

Unit 2

Number Sense: Fractions

FOCUS

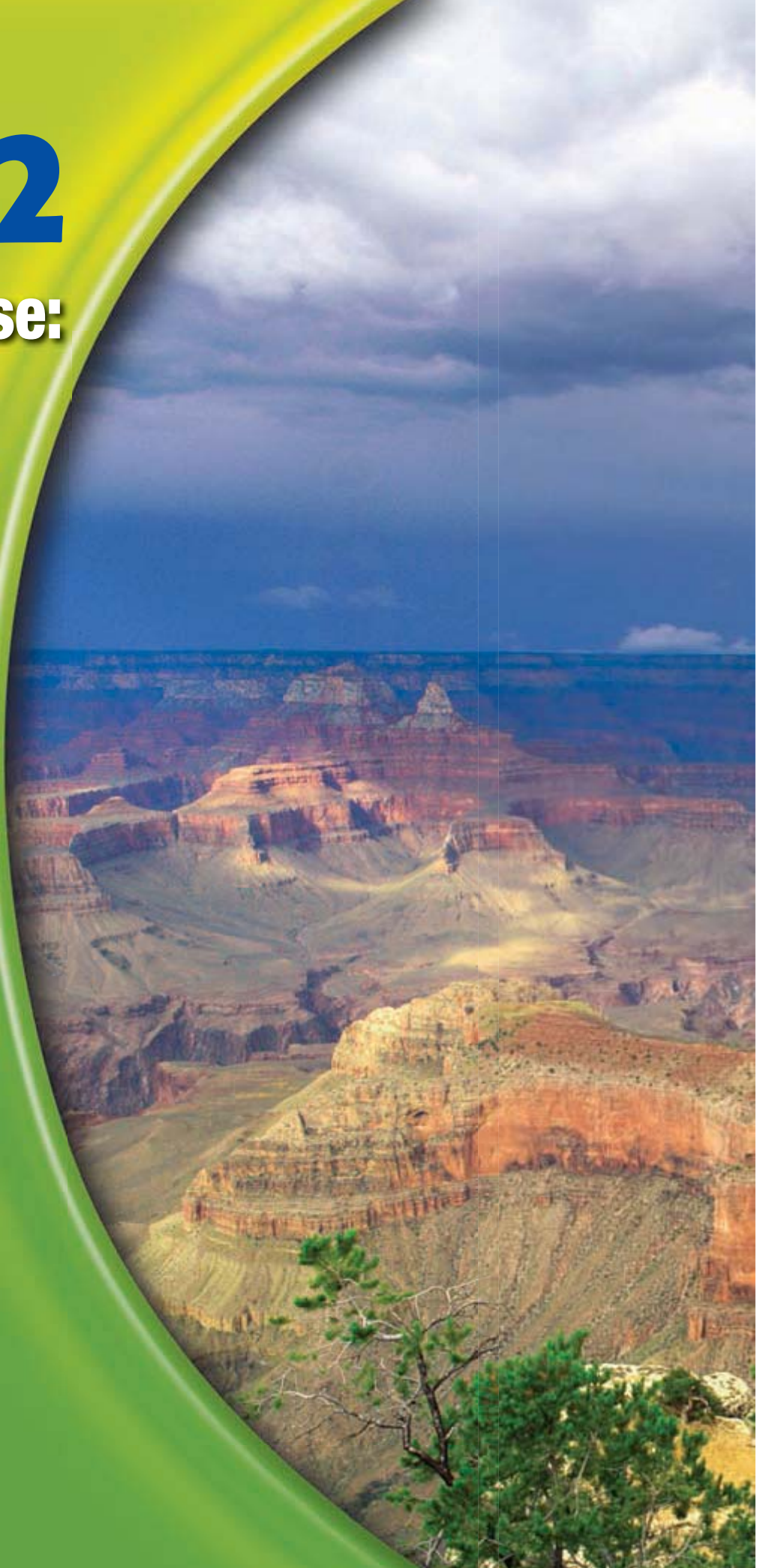
Represent and use numbers in a variety of equivalent forms and apply addition, subtraction, multiplication, and division of fractions.

CHAPTER 4 Fractions, Decimals, and Percents

BIG Idea Represent and use numbers in a variety of forms.

CHAPTER 5 Applying Fractions

BIG Idea Extend understandings of operations. Add, subtract, multiply, and divide to solve fraction problems.



Problem Solving in Geography



Real-World Unit Project

A Traveling We Will Go You're about to embark on a journey to your favorite vacation spot in the United States. In your role as a travel agent, you will plan a vacation for you and your family. You will calculate the total cost including transportation, lodging, and tourist attractions. So bring your sense of adventure and get ready to set off on your trip!

Math Online

Log on to glencoe.com to begin.



Fractions, Decimals, and Percents

BIG Idea

- Represent and use numbers in a variety of equivalent forms.

Key Vocabulary

equivalent fractions (p. 192)

percent (p. 202)

ratio (p. 202)

simplest form (p. 192)

Real-World Link

Reptiles North Carolina's state reptile is the Eastern Box Turtle. Adults range in size from $4\frac{1}{2}$ inches to $5\frac{9}{10}$ inches. You can write these fractions as 4.5 and 5.9, respectively.

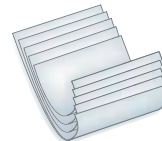
FOLDABLES[®] Study Organizer

Fractions, Decimals, and Percents Make this Foldable to help you organize your notes. Begin with five sheets of $8\frac{1}{2}'' \times 11''$ paper.

- 1 Stack** five sheets of paper $\frac{3}{4}$ inch apart.



- 2 Roll** up bottom edges so that all tabs are the same size.



- 3 Crease** and staple along the fold.



- 4 Write** the chapter title on the front. Label each tab with a lesson number and title.



GET READY for Chapter 4

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Online

Take the Online Readiness Quiz at glencoe.com.

Option 1

Take the Quick Quiz below. Refer to the Quick Review for help.

QUICK Quiz

State which decimal is greater. (Prior Grade)

1. 0.6, 0.61 2. 1.25, 1.52
3. 0.33, 0.13 4. 1.08, 10.8

5. **LUNCH** Kirsten spent \$4.21 on lunch while Almanzo spent \$4.12. Who spent the greater amount?

(Lesson 3-9)

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

6. 125 7. 78 8. 37

9. **MUFFINS** Without calculating, determine whether 51 banana nut muffins can be evenly distributed among 3 persons. Explain.

(Prior Grade)

Divide. (Prior Grade)

10. $12 \div 6$ 11. $18 \div 3$
12. $2 \div 5$ 13. $3 \div 4$

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

14. 2^3 15. 5^5
16. 7^2 17. 9^4

QUICK Review

Example 1

State which decimal is greater, 7.4 or 7.04.

7.4

7.04



7.4 is greater.

Line up the decimal points and compare place value. The 4 in the tenths place is greater than the 0 in the tenths place.

Example 2

Use divisibility rules to determine whether 84 is divisible by 2, 3, 5, 6, or 10.

- 2: Yes, the ones digit, 4, is divisible by 2.
3: Yes, the sum of the digits, 12, is divisible by 3.
5: No, the ones digit is neither 0 nor 5.
6: Yes, the number is divisible by both 2 and 3.
10: No, the ones digit is not 0.

Example 3

Find $1 \div 5$.

$$\begin{array}{r} 0.2 \\ 5 \overline{)1.0} \\ \underline{-10} \\ 0 \end{array}$$

Divide 1 by 5 until there is a remainder of 0 or a repeating pattern.

Example 4

Write 4^3 as a product of the same factor.

$$4^3 = 4 \times 4 \times 4$$

Explore 4-1

Math Lab Exploring Factors

MAIN IDEA

Discover factors of whole numbers.

The students in Mrs. Faccinto's homeroom have lockers numbered 1–30, located down a long hallway. One day the class did an experiment.

ACTIVITY

STEP 1 The first student, Student 1, walked down the hall and opened every locker.



STEP 2 Student 2 closed Locker 2 and every second locker after it.



STEP 3 Student 3 closed Locker 3 and changed the state of every third locker after it. This means that if the locker was open, Student 3 closed it; if the locker was closed, Student 3 opened it.



STEP 4 Student 4 changed the state of every fourth locker, starting with Locker 4. The student continued this pattern until all 30 students had a turn.

ANALYZE THE RESULTS

1. Which lockers were open after Student 30 took a turn? What do the numbers on the open lockers have in common?
2. Explain why the lockers you listed in Exercise 1 were open after Student 30 took a turn.
3. Suppose there were 100 lockers. Which lockers would be open after Student 100 took a turn?
4. **CHALLENGE** Which lockers were touched the greatest number of times?
5. What are the fewest lockers and students needed for 31 lockers to be open at the end of the experiment?

4-1

Prime Factorization

MAIN IDEA

Find the prime factorization of a composite number.

New Vocabulary

prime number
composite number
prime factorization
factor tree

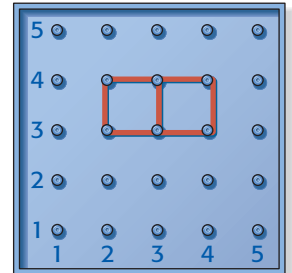
Math Online

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- Concepts In Motion
- Extra Examples
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- Self-Check Quiz

MINI Lab

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



1. Using your geoboard, make as many different rectangles as possible containing 3, 4, 5, 6, 7, 8, 9, and 10 squares.
2. Which numbers of squares can be made into only one rectangle? Into more than one rectangle?

The rectangles in the Mini Lab illustrate prime and 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.

CHECK Your Progress

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

a. 11

b. 15

c. 24

Review Vocabulary

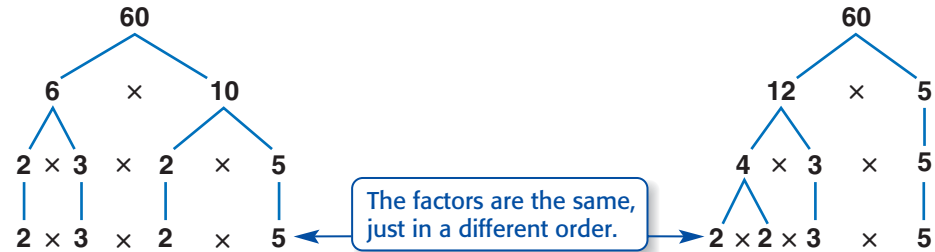
factor two or more numbers that are multiplied together to form a product; *Example:* 2 and 3 are factors of 6.
 (Lesson 1-2)



Every composite number can be written as a product of prime numbers. This product is the **prime factorization** of the number. You can use a **factor tree** to find the prime factorization. The following two factor trees show the prime factorization of 60.

Study Tip

Factors You can also choose any other pair of whole-number factors of 60 such as 3×20 or 4×15 .



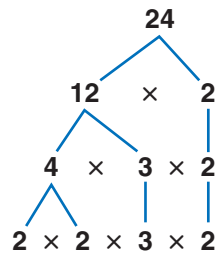
The prime factorization of 60 is $2 \times 2 \times 3 \times 5$, or $2^2 \times 3 \times 5$.

EXAMPLE Find the Prime Factorization

3 Find the prime factorization of 24.

METHOD 1

Use a factor tree.



METHOD 2

Divide by prime numbers.

$$\begin{array}{r} 2 \overline{)24} \\ \underline{2} \\ 2 \\ 2 \overline{)12} \\ \underline{2} \\ 6 \\ 2 \overline{)6} \\ \underline{2} \\ 3 \end{array}$$

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



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

✓ CHOOSE Your Method

Find the prime factorization.

d. 18

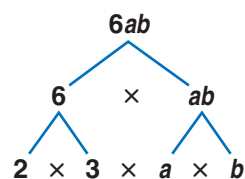
e. 28

f. 16

Algebraic expressions like $6ab$ can also be factored as the product of prime numbers and variables.

EXAMPLE Factor an Algebraic Expression

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



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

✓ CHECK Your Progress

g. **ALGEBRA** Factor $18xy$.



CONTESTS For Exercises 42 and 43, use the following information.

Sandcastle Day at Cannon Beach, Oregon, is one of the largest sandcastle contests on the west coast. Entrants from each age division are given lots measuring 81 square feet, 225 square feet, or 441 square feet, on which to build their castles.



42. Find the prime factorization of 81, 225, and 441.

EXTRA PRACTICE

See pages 676, 707.

43. Use the prime factors to determine two possible dimensions for each plot.

H.O.T. Problems

44. **RESEARCH** Use the Internet or another source to make a Sieve of Eratosthenes to determine the prime numbers up to 100.

45. **CHALLENGE** This whole number is between 30 and 40. It has only two prime factors whose sum is 5. What is the number?

