

Multiplying and Dividing Decimals

“How do you use decimals on vacation?”

If you traveled to Australia, you would need to exchange U.S. dollars for Australian dollars. In a recent month, every U.S. dollar could be exchanged for 1.79662 Australian dollars. To find how many Australian dollars you would receive, you multiply by a decimal.

You will solve a problem about exchanging U.S. currency in Lesson 4-2.

GETTING STARTED

► Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 4. Refer to the lesson or page number in parentheses for review.

Vocabulary Review

Complete each sentence.

- To find the closest value of a number based on a given place, you must the number. (Page 592)
- In 4^3 , 4 is raised to the third . (Lesson 1-4)

Prerequisite Skills

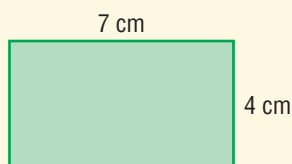
Write each power as a product. Then find the value of the power. (Lesson 1-4)

- 10^2
- 10^3
- 10^5

Evaluate each expression. (Lesson 1-5)

- $2 \times 14 + 2 \times 6$
- $2 \times 1 + 2 \times 1$
- $2 \times 2 + 2 \times 5$
- $2 \times 5 + 2 \times 9$
- $2 \times 7 + 2 \times 3$
- $2 \times 8 + 2 \times 11$

- Find the area of the rectangle. (Lesson 1-8)



Add. (Lesson 3-5)

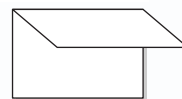
- $6.8 + 6.8 + 10.2 + 10.2$
- $7.1 + 7.1 + 13.3 + 13.3$
- $4.6 + 4.6 + 2.25 + 2.25$
- $11 + 11 + 9.9 + 9.9$
- $12.4 + 12.4 + 5.5 + 5.5$

FOLDABLES Study Organizer

Decimals Make this Foldable to help you organize your notes. Begin with one sheet of construction paper.

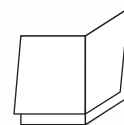
STEP 1 Fold

Fold widthwise to within 1 inch of the bottom edge.



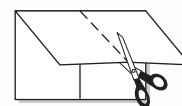
STEP 2 Fold again

Fold in half.



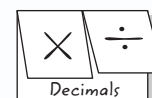
STEP 3 Cut

Open and cut along fold line, forming two tabs.



STEP 4 Label

Label as shown.



Noteables™

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



Readiness To prepare yourself for this chapter with another quiz, visit msmath1.net/chapter_readiness

What You'll LEARN

Use models to multiply a decimal by a whole number.

Materials

- grid paper
- colored pencils
- scissors

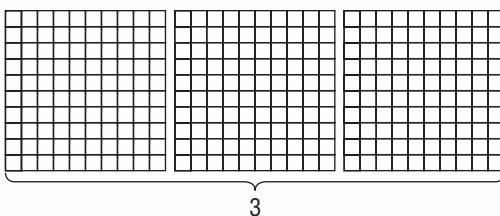
Multiplying Decimals by Whole Numbers

You can use decimal models to multiply a decimal by a whole number. Recall that a 10-by-10 grid represents the number one.

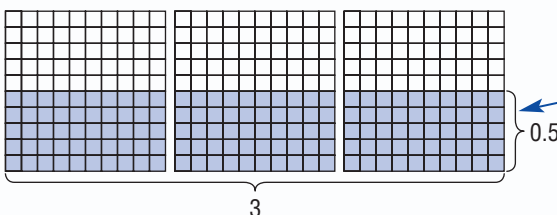
ACTIVITY

Work with a partner.

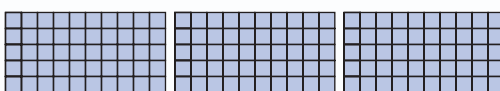
Model 0.5×3 using decimal models.



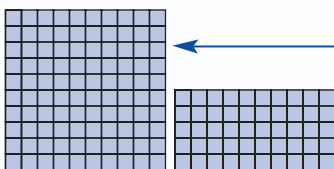
Draw three 10-by-10 decimal models to show the factor 3.



Shade five rows of each decimal model to represent 0.5.



Cut off the shaded rows and rearrange them to form as many 10-by-10 grids as possible.



The product is *one and five tenths*.

So, $0.5 \times 3 = 1.5$.



