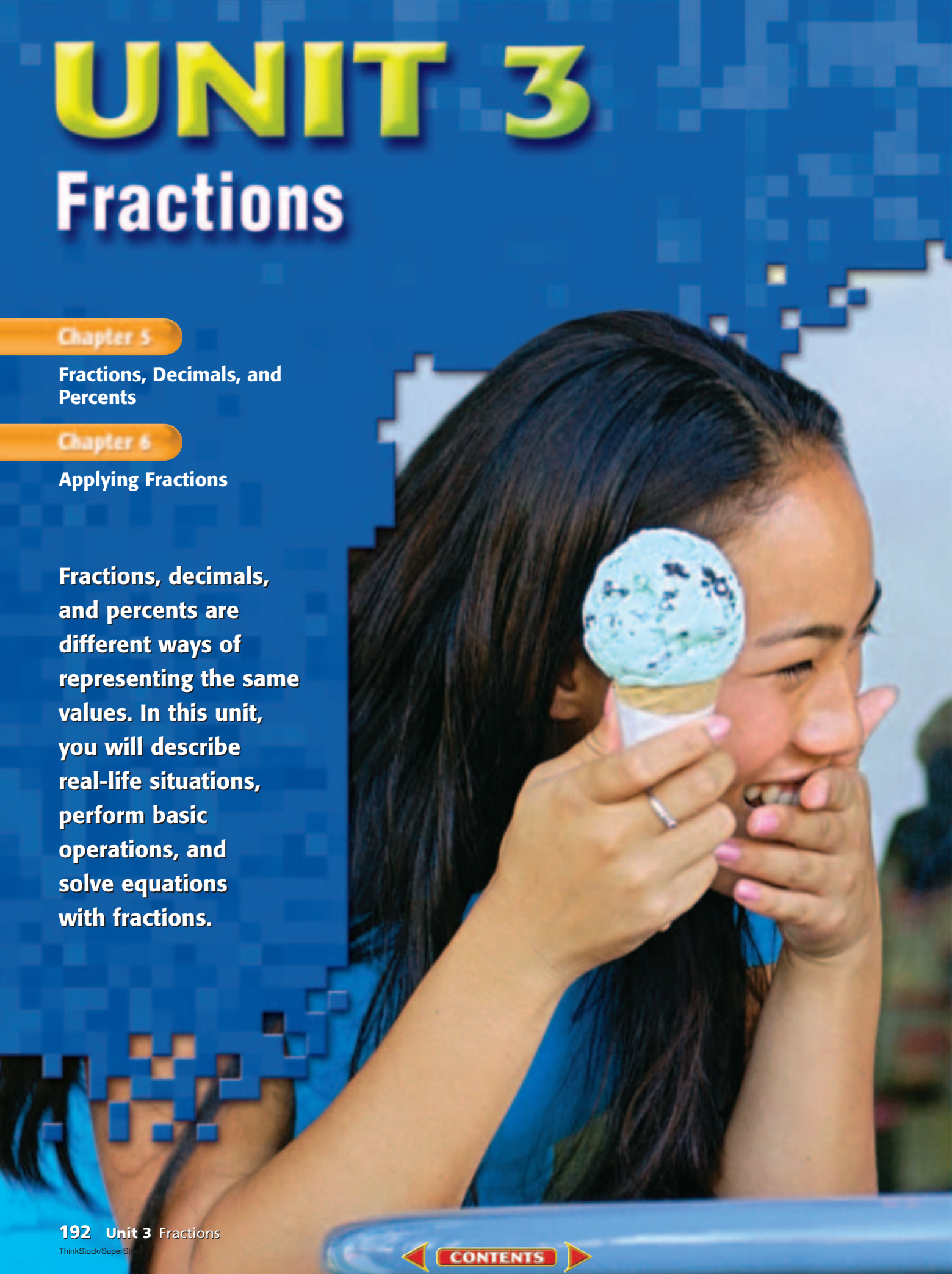
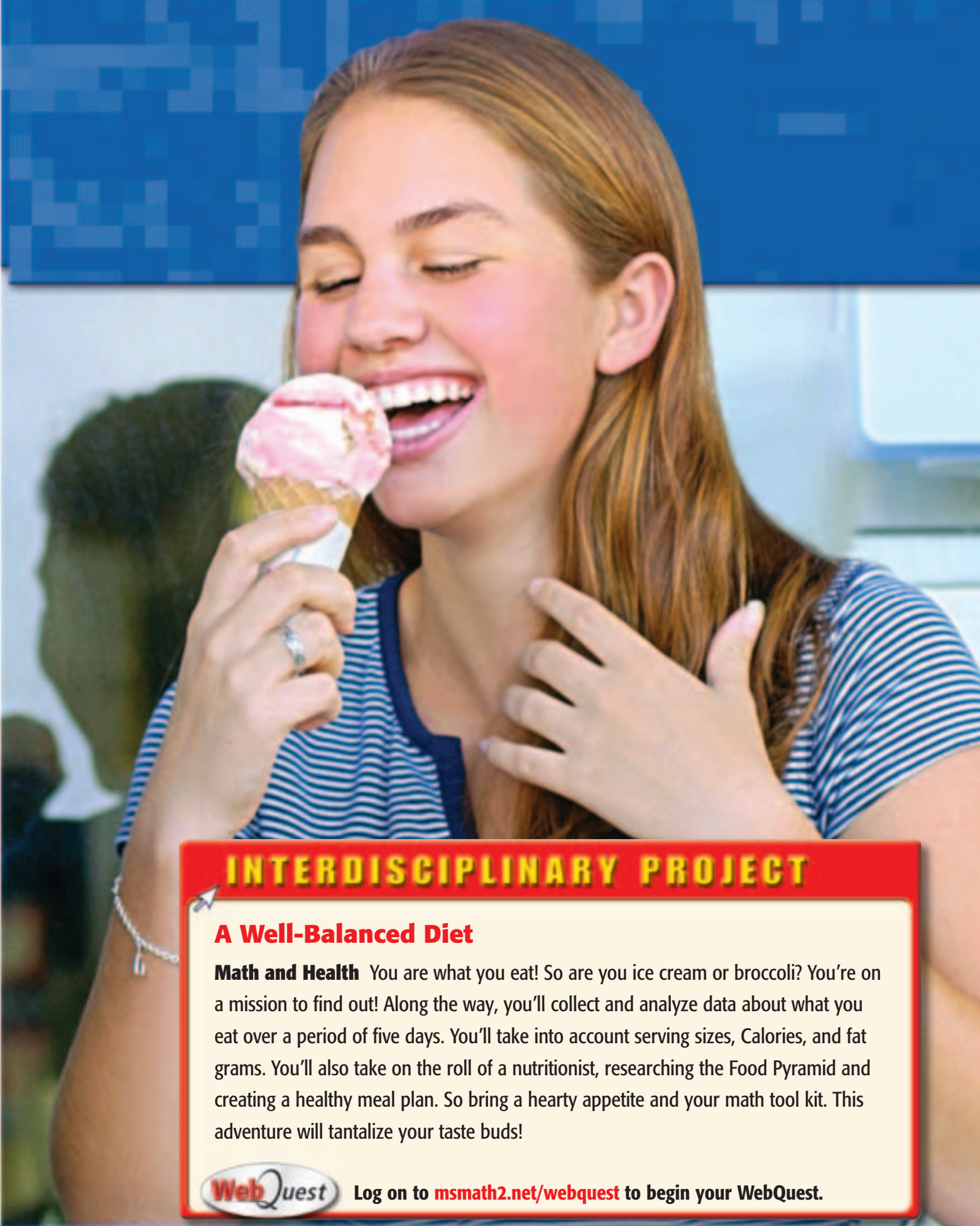
UNIT 3
Fractions

Fractions, decimals, and percents are different ways of representing the same values. In this unit, you will describe real-life situations, perform basic operations, and solve equations with fractions.



CONTENTS



INTERDISCIPLINARY PROJECT

A Well-Balanced Diet

Math and Health You are what you eat! So are you ice cream or broccoli? You're on a mission to find out! Along the way, you'll collect and analyze data about what you eat over a period of five days. You'll take into account serving sizes, Calories, and fat grams. You'll also take on the roll of a nutritionist, researching the Food Pyramid and creating a healthy meal plan. So bring a hearty appetite and your math tool kit. This adventure will tantalize your taste buds!

WebQuest **Log on to msmath2.net/webquest to begin your WebQuest.**

CHAPTER 5

Fractions, Decimals, and Percents

"What does music have to do with math?"

The *frequencies* of two musical notes can be compared using a fraction. If the fraction can be simplified, the two notes are harmonious. In mathematics, you will use fractions to describe many real-life situations.

You will solve problems about music in Lesson 5-3.

Neil Rabinowitz/CORBIS

CONTENTS

GETTING STARTED

Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 5. Refer to the lesson or page number in parentheses for review.

Vocabulary Review

Complete each sentence.

1. After comparing the decimals 0.41 and 0.04, you find that 0.41 is ___?___ than 0.04. (Page 556)
2. Two or more numbers that are multiplied together to form a product are called ___?___. (Lesson 1-2)

Prerequisite Skills

State which decimal is greater. (Page 556)

3. 0.6, 0.61
4. 1.25, 1.52
5. 0.33, 0.13
6. 1.08, 10.8

Use divisibility rules to determine whether each number is divisible by 2, 3, 5, 6, or 10. (Page 554)

7. 125
8. 78
9. 37

Divide. (Page 562)

10. $5\overline{)2.0}$
11. $4\overline{)3.00}$

Write each power as a product of the same factor. (Lesson 1-2)

12. 2^3
13. 5^5
14. 7^2

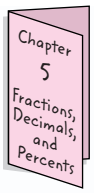
Write each product in exponential form. (Lesson 1-2)

15. $4 \times 4 \times 4$
16. 8×8
17. $1 \times 1 \times 1 \times 1 \times 1$
18. $7 \times 7 \times 7 \times 7$

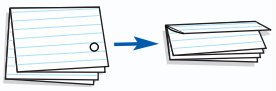
FOLDABLES Study Organizer

Fractions, Decimals, and Percents Begin with a sheet of $8\frac{1}{2}''$ by 11″ construction paper and two sheets of notebook paper.

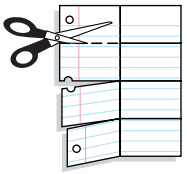
STEP 1 **Fold and Label** Fold the construction paper in half lengthwise. Label the chapter title on the outside.



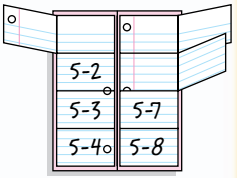
STEP 2 **Fold** Fold the sheets of notebook paper in half lengthwise. Then fold top to bottom twice.



STEP 3 **Cut** Open the notebook paper. Cut along the second folds to make four tabs.



STEP 4 **Glue and Label** Glue the uncut notebook paper side by side onto the construction paper. Label each tab with the lesson number.



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.

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

5-1a HANDS-ON LAB

A Preview of Lesson 5-1

Exploring Factors

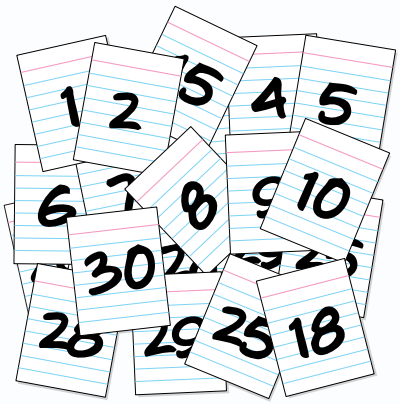
What You'll LEARN

Discover factors of whole numbers.

Materials

- 15 index cards cut in half
- markers

INVESTIGATE *Work as a class.*



STEP 1 Number each index card consecutively with the numbers 1 through 30.

STEP 2 In order around the classroom, give each of thirty students one index card. Have each student stand up and write the number 1 on the back of his or her card.

STEP 3 Begin with the student holding the "2" card. Have this student and every second student sit down and write the number 2 on the back of his or her card. The other students remain standing.

STEP 4 Next, start with the student holding the "3" card. Have this student and every third student stand up or sit down (depending on whether the student is already sitting or standing) and write the number 3 on the back of his or her card.

STEP 5 Continue this process for each of the remaining numbers up to 30. The thirtieth student ends the activity by standing or sitting, and writing the number 30 on the back of his or her card.

Writing Math

Work as a class.

1. How many students are standing at the end of the activity? Which cards are they holding?
2. **LOOK FOR A PATTERN** Suppose there were 100 students holding index cards. Extend the pattern in Exercise 1 to predict the numbers that would be held by students standing at the end of the activity.
3. **Explain** the relationship between the numbers on the front and the back of the cards.
4. Separate the cards into two groups: one group with exactly two numbers on the back of the card and one group with more than two numbers. **Describe** any special characteristics of each group.

5-1 Prime Factorization

What You'll LEARN

Find the prime factorization of a composite number.

NEW Vocabulary

prime number
composite number
prime factorization
factor tree

REVIEW Vocabulary

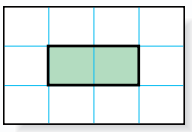
factors: two or more numbers that are multiplied together to form a product (Lesson 1-2)

HANDS-ON Mini Lab

Materials
- grid paper

Work with a partner.

There is only one way that 2 can be expressed as the product of whole numbers. The figure shows that there is only one way that two squares can form a rectangle.



1. Using your grid paper, draw as many different rectangles as possible containing 3, 4, 5, 6, 7, 8, 9, and 10 squares.
2. Which numbers of squares can be drawn in only one rectangle? In more than one rectangle?

The numbers of squares that can only be drawn in exactly one rectangle are prime numbers. The numbers that can be drawn in more than one rectangle are composite numbers.

A **prime number** is a whole number greater than 1 that has exactly two factors, 1 and itself.

A **composite number** is a whole number greater than 1 that has more than two factors.

Whole Numbers	Factors
2	1, 2
3	1, 3
5	1, 5
7	1, 7
4	1, 2, 4
6	1, 2, 3, 6
8	1, 2, 4, 8
9	1, 3, 9
10	1, 2, 5, 10
0	many
1	1

The numbers 0 and 1 are neither prime nor composite.