46. **OPEN ENDED** 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.

47. **WRITING IN MATH** Suppose n represents a whole number. Is $2n$ prime or composite? Explain.

TEST PRACTICE

48. Which number is a prime factor of both 63 and 140?

- A 2 C 5
B 3 D 7

49. Which of the following numbers is *not* a prime number?

- F 2 H 16
G 11 J 31

Spiral Review

50. **ALGEBRA** Graph $y = 3x$. (Lesson 3-7)

51. **MEASUREMENT** Find the perimeter and area of a rectangle with a length of 13 feet and width of 5 feet. (Lesson 3-6)

Add. (Lesson 2-4)

52. $6 + (-4)$

53. $-13 + 9$

54. $25 + (-26)$

55. $-5 + 5$

▶ GET READY for the Next Lesson

PREREQUISITE SKILL State whether each number is divisible by 2, 3, 5, 6, 9, or 10. (Page 668)

56. 24

57. 70

58. 120

59. 99

READING TO SOLVE PROBLEMS

Everyday Meaning

The key to understanding word problems is to understand the meaning of the mathematical terms in the problem. Many words used in mathematics are also used in everyday language.

For example, you will use the terms *factor* and *multiple* in this chapter. Here are two sentences that show their everyday meanings.

- Weather was a *factor* in their decision to postpone the picnic.
- The star quarterback won *multiple* post-season awards.

The table below shows how the everyday meaning is connected to the mathematical meaning.



Term	Everyday Meaning	Mathematical Meaning	Connection
factor from the Latin <i>factor</i> , meaning doer	something that actively contributes to a decision or result	2 and 3 are <i>factors</i> of 6.	A <i>factor</i> helps to make a decision, and in mathematics, factors “make up” a product.
multiple from the Latin <i>multi-</i> , meaning many, and <i>plex</i> , meaning fold	consisting of more than one or shared by many	The <i>multiples</i> of 2 are 0, 2, 4, 6,	<i>Multiple</i> means many, and in mathematics, a number has infinitely many multiples.

PRACTICE

1. Make a list of other words that have the prefixes *fact-* or *multi-*. Determine what the words in each list have in common.
2. **WRITING IN MATH** Write your own rule for remembering the difference between *factor* and *multiple*.

RESEARCH Use a dictionary to find the everyday meanings of *least*, *greatest*, and *common*. Then use the definitions to determine how to find each number. Do not solve.

3. the greatest common factor of 10 and 15
4. the least common multiple of 2 and 3.

MAIN IDEA

Find the greatest common factor of two or more numbers.

New Vocabulary

Venn diagram
greatest common factor (GCF)

Math Online

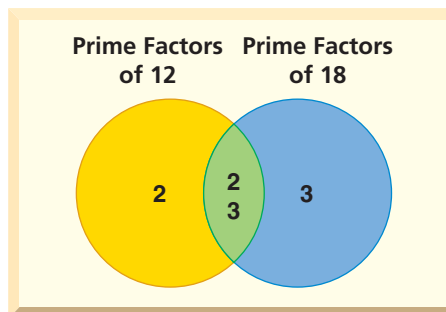
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- Reading in the Content Area

▶ GET READY for the Lesson

VENN DIAGRAM The Venn diagram shows the prime factors of 12 and 18.

1. Which factors are in the overlapping section? What does this mean?
2. Is the product of 2 and 3 also a factor of 12 and 18?
3. Make a Venn diagram showing the prime factors of 12 and 20. Identify the common factors and find their product.



As shown above, **Venn diagrams** use overlapping circles to show how common elements among sets of numbers or objects are related. They can also show common factors. The greatest of the common factors of two or more numbers is the **greatest common factor, or GCF**.

EXAMPLE Find the Greatest Common Factor

- 1** Find the GCF of 18 and 48.

METHOD 1 List the factors of the numbers.

factors of 18: 1, 2, 3, 6, 9, 18

factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

List the factors of 18 and 48.

The common factors of 18 and 48 are 1, 2, 3, and 6.

So, the greatest common factor or GCF is 6.

METHOD 2 Use prime factorization.

Write the prime factorization. Circle the common prime factors.

$$18 = 2 \times 3 \times 3$$

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

Write the prime factorizations of 18 and 48.

The greatest common factor or GCF is 2×3 or 6.

✓ CHOOSE Your Method

Find the GCF of each pair of numbers.

a. 8, 10

b. 6, 12

c. 10, 17

Reading Math

Greatest Common Factor

The greatest common factor is also called the *greatest common divisor* because it is the greatest number that divides evenly into the given numbers.

EXAMPLE Find the GCF of Three Numbers

- 2 Find the GCF of 12, 24, and 60.

Write the prime factorization. Circle the common prime factors.

$$\begin{aligned} 12 &= 2 \times 2 \times 3 \\ 24 &= 2 \times 2 \times 2 \times 3 \\ 60 &= 2 \times 2 \times 3 \times 5 \end{aligned}$$

Write the prime factorization of 12, 24, and 60.

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

CHECK Your Progress

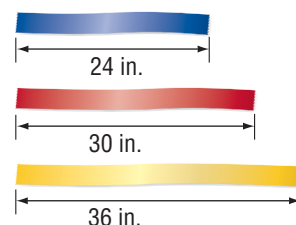
Find the GCF of each set of numbers.

d. 30, 45, 75

e. 42, 70, 84

Real-World EXAMPLES

- 3 **SCHOOL SPIRIT** The cheerleaders are making spirit ribbons. Blue ribbon comes in a 24 inch spool, red ribbon comes in a 30 inch spool, and gold ribbon comes in a 36 inch spool. The cheerleaders want to cut strips of equal length and use the entire spool of each ribbon. What is the length of the longest piece of ribbon that can be cut from each spool?



The length of the longest ribbon that can be cut from each spool is the GCF of the three lengths.

$$\begin{aligned} 24 &= 2 \times 2 \times 2 \times 3 \\ 30 &= 2 \times 3 \times 5 \\ 36 &= 2 \times 2 \times 3 \times 3 \end{aligned}$$

Write the prime factorization of 24, 30, and 36.

The GCF of 24, 30, and 36 is 2×3 or 6. So, the ribbons should be 6 inches long.

- 4 How many spirit ribbons can be made if the ribbons are cut into 6-inch pieces?

There is a total of $24 + 30 + 36$, or 90 inches of ribbon. So, $90 \div 6$, or 15 spirit ribbons can be made.

Study Tip

Prime Numbers
The GCF of a group of prime numbers is 1.

CHECK Your Progress

- f. **CARPENTRY** Mr. Glover wants to make shelves for his garage using an 18-foot board and a 36-foot board. He will cut the boards to make shelves of the same length and wants to use all of both boards. Find the longest possible length of each shelf. How many shelves can he make?



CHECK Your Understanding

Examples 1, 2
(pp. 186–187)

Find the GCF of each set of numbers.

1. 18, 30
2. 45, 60
3. 20, 50
4. 6, 8, 12
5. 8, 20, 40
6. 18, 42, 60

JOBS For Exercises 7 and 8, use the following information.

A store manager wants to display the inventory of three styles of bicycle helmets in rows with the same number of each style in each row.

Bike Helmets	
Style	Inventory
Sport	36
Road	72
Mountain	45

Examples 3, 4
(p. 187)

7. Find the greatest number of helmets that can be placed in each row.
8. How many rows of each helmet are there?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
9–16	1
17–20	2
21–24	3, 4

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

BANDS For Exercises 21 and 22, use the following information.

In a marching band, there are 64 woodwinds, 88 brass, and 16 percussion players. When they march in a parade, there is the same number of students in each row.

21. Find the greatest number of students in each row.
22. How many rows of each group are there?

COMMUNITY SERVICE For Exercises 23 and 24, use the following information.

You want to make care packages for a local shelter. You have 18 toothbrushes, 30 combs, and 12 bars of soap. Each package has the same number of each item.

23. What is the greatest number of care packages you can make using all the items?
24. How many of each item are in each package?

Find the GCF of each set of numbers.

25. 25¢, \$1.50, 75¢, \$3.00
26. 6 feet, 15 feet, 21 feet, 9 feet

ALGEBRA Find the greatest common divisor of each set of expressions.

27. $24a, 6a$
28. $30mn, 40mn$
29. $15xy, 55y$

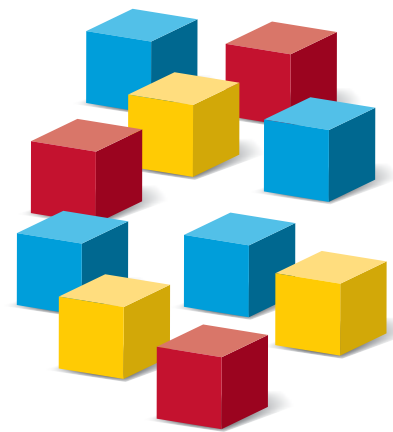
Find two numbers whose greatest common divisor is the given number.

30. 9
31. 12
32. 15
33. 30



GEOMETRY For Exercises 34 and 35, use the following information.

Jeremy is building rectangular prisms using one-inch cubes. He is planning to build three prisms, the first with 96 blue cubes, the second with 240 red cubes, and the third with 200 yellow cubes. All of prisms must be the same height, but not necessarily the same length and width.



EXTRA PRACTICE

See pages 676, 707.

34. What is the maximum height of each prism Jeremy can build?
35. What are the dimensions of all three prisms?

H.O.T. Problems

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

36. The GCF of two numbers is greater than both numbers.
37. If two numbers have no common prime factors, the GCF is 1.
38. The GCF of two numbers is one of the numbers.
39. **WRITING IN MATH** Using the words *factor* and *greatest common factor*, explain the relationship between the numbers 4, 12, and 24.

TEST PRACTICE

- | | |
|---|---|
| <p>40. Student Council earned \$26 selling bottled water, \$32 selling oranges, and \$28 selling energy bars. If all items cost the same, what is the greatest possible price per item?</p> <p>A \$2 C \$7</p> <p>B \$4 D \$8</p> | <p>41. Which set of numbers has the greatest GCF?</p> <p>F 4, 5, 20</p> <p>G 18, 36</p> <p>H 18, 36, 45</p> <p>J 23, 29</p> |
|---|---|

Spiral Review

42. What is the prime factorization of 75? (Lesson 4-1)

ALGEBRA Graph each equation. (Lesson 3-7)

43. $y = -x$

44. $y = x + 3$

45. $y = 2x - 1$

46. **ALGEBRA** Solve the equation $-7y + 18 = 39$. Check your solution. (Lesson 3-5)

▶ GET READY for the Next Lesson

47. **PREREQUISITE SKILL** Serena received a gift card to download music from the Internet. She downloaded 3 songs on Monday, 5 songs on Tuesday, and one half of what was left on Wednesday. She has 6 songs left. How many songs were initially on the gift card? Use the *work backward* strategy. (Lesson 3-4)

4-3

Problem-Solving Investigation

MAIN IDEA: Solve problems by making an organized list.

P.S.I. TEAM +

e-Mail: MAKE AN ORGANIZED LIST

NIKKI: I am ordering a pizza. The crust choices are thin or hand-tossed. The meat choices are pepperoni or sausage. The vegetable choices are olives, mushrooms, or banana peppers.

YOUR MISSION: Nikki chooses from one crust, one meat, and one vegetable choice. **Make an organized list** to find how many different types of pizza Nikki can order.



Understand	You know the crust, meat, and vegetable options for the pizza. You need to find all the possible pizza combinations that can be made.																		
Plan	Make an organized list of all the possible combinations. Use T for thin, H for hand-tossed, P for pepperoni, S for sausage, O for olives, M for mushrooms, and B for banana peppers.																		
Solve	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="3">Choosing thin crust:</td> </tr> <tr> <td>TPO</td> <td>TPM</td> <td>TPB</td> </tr> <tr> <td>TSO</td> <td>TSM</td> <td>TSB</td> </tr> <tr> <td colspan="3">Choosing hand-tossed crust:</td> </tr> <tr> <td>HPO</td> <td>HPM</td> <td>HPB</td> </tr> <tr> <td>HSO</td> <td>HSM</td> <td>HSB</td> </tr> </table> <p>There are 12 different combinations of pizza that can be ordered.</p>	Choosing thin crust:			TPO	TPM	TPB	TSO	TSM	TSB	Choosing hand-tossed crust:			HPO	HPM	HPB	HSO	HSM	HSB
Choosing thin crust:																			
TPO	TPM	TPB																	
TSO	TSM	TSB																	
Choosing hand-tossed crust:																			
HPO	HPM	HPB																	
HSO	HSM	HSB																	
Check	Draw a tree diagram to check the result.																		