Your Turn Use decimal models to show each product.

a. 3×0.5

b. 2×0.7

c. 0.8×4

Writing Math

1. **MAKE A CONJECTURE** Is the product of a whole number and a decimal greater than the whole number or less than the whole number? Explain your reasoning.
2. Test your conjecture on 7×0.3 . Check your answer by making a model or with a calculator.

4-1

Multiplying Decimals by Whole Numbers

What You'll LEARN

Estimate and find the product of decimals and whole numbers.

NEW Vocabulary

scientific notation

Link to READING

Everyday Meaning of Annex: to add something

WHEN am I ever going to use this?

SHOPPING CDs are on sale for \$7.99. Diana wants to buy two. The table shows different ways to find the total cost.

1. Use the addition problem and the estimate to find $2 \times \$7.99$.
2. Write an addition problem, an estimate, and a multiplication problem to find the total cost of 3 CDs, 4 CDs, and 5 CDs.
3. **Make a conjecture** about how to find the product of \$0.35 and 3.

| Cost of Two CDs | |
|-----------------|--|
| Add. | $\$7.99 + \$7.99 = \$15.98$ |
| Estimate. | $\$7.99$ rounds to \$8. $2 \times \$8 = \16 |
| Multiply. | $2 \times \$7.99 = \blacksquare$ |

When multiplying a decimal by a whole number, multiply as with whole numbers. Then use estimation to place the decimal point in the product. You can also count the number of decimal places.

EXAMPLES Multiply Decimals

1 Find 14.2×6 .

Method 1 Use estimation.

Round 14.2 to 14.

$$14.2 \times 6 \rightarrow 14 \times 6 \text{ or } 84$$

$$\begin{array}{r} 14.2 \\ \times 6 \\ \hline 85.2 \end{array}$$

Since the estimate is 84, place the decimal point after the 5.

Method 2 Count decimal places.

There is one place to the right of the decimal point.

$$\begin{array}{r} 14.2 \\ \times 6 \\ \hline 85.2 \end{array}$$

Count the same number of decimal places from right to left.

1 Find 9×0.83 .

Method 1 Use estimation.

Round 0.83 to 1.

$$9 \times 0.83 \rightarrow 9 \times 1 \text{ or } 9$$

$$\begin{array}{r} 0.83 \\ \times 9 \\ \hline 7.47 \end{array}$$

Since the estimate is 9, place the decimal point after the 7.

Method 2 Count decimal places.

There are two places to the right of the decimal point.

$$\begin{array}{r} 0.83 \\ \times 9 \\ \hline 7.47 \end{array}$$

Count the same number of decimal places from right to left.

Your Turn Multiply.

a. 3.4×5

b. 11.4×8

c. 7×2.04



If there are not enough decimal places in the product, you need to annex zeros to the left.

EXAMPLES

Annex Zeros in the Product

1 Find 2×0.018 .

Estimate $2 \times 0.018 \rightarrow 2 \times 0$ or 0. The product is close to zero.

$$\begin{array}{r} 0.018 \\ \times 2 \\ \hline 0.036 \end{array}$$

There are three decimal places.

Annex a zero on the left of 36 to make three decimal places.

Check $0.018 + 0.018 = 0.036$ ✓

2 **ALGEBRA** Evaluate $4c$ if $c = 0.0027$.

$4c = 4 \times 0.0027$ Replace c with 0.0027.

$$\begin{array}{r} 0.0027 \\ \times 4 \\ \hline 0.0108 \end{array}$$

There are four decimal places.

Annex a zero to make four decimal places.

3 **Your Turn** Multiply.

d. 3×0.02

e. 8×0.12

f. 11×0.045

When the number 450 is expressed as the product of 4.5 and 10^2 (a power of ten), the number is written in **scientific notation**. You can use the order of operations or mental math to write numbers like 4.5×10^2 in standard form.

EXAMPLE

Scientific Notation

4 **DINOSAURS** Write 6.5×10^7 in standard form.

Method 1 Use order of operations.

Evaluate 10^7 first. Then multiply.

$$\begin{aligned} 6.5 \times 10^7 &= 6.5 \times 10,000,000 \\ &= 65,000,000 \end{aligned}$$

So, $6.5 \times 10^7 = 65,000,000$.

Method 2 Use mental math.

