICE

Complete.

3. 48 oz = ? lb
4. $5\frac{1}{3}$ yd = ? ft
5. 12 qt = ? gal
6. 28 in. = ? ft
7. $\frac{1}{4}$ T = ? lb
8. 15 pt = ? qt

9. **DINOSAURS** The average weight of the dinosaur *Argentinosaurus* was estimated to be 200,000 pounds. How many tons did it weigh?

10. **HISTORY** Liquid products such as oil and vinegar were once shipped in huge containers called *hogsheads*. A hogshead contained 63 gallons of liquid. How many quarts did it contain?

Christopher Marona

CONTENTS

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
11–30	1, 2, 4, 5
31–32	3

Extra Practice
See pages 579, 601.

Complete.

11. 18 ft = ? yd **12.** 2 lb = ? oz **13.** 4 gal = ? qt

14. 5,000 lb = ? T **15.** $4\frac{1}{2}$ pt = ? c **16.** 72 oz = ? lb

17. 2 mi = ? ft **18.** $1\frac{1}{4}$ mi = ? ft **19.** 9 c = ? pt

20. 3 c = ? fl oz **21.** $2\frac{3}{4}$ qt = ? pt **22.** 120 ft = ? yd

23. 7,040 ft = ? mi **24.** $3\frac{3}{8}$ T = ? lb **25.** 172 oz = ? lb

26. If 4 cups = 1 quart, then 9 cups = ? quarts.

27. If 36 inches = 1 yard, then 2.3 yards = ? inches.

Complete.

28. $1\frac{1}{4}$ gal = ? c **29.** 880 yd = ? mi **30.** 24 fl oz = ? qt

31. MULTI STEP Suppose a car repair company changes the oil of 50 cars and they recover an average of $3\frac{1}{2}$ quarts of oil from each car. How many gallons of oil did they recover?

32. MULTI STEP A window-washing solution can be made by mixing $1\frac{1}{3}$ cups of ammonia and $1\frac{1}{2}$ cups of vinegar with baking soda and water. Will the solution fit in a $\frac{1}{2}$-quart pan? Explain.

33. CRITICAL THINKING Make a table that shows the number of ounces in 1, 2, 3, and 4 pounds. Graph the ordered pairs (pounds, ounces) on a coordinate plane and connect the points. Describe the graph.

Spiral Review with Standardized Test Practice

34. SHORT RESPONSE How many cups of milk are shown at the right?

35. MULTIPLE CHOICE A can of orange juice concentrate makes 48 fluid ounces of orange juice. How many pints is this?

(A) 3 pt (B) 4 pt (C) 6 pt (D) 12 pt

36. Find $1\frac{4}{7} \div 1\frac{5}{6}$. Write in simplest form. (Lesson 6-6)

Solve each equation. Check your solution. (Lesson 6-5)

37. $\frac{y}{4} = 7$ **38.** $\frac{1}{3}x = \frac{5}{9}$ **39.** $-4 = \frac{p}{2.7}$ **40.** $6n = -15$

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Evaluate each expression.** (Lesson 1-3)

41. $2 \cdot 8 + 2 \cdot 9$ **42.** $3(7) + 4(2)$ **43.** $2(6.5 + 3)$ **44.** $5 \cdot 2 + 5 \cdot 8.4$

6-8 Geometry: Perimeter and Area

What You'll LEARN

Find the perimeters and areas of figures.

NEW Vocabulary

perimeter
formula
area

WHEN am I ever going to use this?

PARKS Central Park in New York City contains a running track, walking paths, playgrounds, and even a carousel.

1. If you walked around the outer edge of the entire park, how far would you walk?
2. Describe how you found the distance.
3. Explain how you can use both multiplication and addition to find the distance.

The distance around a geometric figure is called the **perimeter**. To find the perimeter P of a rectangle, add the measures of the four sides.

Noteables™ **Key Concept: Perimeter of a Rectangle**

Words The perimeter P of a rectangle is twice the sum of the length ℓ and width w.

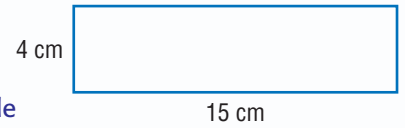
Symbols $P = \ell + \ell + w + w$

$P = 2\ell + 2w$ or $2(\ell + w)$

Model

EXAMPLE 1 **Find the Perimeter of a Rectangle**

Find the perimeter of the rectangle shown at the right.



$P = 2\ell + 2w$	Perimeter of a rectangle
$P = 2(15) + 2(4)$	Replace ℓ with 15 and w with 4.
$P = 30 + 8$	Multiply.
$P = 38$	Add.

The perimeter is 38 centimeters.

You can find the perimeter of irregular figures by adding the lengths of the sides.

EXAMPLE Find the Perimeter of an Irregular Figure

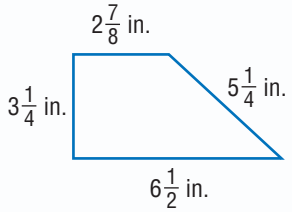
1 **Find the perimeter of the figure.**

Estimate $3 + 5 + 7 + 3 = 18$ in.

$P = 2\frac{7}{8} + 5\frac{1}{4} + 6\frac{1}{2} + 3\frac{1}{4}$

$P = 2\frac{7}{8} + 5\frac{2}{8} + 6\frac{4}{8} + 3\frac{2}{8}$

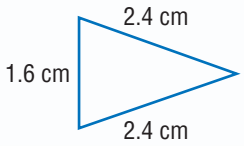
$P = 16\frac{15}{8}$ or $17\frac{7}{8}$



The perimeter is $17\frac{7}{8}$ inches. This is close to the estimate.