Analyze The Strategy

1. Explain why making an organized list was a useful strategy in solving this problem.
2. **WRITING IN MATH** Write a problem that can be solved by making an organized list. Then explain how to solve the problem using this strategy.

For Exercises 3–6, solve each problem by making an organized list.

- SHOPPING** Charmaine went to the store and bought a yellow shirt, a blue shirt, and a red shirt. She also bought a pair of jeans and a pair of khaki dress pants. How many different outfits can be made using one shirt and one pair of pants?
- WORK** The following four numbers are used for employee identification numbers at a small company: 0, 1, 2, and 3. How many different employee identification numbers can be made using each digit once?
- PHOTOS** Joshua, Diego, and Audri stand side-by-side for a photo. How many different ways can the three friends stand next to each other?
- CELLPHONES** How many phone numbers are possible for one area code if the first three numbers are 268, in that order, and the last four numbers are 0, 9, 7, 1 in any order?



Use any strategy to solve Exercises 7–14. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES

- Guess and check.
- Work backward.
- Make an organized list.

- ALGEBRA** Consecutive odd numbers are numbers like 1, 3, 5, and 7. Find two consecutive odd numbers whose sum is 56 and whose product is 783.

- FOOD** The table shows the choices for ordering a deli sandwich. How many different subs can be ordered if you choose only one kind of bread and one kind of meat?

The Sandwich Shop	
Bread	White, Wheat, Whole Grain
Meat	Ham, Turkey, Roast Beef
Cheese	American, Swiss
Dressing	Italian, Ranch

- DVDS** Paul rented 2 times as many DVDs as Angelina last month. Angelina rented 4 fewer than Bret, but 4 more than Jill. Bret rented 9 DVDs. How many DVDs did each person rent?
- CLOTHES** Jeffrey owns 3 shirts, 2 pairs of pants, and 2 pairs of shoes. How many different outfits can he create?
- SNOWFALL** A total of 17 inches of snow fell in a 72-hour period. In the last 24 hours, 6 inches fell, and in the previous 24 hours, 4 inches fell. How many inches fell in the first 24 hours?
- GAS MILEAGE** Mrs. Acosta travels 44 miles in her car and uses 2 gallons of gas. If her gas mileage continues at the same rate, how many gallons of gas would she use to travel 528 miles?
- SCIENCE** Hydrothermal vents are similar to geysers, but are found on the ocean floor. A hydrothermal vent chimney can grow at an average rate of 9 meters in 18 months. What is the average rate of growth per month?
- CRAFTS** Paul makes three different sizes of birdhouses. He can paint each style in red, brown, or yellow. How many different birdhouses can Paul make?

4-4

Simplifying Fractions

MAIN IDEA

Write fractions in simplest form.

New Vocabulary

equivalent fractions
simplest form

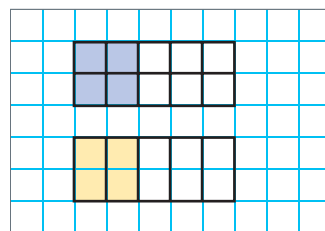
Math Online

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- Extra Examples
- Personal Tutor
- Self-Check Quiz

MINI Lab

On grid paper, draw the two figures shown. Shade 4 out of the 10 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. Based on the figures, what can you conclude about the fractions?

Equivalent fractions have the same value. A fraction is in **simplest form** when the GCF of the numerator and denominator is 1.

EXAMPLES

Write a Fraction in Simplest Form

- 1 Write $\frac{6}{24}$ in simplest form.

METHOD 1 Divide by common factors.

$$\frac{6}{24} = \frac{6 \div 2}{24 \div 2} = \frac{3}{12}$$

2 is a common factor of 6 and 24, so divide by 2.

$$\frac{3}{12} = \frac{3 \div 3}{12 \div 3} = \frac{1}{4}$$

3 is a common factor of 3 and 12, so divide by 3.

The fraction $\frac{1}{4}$ is in simplest form since 1 and 4 have no common factors greater than 1.

METHOD 2 Divide by the GCF.

First, find the GCF of the numerator and denominator.

factors of 6: 1, 2, 3, 6

The GCF of 6 and 24 is 6.

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

Then, divide the numerator and denominator by the GCF, 6.

$$\frac{6}{24} = \frac{6 \div 6}{24 \div 6} = \frac{1}{4}$$

Divide the numerator and denominator by the GCF, 6.

So, $\frac{6}{24}$ written in simplest form is $\frac{1}{4}$.



Study Tip

More Than One Way
To write in simplest form, you can also divide by common factors.

$$\frac{36}{45} = \frac{36 \div 3}{45 \div 3} = \frac{12}{15}$$

$$\frac{12}{15} = \frac{12 \div 3}{15 \div 3} = \frac{4}{5}$$

So, $\frac{36}{45} = \frac{4}{5}$.

2 Write $\frac{36}{45}$ in simplest form.

First, find the GCF of the numerator and denominator.

factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36

The GCF of 36 and 45 is 9.

factors of 45: 1, 3, 5, 9, 15, 45

Then, divide the numerator and denominator by the GCF, 9.

$$\frac{36}{45} = \frac{36 \div 9}{45 \div 9} = \frac{4}{5}$$

Divide the numerator and denominator by the GCF, 9.

So, $\frac{36}{45}$ written in simplest form is $\frac{4}{5}$.

✓ CHOOSE Your Method

Write each fraction in simplest form.

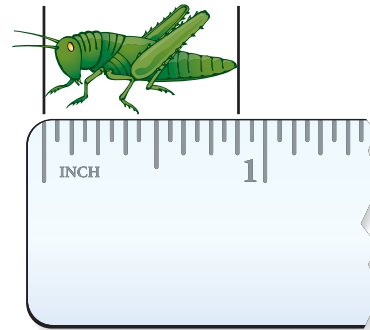
a. $\frac{7}{28}$

b. $\frac{8}{20}$

c. $\frac{27}{36}$

Real-World EXAMPLE

3 SCIENCE Lauren measured a grasshopper for her science project. Each line on her ruler represents $\frac{1}{16}$ inch. Find the length of the grasshopper in simplest form.



$$\begin{aligned} \frac{14}{16} &= \frac{1}{2} \cdot 7 \\ &= \frac{1}{2 \cdot 2 \cdot 2 \cdot 2} \cdot 7 \\ &= \frac{7}{8} \end{aligned}$$

The slashes mean that part of the numerator and part of the denominator are both divided by the same number. For example, $2 \div 2 = 1$.



Real-World Career . . . How Does a Carpenter Use Math?

Carpenters use fractions when they measure and cut boards.

Math Online

For more information visit: glencoe.com



So, $\frac{14}{16}$ written in simplest form is $\frac{7}{8}$.

✓ CHECK Your Progress

d. **CARPENTRY** A carpenter measured a shelf and found it to be $\frac{10}{16}$ inch thick. Find the simplified fraction.

e. **CARPENTRY** A carpenter measured a board to be $\frac{8}{16}$ inch thick. Find the simplified fraction.



CHECK Your Understanding

Examples 1, 2
(pp. 192–193)

Write each fraction in simplest form.

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

2. $\frac{4}{18}$

3. $\frac{10}{25}$

4. $\frac{36}{40}$

Example 3
(p. 193)

5. **ALLOWANCE** Mary received \$15 for her weekly allowance. She spent \$10 at the movie theater with her friends. What fraction of the money, in simplest form, was spent at the theater?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
6–17	1, 2
18–19	3

Write each fraction in simplest form.

6. $\frac{9}{12}$

7. $\frac{25}{35}$

8. $\frac{16}{32}$

9. $\frac{14}{20}$

10. $\frac{10}{20}$

11. $\frac{12}{21}$

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

13. $\frac{24}{28}$

14. $\frac{48}{64}$

15. $\frac{32}{32}$

16. $\frac{20}{80}$

17. $\frac{45}{54}$

18. **PRESIDENTS** Of the 43 U.S. presidents, 15 were elected to serve two terms. What fraction of the U.S. presidents, in simplest form, was elected to serve two terms?

19. **TV SHOWS** A television station has 28 new TV shows scheduled to air this week. What fraction of the television shows, in simplest form, are 30-minute programs?

WYTB Programming	
30-minute	60-minute
20	8

Write each fraction in simplest form.

20. $\frac{45}{100}$

21. $\frac{60}{150}$

22. $\frac{16}{120}$

23. $\frac{35}{175}$

24. **TIME** Fifteen minutes is what part of one hour?
25. **MEASUREMENT** Nine inches is what part of one foot?
26. **CALENDAR** Four days is what part of the month of April?
27. **SLEEP** Marcel spends 8 hours each day sleeping. What fraction of a week, written in simplest form, does Marcel spend sleeping?
28. **MONEY** Each week, Lorenzo receives a \$10 allowance. What fraction of his yearly allowance, in simplest form, does he receive each week?
29. **FIND THE DATA** Refer to the Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would simplify fractions.

EXTRA PRACTICE

See pages 677, 707.

30. **OPEN ENDED** Select a fraction in simplest form. Then, write two fractions that are equivalent to it.

H.O.T. Problems

31. **CHALLENGE** Both the numerator and denominator of a fraction are even. Is the fraction in simplest form? Explain your reasoning.
32. **FIND THE ERROR** Nhu and Booker both wrote $\frac{16}{36}$ in simplest form. Who is correct? Explain.



Nhu

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

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



Booker

33. **WRITING IN MATH** Explain how to determine whether a fraction is in simplest form.

TEST PRACTICE

34. It takes Benito 12 minutes to walk to school. What fraction represents the part of an hour it takes Benito to walk to school?
- A $\frac{12}{1}$ C $\frac{5}{30}$
 B $\frac{4}{15}$ D $\frac{1}{5}$
35. What fraction of a foot is 2 inches?
- F $\frac{1}{6}$ H $\frac{1}{3}$
 G $\frac{1}{4}$ J $\frac{1}{2}$

Spiral Review

36. **SANDWICHES** A deli offers sandwiches with ham, turkey, or roast beef with American, provolone, Swiss, or mozzarella cheese. How many different types of sandwiches can be made if you choose one meat and one cheese? Use the *make an organized list* strategy. (Lesson 4-3)

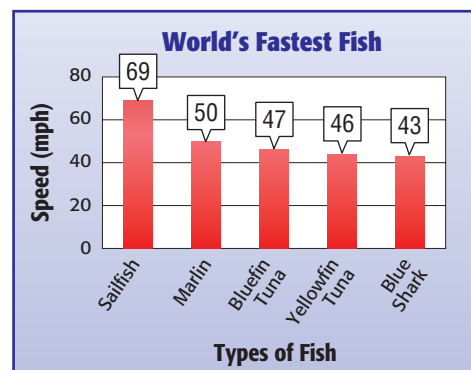
Find the GCF of each set of numbers. (Lesson 4-2)

37. 27, 36

38. 16, 28

39. 20, 50, 65

40. **ANALYZE GRAPHS** Refer to the graph. At these rates, about how much longer would it take a blue shark to swim 280 miles than it would a sailfish? Use the formula $d = rt$. Justify your answer. (Lesson 3-3)



Source: Top Ten of Everything

GET READY for the Next Lesson

PREREQUISITE SKILL Divide. (Page 676)

41. $2 \overline{)1.0}$

42. $4 \overline{)1.00}$

43. $10 \overline{)7.0}$

44. $8 \overline{)3.000}$

MAIN IDEA

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

New Vocabulary

terminating decimals
repeating decimals
bar notation

Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

GET READY for the Lesson

NASCAR The table shows the winning speeds for a 10-year-period at the Daytona 500.

1. What fraction of the speeds are between 130 and 145 miles per hour?
2. Express this fraction using words and then as a decimal.
3. What fraction of the speeds are between 145 and 165 miles per hour? Express this fraction using words and then as a decimal.

Daytona 500		
Year	Winner	Speed (mph)
1998	D. Earnhardt	172.712
1999	J. Gordon	148.295
2000	D. Jarrett	155.669
2001	M. Waltrip	161.783
2002	W. Burton	142.971
2003	M. Waltrip	133.870
2004	D. Earnhardt Jr.	156.345
2005	J. Gordon	135.173
2006	J. Johnson	142.667
2007	K. Harvick	149.335

Source: ESPN Sports Almanac

Our decimal system is based on powers of 10. So, if the denominator of a fraction is a power of 10, you can use place value to write the fraction as a decimal. For example, to write $\frac{7}{10}$ as a decimal, place a 7 in the tenths place.

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

If the denominator of a fraction is a *factor* of 10, 100, 1,000, or any higher power of ten, you can use mental math and place value.