EXAMPLES Identify Numbers as Prime or Composite

Determine whether each number is *prime* or *composite*.

1 **17**

The number 17 has only two factors, 1 and 17, so it is prime.

2 **12**

The number 12 has six factors: 1, 2, 3, 4, 6, and 12. So, it is composite.

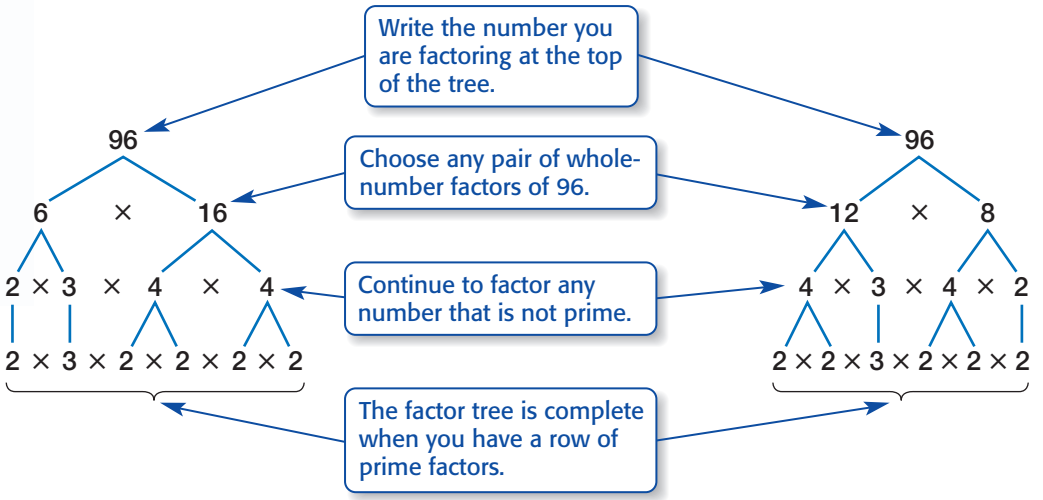
Your Turn **Determine whether each number is *prime* or *composite*.**

a. 11 b. 15 c. 24

Every composite number can be written as a product of prime numbers in exactly one way. The product is called the **prime factorization** of the number. You can use a **factor tree** to find the prime factorization.

STUDY TIP

Commutative Property Multiplication is commutative, so the order of the factors does not matter.



STUDY TIP

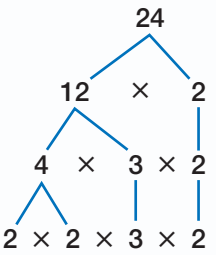
Mental Math You can use divisibility rules to find prime factors. See page 554.

Both trees give the same prime factorization of 96, but in different orders. The prime factorization of 96 is $2 \times 2 \times 2 \times 2 \times 2 \times 3$, or $2^5 \times 3$ using exponents.

EXAMPLE Find the Prime Factorization

1 **Find the prime factorization of 24.**

Method 1 Use a factor tree.



Method 2 Divide by prime numbers.

$$\begin{array}{r} 2 \\ 2\overline{)4} \\ 3\overline{)12} \\ 2\overline{)24} \end{array}$$

← Start here.

The divisors are 2, 2, 3, and 2.

The prime factorization of 24 is $2 \times 2 \times 3 \times 2$ or $2^3 \times 3$.

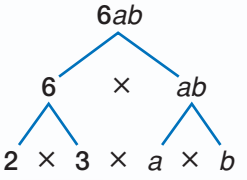
Your Turn **Find the prime factorization of each number.**

d. 18 **e.** 28 **f.** 16

You can factor an expression like $6ab$ as the product of prime numbers and variables.

EXAMPLE Factor an Algebraic Expression

4 **ALGEBRA** **Factor $6ab$.**



$6ab = 2 \cdot 3 \cdot a \cdot b$

Recall that a raised dot means multiplication.

Skill and Concept Check

1. Writing Math Compare and contrast prime and composite numbers.
2. **OPEN ENDED** Draw two different factor trees to find the prime factorization of 36.
3. **Explain** why $2^3 \times 9$ is *not* the prime factorization of 72.
4. **Which One Doesn't Belong?** Identify the number that is not prime.

11	37	17	51

GUIDED PRACTICE

Determine whether each number is *prime* or *composite*.

5. 7
6. 50
7. 67

Find the prime factorization of each number.

8. 34
9. 30
10. 12

Factor each expression.

11. $10ac$
12. $16x^2$

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
13–20, 29	1, 2
21–28, 36–38, 45–47	3
30–35	4

Extra Practice
See pages 574, 600.

Determine whether each number is *prime* or *composite*.

13. 22
14. 44
15. 13
16. 39
17. 81
18. 31
19. 97
20. 43

Find the prime factorization of each number.

21. 36
22. 42
23. 99
24. 64
25. 210
26. 180
27. 126
28. 375

29. **ALGEBRA** Is the value of $3a + 6b$ *prime* or *composite* if $a = 1$ and $b = 5$?

Factor each expression.

30. $15mn$
31. $20pq$
32. $34jkl$
33. $49y^2$
34. $52gh^2$
35. $48a^2b^2$

PACKAGING **For Exercises 36–38, use the following information.**
A juice company is designing a package that holds 36 juice cans. For example, a package could be 1 can high, 6 cans wide, and 6 cans long. Such a package would contain $1 \times 6 \times 6$, or 36 cans.

36. List two other ways to arrange 36 cans.
37. How many different ways can you arrange 36 cans?
38. In which arrangement should the 36 cans be packaged? Explain your reasoning.

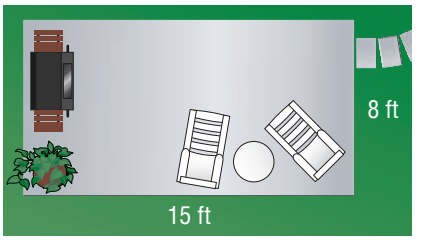
Replace each ■ with prime factors to make a true sentence.

39. $2^3 \times ■ \times 11 = 616$ **40.** $2 \times ■ \times 5^2 = 450$ **41.** $3 \times 2^4 \times ■ = 1{,}200$

42. **NUMBER THEORY** *True* or *False*? All prime numbers are odd. If false, give a counterexample.

43. **NUMBER THEORY** Primes that differ by two are called *twin primes*. For example, 59 and 61 are twin primes. Give three examples of twin primes that are less than 50.

LANDSCAPING **For Exercises 44–47, use the following information.**
Mrs. Franks is building a patio that covers an area measuring 8 feet by 15 feet. She will use rectangular concrete tiles for the patio.



44. What is the area of the patio?

45. Find the prime factorization of the area.

46. If she can only buy tiles with dimensions that are prime numbers, name the dimensions of the concrete tiles available for her patio.

47. How many tiles will she need to cover the patio?

48. **NUMBER THEORY** Suppose n represents a whole number. Is $2n$ prime or composite? Explain.

49. **CRITICAL THINKING** Find the mystery number from the following clues.
- This whole number is between 30 and 40.
- It has only two prime factors.
- The sum of its prime factors is 5.

Spiral Review with Standardized Test Practice

50. **MULTIPLE CHOICE** Which expression represents the prime factorization of 126?

(A) $2^2 \times 3 \times 7$ (B) $2 \times 3^2 \times 7$ (C) $2 \times 3 \times 7^2$ (D) $2^2 \times 3^2 \times 7^2$

51. **SHORT RESPONSE** Determine whether the value of the expression $x^2 - 3x + 11$ is prime or composite when $x = 4$.

52. **ALGEBRA** What is the slope of the line that passes through points at $(-2, 5)$ and $(3, -1)$? (Lesson 4-7)

53. **ALGEBRA** Graph $y = 3x + 1$. (Lesson 4-6)

Tell whether each sum is *positive*, *negative*, or *zero*. (Lesson 3-4)

54. $6 + (-4)$ **55.** $-13 + 9$ **56.** $25 + (-26)$ **57.** $-5 + 5$

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **State whether each number is divisible by 2, 3, 5, 6, 9, or 10.** (Page 554)

58. 24 **59.** 70 **60.** 120 **61.** 99 **62.** 125

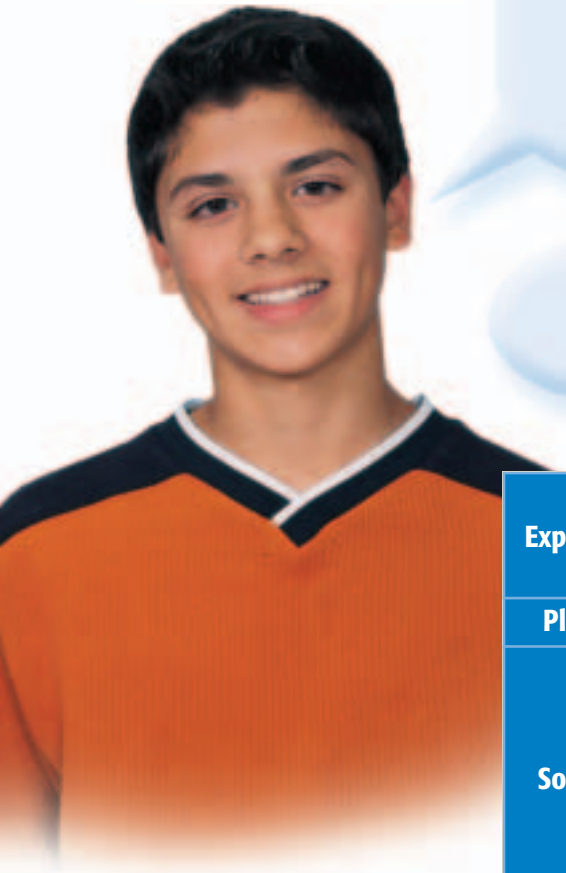
5-2a Problem-Solving Strategy

A Preview of Lesson 5-2

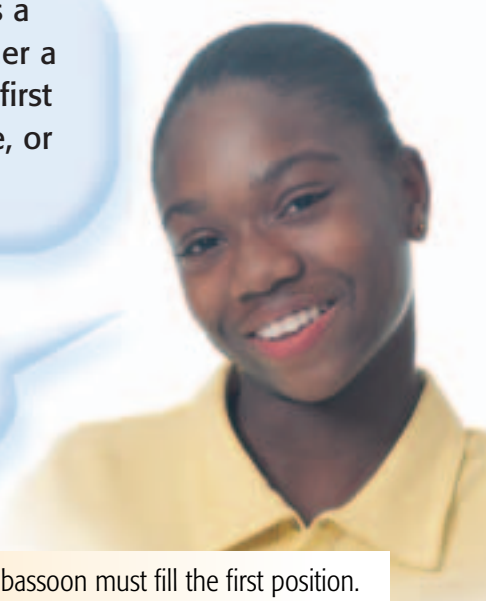
Make an Organized List

What You'll LEARN

Solve problems by making an organized list.



I wonder how many different ways a woodwind trio can be made if either a bass clarinet or a bassoon fills the first position and either a clarinet, oboe, or flute fills the other two positions?



Let's **make an organized list** of all of the possibilities.

Explore

We know that either a bass clarinet or a bassoon must fill the first position. The other two positions are to be filled with two out of the three remaining instruments. We have to find all possible ways the trio can be made.

Plan

Let's make an organized list.

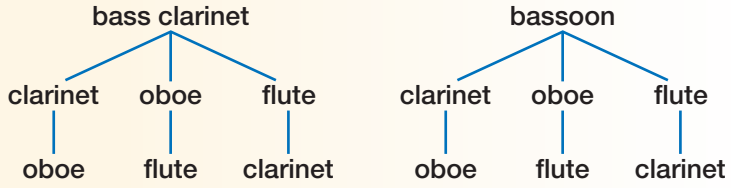
Solve

	Trio 1	Trio 2	Trio 3	Trio 4	Trio 5	Trio 6
Position 1	bass clarinet	bass clarinet	bass clarinet	bassoon	bassoon	bassoon
Position 2	clarinet	oboe	flute	clarinet	oboe	flute
Position 3	oboe	flute	clarinet	oboe	flute	clarinet

There are six possibilities.

Examine

We can draw a tree diagram to check our result.



Analyze the Strategy

1. **Explain** why making an organized list was a useful strategy in solving this problem.
2. **Explain** why a tree diagram is another method for making an organized list.
3. **Write** a problem that could be solved by making an organized list. Explain.

Apply the Strategy

Solve. Use the make an organized list strategy.

4. **FOOD** Daniel is making a peanut butter and jelly sandwich. His choices are creamy or crunchy peanut butter, white or wheat bread, and grape, apple, or strawberry jelly. How many different types of sandwiches can Daniel make?

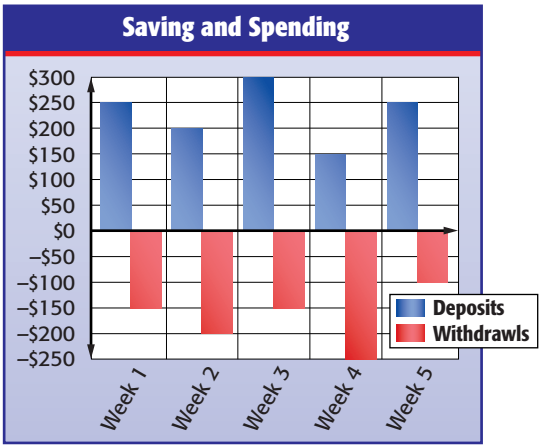
5. **GAMES** On the game board, you plan to move two spaces away from square A. You can either move horizontally, vertically, or diagonally. How many different moves can you make from square A? List them.

A	B	C
D	E	F
G	H	I

Mixed Problem Solving

Solve. Use any strategy.

6. **SAVINGS** The graph below shows deposits and withdrawals. During which week was the difference between deposits and withdrawals the greatest?



7. **SCIENCE FAIR** Mrs. Cassidy is taking a picture with the first, second, and third place winners of the science fair. If Mrs. Cassidy always stands on the far left, how many different ways can the students arrange themselves for the picture?