Move the decimal point 7 places.

$$\begin{aligned} 6.5 \times 10^7 &= 6.5000000 \\ &= 65,000,000 \end{aligned}$$

5 **Your Turn** Write each number in standard form.

g. 7.9×10^3

h. 4.13×10^4

i. 2.3×10^6

REAL-LIFE MATH

DINOSAURS Dinosaurs roamed Earth until about 6.5×10^7 years ago.

Source: www.zoomwhales.com



Skill and Concept Check

- Writing Math** Explain two methods of placing the decimal point in the product.
- OPEN ENDED** Write a multiplication problem where one factor is a decimal and the other is a whole number. The product should be between 2 and 3.
- FIND THE ERROR** Amanda and Kelly are finding the product of 0.52 and 2. Who is correct? Explain.

$$\begin{array}{r} \text{Amanda} \\ 0.52 \\ \times 2 \\ \hline 0.104 \end{array}$$

$$\begin{array}{r} \text{Kelly} \\ 0.52 \\ \times 2 \\ \hline 1.04 \end{array}$$

- NUMBER SENSE** Is the product of 0.81 and 15 greater than 15 or less than 15? How do you know?

GUIDED PRACTICE

Multiply.

$$\begin{array}{r} 5. \quad 0.7 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 0.3 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 0.52 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 2.13 \\ \times 6 \\ \hline \end{array}$$

$$9. \quad 4 \times 0.9$$

$$10. \quad 5 \times 0.8$$

$$11. \quad 9 \times 0.008$$

$$12. \quad 3 \times 0.015$$

- ALGEBRA** Evaluate $129t$ if $t = 2.9$.

- Write 2.5×10^3 in standard form.

Practice and Applications

Multiply.

$$\begin{array}{r} 15. \quad 1.2 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 16. \quad 0.9 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 17. \quad 0.65 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 18. \quad 6.32 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 19. \quad 0.7 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 20. \quad 1.7 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 21. \quad 3.62 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 22. \quad 0.97 \\ \times 2 \\ \hline \end{array}$$

$$23. \quad 2 \times 1.3$$

$$24. \quad 3 \times 0.5$$

$$25. \quad 1.8 \times 9$$

$$26. \quad 2.4 \times 8$$

$$27. \quad 4 \times 0.02$$

$$28. \quad 7 \times 0.012$$

$$29. \quad 9 \times 0.0036$$

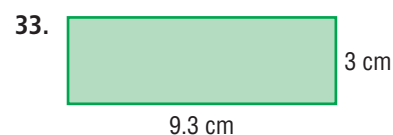
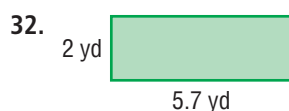
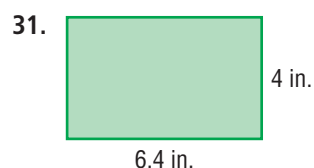
$$30. \quad 0.0198 \times 2$$

HOMEWORK HELP

| For Exercises | See Examples |
|---------------|--------------|
| 15–26, 42–45 | 1, 2 |
| 27–30 | 3 |
| 34–35 | 4 |
| 36–41 | 5 |

Extra Practice
See pages 601, 627.

GEOMETRY Find the area of each rectangle.



34. **ALGEBRA** Evaluate $3.05n$ if $n = 27$.
 35. **ALGEBRA** Evaluate $80.05w$ if $w = 2$.

Write each number in standard form.

36. 5×10^4 37. 4×10^6 38. 1.5×10^3
 39. 9.3×10^5 40. 3.45×10^3 41. 2.17×10^6

42. **MULTI STEP** Laura is trying to eat less than 750 Calories at dinner. A 4-serving, thin crust cheese pizza has 272.8 Calories per serving. A dinner salad has 150 Calories. Will Laura be able to eat the salad and two pieces of pizza for under 750 Calories? Explain.

Soccer For Exercises 43–45, use the table.

The table shows soccer ball prices that Nick found online. He decided to buy one dozen Type 3 soccer balls.

| Soccer Ball | Type 1 | Type 2 | Type 3 | Type 4 | Type 5 |
|-------------|--------|--------|--------|--------|--------|
| Price | 6.99 | 14.99 | 19.99 | 34.99 | 99.99 |

43. What is the total cost?
 44. What is the cost for one dozen of the highest price soccer balls?
 45. How much would one dozen of the lowest priced soccer balls cost?
 46. **WRITE A PROBLEM** Write a problem about a real-life situation that can be solved using multiplication. One factor should be a decimal. Then solve the problem.
 47. Which of the numbers 4, 5, or 6 is the solution of $3.67a = 18.35$?
 48. **CRITICAL THINKING** Write an equation with one factor containing a decimal where it is necessary to annex zeros in the product.