EXAMPLES Use Mental Math

Write each fraction or mixed number as a decimal.

1 $\frac{7}{20}$

THINK $\frac{7}{20} = \frac{35}{100}$

(Diagram: A circle with $\frac{7}{20}$ on the left and $\frac{35}{100}$ on the right. An arrow from 7 to 35 is labeled $\times 5$. An arrow from 20 to 100 is labeled $\times 5$.)

So, $\frac{7}{20} = 0.35$.

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

$5\frac{3}{4} = 5 + \frac{3}{4}$ **Think of it as a sum.**
 $= 5 + 0.75$ **You know that $\frac{3}{4} = 0.75$.**
 $= 5.75$ **Add mentally.**

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

CHECK Your Progress

a. $\frac{3}{10}$

b. $\frac{3}{25}$

c. $6\frac{1}{2}$



Study Tip

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

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

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

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

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

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

Any fraction can be written as a decimal by dividing its numerator by its denominator. Division ends when the remainder is zero.

EXAMPLES Use Division

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

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

Divide 3 by 8.

Division ends when the remainder is 0.

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

4 Write $\frac{1}{40}$ as a decimal.

$$\begin{array}{r}
 0.025 \\
 40 \overline{)1.000} \\
 \underline{-80} \\
 200 \\
 \underline{-200} \\
 0
 \end{array}$$

Divide 1 by 40.

So, $\frac{1}{40} = 0.025$.

CHECK Your Progress

Write each fraction or mixed number as a decimal.

d. $\frac{7}{8}$

e. $2\frac{1}{8}$

f. $7\frac{9}{20}$



Vocabulary Link

Terminate

Everyday Use coming to an end, as in terminate a game

Math Use a decimal whose digits end

- In Examples 1–4, the decimals 0.35, 5.75, 0.375, and 0.025 are called terminating decimals. A **terminating decimal** is a decimal whose digits end.

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

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

$$\begin{array}{r}
 0.333\dots \\
 3 \overline{)1.000} \\
 \underline{-9} \\
 10 \\
 \underline{-9} \\
 10 \\
 \underline{-9} \\
 1
 \end{array}$$

The number 3 repeats. The repetition of 3 is represented by three dots.

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

$$0.33333\dots = 0.\bar{3}$$

$$0.121212\dots = 0.\overline{12}$$

$$11.3858585\dots = 11.\overline{385}$$

**EXAMPLE****Write Fractions as Repeating Decimals****5** Write $\frac{7}{9}$ as a decimal.

$$\begin{array}{r}
 0.777\dots \\
 9 \overline{)7.000} \\
 \underline{-63} \\
 70 \\
 \underline{-63} \\
 70 \\
 \underline{-63} \\
 7
 \end{array}$$

Divide 7 by 9.

Notice that the remainder will never be zero. That is, the division never ends.

So, $\frac{7}{9} = 0.777\dots$ or $0.\overline{7}$.**CHECK Your Progress**

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

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

h. $\frac{3}{11}$

i. $8\frac{1}{3}$

Every terminating decimal can be written as a fraction with a denominator of 10, 100, 1,000, or a higher power of ten. Place the digits that come after the decimal point in the numerator. Use the place value of the final digit as the denominator.

numerator

$$0.25 = \frac{25}{100}$$

hundredths place

**Real-World Link**

The recommended water temperature for goldfish is 65–72°F.
Source: Animal-World

Real-World EXAMPLE**Use a Power of 10****6 FISH** Use the table to find what fraction of the fish in an aquarium are goldfish. Write in simplest form.

$0.15 = \frac{15}{100}$

The final digit, 5, is in the hundredths place.

$= \frac{3}{20}$

Simplify.

Fish	Amount
Guppy	0.25
Angel Fish	0.4
Goldfish	0.15
Molly	0.2

CHECK Your Progress

Determine the fraction of the aquarium made up by each fish. Write the answer in simplest form.

j. molly

k. guppy

l. angel fish



CHECK Your Understanding

Examples 1–5
(pp. 196–198)

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

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

2. $\frac{9}{10}$

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

4. $4\frac{3}{20}$

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

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

7. $\frac{5}{9}$

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

Example 6
(p. 198)

Write each decimal as a fraction or mixed number in simplest form.

9. 0.22

10. 0.1

11. 4.6

12. **HOCKEY** During a hockey game, an ice resurfacer travels 0.75 mile during each ice resurfacing. What fraction represents this distance?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
13–16	1, 2
17–22	3, 4
23–28	5
29–36	6

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

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

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

15. $4\frac{4}{25}$

16. $7\frac{1}{20}$

17. $\frac{5}{16}$

18. $\frac{3}{16}$

19. $\frac{33}{50}$

20. $\frac{17}{40}$

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

22. $9\frac{3}{8}$

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

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

25. $\frac{1}{6}$

26. $\frac{8}{11}$

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

28. $2\frac{6}{11}$

Write each decimal as a fraction or mixed number in simplest form.

29. 0.2

30. 0.9

31. 0.55

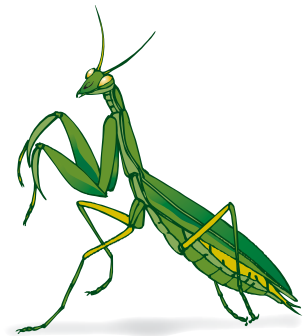
32. 0.34

33. 5.96

34. 2.66

35. **INSECTS** The maximum length of a praying mantis is 30.5 centimeters. What mixed number represents this length?

36. **GROCERIES** Suppose you buy a 1.25 pound package of ham for \$4.99. What fraction of a pound did you buy?



37. **FIND THE DATA** Refer to the Data File on page 16–19 of your book. Choose some data and write a real-world problem in which you would write a percent as a decimal.

Write each of the following as an integer over a whole number.

38. -13

39. $7\frac{1}{3}$

40. -0.028

41. -3.2

EXTRA PRACTICE
See pages 677, 707.

42. **MUSIC** Nicolás practiced playing the cello for 2 hours and 18 minutes. Write the time Nicolás spent practicing as a decimal.



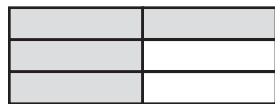
43. **SOFTBALL** The batting average of a softball player is the number of hits divided by the number of at-bats. If Felisa had 50 hits in 175 at-bats and Harmony had 42 hits in 160 at-bats, who had the better batting average? Justify your answer.

H.O.T. Problems

44. **OPEN ENDED** Write a fraction that is equivalent to a terminating decimal between 0.5 and 0.75.
45. **CHALLENGE** The value of pi (π) is 3.1415926... . The mathematician Archimedes believed that π was between $3\frac{1}{7}$ and $3\frac{10}{71}$. Was Archimedes correct? Explain your reasoning.
46. **WRITING IN MATH** 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 causes the difference? Explain.

TEST PRACTICE

47. Which decimal represents the shaded region of the model?



- A 0.666 C 0.667
B $0.\overline{6}$ D $0.6\overline{67}$

48. Based on the information given in the table, what fraction represents $0.\overline{8}$?

- F $\frac{4}{5}$
G $\frac{80}{99}$
H $\frac{5}{6}$
J $\frac{8}{9}$

Decimal	Fraction
$0.\overline{3}$	$\frac{3}{9}$
$0.\overline{4}$	$\frac{4}{9}$
$0.\overline{5}$	$\frac{5}{9}$
$0.\overline{6}$	$\frac{6}{9}$

Spiral Review

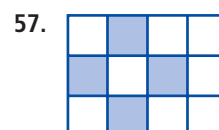
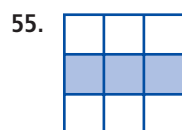
Write each fraction in simplest form. (Lesson 4-4)

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

53. **PIZZA** How many different pizzas can Alfonso order if he can choose thick, thin, or deep dish crust and one topping from either pepperoni, sausage, or mushrooms? Use the *make an organized list* strategy. (Lesson 4-3)

GET READY for the Next Lesson

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



Mid-Chapter Quiz

Lessons 4-1 through 4-5

Determine whether each number is *prime* or *composite*. (Lesson 4-1)

1. 24 2. 61 3. 2

4. **AGE** Kevin just turned 13 years old. How old will he be the next time his age is a prime number? (Lesson 4-1)

Find the prime factorization of each number. (Lesson 4-1)

5. 30 6. 120

Factor each expression. (Lesson 4-1)

7. $14x^2y$ 8. $50mn$

Find the GCF of each set of numbers. (Lesson 4-2)

9. 16, 40 10. 65, 100



11. **MULTIPLE CHOICE** Lakeesha wants to cut a 14-inch by 21-inch poster board into equal-size squares for an art project. She does not want to waste any of the poster board, and she wants the largest squares possible. What is the length of the side of the largest squares she can cut? (Lesson 4-2)

- A 14 C 6
B 7 D 2



12. **MULTIPLE CHOICE** Lynne cannot remember her password to check the messages on her cell phone. She knows that it is a three-digit number consisting of the numbers 1, 4, and 7, but she cannot remember the order. Which list shows all the different possibilities for her password? (Lesson 4-3)

- F 147, 174, 417, 714, 741
G 147, 174, 417, 471, 714, 741
H 417, 471, 714, 741
J 147, 174, 74, 417, 17, 471, 714, 741



13. **PIANO** Evelina spends 40 minutes practicing the flute each afternoon after school. What part of one hour does she spend practicing? Write as a fraction in simplest form.

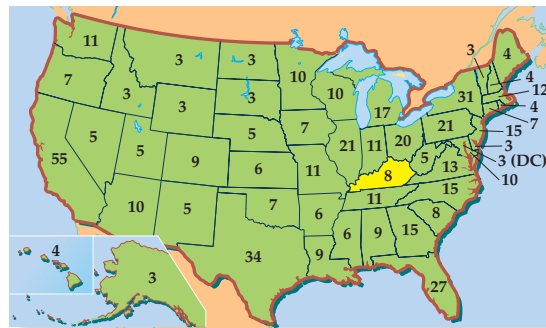
(Lesson 4-4)

Write each fraction in simplest form. (Lesson 4-4)

14. $\frac{20}{36}$
15. $\frac{45}{60}$
16. $\frac{63}{108}$
17. $\frac{60}{72}$



18. **VOTING** In the 2004 presidential election, Kentucky had 8 out of 538 total electoral votes. Write Kentucky's portion of the electoral votes as a fraction in simplest form. (Lesson 4-4)



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

19. $\frac{7}{8}$ 20. $\frac{2}{9}$ 21. $3\frac{13}{20}$

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

22. 0.6 23. 0.48 24. 7.02



25. **ANIMALS** The maximum height of an Asian elephant is 9.8 feet. What mixed number represents this height? (Lesson 4-5)

4-6

Fractions and Percents

MAIN IDEA

Write fractions as percents and percents as fractions.

New Vocabulary

ratio
equivalent ratios

Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

▶ GET READY for the Lesson

In a recent survey, students were asked to choose their favorite sport to play. The results are shown in the table.

Sport	Number of Students
Basketball	3 out of 20
Football	3 out of 25
Gymnastics	1 out of 20
Swimming	9 out of 100

1. For each sport, shade a 10×10 grid that represents the number of students that chose the sport.
2. What fraction of the students chose swimming?

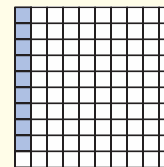
A **ratio** is a comparison of two quantities by division. Ratios like 9 out of 100 can also be written as $9:100$ or $\frac{9}{100}$. When a ratio compares a number to 100, it can be written as a **percent**.

Percent

Key Concept

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

Example



9 out of 100 = 9%

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

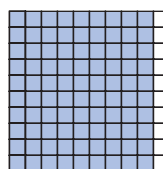
EXAMPLES Write Ratios as Percents

Write each ratio as a percent.

- 1 Annie answered 90 out of 100 questions correctly.

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

Annie answered 90% of the questions correctly.



90%

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

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

On average, 50.5% of the students own a pet.

✓ CHECK Your Progress

- a. 45 out of 100 cars sold b. \$3.30:\$100 spent on soft drinks

Reading Math

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

Study Tip

Percents In Chapter 6 you will learn another way to write percents that does not use equivalent fractions.

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.