8. **SCHOOL** Members of Student Council are raising money to attend a conference. The total costs of the conference are shown in the table. If 24 students are attending the conference, how much does each student have to raise?

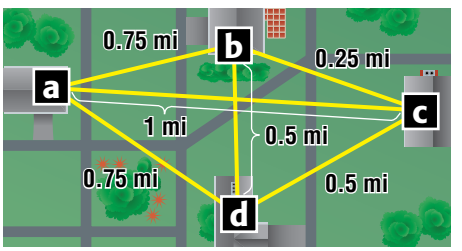
Transportation	$1,200
Registration	$288
Luncheon	$360

9. **NUMBER THEORY** Find two consecutive odd numbers that when added equal 56, and when multiplied equal 783.

10. **MULTI STEP** Terrez took a bag of cookies to play rehearsal. Half were given to the musicians and five to the director of the play. Terrez was left with 15 cookies. How many cookies did he take to rehearsal?

11. **EARTH SCIENCE** Giant kelp seaweed is found in the Pacific Ocean. One plant grows 3 feet the first two days. If it continues to grow at the same rate, what would be the length of the seaweed at the end of 80 days?

12. **STANDARDIZED TEST PRACTICE**
Mary has to make deliveries to three neighbors. She lives at house b on the map. Which is the shortest route to make the deliveries and return home?



(A) b-a-d-c-b
(B) b-a-c-d-b
(C) b-c-a-d-b
(D) b-d-a-c-b

5-2 Greatest Common Factor

What You'll LEARN

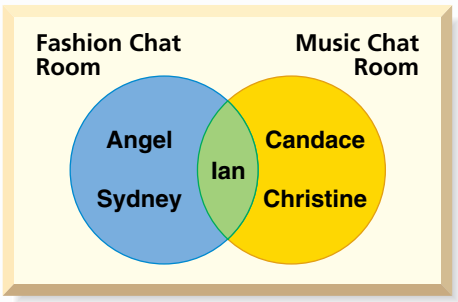
Find the greatest common factor of two or more numbers.

NEW Vocabulary

Venn diagram
greatest common factor (GCF)

WHEN am I ever going to use this?

INTERNET A group of friends spent time in two Internet chat rooms. The diagram shows the chat rooms Angel, Sydney, Ian, Candace, and Christine visited. The friends were able to stay in one chat room or go to the other one.



1. Who visited the Fashion Chat Room?
2. Who visited the Music Chat Room?
3. Who visited both chat rooms?

The diagram above is called a **Venn diagram**. It uses circles to show how elements among sets of numbers or objects are related. The region where circles overlap represents items that are common to two or more sets. It shows that Ian visited both chat rooms.

Venn diagrams can also show factors that are common to two or more numbers. The greatest of these common factors is called the **greatest common factor (GCF)**. The GCF of prime numbers is 1.

EXAMPLE 1 Find the GCF by Listing Factors

Find the GCF of 20 and 24.

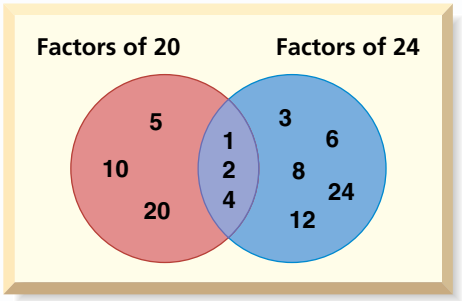
First, list the factors of 20 and 24.

factors of 20: 1, 2, 4, 5, 10, 20
factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

} common factors: 1, 2, 4

Notice that 1, 2, and 4 are common factors of 20 and 24. So, the GCF is 4.

Check You can draw a Venn diagram to check your answer.



READING in the Content Area

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

Your Turn

Find the GCF of each pair of numbers.

a. 8 and 10 b. 6 and 12 c. 10, 17

EXAMPLES Find the GCF Using Prime Factors

Find the GCF of each set of numbers.

2 **18, 48**

Method 1 Write the prime factorization.

$18 = 2 \times 3 \times 3$

$48 = 2 \times 2 \times 2 \times 2 \times 3$

Method 2 Divide by prime numbers.

Divide both 18 and 48 by 2. Then divide the quotients by 3.

$$\begin{array}{r|rr} 3 & 9 & 24 \\ \hline 2 & 18 & 48 \end{array}$$

Start here.

The common prime factors are 2 and 3.
So, the GCF of 18 and 48 is 2×3, or 6.

3 **12, 24, 60**

$12 = 2 \times 2 \times 3$

$24 = 2 \times 2 \times 2 \times 3$

$60 = 2 \times 2 \times 3 \times 5$

Circle the common factors.

The common prime factors are 2, 2, and 3.
So, the GCF is $2 \times 2 \times 3$, or 12.

Your Turn **Find the GCF of each set of numbers.**

d. 36, 48 **e.** 10, 35 **f.** 30, 45, 75

STUDY TIP

Choosing a Method
To find the GCF of two numbers, it is easier to:
- list factors for small numbers, and
- find the prime factorization or use division for large numbers.

EXAMPLE Find the GCF of an Algebraic Expression

4 **ALGEBRA** **Find the GCF of $10a$ and $15a^2$.**

Factor each expression.

$10a = 2 \cdot 5 \cdot a$

$15a^2 = 3 \cdot 5 \cdot a \cdot a$

Circle the common factors.

The GCF is $5 \cdot a$, or $5a$.

EXAMPLE Use the GCF to Solve a Problem

5 **PARADES** **In a parade, 64 eighth-graders are to march in front of 88 seventh-graders. Both groups should have the same number of students in each row. Find the greatest number of students in each row.**

The greatest number of students in each row is the GCF of the number of students in each group.

$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$

$88 = 2 \times 2 \times 2 \times 11 = 2^3 \times 11$

The GCF of 64 and 88 is 2^3, or 8.

So, there should be 8 students in each row.

CONTENTS

Skill and Concept Check

1. **OPEN ENDED** Find two numbers whose GCF is 16.

2. **Draw** a Venn diagram showing the factors of 30 and 42. Name the GCF.

3. **FIND THE ERROR** Charles and Tiffany both found the GCF of 12, 18, and 27. Who is correct? Explain.

Charles

$12 = 2 \cdot 2 \cdot 3$
$18 = 2 \cdot 3 \cdot 3$
$27 = 3 \cdot 3 \cdot 3$
GCF: $2 \cdot 3 \cdot 3 = 18$

Tiffany

$12 = 2 \cdot 2 \cdot 3$
$18 = 2 \cdot 3 \cdot 3$
$27 = 3 \cdot 3 \cdot 3$
GCF: 3

GUIDED PRACTICE

Find the GCF of each set of numbers.

4. 18, 30
5. 45, 60
6. 6, 8, 12
7. 18, 42, 60

8. Find the GCF of $14xy$ and $7x^2$.

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
9–16, 21–22	1, 2
17–20	3
26–29	4
30–33	5

Extra Practice
See pages 574, 600.

Find the GCF of each set of numbers.

9. 12, 78
10. 40, 50
11. 20, 45
12. 32, 48
13. 24, 48
14. 45, 75
15. 56, 96
16. 40, 125
17. 18, 24, 30
18. 36, 60, 84
19. 35, 49, 84
20. 36, 50, 130

21. What is the GCF of $2^4 \times 5$ and $5^2 \cdot 7$?
22. Find the GCF of $2^3 \times 3^2 \times 7$ and $2^2 \times 3 \times 11$.

Determine whether each statement is *sometimes*, *always*, or *never* true.

23. The GCF of two numbers is greater than both numbers.
24. If two numbers have no common prime factors, the GCF is 1.
25. The GCF of two numbers is one of the numbers.

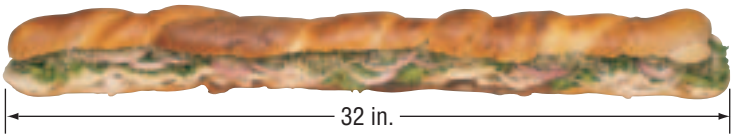
Find the GCF of each set of algebraic expressions.

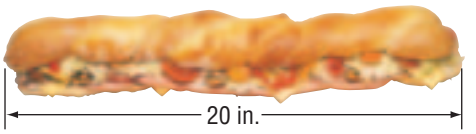
26. $24a$, $6a$
27. $27b^2$, $36b$
28. $16r^3$, $28r$
29. $20x^2$, $50xy^2$

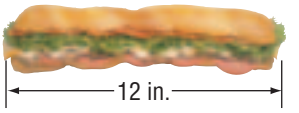
INDUSTRIAL TECHNOLOGY **For Exercises 30 and 31, use the following information.**
Kibbe is building scale models of high-rise buildings for his class project. He designs the models using one-inch cubes. He is planning to build three buildings, the first with 108 blue cubes, the second with 270 red cubes, and the third with 225 yellow cubes. All of the buildings must be the same height, but not necessarily the same length and width.

30. What is the maximum height of each high-rise Kibbe can build?
31. What are the dimensions of all three buildings?

FOOD **For Exercises 32 and 33, use the following information.** The track-and-field coaches threw a party at the end of the season and bought a 32-inch, a 20-inch, and a 12-inch submarine sandwich. Suppose the sandwiches are cut into equal-sized pieces.







32. What is the length of the longest piece that can be cut?

33. If there are 18 people on the team, will everyone receive a sandwich? Explain.

34. **RESEARCH** Use the Internet or another source to find information about the Sieve of Eratosthenes. Explain how you can find the GCF of 18 and 54 using the Sieve.

CRITICAL THINKING **For Exercises 35–37, use the following information.** Numbers that have a GCF of 1 are *relatively prime*. Use this definition to determine whether each statement is true or false. Explain your answer.

35. Any two prime numbers are relatively prime.

36. If two numbers are relatively prime, one of them must be prime.

37. Two consecutive numbers are always relatively prime.

Spiral Review with Standardized Test Practice

38. **MULTIPLE CHOICE** Felisa is making shelves to store her books. How many shelves measuring 8 inches by 12 inches can be cut from a 36-inch-by-56-inch piece of plywood so that there is no waste?

Ⓐ 17 Ⓑ 18 Ⓒ 20 Ⓓ 21

39. **MULTIPLE CHOICE** Which set of numbers does *not* have a GCF of 6?

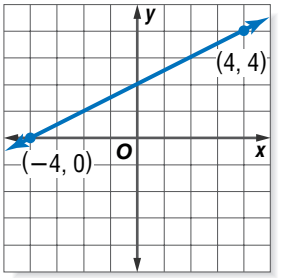
Ⓕ 42, 150 Ⓖ 54, 18 Ⓗ 24, 6 Ⓘ 18, 30

40. **SHORT RESPONSE** Find the GCF of $20st^2$ and $50s^2$.

Determine whether each number is *prime* or *composite*. (Lesson 5-1)

41. 21 42. 31 43. 65 44. 129

45. **ALGEBRA** Find the slope of the line that passes through the pair of points at the right. (Lesson 4-7)



46. **GEOMETRY** Write the ordered pair that is 16 units up from and 11 units to the left of the origin. (Lesson 3-3)

47. **MEASUREMENT** Twenty milliliters is equal to how many liters? (Lesson 1-8)

GETTING READY FOR THE NEXT LESSON

BASIC SKILL **Divide.**

48. $27 \div 3$ 49. $48 \div 2$ 50. $160 \div 40$ 51. $96 \div 6$

5-3 Simplifying Fractions

What You'll LEARN

Write fractions in simplest form.

NEW Vocabulary

equivalent fractions
simplest form

HANDS-ON Mini Lab

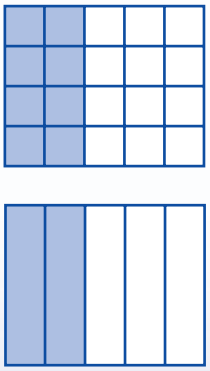
Materials

- grid paper
- colored pencils

Work with a partner.

On grid paper, draw the two figures at the right. Both figures should be the same size. Shade 8 out of the 20 squares in one figure. Shade 2 out of the 5 rectangles in the other.

1. Write a fraction to describe each figure: $\frac{\text{number of shaded parts}}{\text{total number of parts}}$.
2. Which figure has a greater portion of its parts shaded?
3. What can you conclude about the fractions you wrote above?



The fractions $\frac{8}{20}$ and $\frac{2}{5}$ are **equivalent fractions** because they have the same value. The fraction $\frac{2}{5}$ is in **simplest form** because the GCF of the numerator and denominator is 1.

EXAMPLES Write Fractions in Simplest Form

Write each fraction in simplest form.

1 $\frac{8}{20}$

First, find the GCF of the numerator and denominator.

factors of 8: 1, 2, 4, 8
factors of 20: 1, 2, 4, 5, 10, 20

The GCF of 8 and 20 is 4.

Then, divide the numerator and the denominator by the GCF.

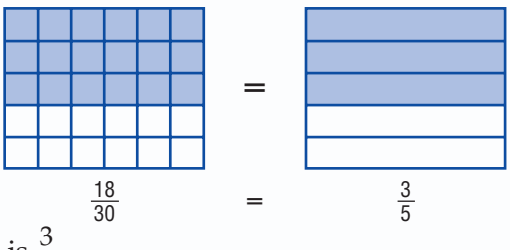
$\frac{8}{20} = \frac{8 \div 4}{20 \div 4} = \frac{2}{5}$ So, $\frac{8}{20}$ written in simplest form is $\frac{2}{5}$.

Check Multiply the numerator and denominator of the answer by the GCF. The result should be the original fraction.

2 $\frac{18}{30}$

$18 = 2 \cdot 3 \cdot 3$
$30 = 2 \cdot 3 \cdot 5$
GCF: $2 \cdot 3 = 6$

$\frac{18}{30} = \frac{18 \div 6}{30 \div 6} = \frac{3}{5}$



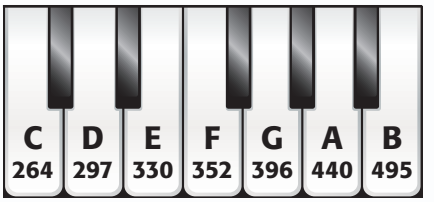
So, $\frac{18}{30}$ written in simplest form is $\frac{3}{5}$.