Your Turn

a. Find the perimeter of the figure.



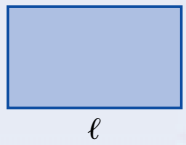
The equation $P = 2\ell + 2w$ is called a **formula** because it shows a relationship among quantities. The formula for the **area** of a rectangle, or the measure of the surface enclosed by a figure, is shown below.

Noteables™ Key Concept: Area of a Rectangle

Words The area A of a rectangle is the product of the length ℓ and width w.

Symbol $A = \ell \cdot w$

Model



EXAMPLE Find the Area of a Rectangle

1 **VOLLEYBALL** **Find the area of the volleyball court shown at the right.**

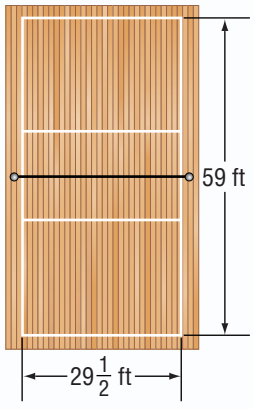
$A = \ell \cdot w$ Area of a rectangle

$A = 59 \cdot 29\frac{1}{2}$ Replace ℓ with 59 and w with $29\frac{1}{2}$.

$A = \frac{59}{1} \cdot \frac{59}{2}$ Rename 59 and $29\frac{1}{2}$.

$A = 1{,}740\frac{1}{2}$ Multiply and simplify.

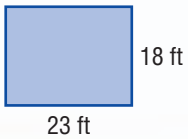
The area is $1{,}740\frac{1}{2}$ square feet.



Your Turn

Find the perimeter and area of each rectangle.

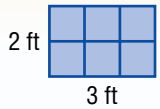
b.



c. length = 13.2 mm
width = 8 mm

STUDY TIP

Area Units When finding area, the units are also multiplied. So, area is given in *square units*. Consider a rectangle 2 ft by 3 ft.



$A = 2 \text{ ft} \times 3 \text{ ft}$
$A = (2 \times 3)(\text{ft} \times \text{ft})$
$A = 6 \text{ ft}^2$

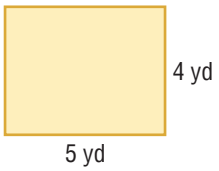
Skill and Concept Check

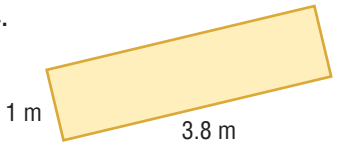
1. Writing Math Explain why perimeter is given in units and area is given in square units.

2. **OPEN ENDED** Draw and label a rectangle that has an area of 24 square centimeters. What is the perimeter of your rectangle?

GUIDED PRACTICE

Find the perimeter and area of each rectangle.

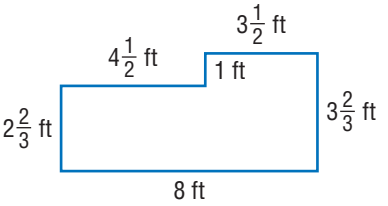
3. 

4. 

5. $\ell = 7$ cm, $w = 6$ cm

6. $\ell = 5\frac{1}{2}$ in., $w = 3$ in.

7. Find the perimeter of the figure at the right.



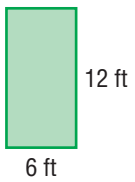
Practice and Applications

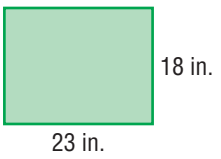
HOMEWORK HELP

For Exercises	See Examples
8–22, 25–28	1, 3
23–24	2

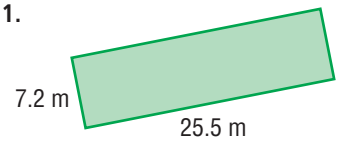
Extra Practice See pages 579, 601.

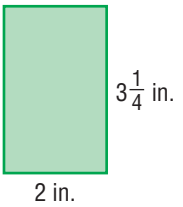
Find the perimeter and area of each rectangle.

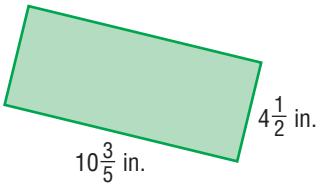
8. 

9. 

10. 

11. 

12. 

13. 

14. $\ell = 5$ ft, $w = 1$ ft

15. $\ell = 18$ cm, $w = 12$ cm

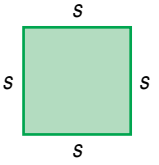
16. $\ell = 6.5$ m, $w = 4$ m

17. $\ell = 4\frac{3}{8}$ in., $w = 3\frac{1}{5}$ in.

18. $\ell = 2$ ft, $w = 18$ in.

19. $\ell = 35$ ft, $w = 7$ yd

For Exercises 20 and 21, use the square at the right.



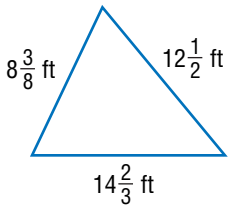
20. Write formulas for the perimeter P and area A of the square.

21. If the side length is doubled, what happens to the perimeter and area?

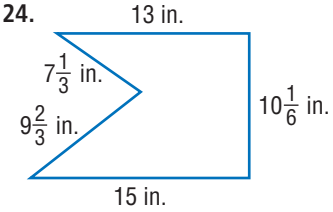
22. Find the width of a rectangle with an area of 30 square inches and a length of 5 inches.