Spiral Review with Standardized Test Practice

49. **MULTIPLE CHOICE** Ernesto bought 7 spiral notebooks. Each notebook cost \$2.29, including tax. What was the total cost of the notebooks?
 Ⓐ \$8.93 Ⓑ \$16.03 Ⓒ \$16.93 Ⓓ \$17.03
 50. **MULTIPLE CHOICE** Before sales tax, what is the total cost of three CDs selling for \$13.98 each?
 Ⓕ \$13.98 Ⓖ \$20.97 Ⓗ \$27.96 Ⓘ \$41.94
 51. Add 15.783 and 390.81. (Lesson 3-5)

Estimate using rounding. (Lesson 3-4)

52. $29.34 - 9.0$ 53. $42.28 - 1.52$ 54. $26.48 + 3.95$

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Find the value of each expression. (Page 590)

55. 43×25 56. 126×13 57. 18×165

What You'll LEARN

Use decimal models to multiply decimals.

Materials

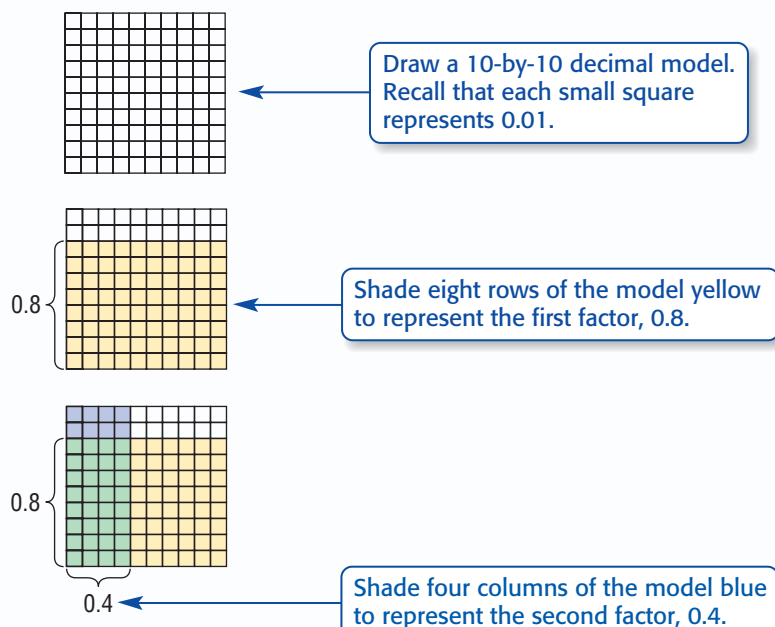
- grid paper
- colored pencils
- scissors

Multiplying Decimals

In the Hands-On Lab on page 134, you used decimal models to multiply a decimal by a whole number. You can use similar models to multiply a decimal by a decimal.

ACTIVITY

Work with a partner.

1 Model 0.8×0.4 using decimal models.

There are 32 hundredths in the region that is shaded green. So, $0.8 \times 0.4 = 0.32$.

Your Turn Use decimal models to show each product.