STUDY TIP

Simplest Form
A fraction is in simplest form when the GCF of the numerator and denominator is 1.

EXAMPLE 1 Use Fractions to Solve a Problem

MUSIC If the fraction of the frequencies of two notes can be simplified, the two notes are harmonious. Use the graphic below to find the simplified fraction of the frequency of notes C and E.



Frequency Chart (Hertz)

$$\frac{\text{frequency of note C}}{\text{frequency of note E}} = \frac{264}{330}$$

$$= \frac{\overset{1}{\cancel{2}} \times 2 \times 2 \times \overset{1}{\cancel{3}} \times \overset{1}{\cancel{11}}}{\underset{1}{\cancel{2}} \times \underset{1}{\cancel{3}} \times 5 \times \underset{1}{\cancel{11}}}$$

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

The slashes mean that part of the numerator and part of the denominator are both divided by the same number. For example, $3 \div 3 = 1$.

The fraction of the frequency of notes C and E is $\frac{4}{5}$.

Your Turn **Find the simplified fraction of the frequency of each pair of notes.**

a. D and G **b.** E and F

REAL LIFE CAREERS

How Does a Music Composer Use Math?

Music composers write notes that can vary in length. There are whole notes, half notes, quarter notes, eighth notes, and sixteenth notes.

Research
For information about a career as a music composer, visit: msmath2.net/careers

Skill and Concept Check

1. **Writing Math** Explain how to determine if a fraction is in simplest form.

2. **OPEN ENDED** Write a fraction that is *not* in simplest form. Then, simplify it.

3. **FIND THE ERROR** Seki and Luther both wrote $\frac{16}{36}$ in simplest form. Who is correct? Explain.

Seki

$$\frac{16}{36} = \frac{16 \div 4}{36 \div 4} = \frac{4}{9}$$

Luther

$$\frac{16}{36} = \frac{16 \div 2}{36 \div 2} = \frac{8}{18}$$

GUIDED PRACTICE

Write each fraction in simplest form.

4. $\frac{3}{9}$ 5. $\frac{18}{30}$ 6. $\frac{81}{90}$

7. **AGRICULTURE** George Washington Carver produced about 100 products from sweet potatoes and about 325 from peanuts. Write the number of sweet potato products as a fraction of the number of peanut products in simplest form.

CONTENTS

Practice and Applications

HOMEWORK HELP

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

Extra Practice
See pages 575, 600.

Write each fraction in simplest form.

8. $\frac{9}{12}$ 9. $\frac{25}{35}$ 10. $\frac{16}{32}$ 11. $\frac{14}{20}$

12. $\frac{10}{20}$ 13. $\frac{12}{21}$ 14. $\frac{15}{25}$ 15. $\frac{24}{28}$

16. $\frac{48}{64}$ 17. $\frac{32}{32}$ 18. $\frac{50}{300}$ 19. $\frac{80}{96}$

Write two fractions that are equivalent to each fraction.

20. $\frac{1}{2}$ 21. $\frac{3}{5}$ 22. $\frac{6}{7}$ 23. $\frac{5}{8}$

24. **PARKING** New York holds the number one spot when it comes to the cost for parking your car. Use the graphic to express the cost of parking a car in Chicago as a fraction of the cost of parking a car in Boston in simplest form.

25. **MUSIC** Find the simplified fraction of the frequency of notes C and A in Example 3 on page 208.

Write each fraction in simplest form.

26. Fifteen minutes is what part of one hour?

27. Nine inches is what part of one foot?

28. Four days is what part of the month of April?

29. **CRITICAL THINKING** Both the numerator and denominator of a fraction are even. Is the fraction in simplest form? Explain.

Spiral Review with Standardized Test Practice

30. **MULTIPLE CHOICE** The drive to the football game took 56 minutes. Twenty-four minutes of the time was spent stopped in traffic. What fraction of the drive was spent stopped in traffic?

(A) $\frac{3}{7}$ (B) $\frac{6}{14}$ (C) $\frac{15}{35}$ (D) $\frac{1}{3}$

31. **SHORT RESPONSE** Draw a model that shows $\frac{15}{25} = \frac{3}{5}$.

32. Find the GCF of 345, 253, and 115. (Lesson 5-2)

33. Find the prime factorization of 630. (Lesson 5-1)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Divide.** (Page 562)

34. $2\overline{)1.0}$ 35. $4\overline{)1.00}$ 36. $10\overline{)7.0}$ 37. $8\overline{)3.000}$

5-4 Fractions and Decimals

What You'll LEARN

Write fractions as terminating or repeating decimals and write decimals as fractions.

NEW Vocabulary

terminating decimals
repeating decimals
bar notation

Link to READING

Everyday Meaning of terminate:
coming to an end,
as in terminate a game

WHEN am I ever going to use this?

SOFTBALL The United States Women's softball team won the gold medal in the 2000 Summer Olympic Games. The table shows the results of the games they played in Sydney, Australia. The number of runs scored by the United States is listed first.

1. How many games did the USA softball team win? How many did they play?
2. Write a fraction comparing the number of times the team won to the total number of games played.

Opponent	Score
Japan	2–1
Australia	1–0
China	3–0
Italy	6–0
New Zealand	2–0
Australia	1–2
China	0–2
Japan	1–2
Cuba	3–0
Canada	6–0

Source: www.usasoftball.com

The softball team won $\frac{7}{10}$ of the games played. When the denominator is a power of 10, you can use place value to write the fraction as a decimal.

Words	Model	Fraction	Decimal
seven tenths		$\frac{7}{10}$	0.7

If the denominator is *not* a power of 10, you can write the fraction as a decimal using division.

EXAMPLES Write Fractions as Decimals

Write each fraction or mixed number as a decimal.

1 $\frac{1}{4}$

The fraction $\frac{1}{4}$ indicates $1 \div 4$.

Method 1 Use paper and pencil.

$$\begin{array}{r} 0.25 \\ 4\overline{)1.00} \\ \underline{8} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Division ends when the remainder is 0.

Method 2 Use a calculator.

1 ÷ 4 ENTER 0.25

So, $\frac{1}{4} = 0.25$.

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

The mixed number $5\frac{3}{4}$ is $5 + \frac{3}{4}$.

Method 1 Use paper and pencil.

$5\frac{3}{4} = 5 + \frac{3}{4}$ Write as a sum.

$= 5 + 0.75$ Write $\frac{3}{4}$ as 0.75.

$= 5.75$ Add.

Method 2 Use a calculator.

3 ÷ 4 + 5 ENTER 5.75

So, $5\frac{3}{4} = 5.75$.

Haslin/CORBIS SYGMA

CONTENTS

In Example 1, the division ends, or terminates, when the remainder is zero. So, 0.25 is called a **terminating decimal**.

Repeating decimals have a pattern in the digits that repeats forever.

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

$$3\overline{)1.000}\quad 0.333\ldots$$
$$9$$
$$10$$
$$9$$
$$10$$
$$9$$
$$1$$

The number 3 repeats. It is represented by three dots.

The remainder after each step is 1.

You can use **bar notation** to indicate that a number repeats forever. A bar is written over the digits that repeat.

$0.33333\ldots = 0.\overline{3}$ $\quad 0.121212\ldots = 0.\overline{12}$ $\quad 11.3858585\ldots = 11.3\overline{85}$

EXAMPLES Write Fractions as Repeating Decimals

Write each fraction or mixed number as a decimal.

3 $\frac{7}{9}$

Method 1 Use paper and pencil.

$$9\overline{)7.00}\quad 0.77\ldots$$
$$63$$
$$70$$
$$63$$
$$7$$

Method 2 Use a calculator.

7 ÷ 9 ENTER 0.7777…

So, $\frac{7}{9} = 0.\overline{7}$.

4 $8\frac{1}{3}$

Method 1 Use paper and pencil.

$8\frac{1}{3} = 8 + \frac{1}{3}$ Write as a sum.

$= 8 + 0.\overline{3}$ Write $\frac{1}{3}$ as $0.\overline{3}$.

$= 8.\overline{3}$ Add.

Method 2 Use a calculator.

1 ÷ 3 + 8 ENTER 8.3333…

So, $8\frac{1}{3} = 8.\overline{3}$.

Your Turn **Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.**

a. $\frac{5}{8}$ **b.** $\frac{2}{3}$ **c.** $1\frac{3}{11}$ **d.** $6\frac{2}{5}$ **e.** $4\frac{5}{6}$

STUDY TIP

Mental Math It will be helpful to memorize the following fraction-decimal equivalencies.

$\frac{1}{2} = 0.5$

$\frac{1}{3} = 0.\overline{3}$ $\quad \frac{2}{3} = 0.\overline{6}$

$\frac{1}{4} = 0.25$ $\quad \frac{3}{4} = 0.75$

$\frac{1}{5} = 0.2$ $\quad \frac{1}{10} = 0.1$

$\frac{1}{8} = 0.125$

You can use a power of 10 to write a decimal as a fraction. Use the place value of the final digit as the denominator.

EXAMPLE Write Decimals as Fractions

5 **Write 0.48 as a fraction in simplest form.**

$0.48 = \frac{48}{100}$ The 8 is in the hundredths place.

$= \frac{12}{25}$ Simplify.

Your Turn **Write each number as a fraction in simplest form.**

f. 0.56 **g.** 0.3 **h.** 2.8

Skill and Concept Check

1. **OPEN ENDED** Write a fraction that is equivalent to a terminating decimal and one that is equivalent to a repeating decimal.

2. Writing Math Compare 1 out of 3 and 3 out of 10. Are these values equal? Explain your reasoning.

GUIDED PRACTICE

Write each repeating decimal using bar notation.

3. 0.6333…
4. 5.313131…
5. 12.470470470…

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

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

Write each decimal as a fraction in simplest form.

10. 0.22
11. 0.1
12. 4.6

13. **SOCCER** Cirilo surveyed his physical education class and found that 12 out of 23 students chose soccer as their favorite sport. Write the fraction of students who chose soccer as a decimal to the nearest thousandth.

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
20–21, 24–27, 32, 43	1, 2
14–19, 22–23, 28–31, 44	3, 4
33–42	5

Extra Practice
See pages 575, 600.

Write each repeating decimal using bar notation.

14. 0.999…
15. 5.92111…
16. 2.010101…
17. 13.1464646…
18. 26.993993…
19. 30.6841841841…

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

20. $\frac{3}{8}$
21. $\frac{4}{5}$
22. $\frac{4}{9}$
23. $\frac{8}{11}$
24. $\frac{5}{32}$
25. $\frac{3}{20}$
26. $1\frac{7}{20}$
27. $6\frac{17}{40}$
28. $\frac{13}{24}$
29. $\frac{5}{7}$
30. $8\frac{1}{33}$
31. $4\frac{203}{999}$

32. **DOGS** There are an estimated 53 billion dogs in the U.S. The table shows the results of a survey taken recently of dog owners. Write the fraction of people who pet and hug their dogs daily as a decimal.

Activity	Fraction of People
Play with your dog daily	$\frac{23}{25}$
Take your dog on vacation	$\frac{9}{20}$
Pet and hug your dog daily	$\frac{19}{20}$
Celebrate your dog's birthday	$\frac{43}{100}$

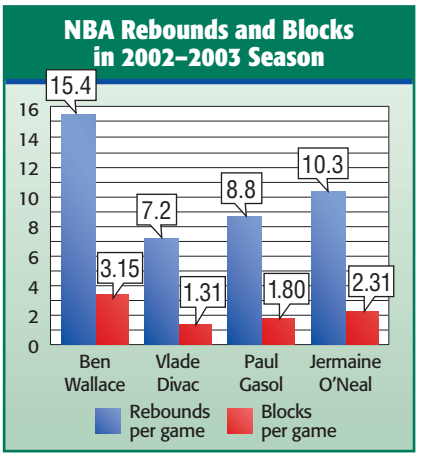
Source: Ralston Purina

Write each decimal as a fraction in simplest form.

33. 0.75
34. 0.34
35. 0.2
36. 0.9
37. 5.96
38. 2.66

CONTENTS

BASKETBALL **Use the graph to write the number of rebounds and blocks per game for each player as a mixed number in simplest form.**



Source: www.nba.com

39. Wallace
40. Divac
41. Gasol
42. O'Neal

43. **MULTI STEP** Kelsey practiced playing the cello for 2 hours and 18 minutes. Write the time Kelsey spent practicing in hours as a decimal.

MATH HISTORY **For Exercises 44 and 45, use the following information.**
The value of pi (π) is 3.1415927… . Pi is a nonrepeating, nonterminating decimal. Mathematicians have used many methods to find the value of π.

44. Archimedes believed that π was between $3\frac{1}{7}$ and $3\frac{10}{71}$. Write each fraction as a decimal rounded to the nearest hundred-thousandth. Was Archimedes correct?
45. The Rhind Papyrus states that the Egyptians used $\frac{256}{81}$ for π. Write the fraction as a decimal rounded to the nearest hundred-thousandth. Which is closer to the actual value of π, Archimedes' value or the Egyptians' value?

46. **CRITICAL THINKING** Fractions with denominators of 2, 4, 8, 16, and 32 produce terminating decimals. Fractions with denominators of 6, 12, 18, and 24 produce repeating decimals. What do you think causes the difference? Explain.

Spiral Review with Standardized Test Practice

47. **MULTIPLE CHOICE** Express $\frac{9}{25}$ as a decimal.

(A) 0.036 (B) 0.36 (C) $0.\overline{36}$ (D) 3.6

48. **SHORT REPONSE** In 2003, Ichiro Suzuki had 212 hits in 679 at-bats. The batting average of a baseball player is the number of hits divided by the number of at-bats. Find Suzuki's batting average to the nearest thousandth.

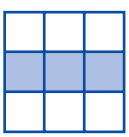
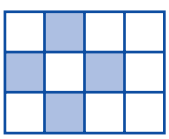
Write each fraction in simplest form. (Lesson 5-3)

49. $\frac{10}{24}$
50. $\frac{39}{81}$
51. $\frac{28}{98}$
52. $\frac{51}{68}$

53. Find the GCF of 36 and 48. (Lesson 5-2)

GETTING READY FOR THE NEXT LESSON

BASIC SKILL **Write a fraction for the number of squares shaded to the total number of squares.**

54. 
55. 
56. 
57. 