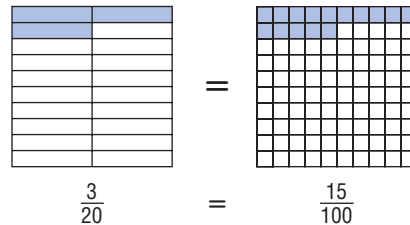
EXAMPLE Write a Fraction as a Percent

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

First, find an equivalent fraction with a denominator of 100.
Then write the fraction as a percent.

$$\frac{3}{20} = \frac{3 \times 5}{20 \times 5} = \frac{15}{100} \text{ or } 15\%$$

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



CHECK Your Progress

Write each fraction as a percent.

c. $\frac{17}{20}$

d. $\frac{3}{5}$

e. $\frac{2}{25}$

Real-World EXAMPLE

- 4 **CHEESE** In 0.5 ounce of colby cheese, 36 of the 50 calories are from fat. What percent of the Calories are from fat?

$$\begin{aligned} \frac{36}{50} &= \frac{72}{100} && \text{Write an equivalent fraction with a denominator of 100.} \\ &= 72\% && \frac{72}{100} = 72\% \end{aligned}$$

About 72% of the Calories are from fat.

CHECK Your Progress

- f. **CHEESE** In a small piece of mozzarella cheese, 17 of the 25 Calories come from fat. What percent of the Calories come from fat?



Real-World Link

Almost 90% of all cheese sold in the United States is cheddar.

Source: Food Reference

EXAMPLE Write a Percent as a Fraction

- 5 Write 48% as a fraction in simplest form.

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

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

CHECK Your Progress

Write each percent as a fraction in simplest form.

g. 40%

h. 6%

i. 24%



CHECK Your Understanding

Examples 1, 2
(p. 202)

Write each ratio as a percent.

1. 57:100 insects are spiders 2. \$29.20 per \$100

Example 3
(p. 203)

Write each fraction as a percent.

3. $\frac{1}{4}$ 4. $\frac{6}{10}$ 5. $\frac{17}{20}$

Example 4
(p. 203)

6. **TECHNOLOGY** Tansy used $\frac{2}{5}$ of the memory available on her flash drive. What percent of the memory did she use?

Example 5
(p. 203)

Write each percent as a fraction in simplest form.

7. 90% 8. 75% 9. 22%

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–15	1, 2
16–23	3
24–25	4
26–33	5

Write each ratio as a percent.

10. 87 out of 100 books read 11. 42 per 100 teenagers
12. 12.2 out of 100 points earned 13. 99.9:100 miles driven
14. $11\frac{3}{4}$ out of 100 feet 15. $66\frac{2}{3}$:100 yards run

Write each fraction as a percent.

16. $\frac{7}{10}$ 17. $\frac{16}{20}$ 18. $\frac{15}{25}$ 19. $\frac{13}{50}$
20. $\frac{1}{5}$ 21. $\frac{3}{5}$ 22. $\frac{19}{20}$ 23. $\frac{10}{10}$

24. **PETS** Twenty out of every 25 households own one dog. What percent of households own one dog?

25. **SPORTS** If 15 out of every 50 teens like to ski, what percent of teens like to ski?

Write each percent as a fraction in simplest form.

26. 45% 27. 30% 28. 62% 29. 88%
30. 68% 31. 13% 32. 2% 33. 300%

Replace each \bullet with $>$, $<$, or $=$.

34. $\frac{1}{4} \bullet 25\%$ 35. $\frac{9}{20} \bullet 55\%$ 36. $78\% \bullet \frac{3}{5}$
37. $38\% \bullet \frac{19}{50}$ 38. $12\% \bullet 1\frac{1}{5}$ 39. $2\frac{2}{5} \bullet 24\%$

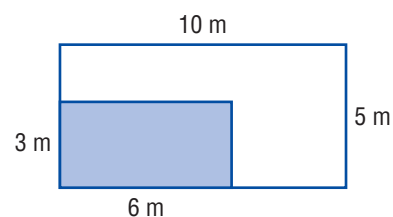
EXTRA PRACTICE

See pages 678, 708.

40. **VOLUNTEERING** A Girl Scouts event is expecting 40 out of 50 people to volunteer at a charity auction. So far 30 volunteers have arrived at the auction. What percent of the volunteers have not yet arrived?

H.O.T. Problems

41. **GEOMETRY** What percent of the larger rectangle shown is *not* shaded?



42. **CHALLENGE** Apply what you know about percents, fractions, and decimals to write $12\frac{1}{2}\%$ as a fraction. Justify your answer.

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

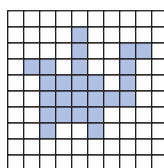
$$\frac{5}{20}$$

$$5\%$$

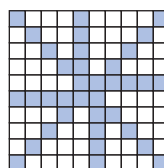
$$\frac{1}{4}$$

$$50 \text{ out of } 200$$

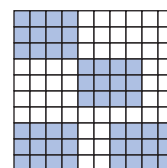
44. **WRITING IN MATH** Explain how you know which model represents 36%. Then explain why that model also represents $\frac{9}{25}$.



Model 1



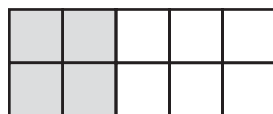
Model 2



Model 3

TEST PRACTICE

45. What percent of the model is shaded?



A 25%

C 40%

B 30%

D 60%

46. Cats spend about $\frac{3}{10}$ of their time awake grooming themselves. Which number is equivalent to $\frac{3}{10}$?

F 3%

H 33.3%

G 30%

J 300%

Spiral Review

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

47. 0.6

48. 0.15

49. 2.8

50. **TIME** The drive to a football game took 56 minutes. Twenty-four minutes of the time was spent stopped in traffic. What fraction of the drive, in simplest form, was spent in stopped traffic? (Lesson 4-4)

Solve each equation. (Lesson 3-2)

51. $x + 7 = 10$

52. $m - 2 = 8$

53. $12 + a = 16$

▶ GET READY for the Next Lesson

PREREQUISITE SKILL Multiply or divide. (Pages 675, 676)

54. 16.2×10

55. 0.71×100

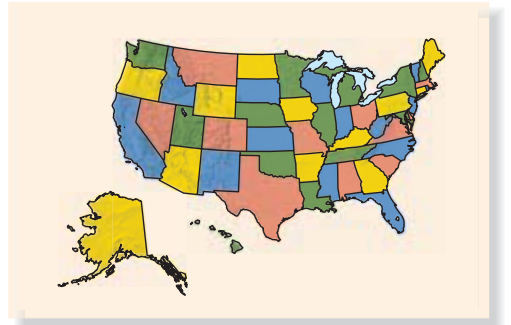
56. $14.4 \div 100$

57. $791 \div 1,000$



Real-World EXAMPLE

- 2 GEOGRAPHY** Alaska is the largest state, making up about $16\frac{1}{10}\%$ of the land area of the United States. Write this amount as a decimal.



$$\begin{aligned}
 16\frac{1}{10}\% &= 16.1\% && \text{Write } \frac{1}{10} \text{ as } 0.1. \\
 &= 16.1 && \text{Remove the \% symbol and divide by 100.} \\
 &= 0.161 && \text{Add leading zero.} \\
 \text{So, } 16\frac{1}{10}\% &= 0.161.
 \end{aligned}$$

CHECK Your Progress

- d. **GEOGRAPHY** About $6\frac{4}{5}\%$ of the total area of the United States is water. What decimal represents this amount?
- e. **GEOGRAPHY** The total area of Australia is about $38\frac{11}{20}\%$ of the total area of North America. Write the amount as a decimal.

EXAMPLE Write Decimals as Percents

- 3** Write 0.4 as a percent.

METHOD 1 Write the decimal as fraction.

$$\begin{aligned}
 0.4 &= \frac{4}{10} \text{ or } \frac{40}{100} && \text{Write the decimal as a fraction.} \\
 &= 40\% && \text{Write the fraction as a percent.}
 \end{aligned}$$

METHOD 2 Multiply mentally.

$$\begin{aligned}
 &\text{Multiply by 100 and add the \% symbol.} \\
 0.4 &= 0.40 && \text{Multiply by 100. Add a placeholder zero.} \\
 &= 40\% && \text{Add the \% symbol.}
 \end{aligned}$$

So, $0.4 = 40\%$.

CHOOSE Your Method

Write each decimal as a percent.

f. 0.5

g. 0.34

h. 0.98

Study Tip

Multiplication When multiplying by 100, the decimal point moves two places right.



Real-World Link

Of the world's icebergs, 93% are found surrounding the Antarctic.

Source: JPL Polar Oceanography Group

Real-World EXAMPLE

4 SCIENCE About 0.875 of an iceberg's mass is underwater. What percent of an iceberg's mass is underwater?

$$\begin{aligned}
 0.875 &= \underline{0.875} && \text{Multiply by 100.} \\
 &= 87.5\% && \text{Add the \% symbol.}
 \end{aligned}$$

So, 87.5% of an iceberg's mass is underwater.

✓ CHECK Your Progress

i. **EXERCISE** Each day, Rico and his dog walk 0.625 mile. What percent of a mile do they walk?

Percent as a Decimal

Key Concept

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

$$25\% = \underline{.25} \text{ or } 0.25$$

Decimal as a Percent

Key Concept

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

$$0.58 = \underline{0.58} = 58\%$$

✓ CHECK Your Understanding

Example 1 Write each percent as a decimal.

(p. 206)

1. 68%
2. 5%
3. 27.6%



Example 2 4. **SPENDING** A family spends about $33\frac{2}{5}\%$ of their annual income on housing.

(p. 207)

What decimal represents the amount spent on housing?

Example 3 Write each decimal as a percent.

(p. 207)

5. 0.09
6. 0.3
7. 0.73

Example 4 8. **BASKETBALL** The table shows the top five WNBA players with the highest free throw averages. What percent of the time does Sue Bird make a free throw?

(p. 208)

Player	Average
Eva Nemcova	0.897
Seimone Augustus	0.897
Elena Tornikidou	0.882
Sue Bird	0.878
Cynthia Cooper	0.871

Source: Women's National Basketball Association



Practice and Problem Solving

HOMework HELP

For Exercises	See Examples
9–20	1
21–22	2
23–34	3
35–37	4

Write each percent as a decimal.

9. 27% 10. 70% 11. 6% 12. 4%
13. 18.5% 14. 56.4% 15. 2.2% 16. 3.8%
17. $27\frac{7}{10}\%$ 18. $15\frac{1}{2}\%$ 19. $30\frac{1}{4}\%$ 20. $46\frac{2}{5}\%$
21. **BONES** An adult human body has $68\frac{3}{5}\%$ of the number of bones it had at birth. What decimal represents this amount?
22. **VIDEO GAMES** Brian reaches the sixth level of a video game $92\frac{3}{4}\%$ of the time he plays. What decimal represents this percent?

Write each decimal as a percent.

23. 0.7 24. 0.6 25. 5.8 26. 8.2
27. 0.95 28. 0.08 29. 0.17 30. 0.78
31. 0.675 32. 0.145 33. 0.012 34. 0.7025

BASEBALL The table shows the top five Major League Baseball players with the highest batting averages in a recent year. Express each player's batting average as a percent.

Player	Average
Joe Mauer	0.347
Freddy Sanchez	0.344
Derek Jeter	0.344
Robinson Cano	0.342
Miguel Cabrera	0.339

Source: Major League Baseball

35. Joe Mauer
36. Derek Jeter
37. Miguel Cabrera

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

38. 0.25% ● 0.125 39. 0.76 ● 76.5% 40. 500% ● 50
41. 99% ● 0.985 42. 0.325 ● 30% 43. 56% ● 0.5625

44. **SPORTS** A tennis player won 0.805 of the matches she played. What percent of the matches did she lose?

ANALYZE TABLES For Exercises 45–48, use the table and the information given.

Model airplane measurements are based on a scale of the life-size original. For example, a scale of $\frac{1}{72}$ is about 1% of the size of the original. Percents are rounded to the nearest thousandth.

Scale	Percent Equivalent
$\frac{1}{72}$	1.389%
$\frac{1}{24}$	4.167%
$\frac{1}{48}$	2.083%
$\frac{1}{20}$	5%
$\frac{1}{32}$	3.125%

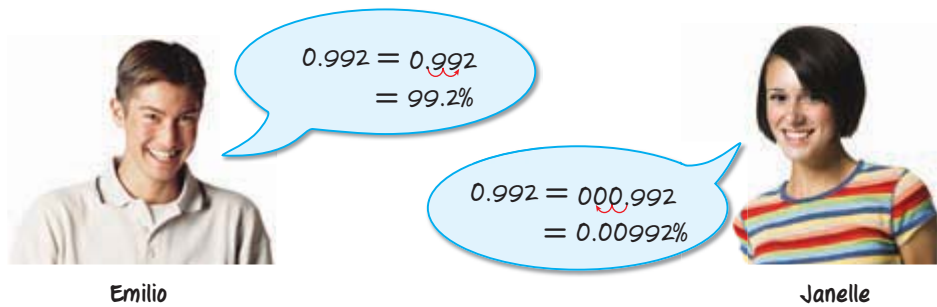
45. Find the decimal equivalents for each scale.
46. Which scale is the smallest?
47. About how long is a model of an actual 88.5-foot C-119 boxcar plane using a $\frac{1}{72}$ scale?
48. Which scale is used if a model of an 88.5-foot C-119 boxcar plane is about 33.1875 inches long?