Find the perimeter of each figure.

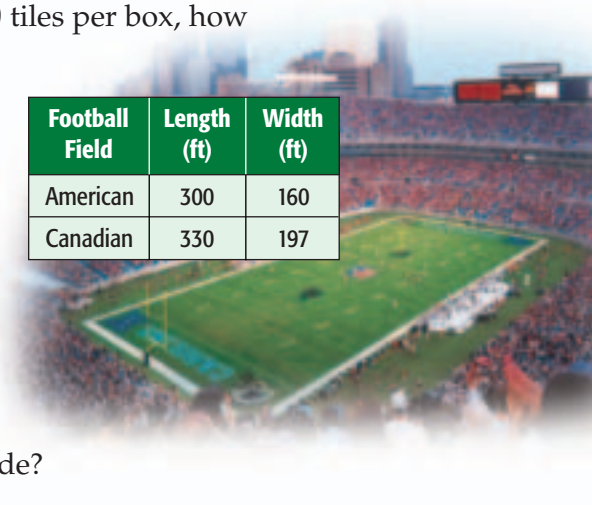
23.



24.



25. FLOORING Jasmine plans to use 1-foot square tiles to tile her kitchen floor, which measures 18 feet by 14 feet. If there are 40 tiles per box, how many boxes must she buy?



FOOTBALL For Exercises 26 and 27, use the table at the right.

Football Field	Length (ft)	Width (ft)
American	300	160
Canadian	330	197

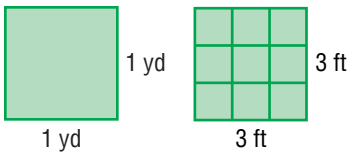
26. How much greater is the area of a Canadian football field than an American football field?

27. An *acre* equals 43,560 square feet. How many acres is a Canadian football field? Round to the nearest tenth of an acre and explain your method.

28. A rectangle is made with exactly 9 feet of string. One side is $2\frac{5}{16}$ feet long. What is the length of the other side?

29. CRITICAL THINKING Compare and contrast the perimeters and areas of rectangles that have the following dimensions: 1 by 9, 2 by 8, 3 by 7, and 4 by 6.

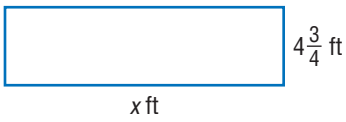
EXTENDING THE LESSON For Exercises 30–32, refer to the figures at the right.



30. 1 yd^2 = ___?___ ft^2 **31.** 4 yd^2 = ___?___ ft^2 **32.** 1 ft^2 = ___?___ in^2

Spiral Review with Standardized Test Practice

33. MULTIPLE CHOICE The perimeter of the rectangle shown at the right is $41\frac{1}{2}$ feet. What is the value of x?



(A) 16 (B) 32 (C) $36\frac{3}{4}$ (D) 64

34. SHORT RESPONSE Determine the area of a rectangle that is 3 centimeters wide and 7 centimeters long.

Complete. (Lesson 6-7)

35. $5\frac{1}{4}$ T = ___?___ lb **36.** 8 yd = ___?___ ft **37.** 15 pt = ___?___ qt **38.** 72 in. = ___?___ ft

39. Find $22 \div \frac{2}{3}$. Write in simplest form. (Lesson 6-6)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Multiply. Write in simplest form. (Lesson 6-4)

40. $\frac{9}{8} \cdot 16$ **41.** $\frac{22}{7} \cdot 14$ **42.** $2 \cdot \frac{3}{7} \cdot 35$ **43.** $\frac{22}{7} \cdot 1\frac{1}{2}$

6-9a HANDS-ON LAB

A Preview of Lesson 6-9

Circumference

What You'll LEARN

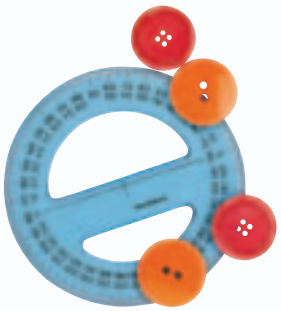
Find a relationship between circumference and diameter.

Materials

- ruler
- measuring tape
- circular objects

INVESTIGATE *Work with a partner.*

In this lab, you will investigate how *circumference*, or the distance around a circle, is related to its *diameter*, or the distance across a circle.



STEP 1 Use a ruler to measure the diameter of a circular object. Record the measure in a table like the one shown below.

Object	Diameter (cm)	Circumference (cm)

STEP 2 Make a small mark at the edge of the circular object. The measuring tape should be on a flat surface. Place the mark at the beginning of the measuring tape. Roll the object along the tape for one revolution, until you reach the mark again.

STEP 3 Record the length in the table. This is the circumference.

STEP 4 Repeat this activity with circular objects of various sizes.

Writing Math

Work with a partner.

1. For each object, divide the circumference by the diameter. Add another column to your table and record the results. Round to the nearest tenth if necessary.
2. What do you notice about the ratios?
3. **Graph** the ordered pair (diameter, circumference) on a coordinate plane for each object. What do you find?
4. Select two points on the graph and find the slope between them. Select two different points and find the slope. What do you observe about the slopes?
5. Use the graph to predict the circumference of a circular object that has a diameter of 18 centimeters.
6. **Write** a rule describing how you would find the circumference C of a circle if you know the diameter d.

STUDY TIP

Look Back You can review **slope** in Lesson 4-7.

Matt Meadows

6-9 Geometry: Circles and Circumference

What You'll LEARN

Find the circumference of circles.