CHAPTER 5

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **Define** *prime number* and give an example. (Lesson 5-1)

2. **Describe** how you know when a fraction is in simplest form. (Lesson 5-3)

Skills and Applications

3. Determine whether 24 is *prime* or *composite*. (Lesson 5-1)

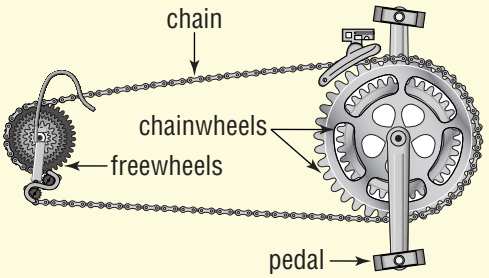
Factor each expression. (Lesson 5-1)

4. 30 5. 120 6. $14x^2y$ 7. $50mn$

Find the GCF of each set of numbers or algebraic expressions. (Lesson 5-2)

8. 16, 40 9. 65, 100 10. $12x$, $20x^3$ 11. $45a^2b^2$, $81ab^3$

12. **CYCLING** The *gear ratio* of a bicycle is the comparison of the number of teeth on a chainwheel to the number on a freewheel. If the gear ratio for Alexis' 10-speed bike is $\frac{52}{16}$, write this fraction in simplest form. (Lesson 5-3)



Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal. (Lesson 5-4)

13. $\frac{7}{8}$ 14. $\frac{2}{9}$ 15. $3\frac{13}{20}$

Write each decimal as a fraction in simplest form. (Lesson 5-4)

16. 0.6 17. 0.48 18. 7.02

Standardized Test Practice

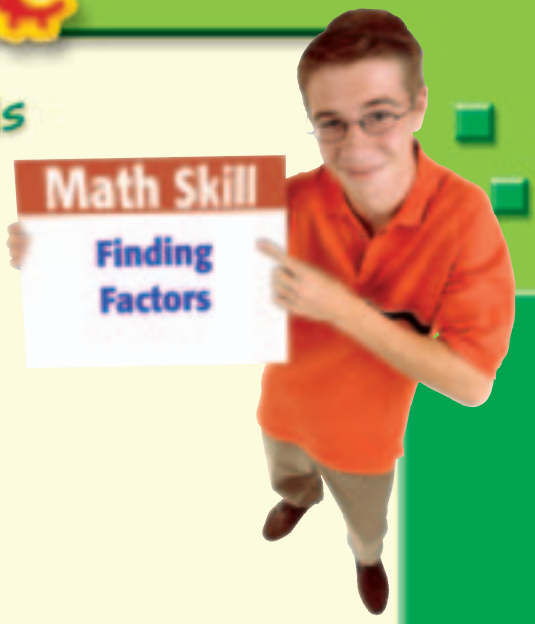
19. **MULTIPLE CHOICE** What is the greatest number of crayons in each row of an 8-, a 64-, and a 96-crayon box if all rows have the same number? (Lesson 5-2)

(A) 2 (B) 4 (C) 8 (D) 12

20. **GRID IN** Amy spent 35 minutes in the afternoon practicing the piano. What part of one hour did she spend practicing? Write as a fraction in simplest form. (Lesson 5-3)

The Game Zone

A Place To Practice Your Math Skills



The Factor Fair

GET READY!

Players: two teams
Materials: 36 index cards, tape

GET SET!

- Number the index cards 1 through 36.
- Tape the index cards in order on the chalkboard.
- Divide the class into two teams.

GO!

- Team A chooses one of the index cards, such as the 8 card, and takes it off the chalkboard. Team A gets 8 points. Team B gets all the cards that are factors of 8 that have not yet been taken. The sum of the factors are the points they receive. For example, Team B would receive 1 + 2 + 4, or 7 points.

Team A	Team B
8	1 2 + 4 7

- Team B then chooses a card and gets those points.
- A team loses a turn if it selects an illegal number. A number is considered illegal if it does not have at least one factor available.
- Teams continue to take turns until there are no legal plays remaining.
- **Who Wins?** The team with the most points is the winner.

5-5 Fractions and Percents

What You'll LEARN

Write fractions as percents and percents as fractions.

NEW Vocabulary

ratio
percent

REVIEW Vocabulary

simplest form: a fraction whose numerator and denominator have a GCF of 1 (Lesson 5-3)

WHEN am I ever going to use this?

EDUCATION The table shows the results of a survey in which students were asked to choose methods that make learning new subjects more interesting.

1. Shade a 10×10 grid that represents the number of students that chose each method.
2. What fraction of the students chose the Internet as the method that makes learning more interesting?

Method	Number of Students
Internet	34 out of 100
Teacher	29 out of 100
TV Program	24 out of 100
Textbook	12 out of 100

Source: Opinion Research Corporation

A **ratio** is a comparison of two numbers by division. Ratios, like the ones above, can be written in several different ways.

$$34 \text{ out of } 100 \qquad 34{:}100 \qquad \frac{34}{100}$$

When a ratio compares a number to 100, it can be written as a **percent**.

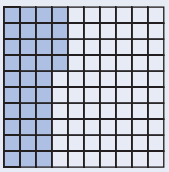
Noteables™ Key Concept: Percent

Words A percent is a ratio that compares a number to 100.

Symbols $\frac{n}{100} = n\%$

Ratio 34 to 100

Model

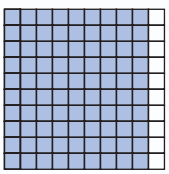


EXAMPLES Write Ratios as Percents

Write each ratio as a percent.

1 **Annie answered 90 out of 100 questions correctly.**

You can represent 90 out of 100 with a model.



$\frac{90}{100} = 90\%$

2 **On average, 50.5 out of 100 students own a pet.**

$\frac{50.5}{100} = 50.5\%$

Your Turn **Write each ratio as a percent.**

a. $\frac{45}{100}$ b. 19.2 out of 100 c. \$3.30:\$100

READING Math

Percent *Percent* means per *hundred* or *hundredths*. The symbol % means percent.

Fractions and percents are ratios that can represent the same number. You can write a fraction as a percent by finding an equivalent fraction with a denominator of 100.

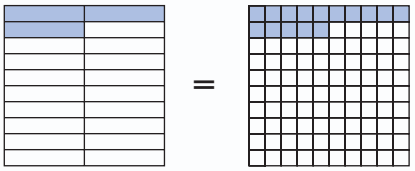
EXAMPLE 1 Write a Fraction as a Percent

Write $\frac{3}{20}$ as a percent.

Since 100 ÷ 20 = 5, . . . → $\frac{3}{20} = \frac{15}{100}$ (×5 above and below) . . . multiply the numerator and denominator by 5.

$\frac{15}{100} = 15\%$

So, $\frac{3}{20} = 15\%$.



$\frac{3}{20} = \frac{15}{100}$

Your Turn **Write each fraction as a percent.**

d. $\frac{17}{20}$ **e.** $\frac{3}{5}$ **f.** $\frac{2}{25}$

You can also use the meaning of percent to write percents as fractions.

EXAMPLE 2 Write a Percent as a Fraction

Write 48% as a fraction in simplest form.

$48\% = \frac{48}{100}$ Definition of percent

$= \frac{12}{25}$ Simplify.

Your Turn **Write each percent as a fraction.**

g. 40% **h.** 6% **i.** 24%

REAL-LIFE MATH

COINS Each new quarter has a diameter of 24.26 millimeters, a thickness of 1.75 millimeters, and weighs 5.670 grams.

Source: www.usmint.gov

EXAMPLE 3 Use Percent to Solve a Problem

COINS **The 50 State Quarters® Program allows the United States Mint to release a new quarter every ten weeks from 1999 through 2008 commemorating the 50 states. By the end of 2004, 30 state coins were released. What percent of the coins is this?**

By the end of 2004, 30 out of 50 state coins were released.

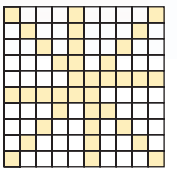
$\frac{30}{50} = \frac{60}{100}$ Write an equivalent fraction with a denominator of 100.

$= 60\%$ $\frac{60}{100} = 60\%$

So, 60% of the state coins were released by the end of 2004.

Skill and Concept Check

1. **Write** a fraction in simplest form and a percent to represent the shaded area at the right.



2. **OPEN ENDED** Draw a model that shows 25%.

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

$\frac{10}{100}$	1%	$\frac{1}{10}$	100 out of 1,000

GUIDED PRACTICE

Write each ratio as a percent.

4. $\frac{57}{100}$ 5. \$29.20 per \$100 6. 11 teams out of 100

Write each fraction as a percent.

7. $\frac{1}{4}$ 8. $\frac{6}{10}$ 9. $\frac{4}{5}$ 10. $\frac{17}{20}$

Write each percent as a fraction in simplest form.

11. 90% 12. 80% 13. 75% 14. 22%

15. **ELECTRICITY** Electrical power is measured in a unit called the watt. Write a percent that compares the amount of power given off by a 75-watt bulb to the power given off by a 100-watt bulb.

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
16–23	1, 2
24–35	3
39–50	4
36–38	5

Extra Practice
See pages 575, 600.

Write each ratio as a percent.

16. $\frac{87}{100}$ 17. $\frac{12.2}{100}$ 18. 42 per 100

19. $11\frac{2}{7}$ out of 100 20. $66\frac{2}{3}$:100 21. 99.9:100

22. Fifty-one out of every 100 households have at least one computer.

23. Twenty out of every 100 adults use the Internet to check on news, weather, and sports.

Write each fraction as a percent.

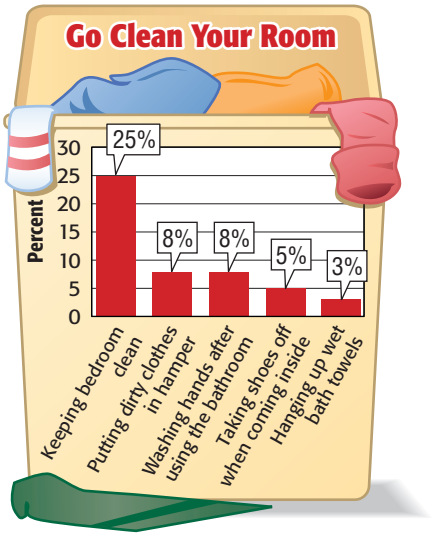
24. $\frac{7}{10}$ 25. $\frac{16}{20}$ 26. $\frac{15}{25}$ 27. $\frac{37}{50}$

28. $\frac{73}{100}$ 29. $\frac{13}{50}$ 30. $\frac{1}{5}$ 31. $\frac{19}{20}$

32. $\frac{3}{5}$ 33. $\frac{3}{25}$ 34. $\frac{10}{10}$ 35. $\frac{19}{25}$

36. **SPECIAL OLYMPICS** Mila and Randi are volunteers for their school district's Special Olympics competition. They are expecting 100 participants, but only 67 have registered so far. What percent of the Special Olympics participants still need to register before the competition begins?

CHORES **For Exercises 37 and 38, use the graphic. It shows the percent of chores that parents have to remind their children to do the most.**



Source: Opinion Research Corp. for The Soap and Detergent Association

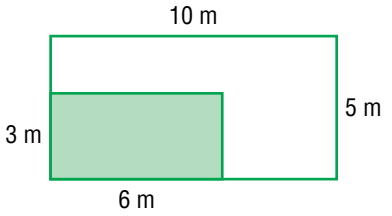
37. What fraction of parents remind their children to clean their rooms?

38. If 1,500 parents were surveyed, how many have to remind their children to put their dirty clothes in the hamper?

Write each percent as a fraction in simplest form.

39. 45%
40. 30%
41. 50%
42. 20%
43. 62%
44. 88%
45. 68%
46. 13%
47. 44%
48. 52%
49. 2%
50. 14%

51. **GEOMETRY** What percent of the larger rectangle at the right is shaded?



52. What percent of 100 is 1?

53. 17% of 100 is what number?

54. **CRITICAL THINKING** Kenneth and Rico both finished a 1-minute typing test on the computer. Kenneth misspelled one word and received a score of 96% correct. Rico also misspelled one word but received a score of 90% correct. Explain why both students received different scores with only one misspelled word.

Spiral Review with Standardized Test Practice

55. **MULTIPLE CHOICE** Find the ratio that represents 20%.

(A) $\frac{20}{100}$ (B) 2:10

(C) 200 per 1,000 (D) all of the above

56. **SHORT RESPONSE** Write a percent for a $7.50 donation from a $100 check.

Write each repeating decimal using bar notation. (Lesson 5-4)

57. 0.6555…
58. 4.232323…
59. 0.414141…

60. **MUSIC** In a survey, 12 of the 78 people preferred classical music. Write this ratio as a fraction in simplest form. (Lesson 5-3)

GETTING READY FOR THE NEXT LESSON

BASIC SKILL **Multiply or divide.**

61. 16.2×10
62. 0.71×100
63. $14.4 \div 100$
64. $791 \div 1{,}000$

5-6 Percents and Decimals

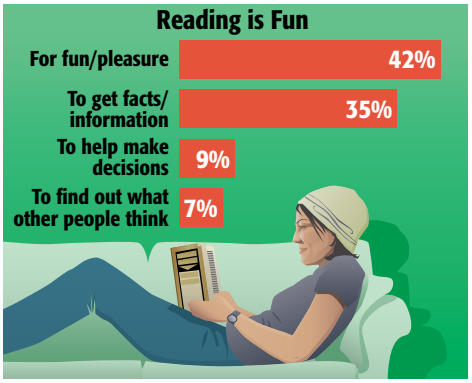
What You'll LEARN

Write percents as decimals and decimals as percents.

WHEN am I ever going to use this?

READING The graphic shows the reasons that students in 6th through 12th grades read.