EXTRA PRACTICE

See pages 678, 708.

H.O.T. Problems

49. **OPEN ENDED** Write any decimal between 0 and 1. Then write it as a fraction in simplest form and as a percent.
50. **FIND THE ERROR** Emilio and Janelle both wrote 0.992 as a percent. Who is correct? Explain.

**CHALLENGE** Write each fraction as a percent.

51. $\frac{3}{8}$ 52. $\frac{1}{40}$ 53. $\frac{1}{32}$
54. **WRITING IN MATH** Write a word problem about a real-world situation in which you would change a decimal to a percent.

TEST PRACTICE

55. It is estimated that 13.9% of the population of Texas was born outside the United States. Which number is *not* equivalent to 13.9%?
- A $\frac{139}{1,000}$ C 0.139
- B $\frac{13.9}{100}$ D 1.39
56. Which of the following is ordered from least to greatest?
- F $0.42, \frac{2}{5}, 50\%, \frac{3}{4}$
- G $\frac{2}{5}, 0.42, 50\%, \frac{3}{4}$
- H $\frac{3}{4}, \frac{2}{5}, 0.42\%, 50\%$
- J $\frac{3}{4}, 0.42, \frac{2}{5}, 50\%$

Spiral Review

Write each ratio as a percent. (Lesson 4-6)

57. 72 out of 100 animals 58. \$9.90:\$100 59. 3.1 out of 100 households
60. Write $9\frac{3}{8}$ as a decimal. (Lesson 4-5)
61. **AIRPLANES** Write an integer that represents an airplane descending 125 feet. (Lesson 2-1)
62. **MONEY** Marina earned \$187.50 by working 30 hours. If she works 35 hours at this rate, how much will she earn? (Lesson 1-1)

GET READY for the Next Lesson**PREREQUISITE SKILL** Write the prime factorization of each number. (Lesson 4-1)

63. 50 64. 32 65. 76 66. 105

4-8

Least Common Multiple

MAIN IDEA

Find the least common multiple of two or more numbers.

New Vocabulary

multiple

least common multiple (LCM)

Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

MINI Lab

Use cubes to build the first row of each prism as shown.

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

Number of Rows	1	2	3	4
Cubes in Prism A	4	■	■	■
Cubes in Prism B	6	■	■	■



Prism A



Prism B

2. Add rows until each prism has four rows.
3. Describe two prisms that have the same number of cubes.
4. If you keep adding rows, will the two prisms have the same number of cubes again?

- 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.

EXAMPLES Find the LCM

- 1 Find the LCM of 6 and 10.

METHOD 1 List the nonzero multiples.

List the multiples of 6 until you come to a number that is also a multiple of 10.

multiples of 6: 6, 12, 18, 24, **30**, ...

multiples of 10: 10, 20, **30**, ...

Notice that 30 is also a multiple of 10. The LCM of 6 and 10 is 30.

METHOD 2 Use prime factorization.

$$6 = 2 \cdot 3$$

$$10 = 2 \cdot 5$$

The prime factors of 6 and 10 are 2, 3, and 5.

The LCM is the least product that contains the prime factors of each number. So, the LCM of 6 and 10 is $2 \cdot 3 \cdot 5$ or 30.

Vocabulary Link

Multiply

Everyday Use to find the product

Multiple

Math Use the product of a number and any whole number



2 Find the LCM of 45 and 75.

Use Method 2. Find the prime factorization of each number.

$$45 = 3 \cdot 3 \cdot 5 \text{ or } 3^2 \cdot 5$$

$$75 = 3 \cdot 5 \cdot 5 \text{ or } 3 \cdot 5^2$$

The prime factors of 45 and 75 are 3 and 5. Write the prime factorization using exponents.

The LCM is the product of the prime factors 3 and 5, with each one raised to the *highest* power it occurs in *either* prime factorization.

The LCM of 45 and 75 is $3^2 \cdot 5^2$, which is 225.

✓ CHOOSE Your Method

Find the LCM of each set of numbers.

a. 3, 12

b. 10, 12

c. 25, 30



Real-World Link

Each day, about 700,000 people in the U.S. celebrate their birthday.

Real-World EXAMPLE

3 PARTY Ling needs to buy paper plates, napkins, and cups for a party. Plates come in packages of 12, napkins come in packages of 16, and cups come in packages of 8. What is the least number of packages she will have to buy if she wants to have the same number of plates, napkins, and cups?

First find the LCM of 8, 12, and 16.

$$8 = 2 \cdot 2 \cdot 2 \text{ or } 2^3$$

$$12 = 2 \cdot 2 \cdot 3 \text{ or } 2^2 \cdot 3$$

$$16 = 2 \cdot 2 \cdot 2 \cdot 2 \text{ or } 2^4$$

The prime factors of 8, 12, and 16 are 2 and 3. Write the prime factorization using exponents.

The LCM of 8, 12, and 16 is $2^4 \cdot 3$, which is 48.

To find the number of packages of each Ling needs to buy, divide 48 by the amount in each package.

cups: $48 \div 8$ or 6 packages

plates: $48 \div 12$ or 4 packages

napkins: $48 \div 16$ or 3 packages

So, Ling will need to buy 6 packages of cups, 4 packages of plates, and 3 packages of napkins.

✓ CHECK Your Progress

d. **VEHICLES** Mr. Hernandez changes his car's oil every 3 months, rotates the tires every 6 months, and replaces the air filter once a year. If he completed all three tasks in April, what will be the next month he again completes all three tasks?



CHECK Your Understanding

Examples 1–3
(pp. 211–212)

Find the LCM of each set of numbers.

- | | | |
|-----------|-------------|--------------|
| 1. 4, 14 | 2. 6, 7 | 3. 12, 15 |
| 4. 21, 35 | 5. 3, 5, 12 | 6. 6, 14, 21 |

Example 3
(p. 212)

7. **GOVERNMENT** The number of years per term for a U.S. President, senator, and representative is shown. Suppose a senator was elected in the presidential election year 2008. In what year will he or she campaign again during a presidential election year?

Elected Office	Term (yr)
President	4
Senator	6
Representative	2

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
8–13, 20	1, 2
14–19, 21	3

Find the LCM of each set of numbers.

- | | | |
|----------------|----------------|----------------|
| 8. 6, 8 | 9. 8, 18 | 10. 12, 16 |
| 11. 24, 36 | 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. **CHORES** Hernando walks his dog every two days. He gives his dog a bath once a week. Today, Hernando walked his dog and then gave her a bath. How many days will pass before he does both chores on the same day?
21. **TEXT MESSAGING** Three friends use text messaging to notify their parents of their whereabouts. If all three contact their parents at 3:00 P.M., at what time will all three contact their parents again at the same time?

Friend	Time Interval
Linda	every 30 min
Brandon	every 45 min
Edward	every 60 min

Find the LCM of each set.

- | | | |
|---------------------|------------------|----------------------|
| 22. \$3.00, \$14.00 | 23. 10¢, 25¢, 5¢ | 24. 9 inches, 2 feet |
|---------------------|------------------|----------------------|

Write two numbers whose LCM is the given number.

- | | | | |
|--------|--------|--------|--------|
| 25. 35 | 26. 56 | 27. 70 | 28. 30 |
|--------|--------|--------|--------|

29. **SNACKS** Alvin's mom needs to buy snacks for soccer practice. Juice boxes come in packages of 10. Oatmeal snack bars come in packages of 8. She wants to have the same number of juice boxes and snack bars, what is the least number of packages of each snack that she will have to buy?

EXTRA PRACTICE

See pages 678, 707.

30. **REASONING** The LCM of two consecutive positive numbers is greater than 200 and is a multiple of 7. What are the least possible numbers?

H.O.T. Problems

31. **CHALLENGE** Two numbers have a GCF of $3 \cdot 5$. Their LCM is $2^2 \cdot 3 \cdot 5$. If one of the numbers is $3 \cdot 5$, what is the other number?

32. **SELECT A TECHNIQUE** The schedule for each of three trains is shown. Suppose a train from each line leaves Clark Street at 11:35 A.M. Which of the following technique(s) might you use to determine the next time all three trains will be leaving at the same time? Justify your selection(s). Then use the technique to solve the problem.

Clark Street Train Station	
Train	Leaves Station
Red-line	every 14 minutes
Blue-line	every 16 minutes
Brown-line	every 8 minutes

mental math

number sense

estimation

33. **OPEN ENDED** Write three numbers that have an LCM of 30.

34. **WRITING IN MATH** Describe the relationship between 4, 20, and 5 using the words *factor* and *multiple*.

**TEST PRACTICE**

35. Which rule describes the common multiples of 12 and 18, where n represents the counting numbers?

- A $12n$
- B $18n$
- C $36n$
- D $216n$

36. **SHORT RESPONSE** Wil swims every third day, runs every fourth day, and lifts weights every fifth day. If Wil does all three activities today, how many days will pass before he does all three activities on the same day again?

Spiral Review

Write each percent as a decimal. (Lesson 4-7)

37. 55%

38. 26.4%

39. $\frac{1}{4}\%$

40. 2%

41. **DIAMONDS** Sixty-eight percent of engagement rings have a diamond that is round in shape. Write this percent as a fraction in simplest form. (Lesson 4-6)

42. **ALGEBRA** Solve $3x = 18$. (Lesson 3-3)

43. **ALGEBRA** Rose swam 7 laps more than twice the number of laps her sister swam. Write an algebraic expression to represent this situation. (Lesson 3-1)

GET READY for the Next Lesson

PREREQUISITE SKILL Replace each \bullet with $<$, $>$ or $=$ to make a true sentence. (Page 670)

44. $6.85 \bullet 5.68$ 45. $2.34 \bullet 2.43$ 46. $6.9 \bullet 5.99$

4-9

Comparing and Ordering Rational Numbers

MAIN IDEA

Compare and order fractions, decimals, and percents.

New Vocabulary

rational numbers
common denominator
least common denominator (LCD)

Math Online

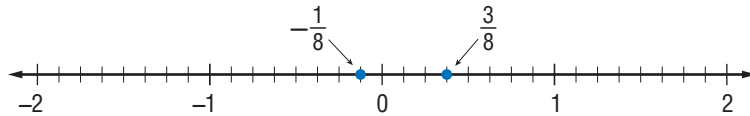
glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

MINI Lab

In Chapter 2, you used a number line to compare integers. You can also use a number line to compare positive and negative fractions.

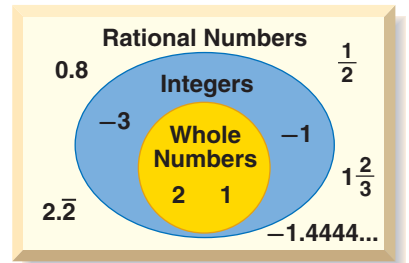
The number line shows that $-\frac{1}{8} < \frac{3}{8}$.



Graph each pair of numbers on a number line. Then determine which number is less.

- $-\frac{7}{8}, -\frac{3}{8}$
- $-\frac{5}{8}, -1\frac{1}{8}$
- $-\frac{13}{8}, -\frac{3}{8}$
- $-1\frac{7}{8}, -1\frac{5}{8}$
- $-\frac{1}{2}, -\frac{3}{4}$
- $1\frac{1}{4}, -1\frac{1}{4}$

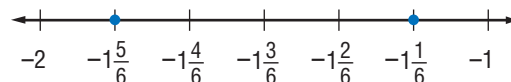
The different types of numbers you have been using are all examples of rational numbers. A **rational number** is a number that can be expressed as a fraction. Fractions, terminating and repeating decimals, percents, and integers are all rational numbers. The points corresponding to rational numbers begin to “fill in” the number line.



EXAMPLE Compare Rational Numbers

- 1 Replace the \bullet with $<$, $>$, or $=$ to make $-1\frac{5}{6} \bullet -1\frac{1}{6}$ a true sentence.

Graph each rational number on a number line. Mark off equal size increments of $\frac{1}{6}$ between -2 and -1 .



The number line shows that $-1\frac{5}{6} < -1\frac{1}{6}$.

CHECK Your Progress

- a. Replace the \bullet with $<$, $>$, or $=$ to make $-5\frac{5}{9} \bullet -5\frac{1}{9}$ a true sentence.