NEW Vocabulary

circle
center
diameter
radius
circumference

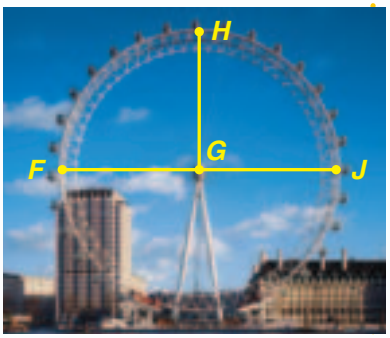
MATH Symbols

π (pi)

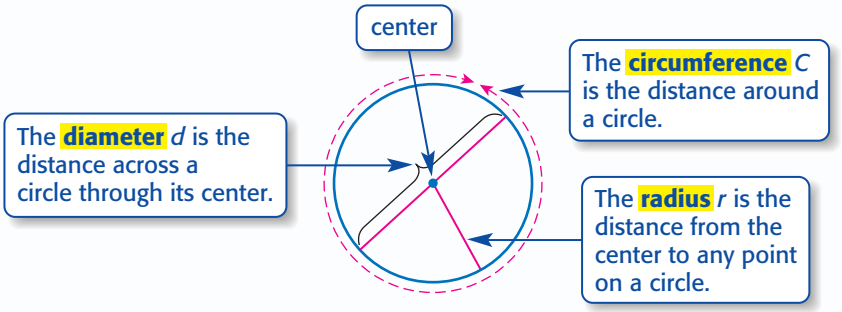
WHEN am I ever going to use this?

FERRIS WHEELS The London Eye Ferris wheel measures 450 feet across.

1. Which point appears to be the center of the Ferris wheel?
2. Is the distance from G to F greater than, less than, or equal to the distance from G to J?



A **circle** is the set of all points in a plane that are the same distance from a given point, called the **center**.



The diameter of a circle is 2 times the radius, or $d = 2r$. Another relationship that is true of all circles is $\frac{C}{d} = 3.1415926\ldots$. This nonterminating and nonrepeating number is represented by the Greek letter **π (pi)**. An approximation often used for π is 3.14.

Noteables™ Key Concept: Circumference of a Circle

Words The circumference C of a circle is equal to its diameter d times π, or 2 times its radius r times π.

Symbols $C = \pi d$ or $C = 2\pi r$

EXAMPLE 1 Find Circumference

FERRIS WHEELS Find the circumference of the Ferris wheel above.

$C = \pi d$ Circumference of a circle

$C \approx 3.14(450)$ Replace π with 3.14 and d with 450.

$C \approx 1{,}413$ Multiply.

So, the distance around the Ferris wheel is about 1,413 feet.

Another approximation for π is $\frac{22}{7}$. Use this value when the radius or diameter is a multiple of 7 or has a multiple of 7 in its numerator.

EXAMPLE Find Circumference

1 **Find the circumference of a circle with a radius of 21 inches.**

Since 21 is a multiple of 7, use $\frac{22}{7}$ for π.

$C = 2\pi r$ Circumference of a circle

$C \approx 2 \cdot \frac{22}{7} \cdot 21$ Replace π with $\frac{22}{7}$ and r with 21.

$C \approx 2 \cdot \frac{22}{\cancel{7}_{1}} \cdot \frac{\cancel{21}^{3}}{1}$ Divide by the GCF, 7.

$C \approx 132$ Simplify.

The circumference of the circle is about 132 inches.

STUDY TIP

Technology You can use a calculator to find the circumference. To find $2\pi(21)$, press 2 [×] [π] [×] 21 [ENTER]. The circumference is about 131.9468915.

Your Turn **Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary.**

a. diameter = 4.5 cm **b.** radius = $\frac{7}{8}$ ft **c.** radius = 35 in.

Skill and Concept Check

1. **Writing Math** Explain how circumference is affected by an increase in radius.

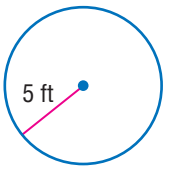
2. **OPEN ENDED** Describe a real-life situation in which finding the circumference of a circle would be useful.

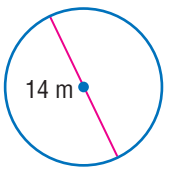
3. **FIND THE ERROR** Aidan and Mya are finding the circumference of a circle with a radius of 5 inches. Who is correct? Explain.

Aidan	Mya
$C = \pi \cdot 5 = 5\pi$	$C = 2 \cdot \pi \cdot 5 = 10\pi$

GUIDED PRACTICE

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary.

4. 

5. 

6. 

7. radius = 11.7 cm

8. radius = 28 ft

9. diameter = $3\frac{1}{2}$ yd

10. **MUSIC** Purdue University's marching band has a drum with a diameter of 8 feet. What is its circumference to the nearest tenth?

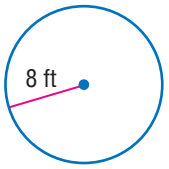
Practice and Applications

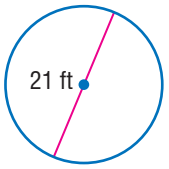
HOMEWORK HELP

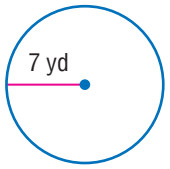
For Exercises	See Examples
11–23	1, 2

Extra Practice
See pages 579, 601.

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary.

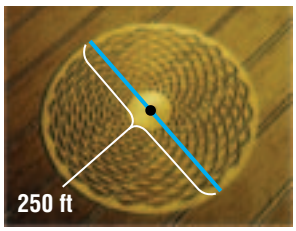
11. 