1. Write the percent of students who read for fun as a fraction.
2. Write the fraction as a decimal.



Source: National Education Association, *American Demographics*

In Lesson 5-4, you learned that any fraction can be written as a decimal. You can use this fact to write percents as decimals.

EXAMPLES Write Percents as Decimals

1 **GEOGRAPHY** **Alaska is the largest state, making up more than 16% of the land area of the United States. Write 16% as a decimal.**

$16\% = \frac{16}{100}$ Write the percent as a fraction.

$= 0.16$ Write the fraction as a decimal.

So, $16\% = 0.16$.

2 **Write 85.3% as a decimal.**

$85.3\% = \frac{85.3}{100}$ Write the percent as a fraction.

$= \frac{85.3 \times 10}{100 \times 10}$ Multiply by 10 to remove the decimal in the numerator.

$= \frac{853}{1{,}000}$ Simplify.

$= 0.853$ Write the fraction as a decimal.

So, $85.3\% = 0.853$.

Study the pattern in the percents and the equivalent decimals in Examples 1 and 2. Notice that you can write the percent as a decimal by dividing the number by 100 and removing the percent symbol.

Noteables™ Key Concept: Write Percents as Decimals

Words To write a percent as a decimal, divide the percent by 100 and remove the percent symbol.

Symbols $25\% = \underset{\sim}{25} = 0.25$

EXAMPLES Write Percents as Decimals

3 **Write 23% as a decimal.**

$23\% = \underset{\sim}{23}$ Divide by 100.

$= 0.23$ Remove the %.

So, $23\% = 0.23$.

4 **Write $3\frac{1}{4}\%$ as a decimal.**

$3\frac{1}{4}\% = 3.25\%$ Write $\frac{1}{4}$ as 0.25.

$= \underset{\sim}{03.25}$ Divide by 100.

$= 0.0325$ Remove the %.

So, $3\frac{1}{4}\% = 0.0325$.

Your Turn **Write each percent as a decimal.**

a. 76% b. 8.5% c. $92\frac{1}{2}\%$

REAL-LIFE MATH

GEOGRAPHY A large Antarctic iceberg can weigh 400 million tons, rise 10 stories above the surface of the water, and supply water for 3 million people for a year.

Source: www.chennaionline.com

You can also use fractions to help you write decimals as percents.

EXAMPLES Write Decimals as Percents

5 **GEOGRAPHY** **Nearly 0.02 of the world's fresh water comes from the Antarctic Icecap. Write 0.02 as a percent.**

$0.02 = \frac{2}{100}$ Definition of decimal

$= 2\%$ Definition of percent

So, $0.02 = 2\%$.

6 **Write 0.347 as a percent.**

$0.347 = \frac{347}{1{,}000}$ Definition of decimal

$= \frac{34.7}{100}$ Divide both numerator and denominator by 10.

$= 34.7\%$ Definition of percent

So, $0.347 = 34.7\%$.

Study the pattern in the decimals and the equivalent percents in Examples 5 and 6. Notice that you can write the decimal as a percent by multiplying the number by 100 and adding the percent symbol.

STUDY TIP

Mental Math

- To write a percent as a decimal, move the decimal point two places to the left.
- To write a decimal as a percent, move the decimal point two places to the right.

Noteables™ **Key Concept: Write Decimals as Percents**

Words To write a decimal as a percent, multiply the percent by 100 and add a percent symbol.

Symbols $0.58 = \underset{\sim}{0.58} = 58\%$

EXAMPLES Write Decimals as Percents

7 **Write 0.64 as a percent.**

$0.64 = \underset{\sim}{0.64}$ Multiply by 100.

$= 64\%$ Add the %.

So, $0.64 = 64\%$.

8 **Write 0.875 as a percent.**

$0.875 = \underset{\sim}{0.875}$ Multiply by 100.

$= 87.5\%$ Add the %.

So, $0.875 = 87.5\%$.

Skill and Concept Check

1. **OPEN ENDED** Choose a decimal. Then write it as a fraction in simplest form and as a percent.

2. **FIND THE ERROR** Jessica and Gregorio both wrote 0.881 as a percent. Who is correct? Explain.

Jessica	Gregorio
$0.881 = 0.881$	$0.881 = 000.881$
$= 88.1\%$	$= 0.00881\%$

GUIDED PRACTICE

Write each percent as a decimal.

3. 68%
4. 3%
5. 27.6%
6. $45\frac{1}{2}\%$

Write each decimal as a percent.

7. 0.56
8. 0.12
9. 0.08
10. 0.399

11. **GEOGRAPHY** Pennsylvania makes up 1.2% of the landmass of the United States. Write this percent as a decimal.

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
12–19, 34–37	1, 2, 3, 4
20–33	5, 6, 7, 8

Extra Practice
See pages 576, 600.

Write each percent as a decimal.

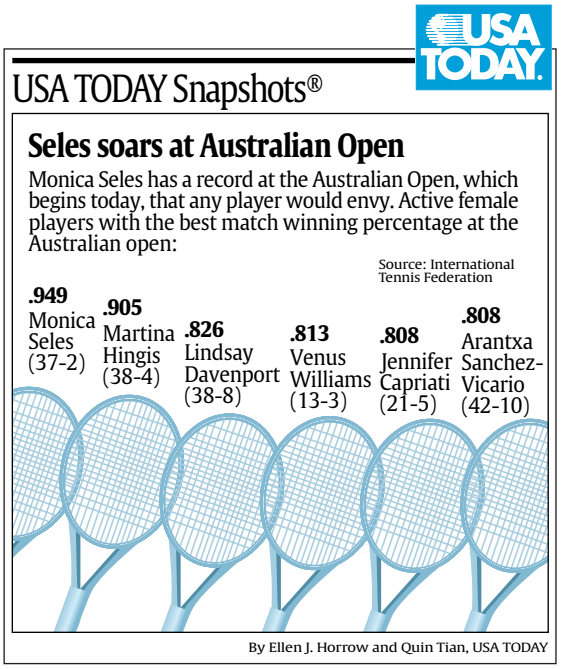
12. 27%
13. 70%
14. 6%
15. 1%
16. 18.5%
17. 2.2%
18. $15\frac{1}{2}\%$
19. $30\frac{1}{4}\%$

Write each decimal as a percent.

20. 0.95
21. 0.08
22. 0.17
23. 0.6
24. 0.675
25. 0.145
26. 0.012
27. 0.7025

TENNIS For Exercises 28–32, use the graphic at the right. Write each decimal as a percent for the following players.

28. Monica Seles
29. Martina Hingis
30. Venus Williams
31. Jennifer Capriati
32. Based on her winning percentage, which player wins 413 out of every 500 games played?



33. **BIRDS** Birds shown in a field guide are 0.10 to 0.67 their actual size. What percent of their actual size are they?

MODEL TRAINS **For Exercises 34–37, use the table at the right.**

Scale	Approximate Percent Equivalent
G	4.4%
O	2.083%
HO	1.15%
N	0.625%
Z	0.45%

Source: www. internettrains.com

34. The five scales at the right can be used to build a model train based on the life-size original. For example, a G-scale train is about 4% of the size of the original. So, the model of a 75-foot-long locomotive measures 40 inches. Find the decimal equivalents for each scale.
35. Which scale is the smallest?
36. Find the approximate length of a 75-foot train in the N scale.
37. Name the scale used when a model of a 75-foot train measures approximately 18.75 inches.

CRITICAL THINKING **For Exercises 38–43, choose the greater number in each pair.**

38. $1\frac{1}{4}\%$, 0.125
39. 0.76, 76.5%
40. 42%, 4.2
41. 99%, 0.985
42. $\frac{13}{40}$, 0.30
43. 0.56, $\frac{45}{80}$

Spiral Review with Standardized Test Practice

44. **MULTIPLE CHOICE** Which is 0.08 written as a percent?

(A) 0.08% (B) 0.8% (C) 8% (D) 80%

45. **MULTIPLE CHOICE** Which is 96.3% written as a decimal?

(F) 0.0963 (G) 0.963 (H) 9.63 (I) 963

46. **GRID IN** Write $78\frac{1}{2}\%$ as a decimal.

Write each ratio as a percent. (Lesson 5-5)

47. $\frac{72}{100}$
48. 90.9:100
49. 18 per 100
50. 23.1 out of 100

51. Write $9\frac{3}{8}$ as a decimal. (Lesson 5-4)

52. **BALLOONS** Write an integer to represent a hot-air balloon descending 83 feet. (Lesson 3-1)

TESTS **For Exercises 53 and 54, use the stem-and-leaf plot of Chapter 5 test scores at the right.**

Stem	Leaf
10	0
9	2 3 3 3 4 5 9
8	0 1 1 2 3 5 9 9
7	0 4 6 8 8 9
6	4

8 | 1 = 81 points

53. How many students took the test? (Lesson 2-5)
54. What was the median score? (Lesson 2-4)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Use exponents to write the prime factorization of each number.** (Lesson 5-1)

55. 50
56. 32
57. 76
58. 105

5-7 Least Common Multiple

What You'll LEARN

Find the least common multiple of two or more numbers.

NEW Vocabulary

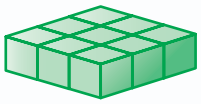
multiple
least common multiple (LCM)

HANDS-ON Mini Lab

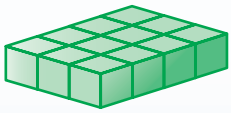
Materials
- centimeter cubes

Work with a partner.

Use 9 centimeter cubes to model the first floor of Building 1 and 12 centimeter cubes to model the first floor of Building 2, as shown.



Building 1



Building 2

1. Add a second floor to each building. Record the total number of cubes used in a table like the one shown below.

Number of Floors	1	2	3	4	5
Number of Cubes in Building 1	9	?	?	?	?
Number of Cubes in Building 2	12	?	?	?	?

2. Continue adding floors until each building has five floors. Record your results.
3. Describe two buildings that have the same number of cubes.
4. If you keep adding floors, will the two buildings have the same number of cubes again? Explain.

In the Mini Lab, you listed multiples of 9 and 12. A **multiple** is the product of a number and any whole number. The **least common multiple**, or **(LCM)**, of two or more numbers is the least of their common multiples, excluding zero. So, the LCM of 9 and 12 is 36.

You can use several strategies to find the LCM of two or more numbers.

EXAMPLE 1 Find the LCM by Listing Multiples

Find the LCM of 6 and 10.

First, list the multiples of 6 and 10.

multiples of 6: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, …

multiples of 10: 10, 20, 30, 40, 50, 60, 70, 80, …

Notice that 30, 60, …, are common multiples. So, the LCM of 6 and 10 is 30.

Your Turn **Find the LCM of each pair of numbers.**

a. 3, 12 b. 10, 12 c. 4, 5

You can also use prime factorization to find the LCM. The LCM is the smallest product that contains the prime factors of each number.

EXAMPLES Find the LCM Using Prime Factors

2 **Find the LCM of 24 and 36.**

Method 1 Write the prime factorization.

$24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3$

$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$

The prime factors of 24 and 36 are 2 and 3. Multiply the greatest power of both 2 and 3.

Method 2 Divide by prime numbers.

$$\begin{array}{r|rr} & 2 & 3 \\ \hline 3 & 6 & 9 \\ \hline 2 & 12 & 18 \\ \hline 2 & 24 & 36 \end{array}$$ ← Start here.

Start dividing by prime factors until both numbers cannot be divided by the same divisor. Then multiply the divisors and quotients to find the LCM.

The LCM of 24 and 36 is $2^3 \times 3^2$, or 72.

3 **Find the LCM of 4, 10, and 15.**

$4 = 2^2$

$10 = 2 \times 5$

$15 = 3 \times 5$

LCM: $2^2 \times 3 \times 5 = 60$

So, the LCM of 4, 10, and 15 is 60.

Your Turn **Find the LCM of each set of numbers.**

d. 9, 15 **e.** 10, 20, 30 **f.** 6, 17, 34

STUDY TIP

Choosing a Method
To find the LCM of two or more numbers, it is easier to:
- list factors for small numbers, and
- use prime factorization or division for large numbers.

Skill and Concept Check

1. **Writing Math** Describe the relationship between 12, 4, and 3 using the words *multiple* and *factor*.

2. **OPEN ENDED** Find three numbers that each have a multiple of 30.

3. **NUMBER SENSE** Determine whether the LCM for all pairs of odd numbers is *sometimes*, *always*, or *never* their product. Explain.

GUIDED PRACTICE

Find the LCM of each set of numbers.

4. 4, 10 5. 6, 7 6. 3, 5, 12

7. **PICNIC** Flavio is having a cookout for his class and serving hot dogs. Hot dogs come in packages of 10. Hot dog buns come in packages of 8. If Flavio wants to have the same number of hot dogs and buns, what is the least number of each that he will have to buy?

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
8–13, 20, 24	1, 2
14–19, 22–23	3

Extra Practice
See pages 576, 600.

Find the LCM of each set of numbers.

8. 6, 8
9. 12, 16
10. 30, 45
11. 8, 18
12. 11, 12
13. 45, 63
14. 2, 3, 5
15. 6, 8, 9
16. 8, 12, 16
17. 12, 15, 28
18. 22, 33, 44
19. 12, 16, 36

20. Find the LCM of 2×3^2 and $2^3 \times 3$.

21. **PATTERNS** Write a rule that describes the common multiples of 9 and 15 that are greater than 180.

PLANETS **For Exercises 22 and 23, use the following information and the table at the right.**

The nine planets in our solar system revolve around the Sun at different orbital speeds.

Planet	Orbital Speed (mi/s)
Earth	18
Mercury	30
Pluto	3

Source: infoplease.com

22. When will the number of miles revolved by Earth, Mercury, and Pluto be the same?
23. In how many seconds does Earth revolve the number of miles in Exercise 22? Mercury? Pluto?
24. **NUMBER THEORY** The LCM of two consecutive numbers is greater than 200 and is a multiple of 7. Name the numbers.
25. **CRITICAL THINKING** Two numbers have an LCM of $2^2 \times 3 \times 5^2$. Their GCF is 2×5. If one of the numbers is $2 \times 3 \times 5$, what is the other number?