A **common denominator** is a common multiple of the denominators of two or more fractions. The **least common denominator** or **LCD** is the LCM of the denominators. You can use the LCD to compare fractions.

EXAMPLE Compare Rational Numbers

- 2 Replace the \bullet with $<$, $>$, or $=$ to make $\frac{7}{12} \bullet \frac{8}{18}$ a true sentence.

$12 = 2^2 \cdot 3$ and $18 = 2 \cdot 3^2$. So, the LCM is $2^2 \cdot 3^2$ or 36. The LCD of the denominators 12 and 18 is 36.

$$\begin{aligned} \frac{7}{12} &= \frac{7 \times 3}{12 \times 3} & \frac{8}{18} &= \frac{8 \times 2}{18 \times 2} \\ &= \frac{21}{36} & &= \frac{16}{36} \end{aligned}$$

Since $\frac{21}{36} > \frac{16}{36}$, then $\frac{7}{12} > \frac{8}{18}$.

CHECK Your Progress

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

b. $\frac{5}{6} \bullet \frac{7}{9}$

c. $\frac{1}{5} \bullet \frac{7}{50}$

d. $-\frac{9}{16} \bullet -\frac{7}{10}$



You can also compare fractions by writing each fraction as a decimal and then comparing the decimals.

Real-World EXAMPLE

- 3 **ROLLER SHOES** In Mr. Huang's math class, 6 out of 32 students own roller shoes. In Mrs. Trevino's math class, 5 out of 29 students own roller shoes. In which class do a greater fraction of students own roller shoes?

Since the denominators are large, write $\frac{6}{32}$ and $\frac{5}{29}$ as decimals and then compare.

$$6 \div 32 = 0.1875 \quad 5 \div 29 \approx 0.1724 \quad \text{Divide.}$$

Since $0.1875 > 0.1724$, then $\frac{6}{32} > \frac{5}{29}$.

So, a greater fraction of students in Mr. Huang's class own roller shoes.

CHECK Your Progress

- e. **BOWLING** Twelve out of 32 students in second period class like to bowl. In fifth period class, 12 out of 29 students like to bowl. In which class do a greater fraction of the students like to bowl?



Real-World Link

The first roller shoe was introduced in 2001.

Source: Associated Content, Inc.



These fraction-decimal-percent equivalents are used frequently.

Fractions-Decimals-Percents			Key Concept
$\frac{1}{4} = 0.25 = 25\%$	$\frac{1}{5} = 0.2 = 20\%$	$\frac{1}{8} = 0.125 = 12.5\%$	$\frac{1}{10} = 0.1 = 10\%$
$\frac{1}{2} = 0.5 = 50\%$	$\frac{2}{5} = 0.4 = 40\%$	$\frac{3}{8} = 0.375 = 37.5\%$	$\frac{3}{10} = 0.3 = 30\%$
$\frac{3}{4} = 0.75 = 75\%$	$\frac{3}{5} = 0.6 = 60\%$	$\frac{1}{3} = 0.\overline{3} = 33.\overline{3}\%$	$\frac{7}{10} = 0.7 = 70\%$
$1 = 1.00 = 100\%$	$\frac{4}{5} = 0.8 = 80\%$	$\frac{2}{3} = 0.\overline{6} = 66.\overline{6}\%$	$\frac{9}{10} = 0.9 = 90\%$

The Greek letter π (pi) represents the nonterminating and nonrepeating number whose first few digits are 3.1415926.... This number is not rational. You will learn more about *irrational numbers* in Chapter 12.

Test-Taking Tip

Reading Choices

Read all answer choices carefully before deciding on the correct answer. Often two choices will look very familiar.

TEST EXAMPLE

4 Which list shows the numbers 3.44, π , 3.14, and $3.\overline{4}$ in order from least to greatest?

- A π , 3.14, 3.44, $3.\overline{4}$ C 3.14, π , $3.\overline{4}$, 3.44
 B π , 3.14, $3.\overline{4}$, 3.44 D 3.14, π , 3.44, $3.\overline{4}$

Read the Item

Compare the digits using place value.

Solve the Item

Line up the decimal points and compare using place value.

3.140	Annex a zero.	3.440	Annex a zero.
3.1415926...	$\pi \approx 3.1415926...$	3.444...	$3.\overline{4} = 3.444...$

Since $0 < 1$, $3.14 < \pi$.

Since $0 < 4$, $3.44 < 3.\overline{4}$.

So, the order of the numbers from least to greatest is 3.14, π , 3.44, and $3.\overline{4}$... The answer is D.

CHECK Your Progress

f. The amount of rain received on four consecutive days was 0.3 inch, $\frac{3}{5}$ inch, 0.75 inch, and $\frac{2}{3}$ inch. Which list shows the amounts from least to greatest?

- F 0.3 in., $\frac{2}{3}$ in., $\frac{3}{5}$ in., 0.75 in. H 0.75 in., $\frac{2}{3}$ in., $\frac{3}{5}$ in., 0.3 in.
 G 0.3 in., $\frac{3}{5}$ in., $\frac{2}{3}$ in., 0.75 in. J $\frac{3}{5}$ in., $\frac{2}{3}$ in., 0.3 in., 0.75 in.



CHECK Your Understanding

Examples 1–2
(pp. 215–216)

Replace each ● with $<$, $>$, or $=$ to make a true sentence. Use a number line if necessary.

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

Example 3
(p. 216)

5. **SOCCER** The table shows the average saves for two soccer goalies. Who has the better average, Elliot or Shanna? Explain.

Name	Average
Elliot	3 saves out of 4
Shanna	7 saves out of 11

6. **SCHOOL** On her first quiz in social studies, Majorie answered 23 out of 25 questions correctly. On her second quiz, she answered 27 out of 30 questions correctly. On which quiz did Majorie have the greater score?

Example 4
(p. 217)

7. **MULTIPLE CHOICE** The lengths of four insects are 0.02-inch, $\frac{1}{8}$ -inch, 0.1-inch, and $\frac{2}{3}$ -inch. Which list shows the lengths in inches from least to greatest?

- A 0.1, 0.02, $\frac{1}{8}$, $\frac{2}{3}$ C 0.02, 0.1, $\frac{1}{8}$, $\frac{2}{3}$
 B $\frac{1}{8}$, 0.02, 0.1, $\frac{2}{3}$ D $\frac{2}{3}$, 0.02, 0.1, $\frac{1}{8}$

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
8–19	1, 2
20–25, 49	3
26–31, 48	4

Replace each ● with $<$, $>$, or $=$ to make a true sentence. Use a number line if necessary.

8. $-\frac{3}{5} \bullet -\frac{4}{5}$ 9. $-\frac{5}{7} \bullet -\frac{2}{7}$ 10. $-7\frac{5}{8} \bullet -7\frac{1}{8}$ 11. $-3\frac{2}{3} \bullet -3\frac{4}{6}$
 12. $\frac{7}{10} \bullet \frac{2}{3}$ 13. $\frac{4}{7} \bullet \frac{5}{8}$ 14. $\frac{2}{3} \bullet \frac{10}{15}$ 15. $-\frac{17}{24} \bullet -\frac{11}{12}$
 16. $2\frac{3}{4} \bullet 2\frac{2}{3}$ 17. $6\frac{2}{3} \bullet 6\frac{1}{2}$ 18. $5\frac{5}{7} \bullet 5\frac{11}{14}$ 19. $3\frac{11}{16} \bullet 3\frac{7}{8}$
 20. 40% ● 112 out of 25 21. 3 out of 5 ● 59%
 22. 0.82 ● 5 out of 6 23. 9 out of 20 ● 0.45

24. **MONEY** The table shows how much copper is in each type of coin. Which coin contains the greatest amount of copper?

Coin	Amount of Copper
Dime	$\frac{12}{16}$
Nickel	$\frac{3}{4}$
Penny	$\frac{1}{400}$
Quarter	$\frac{23}{25}$

25. **BASKETBALL** Gracia and Jim were shooting free throws. Gracia made 4 out of 15 free throws. Jim *missed* the free throw 6 out of 16 times. Who made the free throw a greater fraction of the time?





Order each set of numbers from least to greatest.

26. $0.23, 19\%, \frac{1}{5}$ 27. $\frac{8}{10}, 81\%, 0.805$ 28. $-0.615, -\frac{5}{8}, -0.62$
 29. $-1.4, -1\frac{1}{25}, -1.25$ 30. $7.49, 7\frac{49}{50}, 7.5$ 31. $3\frac{4}{7}, 3\frac{3}{5}, 3.47$

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

32. $\frac{5}{8}$ yard ● $\frac{1}{16}$ yard 33. 0.25 pound ● $\frac{2}{9}$ pound
 34. $2\frac{5}{6}$ hours ● 2.8 hours 35. $1\frac{7}{12}$ gallons ● $1\frac{5}{8}$ gallons

MEASUREMENT Order each of the following from least to greatest.

36. 4.4 miles, $4\frac{3}{8}$ miles, $4\frac{5}{12}$ miles 37. 6.5 cups, $6\frac{1}{3}$ cups, 6 cups
 38. 1.2 laps, 2 laps, $\frac{1}{2}$ lap 39. $\frac{1}{5}$ gram, 5 grams, 1.5 grams

ANIMALS For Exercises 40–42, use the table that shows the lengths of the smallest mammals.

Animal	Length (ft)
Eastern Chipmunk	$\frac{1}{3}$
Kitti's Hog-Nosed Bat	$0.8\bar{3}$
European Mole	$\frac{5}{12}$
Masked Shrew	$\frac{1}{6}$
Spiny Pocket Mouse	0.25

Source: Scholastic Book of World Records

40. Which animal is the smallest mammal?
 41. Which animal is smaller than the European mole but larger than the spiny pocket mouse?
 42. Order the animals from greatest to least size.

SOFTBALL For Exercises 43 and 44, use the following table which shows the at-bats, hits, and home run statistics for four players on the 2004 Olympics U.S. Women's softball team.

Player	At-Bats	Hits	Home Runs
Crystal Bustos	26	9	5
Kelly Krestschman	21	7	1
Stacey Nuveman	16	5	2
Natasha Watley	30	12	0

Source: Olympic Movement

43. Write the ratio of hits to at-bats as a decimal to the nearest thousandth for each player. Who had the greatest batting average during the Olympic games?
 44. Write the ratio of home runs to at-bats as a decimal for each player. Who had the greatest home run average during the Olympic games?



Real-World Link

The Olympic gold medals are actually made out of 92.5% silver, with the gold medal covered in 6 grams of pure gold.

EXTRA PRACTICE

See pages 679, 707.

H.O.T. Problems

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

12 out of 15

0.08

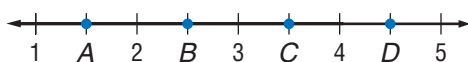
80%

 $\frac{4}{5}$

46. **CHALLENGE** Explain how you know which number, $1\frac{15}{16}$, $\frac{17}{8}$, or $\frac{63}{32}$, is nearest to 2.
47. **WRITING IN MATH** Write a word problem about a real-world situation in which you would compare rational numbers. Then solve the problem.

**TEST PRACTICE**

48. Which point shows the location of $\frac{7}{2}$ on the number line?



- A point A
B point B
C point C
D point D

49. Which list of numbers is ordered from least to greatest?

F $\frac{1}{4}, 4\frac{1}{4}, 0.4, 0.04$ G $0.04, 0.4, 4\frac{1}{4}, \frac{1}{4}$ H $0.04, \frac{1}{4}, 0.4, 4\frac{1}{4}$ J $0.4, \frac{1}{4}, 0.04, 4\frac{1}{4}$

50. Which of the following fractions is closest to 0?

A $-\frac{3}{4}$ C $\frac{7}{12}$ B $-\frac{2}{3}$ D $\frac{5}{8}$ **Spiral Review**

Find the LCM of each set of numbers. (Lesson 4-8)

51. 14, 21

52. 3, 13

53. 12, 16

SALES TAX The table shows the sales tax rate for the states shown. Write each sales tax rate as a decimal. (Lesson 4-7)

54. Kentucky
55. Illinois
56. North Carolina

State	Sales Tax
Illinois	6.25%
Kentucky	6%
North Carolina	4.25%
South Carolina	5%

Source: Federation of Tax Administrators

Find the GCF of each set of numbers. (Lesson 4-2)

57. 18, 72

58. 40, 12

59. 72, 20

ALGEBRA Solve each equation. (Lesson 3-5)

60. $4x + 3 = 15$

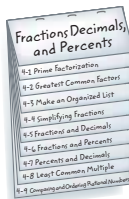
61. $2n - 5 = 19$

62. $-8 = -3d + 1$

FOLDABLES
 Study Organizer

GET READY to Study

Be sure the following Big Ideas are noted in your Foldable.