12. 

13. 

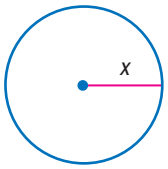
14. radius = 38.4 cm
15. diameter = 15.1 m
16. radius = $1\frac{3}{4}$ in.
17. radius = 2 km
18. diameter = 10 ft
19. radius = 45.5 m
20. radius = 56 cm
21. radius = $2\frac{5}{8}$ in.
22. diameter = $10\frac{1}{2}$ in.

23. **CROPS** The mysterious crop circle shown at the right was created in England in a single night by an unknown source. What is the circumference of the circle?



24. **RESEARCH** Use the Internet or another source to find three other parts of circles: *arcs*, *central angles*, and *inscribed angles*. Draw a circle and label these parts.

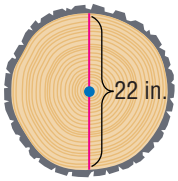
CRITICAL THINKING **For Exercises 25 and 26, refer to the figure at the right.**



25. How many lengths x will fit on the circumference of the circle?
26. If the value of x is doubled, what effect will this have on the diameter? on the circumference?

Spiral Review with Standardized Test Practice

27. **SHORT RESPONSE** What is the circumference of the tree trunk whose cross section is shown at the right? Use 3.14 for π.



28. **MULTIPLE CHOICE** About how far does a bicycle wheel travel in 150 revolutions of the wheel if its diameter is 11 inches? Use 3.14 for π.

(A) 431.75 ft (B) 863.5 ft (C) 5,181 ft (D) 10,362 ft

Find the perimeter and area of each rectangle. (Lesson 6-8)

29. $\ell = 5$ cm, $w = 3.8$ cm
30. $\ell = 2\frac{1}{4}$ ft, $w = 11$ ft

31. Twenty-four feet equals how many yards? (Lesson 6-7)

INTERDISCIPLINARY PROJECT

A Well-Balanced Diet

Math and Health It's time to complete your project. Use the data you have gathered about the food you eat and about the Food Pyramid to prepare a Web page or poster. Be sure to include a chart and calculations with your project.

WebQuest msmath2.net/webquest

CHAPTER 6

Study Guide and Review

Vocabulary and Concept Check

area (p. 271)
center (p. 275)
circle (p. 275)
circumference (p. 275)
compatible numbers (p. 242)
cup (p. 267)
diameter (p. 275)
formula (p. 271)
gallon (p. 267)
multiplicative inverse (p. 258)
ounce (p. 267)
perimeter (p. 270)
pint (p. 267)
pound (p. 267)
quart (p. 267)
radius (p. 275)
reciprocal (p. 258)
ton (p. 267)

Choose the correct term or number to complete each sentence.

1. The (radius, diameter) is the distance across a circle through its center.
2. To add like fractions, add the (numerators, denominators).
3. (Perimeter, Area) is the measure of the surface enclosed by a figure.
4. Fractions with different denominators are called (like, unlike) fractions.
5. When dividing by a fraction, multiply by its (value, reciprocal).
6. One cup is equivalent to (8, 12) fluid ounces.

Lesson-by-Lesson Exercises and Examples

6-1 Estimating with Fractions (pp. 240–243)

Estimate.

7. $2\frac{9}{10} \div 1\frac{1}{8}$
8. $6\frac{2}{9} - 5\frac{1}{7}$
9. $\frac{13}{15} \times \frac{1}{5}$
10. $\frac{1}{2} + \frac{3}{8}$
11. $\frac{1}{2} \cdot 25$
12. $15\frac{6}{7} \div 7\frac{1}{3}$

Example 1 Estimate $5\frac{1}{12} + 2\frac{5}{6}$.

$5\frac{1}{12} + 2\frac{5}{6} \rightarrow 5 + 3 = 8$

Example 2 Estimate $\frac{7}{8} - \frac{4}{7}$.

$\frac{7}{8} - \frac{4}{7} \rightarrow 1 - \frac{1}{2} = \frac{1}{2}$

6-2 Adding and Subtracting Fractions (pp. 244–247)

Add or subtract. Write in simplest form.

13. $\frac{2}{6} - \frac{1}{6}$
14. $\frac{3}{7} + \frac{9}{14}$
15. $\frac{5}{6} - \frac{3}{4}$
16. $\frac{1}{9} + \frac{5}{9}$
17. $\frac{4}{5} + \frac{4}{5}$
18. $\frac{9}{10} - \frac{3}{10}$
19. $\frac{5}{8} - \frac{5}{12}$
20. $\frac{11}{12} - \frac{1}{6}$
21. $-\frac{3}{4} + \frac{7}{20}$

Example 3 Find $\frac{1}{8} + \frac{3}{8}$.

$\frac{1}{8} + \frac{3}{8} = \frac{1+3}{8}$ Add the numerators.

$= \frac{4}{8}$ or $\frac{1}{2}$ Simplify.

Example 4 Find $\frac{3}{10} - \frac{1}{4}$.

$\frac{3}{10} - \frac{1}{4} = \frac{6}{20} - \frac{5}{20}$ or $\frac{1}{20}$

6-3 Adding and Subtracting Mixed Numbers (pp. 248–251)

Add or subtract. Write in simplest form.