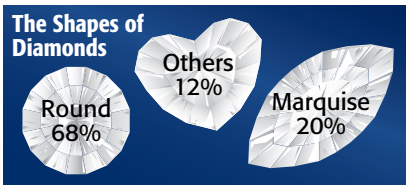
Spiral Review with Standardized Test Practice

26. **MULTIPLE CHOICE** Find the LCM of 27 and 30.

(A) 810 (B) 300 (C) 270 (D) 3

27. **SHORT RESPONSE** Presidents are elected every four years. Senators are elected every six years. If a senator was elected in the presidential election year 2000, in what year will she campaign again during a presidential election year?
28. Write 55.7% as a decimal to the nearest hundredth. (Lesson 5-6)

DIAMONDS **The graph shows the percent of diamond engagement rings that are different shapes. Write each percent as a fraction in simplest form.** (Lesson 5-5)



Source: Diamond Information Center

29. round
30. marquise
31. others

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Replace each ● with < or > to make a true sentence.** (Page 556)

32. 6.85 ● 5.68
33. 2.34 ● 2.43
34. 6.9 ● 5.99
35. 1.001 ● 1.1

5-8 Comparing and Ordering Rational Numbers

What You'll LEARN

Compare and order fractions, decimals, and percents.

NEW Vocabulary

common denominator
least common denominator (LCD)
rational numbers

WHEN am I ever going to use this?

SOFTBALL The table shows how Latanya and Patrick did during the first month of the softball season.

Player	At-bats	Hits
Latanya	12	7
Patrick	18	8

1. A batting average is the ratio of hits to at-bats. Write each player's batting average as a fraction.
2. Estimate which fraction is greater than $\frac{1}{2}$. Which is less than $\frac{1}{2}$?
3. Which player has the better batting average?

To compare and order fractions like the ones above, you can rewrite each fraction with a common denominator and then compare the numerators.

A **common denominator** is a common multiple of the denominators of two or more fractions. The **least common denominator (LCD)** is the LCM of the denominators.

EXAMPLE 1 Compare Fractions

Who has the better batting average, Latanya or Patrick?

Method 1 Rename using the LCD. Then compare numerators.

Latanya: $\frac{7}{12} = \frac{7 \times 3}{12 \times 3} = \frac{21}{36}$

Patrick: $\frac{8}{18} = \frac{8 \times 2}{18 \times 2} = \frac{16}{36}$

The LCD is 36.

Since $\frac{21}{36} > \frac{16}{36}$, then $\frac{7}{12} > \frac{8}{18}$. Latanya has the better average.

Method 2 Write each fraction as a decimal. Then compare decimals.

Latanya: $\frac{7}{12} = 0.58\overline{3}$

Patrick: $\frac{8}{18} = 0.\overline{4}$

Since $0.58\overline{3} > 0.\overline{4}$, then $\frac{7}{12} > \frac{8}{18}$. Latanya has the better average.

Your Turn **Replace each ● with <, >, or = to make a true sentence.**

a. $\frac{5}{6} \bullet \frac{7}{9}$ b. $\frac{1}{5} \bullet \frac{7}{50}$ c. $\frac{9}{16} \bullet \frac{7}{10}$

EXAMPLE 2 Compare Ratios

MOUNTAIN BIKING **In Coach Ito's first period class, 19 out of 32 students owned a mountain bike. In his seventh period class, 16 out of 28 students owned a mountain bike. Did a greater fraction of students own a mountain bike in the first period class or the seventh period class?**

Estimate Both fractions are slightly greater than $\frac{1}{2}$.

Since the denominators are large, write $\frac{19}{32}$ and $\frac{16}{28}$ as decimals and then compare.

$19 \div 32 \approx 0.5938$ $\quad 16 \div 28 \approx 0.5714$ Use a calculator.

Since $0.5938 > 0.5714$, then $\frac{19}{32} > \frac{16}{28}$. So, a greater fraction of students in the first period class owned a mountain bike.

REAL-LIFE MATH

MOUNTAIN BIKING More than 7.5 million people participate in off-road mountain biking each year.

Source: National Sporting Goods Association

Some fractions, decimals, and percents are used more frequently than others. So, it is a good idea to be familiar with these common fraction-decimal-percent equivalents.

Concept Summary **Fraction-Decimal-Percent Equivalents**

$\frac{1}{5} = 0.2 = 20\%$	$\frac{1}{10} = 0.1 = 10\%$	$\frac{1}{4} = 0.25 = 25\%$
$\frac{2}{5} = 0.4 = 40\%$	$\frac{3}{10} = 0.3 = 30\%$	$\frac{1}{2} = 0.5 = 50\%$
$\frac{3}{5} = 0.6 = 60\%$	$\frac{7}{10} = 0.7 = 70\%$	$\frac{3}{4} = 0.75 = 75\%$
$\frac{4}{5} = 0.8 = 80\%$	$\frac{9}{10} = 0.9 = 90\%$	

EXAMPLE 3 Order Ratios

Order 0.6, 48%, and $\frac{1}{2}$ from least to greatest.

Use estimation to find that 48% is the least. Then, compare $\frac{1}{2}$ and 0.6 using decimals.

$\frac{1}{2} = 0.5$ and $0.5 < 0.6$ $\quad$ So, $48\% < \frac{1}{2} < 0.6$.

Check You can change 48% and 0.6 to fractions, then compare all three fractions using the LCD.

$0.6 = \frac{60}{100}$ $\quad 48\% = \frac{48}{100}$ $\quad \frac{1}{2} = \frac{50}{100}$

Since $\frac{48}{100} < \frac{50}{100} < \frac{60}{100}$, $48\% < \frac{1}{2} < 0.6$.

Your Turn **Order each set of ratios from least to greatest.**

d. 22%, 0.3, $\frac{2}{10}$ $\quad$ **e.** $\frac{1}{5}$, 2%, 0.18 $\quad$ **f.** 0.74, $\frac{3}{4}$, 70%

CONTENTS

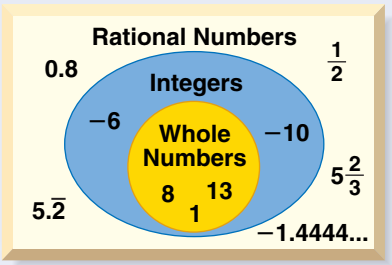
Fractions, terminating and repeating decimals, and integers are called **rational numbers** because they can be written as fractions.

Noteables™ — Key Concept: Rational Numbers

Words Rational numbers are numbers that can be written as fractions.

Symbols $\frac{a}{b}$, where a and b are integers and $b \neq 0$

Model



Standardized Test Practice

EXAMPLE 1 Identify Rational Numbers

MULTIPLE-CHOICE TEST ITEM

Find the number that is *not* rational.

(A) -8 (B) $0.0\overline{9}$ (C) $\frac{3}{2}$ (D) 2.010010001…

Read the Test Item To find the number that is not rational, identify three rational numbers.

Solve the Test Item -8, $0.0\overline{9}$, and $\frac{3}{2}$ can be expressed as fractions. So, 2.010010001… is not rational, and the answer is D.

Test-Taking Tip

Eliminate Possibilities
Eliminate the possibilities that you know are incorrect. Then consider the choices that are left.

Skill and Concept Check

1. **OPEN ENDED** Write two fractions whose LCD is 30.

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

9 out of 15	0.06	60%	$\frac{3}{5}$

GUIDED PRACTICE

Find the LCD for each pair of fractions.

3. $\frac{4}{5}, \frac{3}{9}$

4. $\frac{3}{8}, \frac{11}{32}$

Replace each ● with <, >, or = to make a true sentence.

5. $\frac{6}{15}$ ● $\frac{3}{8}$

6. $\frac{1}{6}$ ● $\frac{3}{18}$

7. $\frac{5}{4}$ ● $\frac{8}{7}$

8. $\frac{1}{8}$ ● 0.2

Order each set of ratios from least to greatest.

9. 60%, $\frac{31}{50}$, 0.59

10. $\frac{3}{20}$, 0.02, 16%

Determine whether each number is rational. Write *yes* or *no*.

11. $\frac{1}{11}$

12. 1.121121112…

Practice and Applications

HOMEWORK HELP

For Exercises	See Examples
13–30, 36, 51–53	1
31–35, 43, 50, 54–55	2
37–42	3
44–49	4

Extra Practice
See pages 576, 600.

Find the LCD for each pair of fractions.

13. $\frac{1}{4}, \frac{3}{10}$
14. $\frac{5}{6}, \frac{7}{15}$
15. $\frac{9}{14}, \frac{2}{5}$
16. $\frac{1}{6}, \frac{3}{8}$
17. $\frac{7}{12}, \frac{13}{36}$
18. $\frac{13}{17}, \frac{3}{4}$

Replace each ● with <, >, or = to make a true sentence.

19. $\frac{7}{10} \bullet \frac{2}{3}$
20. $\frac{5}{14} \bullet \frac{3}{7}$
21. $\frac{4}{7} \bullet \frac{5}{8}$
22. $\frac{2}{3} \bullet \frac{10}{15}$
23. $\frac{16}{20} \bullet \frac{40}{50}$
24. $\frac{11}{15} \bullet \frac{5}{9}$
25. $\frac{9}{13} \bullet \frac{14}{20}$
26. $\frac{17}{24} \bullet \frac{11}{12}$
27. $\frac{7}{5} \bullet \frac{14}{11}$
28. $2\frac{3}{4} \bullet 2\frac{2}{3}$
29. $-\frac{11}{16} \bullet -\frac{7}{8}$
30. $-\frac{3}{2} \bullet -1\frac{1}{2}$
31. $0.82 \bullet \frac{5}{6}$
32. $\frac{9}{20} \bullet 0.45$
33. $\frac{3}{5} \bullet 59\%$
34. $40\% \bullet \frac{11}{25}$

35. Which average is better for a soccer goalie: 3 saves out of 4 or 7 saves out of 11? Explain.

36. Order the fractions from greatest to least: $\frac{7}{8}, \frac{4}{5}, \frac{22}{25}$.

Order each set of ratios from least to greatest.

37. $0.23, 19\%, \frac{1}{5}$
38. $\frac{8}{10}, 81\%, 0.805$
39. $0.615, \frac{5}{8}, 62\%$
40. $0.4, \frac{1}{25}, 0.25$
41. $-0.49, -\frac{49}{50}, -0.5$
42. $-\frac{4}{7}, -44\%, -0.47$

43. **DARTS** Bianca and Christopher were playing darts. Bianca hit the bull's-eye 5 out of 18 times. Christopher missed the bull's-eye 4 out of 15 times. Who hit the bull's-eye a greater fraction of the time?

Determine whether each number is rational. Write *yes* or *no*.

44. $\frac{1}{9}$
45. 1.141141114…
46. 1.2345…
47. π
48. $-3\frac{4}{5}$
49. $5.\overline{23}$

50. **WEATHER** Refer to the table at the right that shows about how much rain falls in Albuquerque and Denver. Which city has the greater fraction of inches of rain per day? Explain.

City	Amount of Rain (in.)	Number of Days
Albuquerque, NM	9	60
Denver, CO	15	90

Source: www.weather.com

51. **BAKING** Ofelia needs $2\frac{3}{4}$ cups of water for a cake recipe. If her measuring cup only shows decimals in increments of tenths, how will Ofelia measure out the water for the recipe?

52. **MULTI STEP** Find one terminating decimal and one repeating decimal between $\frac{2}{3}$ and $\frac{3}{4}$.

53. **NUMBER SENSE** Is $1\frac{15}{16}$, $\frac{17}{8}$, or $\frac{63}{32}$ nearest to 2? Explain.

BASEBALL **For Exercises 54–56, use the following information and the table below.**
Mark McGwire of the St. Louis Cardinals and Sammy Sosa of the Chicago Cubs competed in a home run race during the 1998 baseball season.

Player	Games	At-bats	Home Runs
McGwire	155	509	70
Sosa	159	643	66

54. Write the ratio of home runs to games as a decimal for both players. Who had a better chance of hitting a home run during a game?

55. Write the ratio of home runs to at-bats as a decimal for both players. Who had a better chance of hitting a home run during an at-bat?

56. **WRITE A PROBLEM** In 2001, Barry Bonds of the San Francisco Giants set the single-season home run record. He had 476 at-bats and hit 73 home runs in 153 games. Use this information and the information in Exercises 54 and 55 to write and then solve a problem involving ratios.

Data Update Has anyone surpassed Bonds' single-season mark of 73 home runs? Visit msmath2.net/data_update to learn more.

57. **CRITICAL THINKING** How do you order fractions that have the same numerator? Explain.

Spiral Review with Standardized Test Practice

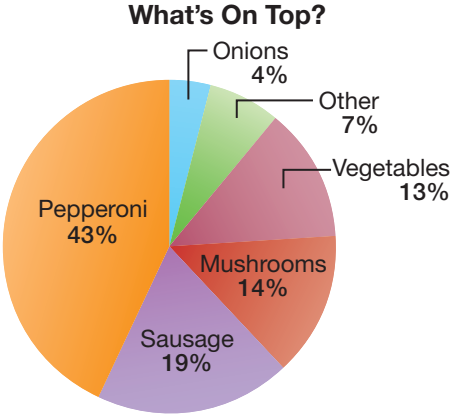
58. **MULTIPLE CHOICE** Find the least fraction.

(A) $\frac{3}{4}$ (B) $\frac{7}{9}$ (C) $\frac{13}{18}$ (D) $\frac{11}{15}$

59. **SHORT RESPONSE** Order the ratios from least to greatest: $47.\overline{4}$, $\frac{4}{7}$, $47\frac{2}{5}$, 47.41, 47%.

60. Find the LCM of 14 and 21. (Lesson 5-7)

FOOD The graph shows what percent of Americans chose the given pizza toppings as their favorite. Write the percent of people who chose each topping as a decimal. (Lesson 5-6)



Source: Market Facts for Bolla

61. onions

62. vegetables

63. mushrooms

64. **ALGEBRA** Translate the following sentence into an algebraic equation. *Four less than two times a number is 30.* (Lesson 4-1)

CHAPTER 5

Study Guide and Review

Vocabulary and Concept Check

bar notation (p. 211)
common denominator (p. 227)
composite number (p. 197)
equivalent fractions (p. 207)
factor tree (p. 198)
greatest common factor (GCF) (p. 203)
least common denominator (LCD) (p. 227)
least common multiple (LCM) (p. 224)
multiple (p. 224)
percent (p. 216)
prime factorization (p. 198)
prime number (p. 197)
ratio (p. 216)
rational numbers (p. 229)
repeating decimals (p. 211)
simplest form (p. 207)
terminating decimals (p. 211)
Venn diagram (p. 203)

Choose the letter of the term or number that best matches each phrase.