BIG Ideas
Greatest Common Factor (Lesson 4-2)

- The greatest common factor or GCF is the greatest of the common factors of two or more numbers.

Fractions, Decimals, and Percents

(Lessons 4-4 to 4-7)

- A fraction is in simplest form when the GCF of the numerator and denominator is 1.
- A terminating decimal is a decimal whose digits end. Repeating decimals have a pattern in their digits that repeats forever.
- A percent is a part to whole ratio that compares a number to 100.
- To write a percent as a decimal, divide the percent by 100 and remove the percent symbol.
- To write a decimal as a percent, multiply the percent by 100 and add the percent symbol.

Least Common Multiple (Lesson 4-8)

- The least common multiple or LCM of two or more numbers is the least of their common multiples.

Rational Numbers (Lesson 4-9)

- A rational number is one that can be expressed as a fraction.

Key Vocabulary

bar notation (p. 197)	multiple (p. 211)
common denominator (p. 216)	percent (p. 202)
composite number (p. 181)	prime factorization (p. 182)
equivalent fractions (p. 192)	prime number (p. 181)
factor tree (p. 182)	ratio (p. 202)
greatest common factor (GCF) (p. 186)	rational number (p. 215)
least common denominator (p. 216)	repeating decimal (p. 197)
least common multiple (LCM) (p. 211)	simplest form (p. 192)
	terminating decimal (p. 197)
	Venn diagram (p. 186)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

1. A ratio is a comparison of two numbers by multiplication.
2. A rational number is a whole number greater than 1 that has exactly two factors, 1 and itself.
3. 1.875 is an example of a terminating decimal.
4. A common denominator for the fractions $\frac{2}{3}$ and $\frac{1}{4}$ is 12.
5. The greatest common factor of 3 and 5 is 15.
6. A ratio that compares a number to 100 is a percent.
7. The fractions $\frac{9}{21}$ and $\frac{3}{7}$ are equivalent fractions.

4-4

Simplifying Fractions (pp. 192–195)

Write each fraction in simplest form.

22. $\frac{12}{15}$ 23. $\frac{35}{60}$ 24. $\frac{11}{121}$
25. $\frac{14}{63}$ 26. $\frac{37}{45}$ 27. $\frac{55}{110}$

28. **CATS** The average household cat sleeps 18 hours a day. Write a fraction in simplest form comparing the number of hours a household cat sleeps to the number of hours in a day.

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

Find the GCF of the numerator and denominator.

$$24 = 1, 2, 3, 4, 6, \mathbf{8}, 12, 24$$

$$32 = 1, 2, 4, \mathbf{8}, 16, 32$$

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

4-5

Fractions and Decimals (pp. 196–200)

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

29. $\frac{3}{4}$ 30. $\frac{7}{8}$ 31. $\frac{5}{9}$
32. $4\frac{1}{3}$ 33. $6\frac{2}{5}$ 34. $1\frac{6}{7}$

Write each decimal as a fraction in simplest form.

35. 0.7 36. 0.44 37. 0.05
38. 0.18 39. 0.54 40. 0.08
41. **RUNNING** Jeremy ran a mile in 5 minutes and 8 seconds. Write this time in minutes as a decimal.

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.

$$\begin{aligned} 0.64 &= \frac{64}{100} \\ &= \frac{16}{25} \end{aligned}$$

Write as a fraction with a denominator of 100.
Simplify.

4-6

Fractions and Percents (pp. 202–205)

Write each fraction as a percent.

42. $\frac{32}{100}$ 43. $\frac{11}{25}$ 44. $\frac{47}{50}$ 45. $\frac{8}{20}$

Write each percent as a fraction in simplest form.

46. 68% 47. 95% 48. 42% 49. 16%
50. **LUNCH** In Mrs. Soulise's class, 56% of the students buy their lunch. Write this percent as a fraction in simplest form.

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

$$\begin{aligned} \frac{27}{50} &= \frac{54}{100} \\ &= 54\% \end{aligned}$$

Write an equivalent fraction with a denominator of 100.
Definition of percent

Example 8 Write 96% as a fraction.

$$\begin{aligned} 96\% &= \frac{96}{100} \\ &= \frac{24}{25} \end{aligned}$$

Definition of percent
Simplify.

4-7

Percents and Decimals (pp. 206–210)

Write each percent as a decimal.

51. 48%

52. 7%

53. 12.5%

54. $75\frac{1}{4}\%$

Write each decimal as a percent.

55. 0.61

56. 0.055

57. 0.19

58. 0.999

59. **FOOD** A serving of oatmeal contains 3 grams of fiber. This is 12% of the recommended daily allowance. 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.

$$0.625 = 0.\overbrace{625}^{\text{Multiply by 100.}}$$

Multiply by 100.

$$= 62.5\%$$

Add the % symbol.

4-8

Least Common Multiple (pp. 211–214)

Find the LCM of each set of numbers.

60. 9, 15

61. 4, 8

62. 16, 24

63. 3, 8, 12

64. 4, 9, 12

65. 15, 24, 30

66. **BREAKFAST** At a bakery, muffins come in dozens and individual serving containers of orange juice come in packs of 8. If Avery needs to have the same amount of muffins as orange juice containers, what is the least possible number of sets of each he needs to buy?

Example 11 Find the LCM of 8 and 36.

Write each prime factorization.

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

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

$$\text{LCM: } 2^3 \times 3^2 = 72$$

The LCM of 8 and 36 is 72.

4-9

Comparing and Ordering Rational Numbers (pp. 215–220)Replace each \bullet with $<$, $>$, or $=$ to make a true sentence.

67. $\frac{3}{8} \bullet \frac{2}{3}$

68. $-0.45 \bullet -\frac{9}{20}$

69. $\frac{8}{9} \bullet 85\%$

70. $-3\frac{3}{4} \bullet -3\frac{5}{8}$

71. **SCHOOL** Michael received a $\frac{26}{30}$ on his English quiz and received 81% on his biology test. In which class did he receive the higher score?

Example 12 Replace \bullet with $<$, $>$, or $=$ to make $\frac{3}{5} \bullet \frac{5}{8}$ 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 $\frac{3}{5} < \frac{5}{8}$.

- Find the prime factorization of 72.
- Find the GCF of 24 and 40.

- SCHEDULES** Farijah registered for French, Pre-Algebra, Life Science, English, and Social Studies. French is only offered first period, Pre-Algebra is only offered fifth period, and she must have lunch fourth period. How many different schedules can she create out of a six period day? Use the *make an organized list* strategy.

Write each fraction in simplest form.

- $\frac{24}{60}$
- $\frac{64}{72}$

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

- $\frac{7}{9}$
- $4\frac{5}{8}$
- 91%

- COINS** The United States Mint released a new quarter every ten weeks from 1999 to 2008 commemorating the 50 states. By the end of 2006, 40 state coins had been released. What percent of the coins is this?

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

- 0.84
- 0.006
- 42%

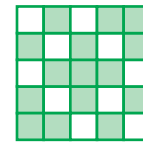
- MULTIPLE CHOICE** Which of the following is equivalent to the decimal 0.087?
 - 0.87%
 - 8.7%
 - 87%
 - 870%

Write each fraction or decimal as a percent.

- $\frac{15}{25}$
- 0.26
- 0.135

- FLOORING** Mr. Daniels is putting new floor tiles in his bathroom. He has already tiled 34 square feet of the floor measuring 5 feet by 10 feet. What percent of the floor has he tiled?

- MULTIPLE CHOICE** What percent of the figure below is unshaded?



- 15%
- 30%
- 40%
- 60%

Find the LCM of each set of numbers.

- 18, 42
- 4, 5, 12

- PRACTICE** Rico has track practice every 3 days. He has saxophone practice every 4 days. If Rico has both track and saxophone practice today, after how many days will Rico have both track and saxophone practice again?

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

- $-\frac{3}{5} \bullet -\frac{5}{9}$
- $4\frac{7}{12} \bullet 4\frac{6}{8}$
- $\frac{13}{20} \bullet 65\%$

- BASKETBALL** To make it past the first round of tryouts for the basketball team, Paul must make at least 35% of his free-throw attempts. During the first round of tryouts he makes 17 out of 40 attempts. Did Paul make it to the next round of tryouts? Explain your reasoning.

PART 1 Multiple Choice

Read each question. Then fill in the correct answer on the answer sheet provided by your teacher or on a sheet of paper.

- A large school system estimates that 0.706 of its students will take the bus to school throughout the school year. Which number is greater than 0.706?
 - $\frac{706}{1,000}$
 - $-1\frac{6}{7}$
 - $\frac{76}{100}$
 - -7.06
- Debra is working on three different art projects. She has completed $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ of these projects, respectively. Which list shows the percent of work completed on these projects from least to greatest?
 - 37.5%, 50%, 25%
 - 50%, 37.5%, 25%
 - 25%, 37.5%, 50%
 - 25%, 50%, 87.5%
- Which of the following is the prime factored form of the lowest common denominator of $\frac{1}{6}$ and $\frac{3}{8}$?

A $2^2 \times 3 \times 5$	C 2×6
B $2^3 \times 5$	D $2^3 \times 3$

TEST-TAKING TIP

Question 3 Eliminate any answer choices that you know are incorrect. Since the LCD, 24, does not have a factor of 5, you can eliminate answer choices A and B.

- Solve the equation $x + 7 = -3$. What is the value of x ?

F 4	H -4
G 3	J -10
- At a wedding reception, the number of seats s is equal to 8 times the number of tables t . Which equation matches this situation?
 - $s = 8 + t$
 - $t = 8 \cdot s$
 - $s = 8 \cdot t$
 - $t = 8 - t$
- Which problem situation matches the equation below?

$$x + 12 = 35$$
 - The difference between two numbers is 35. One of the numbers is 12. What is x , the other number?
 - Laura is 12 years younger than her brother. If Laura is 35 years old, find her brother's age x .
 - The sum of a number, x , and 12 is 35. What is the value of x ?
 - Karen had \$35. If she received \$12, what is x , the total amount she now has?
- Which of the following is true when evaluating the expression $3 \cdot 4^2 - 12 \div 6$?
 - Multiply 3 by 4 first since multiplication comes before subtraction.
 - Evaluate 4^2 first since it is a power.
 - Divide 12 by 6 first since division comes before multiplication.
 - Multiply 3 by 4 first since all operations occur in order from left to right.

8. Which sequence follows the rule $2n + 5$, where n represents the position of a term in the sequence?
- F 3, 5, 7, 9, 11, ... H 7, 9, 11, 13, 15, ...
 G 6, 8, 10, 12, 14, ... J 8, 12, 16, 20, 24, ...

9. Nicholas used the Distributive Property to evaluate the expression $5(12 + 7)$ mentally. Which of the following is a correct use of the Distributive Property to evaluate this expression?

- A $5(12 + 7) = 5(12) + 5(7) = 60 + 35$ or 95
 B $5(12 + 7) = 5(12) + 7 = 60 + 7$ or 67
 C $5(12 + 7) = 12 + 5(7) = 12 + 35$ or 47
 D $5(12 + 7) = 5 + 60 + 5 + 7 = 65 + 12$ or 77

10. Which of the following relationships is represented by the data in the table?

x	y
1	5,280
2	10,560
3	15,840
4	21,120
5	26,400

- F conversion of miles to feet
 G conversion of inches to yards
 H conversion of feet to miles
 J conversion of yards to inches
11. If $g = 4$, $m = 3$, and $n = 6$, then $\frac{mn + 2}{g} + 1$ is equivalent to which of the following?
- A 6 C 3
 B 5 D 2

PART 2 Short Response/Grid In

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

12. Write 7.2% as a decimal.
13. Jeremy expects 8 out of the 10 friends he invited to come to his party. What percent of his friends does he expect to come?

PART 3 Extended Response

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

14. The prime factorization of 24 is $2 \times 2 \times 2 \times 3$. The table lists each unique prime factor and the products of all possible unique combinations of two, three, and four prime factors.

Unique Prime Factors	2, 3
Products of Two Factors	$2 \times 2, 2 \times 3$
Products of Three Factors	$2 \times 2 \times 2, 2 \times 2 \times 3$
Product of Four Factors	$2 \times 2 \times 2 \times 3$

- a. Find each product.
 b. What do the products have in common?
 c. What other numbers are factors of 24?
 d. Explain how you can use the prime factors of a number to find all of its factors. Test your conjecture by finding the factors of 60.

NEED EXTRA HELP?														
If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Go to Lesson...	4-9	4-9	4-2	3-2	3-1	3-1	1-4	1-9	1-8	2-6	1-4	4-7	4-6	4-9