22. $3\frac{2}{15} + 6\frac{9}{15}$

23. $9\frac{4}{5} - 2\frac{1}{5}$

24. $4\frac{1}{3} - 2\frac{2}{3}$

25. $8\frac{2}{7} + 1\frac{6}{7}$

26. $7\frac{11}{12} - 4\frac{3}{12}$

27. $7\frac{3}{5} - 5\frac{1}{3}$

28. $5\frac{3}{4} + 1\frac{1}{6}$

29. $3\frac{5}{8} + 11\frac{1}{2}$

30. $4\frac{3}{10} - 2\frac{4}{5}$

Example 5 **Find $5\frac{2}{3} + 3\frac{1}{2}$.**

$5\frac{2}{3} + 3\frac{1}{2} = 5\frac{4}{6} + 3\frac{3}{6}$ Rename the fractions.

$= 8\frac{7}{6}$ or $9\frac{1}{6}$ Add the whole numbers and add the fractions.

Example 6 **Find $4\frac{1}{5} - 2\frac{3}{5}$.**

$4\frac{1}{5} - 2\frac{3}{5} = 3\frac{6}{5} - 2\frac{3}{5}$ Rename $4\frac{1}{5}$ as $3\frac{6}{5}$.

$= 1\frac{3}{5}$ Subtract the whole numbers and subtract the fractions.

6-4 Multiplying Fractions and Mixed Numbers (pp. 254–257)

Multiply. Write in simplest form.

31. $\frac{3}{5} \times \frac{2}{7}$

32. $\frac{5}{12} \times \frac{4}{9}$

33. $\frac{3}{5} \times \frac{10}{21}$

34. $4 \times \frac{13}{20}$

35. $-2\frac{1}{3} \times \frac{3}{4}$

36. $4\frac{1}{2} \times 2\frac{1}{12}$

37. **TRACK AND FIELD** One lap around the high school track is $\frac{3}{8}$ of a mile. If Matthew runs $4\frac{1}{2}$ laps, how far does he run?

Example 7 **Find $\frac{5}{9} \times \frac{2}{3}$.**

$\frac{5}{9} \times \frac{2}{3} = \frac{5 \times 2}{9 \times 3}$ Multiply the numerators and multiply the denominators.

$= \frac{10}{27}$ Simplify.

Example 8 **Find $3\frac{1}{2} \times 2\frac{3}{4}$.**

$3\frac{1}{2} \times 2\frac{3}{4} = \frac{7}{2} \times \frac{11}{4}$ Rename $3\frac{1}{2}$ and $2\frac{3}{4}$.

$= \frac{7 \times 11}{2 \times 4}$ Multiply the numerators and multiply the denominators.

$= \frac{77}{8}$ or $9\frac{5}{8}$ Simplify.

6-5 Algebra: Solving Equations (pp. 258–261)

Find the multiplicative inverse of each number.

38. $\frac{7}{12}$

39. 5

40. $3\frac{1}{3}$

Solve each equation. Check your solution.

41. $8 = \frac{w}{2}$

42. $\frac{4}{5}b = 12$

43. $-7.6 = \frac{n}{3}$

44. **EARTH SCIENCE** In 1996, a new planet was discovered. Earth's diameter, 7,970 miles, is only $\frac{5}{86}$ the size of this planet's diameter. Solve $\frac{5}{86}d = 7{,}970$ to find d, the diameter of this planet in miles.

Example 9 **Find the multiplicative inverse of $\frac{9}{5}$.**

$\frac{9}{5} \cdot \frac{5}{9} = 1$ The product of $\frac{9}{5}$ and $\frac{5}{9}$ is 1.

The multiplicative inverse of $\frac{9}{5}$ is $\frac{5}{9}$.

Example 10 **Solve $\frac{3}{4}g = 2$.**

$\frac{3}{4}g = 2$ Write the equation.

$\frac{4}{3} \cdot \frac{3}{4}g = \frac{4}{3} \cdot 2$ Multiply each side by the reciprocal of $\frac{3}{4}$.

$g = \frac{8}{3}$ or $2\frac{2}{3}$ Simplify.

Mixed Problem Solving
For mixed problem-solving practice, see page 601.

6-6 Dividing Fractions and Mixed Numbers (pp. 264–266)

Divide. Write in simplest form.

45. $\frac{3}{5} \div \frac{6}{7}$ 46. $\frac{1}{2} \div \frac{1}{3}$ 47. $5 \div \frac{10}{13}$

48. $4 \div \frac{2}{3}$ 49. $2\frac{3}{4} \div \frac{5}{6}$ 50. $-\frac{2}{5} \div 3$

51. $\frac{6}{11} \div 4$ 52. $4\frac{3}{10} \div 2\frac{1}{5}$ 53. $-\frac{2}{7} \div \frac{8}{21}$

Example 11 Find $2\frac{4}{5} \div \frac{7}{10}$.

$2\frac{4}{5} \div \frac{7}{10} = \frac{14}{5} \div \frac{7}{10}$ Rename $2\frac{4}{5}$.

$= \frac{\overset{2}{\cancel{14}}}{\underset{1}{\cancel{5}}} \cdot \frac{\overset{2}{\cancel{10}}}{\underset{1}{\cancel{7}}}$ Multiply by the reciprocal of $\frac{7}{10}$.

$= \frac{4}{1}$ or 4 Simplify.

6-7 Measurement: Changing Customary Units (pp. 267–269)

Complete.

54. 4 qt = ? pt 55. 6 gal = ? qt

56. 48 oz = ? lb 57. 8,000 lb = ? T

58. 9 c = ? pt 59. 36 in. = ? ft

Example 12 Complete: 32 qt = ? gal

Since 4 quarts are in 1 gallon, divide by 4.