1. a common multiple of the denominators of two or more fractions
2. a fraction in which the GCF of the numerator and denominator is 1
3. a ratio that compares a number to 100
4. a whole number greater than 1 that has exactly two factors, 1 and itself
5. a comparison of two numbers by division

a. ratio
b. simplest form
c. common denominator
d. percent
e. prime number
f. multiple
g. bar notation

Lesson-by-Lesson Exercises and Examples

5-1 Prime Factorization (pp. 197–200)

Determine whether each number is *prime* or *composite*.

6. 45
7. 37
8. 91
9. 118

Find the prime factorization of each number.

10. 54
11. 128
12. 68
13. 95

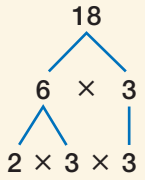
14. **ALGEBRA** Factor the expression $36x^2yz^3$.

Example 1 **Determine whether 21 is *prime* or *composite*.**

The number 21 has factors 1, 3, 7, and 21. So, 21 is a composite number.

Example 2 **Find the prime factorization of 18.**

Use a factor tree.



The prime factorization of 18 is 2×3^2.

5-2 Greatest Common Factor (pp. 203–206)

Find the GCF of each set of numbers.

15. 18, 27
16. 30, 72
17. 28, 70, 98
18. 42, 63, 105

Find the GCF of each set of algebraic expressions.

19. $18w, 54w^2y$
20. $21de^2, 35d^3e^3$

Example 3 **Find the GCF of 24 and 56.**

First, make a list of all of the factors of 24 and 56.

factors of 24: 1, 2, 3, 4, 6, 8, 12, 24
factors of 56: 1, 2, 4, 7, 8, 14, 28, 56
common factors: 1, 2, 4, 8

The GCF of 24 and 56 is 8.

5-3 Simplifying Fractions (pp. 207–209)

Write each fraction in simplest form.

21. $\frac{12}{15}$
22. $\frac{35}{60}$
23. $\frac{11}{121}$
24. $\frac{14}{63}$
25. $\frac{37}{45}$
26. $\frac{55}{110}$

27. **LIFE SCIENCE** The human body has 60,000 miles of blood vessels. The distance across the United States from east to west is 3,000 miles. Write a fraction in simplest form that compares the distance across the United States to the miles of blood vessels.

Example 4 **Write $\frac{24}{32}$ in simplest form.**

Find the GCF of the numerator and denominator.

$24 = 2 \times 2 \times 2 \times 3$
$32 = 2 \times 2 \times 2 \times 2 \times 2$

GCF: $2 \times 2 \times 2 = 8$

$\frac{24}{32} = \frac{24 \div 8}{32 \div 8} = \frac{3}{4}$ Divide the numerator and denominator by the GCF.

So, $\frac{24}{32}$ in simplest form is $\frac{3}{4}$.

5-4 Fractions and Decimals (pp. 210–213)

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

28. $\frac{3}{4}$
29. $\frac{7}{8}$
30. $\frac{5}{9}$
31. $4\frac{1}{3}$
32. $6\frac{2}{5}$
33. $1\frac{6}{7}$

Write each decimal as a fraction in simplest form.

34. 0.7
35. 0.44
36. 0.05
37. 0.18
38. 0.54
39. 0.08

Example 5 **Write $\frac{3}{8}$ as a decimal.**

$$\begin{array}{r} 0.375 \\ 8\overline{)3.000} \\ \underline{24} \\ 60 \\ \underline{56} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

So, $\frac{3}{8} = 0.375$.

Example 6 **Write 0.64 as a fraction in simplest form.**

$0.64 = \frac{64}{100}$ Write as a fraction with a denominator of 100.

$= \frac{16}{25}$ Simplify.

Mixed Problem Solving
For mixed problem-solving practice, see page 600.

5-5 Fractions and Percents (pp. 216–219)

Write each fraction as a percent.

40. $\frac{32}{100}$ **41.** $\frac{11}{25}$ **42.** $\frac{47}{50}$ **43.** $\frac{8}{20}$

Write each percent as a fraction in simplest form.

44. 68% **45.** 95% **46.** 42% **47.** 16%

48. FOOD A recent survey showed that 58% of school children chose peanut butter and jelly sandwiches as their favorite lunch food. Write this percent as a fraction in simplest form.

Example 7 **Write $\frac{27}{50}$ as a percent.**

$\frac{27}{50} = \frac{54}{100}$ Write an equivalent fraction with a denominator of 100.

$= 54\%$ Definition of percent

Example 8 **Write 96% as a fraction in simplest form.**

$96\% = \frac{96}{100}$ Definition of percent

$= \frac{24}{25}$ Simplify.

5-6 Percents and Decimals (pp. 220–223)

Write each percent as a decimal.

49. 48% **50.** 7% **51.** 12.5% **52.** $75\frac{1}{4}\%$

Write each decimal as a percent.

53. 0.61 **54.** 0.055 **55.** 0.19 **56.** 0.999

57. WEATHER Twenty-three percent of the days last month were rainy. Write this percent as a decimal.

Example 9 **Write 35% as a decimal.**

$35\% = \frac{35}{100}$ Write the percent as a fraction.

$= 0.35$ Write the fraction as a decimal.

Example 10 **Write 0.625 as a percent.**

$0.625 = 0.625$ Multiply by 100.

$= 62.5\%$ Add the %.

5-7 Least Common Multiple (pp. 224–226)

Find the LCM of each set of numbers.

58. 9, 15 **59.** 4, 8

60. 16, 24 **61.** 3, 8, 12

62. 4, 9, 12 **63.** 15, 24, 30

Example 11 **Find the LCM of 8 and 36.**

Write each prime factorization.

$8 = 2^3$ $36 = 2^2 \times 3^2$

LCM: $2^3 \times 3^2 = 72$

The LCM of 8 and 36 is 72.

5-8 Comparing and Ordering Rational Numbers (pp. 227–231)

Replace each ● with <, >, or = to make a true sentence.

64. $\frac{3}{8}$ ● $\frac{2}{3}$ **65.** 0.45 ● $\frac{9}{20}$

66. $\frac{8}{9}$ ● 85% **67.** $3\frac{3}{4}$ ● $3\frac{5}{8}$

68. 72% ● $\frac{8}{11}$ **69.** $\frac{5}{7}$ ● $\frac{60}{84}$

Example 12 **Replace ● with <, >, or = to make $\frac{3}{5}$ ● $\frac{5}{8}$ a true sentence.**

Find equivalent fractions. The LCD is 40.

$\frac{3}{5} = \frac{3 \times 8}{5 \times 8} = \frac{24}{40}$ $\frac{5}{8} = \frac{5 \times 5}{8 \times 5} = \frac{25}{40}$

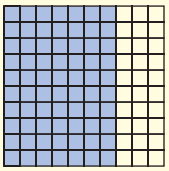
Since $\frac{24}{40} < \frac{25}{40}$, then $\frac{3}{5} < \frac{5}{8}$.

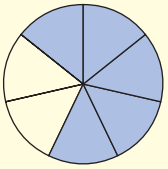
CHAPTER 5

Practice Test

Vocabulary and Concepts

1. Which of the models shown at the right represents a greater fraction?





2. **Explain** how to write a percent as a decimal.

Skills and Applications

3. Find the prime factorization of 72.

4. Find the GCF of 24 and 40.

Write each fraction in simplest form.

5. $\frac{24}{60}$

6. $\frac{64}{72}$

Write each fraction, mixed number, or percent as a decimal. Use bar notation if the decimal is a repeating decimal.

7. $\frac{7}{9}$

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

9. 91%

Write each decimal or percent as a fraction in simplest form.

10. 0.84

11. 0.006

12. 34%

Write each fraction or decimal as a percent.

13. $\frac{15}{25}$

14. 0.26

15. 0.135

16. **PAINTING** Suppose you are painting a wall that measures 10 feet by 10 feet. You have already painted 46 square feet. Write a percent for the portion of the wall that remains unpainted.

Replace each ● with $<$, $>$, or $=$ to make a true sentence.

17. $\frac{3}{5}$ ● $\frac{5}{9}$

18. $\frac{7}{12}$ ● $\frac{6}{8}$

19. $\frac{13}{20}$ ● 65%

Standardized Test Practice

20. **MULTIPLE CHOICE** One type of cicada emerges from hibernation every 17 years. Another type emerges every 13 years. If both types come out of hibernation one year, in how many years would this happen again?

(A) 30 yr (B) 68 yr (C) 120 yr (D) 221 yr

CHAPTER 5

Standardized Test Practice

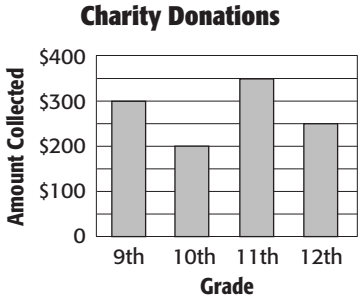
PART 1 Multiple Choice

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

1. Which number is divisible by 2, 3, 5, 6, 9, and 10? (Prerequisite Skill, p. 554)

   (A) 90 (B) 120
   (C) 150 (D) 200

2. Students at Lincoln High School have collected money this year for charity. According to the graph, how much did all four classes collect this year? (Lesson 1-1)



   (F) $950 (G) $1,000
   (H) $1,050 (I) $1,100

3. Which expression is the same as k^6? (Lesson 1-2)

   (A) $k + k + k + k + k + k$
   (B) $6k$
   (C) $k^3 + k^3$
   (D) $k \times k \times k \times k \times k \times k$

TEST-TAKING TIP

Question 2 When an item includes a graph, scan the graph to see what kind of information it includes and how the information is organized. Read each answer choice and compare it with the graph to see if the information in the answer choice is correct. Eliminate any wrong answer choices.

4. Which sentence shows the Commutative Property of Multiplication? (Lesson 1-6)

   (F) $f \cdot (g \cdot h) = (f \cdot g) \cdot h$
   (G) $q \cdot (r + s) = q \cdot r + q \cdot s$
   (H) $x \cdot y = y \cdot x$
   (I) $a + b = b + a$

5. In which quadrant is $(-5, -3)$ located? (Lesson 3-3)

   (A) quadrant I (B) quadrant II
   (C) quadrant III (D) quadrant IV

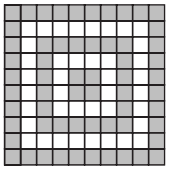
6. Write an addition sentence modeled by the number line. (Lesson 3-4)

   (F) $-3 + 7 = 4$ (G) $3 + 4 = 7$
   (H) $-7 + 3 = -4$ (I) $3 + (-7) = -4$

7. Which of the ordered pairs is *not* a solution of $y = -3x + 7$? (Lesson 4-6)

   (A) $(-1, 10)$ (B) $(1, 4)$
   (C) $(2, 1)$ (D) $(3, 2)$

8. Find the percent that represents the shaded area. (Lesson 5-5)



   (F) 75% (G) 60%
   (H) 50% (I) 40%

9. Mrs. Benitez hired a contractor for a kitchen renovation project. The contractor renovated 60% of the kitchen the first week. What part of the project is left to do? (Lesson 5-6)

   (A) 0.04 (B) 0.4
   (C) 0.44 (D) 4.00

CONTENTS

PART 2 Short Response/Grid In

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

10. Find the eighth term in the following sequence. 1, 3, 7, 13, 21, … . (Lesson 1-7)

For Questions 11 and 12, use the information below.
The table gives monthly water-level readings of Snail Creek Lake over an 8-month period. The readings indicate the number of inches above or below flood level.

Month	J	F	M	A	M	J	J	A
Water Level	−8	−8	−6	−5	−2	−5	0	3

11. Find the median of the readings. (Lesson 3-2)

12. Find the range of readings. (Lesson 3-5)

13. The equation $4.5h + 75 = 165$, where h is the number of hours, describes how long Hannah must work to earn \$165. How many hours must she work to earn \$165? (Lesson 4-4)

14. Write an equation for the function shown in the table. (Lesson 4-6)

x	−1	0	1	2
y	3	1	−1	−3

15. Aaron invited 30 friends to a party, but only 22 of them were able to attend. What fraction of the friends could not attend? (Lesson 5-5)

16. A string of red, green, and blue lights blink at different rates. The red lights blink once every 4 seconds, the green lights blink once every 7 seconds, and the blue lights blink once every 9 seconds. How many seconds will go by between times when all three colors will blink at the same time? (Lesson 5-7)

17. Tino painted a mural on the side of his shed. He used $\frac{1}{7}$ can of yellow paint, $\frac{1}{4}$ can of red paint, and $\frac{2}{9}$ can of white paint. Of which color did he use the least? (Lesson 5-8)

PART 3 Extended Response

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

18. A soft drink company sells its beverages in packages of 12 and 24 plastic bottles. It added a package with 30 bottles. (Lessons 5-2 and 5-7)

- **a.** Suppose the company designed boxes so that all three packages have the same number of bottles in each row. What is the greatest number of bottles in each row?
- **b.** The time it takes to seal a package is equal to 1 second per bottle. If three assembly lines containing the 12, 24, and 30 packages begin at the same time, when is the first time that all three packages are sealed at the same time?

19. The table shows the number of students who volunteered at the food bank. (Lesson 5-8)

Classroom	Number of Students Volunteering	Total Number of Students
A	7	24
B	3	8
C	6	18

- **a.** Model each ratio of the number of students volunteering to the total number of students on grid paper.
- **b.** Which classroom had the greatest number of students volunteering?
- **c.** Which classroom had the greatest fraction of students volunteering?
- **d.** Write each ratio as a fraction in simplest form, as a decimal, and as a percent.