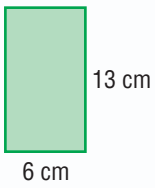
$32 \div 4 = 8$

32 quarts = 8 gallons

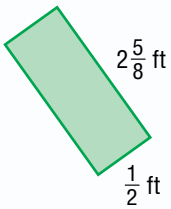
6-8 Geometry: Area and Perimeter (pp. 270–273)

Find the perimeter and area of each rectangle.

60.



61.



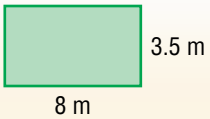
62. $\ell = 9$ cm, $w = 4$ cm

63. $\ell = 5$ in., $w = \frac{1}{2}$ in.

64. $\ell = 3.2$ m, $w = 6$ m

65. $\ell = 4\frac{1}{2}$ ft, $w = 2\frac{1}{3}$ ft

Example 13 Find the perimeter and area of the rectangle.



$P = 2\ell + 2w$ Perimeter of a rectangle

$P = 2(8) + 2(3.5)$ Substitution

$P = 23$ Simplify.

The perimeter is 23 meters.

$A = \ell \cdot w$ Area of a rectangle

$A = 8 \cdot 3.5$ Replace ℓ with 8 and w with 3.5.

$A = 28$ Multiply.

The area is 28 square meters.

6-9 Geometry: Circles and Circumference (pp. 275–277)

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth if necessary.

66. $r = 4.2$ cm 67. $d = 8$ yd

68. $r = \frac{7}{11}$ ft 69. $d = 8\frac{2}{5}$ ft

Example 14 Find the circumference of a circle with a diameter of 12.2 meters. Round to the nearest tenth.

$C = \pi d$ Circumference of a circle

$C \approx 3.14(12.2)$ $\pi \approx 3.14$ and $d = 12.2$

$C \approx 38.308$ Multiply.

The circumference is about 38.3 meters.

CONTENTS

CHAPTER 6

Practice Test

Vocabulary and Concepts

1. **Explain** how to add unlike fractions.
2. **Define** perimeter.

Skills and Applications

Estimate.

3. $5\frac{7}{9} - 1\frac{2}{13}$
4. $3\frac{1}{12} + 6\frac{5}{7}$
5. $\frac{3}{7} \times \frac{13}{15}$

Add, subtract, multiply, or divide. Write in simplest form.

6. $\frac{4}{15} + \frac{8}{15}$
7. $\frac{7}{10} - \frac{1}{6}$
8. $\frac{5}{8} \times \frac{2}{5}$
9. $6 \times \frac{8}{21}$
10. $4\frac{5}{12} - 2\frac{1}{12}$
11. $6\frac{7}{9} + 3\frac{5}{12}$
12. $8\frac{2}{7} - 1\frac{5}{14}$
13. $-\frac{5}{6} \div \frac{2}{3}$
14. $\frac{8}{9} \div 5\frac{1}{3}$

15. **COOKING** Taylor wants to make $2\frac{1}{2}$ times the quantity given in a recipe. The recipe calls for $1\frac{3}{4}$ cups of flour. How much flour will Taylor need?

16. **FLAG DAY** A giant cake decorated as an American flag measured 60 feet by 90 feet. What was the perimeter of the cake?

Solve each equation. Check your solution.

17. $\frac{y}{3} = 8$
18. $-6 = \frac{2}{5}m$
19. $\frac{3}{4} = \frac{5}{8}x$

Complete.

20. 42 ft = ___?___ yd
21. 9 qt = ___?___ pt
22. 7,600 lb = ___?___ T

23. Find the perimeter and area of the rectangle.

24. Find the circumference of a circle with a radius of 5 meters. Round to the nearest tenth.

Standardized Test Practice

25. **MULTIPLE CHOICE** In the 1999–2000 school year, the average backpack weighed $7\frac{1}{2}$ pounds. In the 2001–2002 school year, the average backpack weighed $7\frac{1}{5}$ pounds. By how much did the average backpack weight decrease?

(A) $\frac{1}{5}$ lb (B) $\frac{3}{10}$ lb (C) $\frac{1}{2}$ lb (D) $\frac{7}{10}$ lb

CHAPTER 6

Standardized Test Practice

PART 1 Multiple Choice

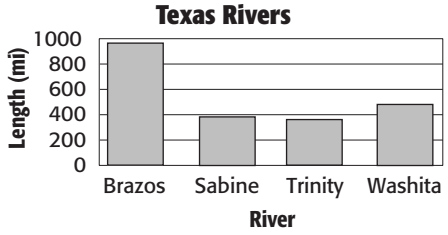
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

1. The table shows four major rivers that run through Texas. Which is the most appropriate way to display this information? (Lessons 2-2 and 2-7)

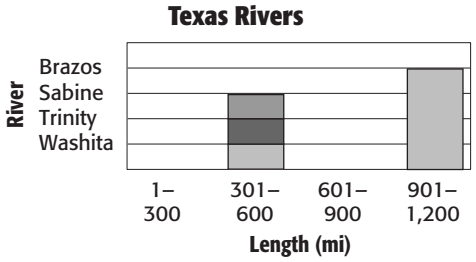
River	Length (mi)
Brazos	950
Sabine	380
Trinity	360
Washita	500

Source: *The World Almanac*

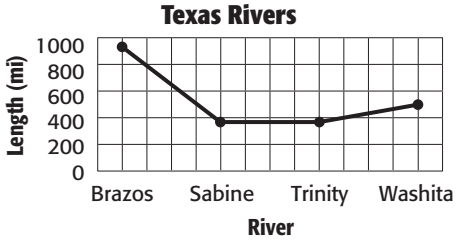
Ⓐ



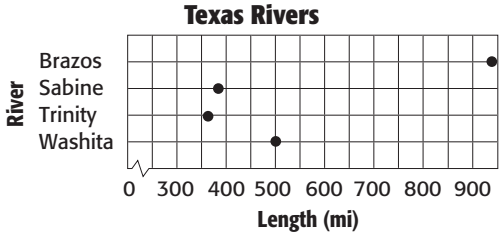
Ⓑ



Ⓒ

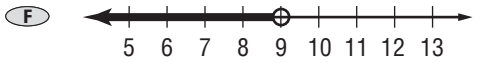


Ⓓ

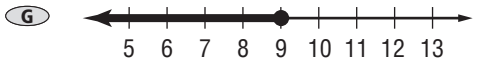


2. Which is the solution of $2x - 5 > 13$? (Lesson 4-5)

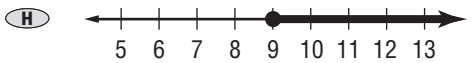
Ⓕ



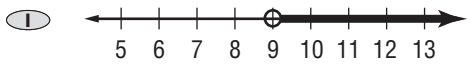
Ⓖ



Ⓗ



Ⓘ



3. A jellyfish's body is made up of 95% water. What is 95% written as a decimal? (Lesson 5-6)

Ⓐ 0.095 Ⓑ 0.95

Ⓒ 9.5 Ⓓ 95

4. Dimitri has $6\frac{1}{8}$ ounces of orange juice and $10\frac{2}{3}$ ounces of cranberry juice. What is the best estimate of the total ounces of juice that he has? (Lesson 6-1)

Ⓕ 15 oz Ⓖ 16 oz

Ⓗ 17 oz Ⓘ 18 oz

5. Cole had $\frac{7}{8}$ of a tank of gas in the lawn mower. After mowing the grass, he had $\frac{1}{4}$ of a tank. What fraction of a tank did Cole use mowing the lawn? (Lesson 6-2)

Ⓐ $\frac{1}{8}$ Ⓑ $\frac{3}{8}$ Ⓒ $\frac{5}{8}$ Ⓓ $\frac{3}{4}$

6. What is the solution of $27 = \frac{3}{4}t$? (Lesson 6-5)

Ⓕ 108 Ⓖ 36

Ⓗ 20.25 Ⓘ 9

7. Kaylee bought 16 gallons of fruit juices and soda for the school's graduation picnic. How many quarts of drinks did Kaylee buy? (Lesson 6-7)

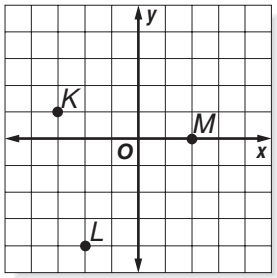
Ⓐ 4 qt Ⓑ 16 qt Ⓒ 18 qt Ⓓ 64 qt

PART 2 Short Response/Grid In

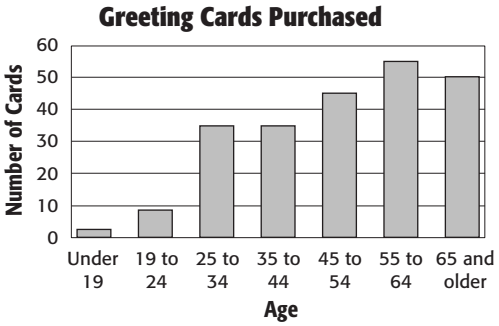
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

8. If 4 computers are needed for every 7 students in a grade, how many computers are needed for 280 students? (Lesson 1-1)

9. What are the coordinates of point K? (Lesson 3-3)



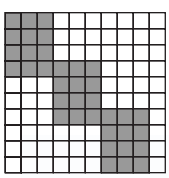
10. The graph shows the average number of greeting cards purchased yearly by the average person in the United States.



Source: American Greetings Corporation

Let c represent the number of cards purchased by Americans ages 35 to 44. Write an expression using c to represent the number of cards purchased by Americans ages 45 to 54. (Lesson 4-1)

11. Write a percent to represent the shaded area. (Lesson 5-5)

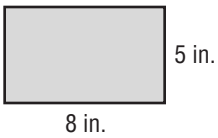


12. Find $7\frac{2}{7} + 3\frac{1}{4}$. (Lesson 6-3)

13. To make one batch of cookies, you need $\frac{3}{4}$ cup of butter. How much butter would you need to make $2\frac{1}{2}$ batches of cookies? (Lesson 6-4)

14. A box of laundry detergent contains 35 cups. If you use $1\frac{1}{4}$ cups per load of laundry, how many loads can you wash with 1 box? (Lesson 6-6)

15. What is the area of the rectangle? (Lesson 6-8)



PART 3 Extended Response

Record your answers on a sheet of paper. Show your work.

16. Suppose you want to build a 4-foot wide deck around a circular swimming pool that has a radius of 66 inches. You also want to put a fence around the deck. (Lesson 6-9)

a. Make a drawing of the problem. Include labels.

b. About how much fencing will you need to the nearest foot?

c. The fence costs $10 per foot. How much would you save if you put the fence just around the pool instead of the deck? Explain.

TEST-TAKING TIP

Question 16 Many standardized tests include any necessary formulas in the test booklet. It helps to be familiar with formulas such as the area of a rectangle and the circumference of a circle, but use any formulas that are given to you with the test.