a. 0.3×0.3

b. 0.4×0.9

c. 0.9×0.5

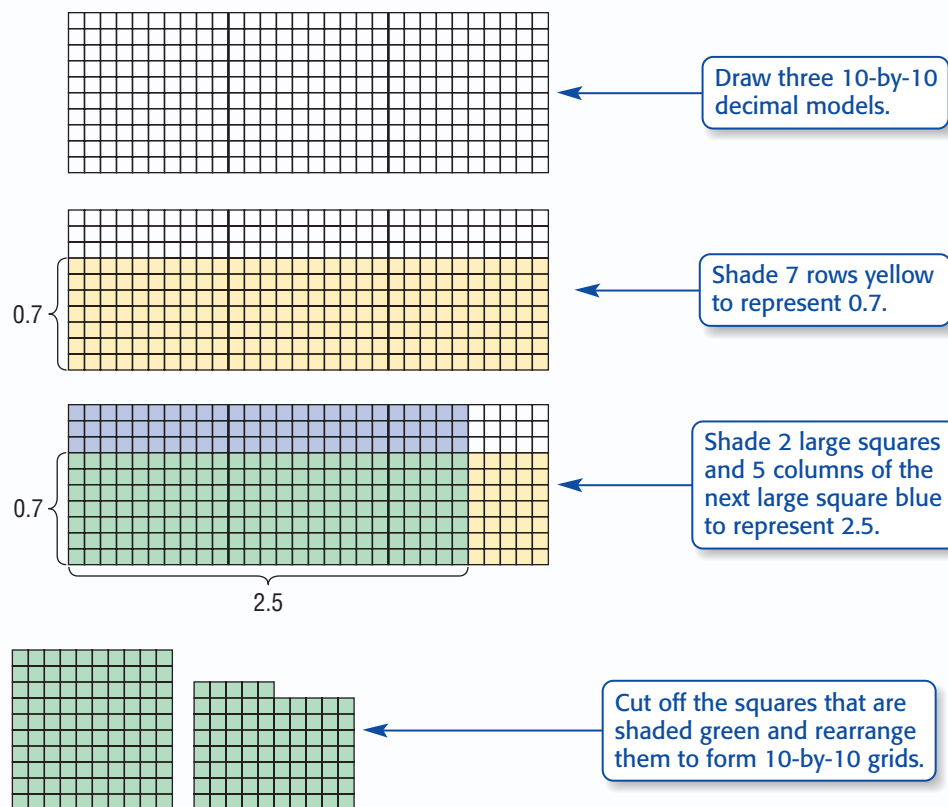
Writing Math

1. Tell how many decimal places are in each factor and in each product of Exercises a–c above.
2. **MAKE A CONJECTURE** Use the pattern you discovered in Exercise 1 to find 0.6×0.2 . Check your conjecture with a model or a calculator.
3. Find two decimals whose product is 0.24.

ACTIVITY

Work with a partner.

1 Model 0.7×2.5 using decimal models.



There are one and seventy-five hundredths in the region that is shaded green. So, $0.7 \times 2.5 = 1.75$.

Your Turn Use decimal models to show each product.

d. 1.5×0.7

e. 0.8×2.4

f. 1.3×0.3

Writing Math

4. **MAKE A CONJECTURE** How does the number of decimal places in the product relate to the number of decimal places in the factors?
5. Analyze each product.
 - a. Explain why the first product is less than 0.6.
 - b. Explain why the second product is equal to 0.6.
 - c. Explain why the third product is greater than 0.6.

| First Factor | | Second Factor | | Product |
|--------------|----------|---------------|-----|---------|
| 0.9 | \times | 0.6 | $=$ | 0.54 |
| 1.0 | \times | 0.6 | $=$ | 0.6 |
| 1.5 | \times | 0.6 | $=$ | 0.90 |

4-2

Multiplying Decimals

What You'll LEARN

Multiply decimals by decimals.

WHEN am I ever going to use this?

SHOPPING A candy store is having a sale. The sale prices are shown in the table.



| Candy Store (Cost per lb) | |
|------------------------------|--------|
| jellybeans | \$2.07 |
| gummy worms | \$2.21 |
| snow caps | \$2.79 |

- Suppose you fill a bag with 1.3 pounds of jellybeans. The product 1.3×2 can be used to estimate the total cost. Estimate the total cost.
- Multiply 13 by 200.
- How are the answers to Exercises 1 and 2 related?

Repeat Exercises 1–3 for each amount of candy.

- 1.7 pounds of gummy worms
- 2.28 pounds of snow caps
- Make a conjecture** about how to place the decimal point in the product of two decimals.

When multiplying a decimal by a decimal, multiply as with whole numbers. To place the decimal point, find the sum of the number of decimal places in each factor. The product has the same number of decimal places.

EXAMPLES Multiply Decimals

- 1** Find 4.2×6.7 . **Estimate** $4.2 \times 6.7 \rightarrow 4 \times 7$ or 28

$$\begin{array}{r}
 4.2 \quad \leftarrow \text{one decimal place} \\
 \times 6.7 \quad \leftarrow \text{one decimal place} \\
 \hline
 294 \\
 252 \\
 \hline
 28.14 \quad \leftarrow \text{two decimal places}
 \end{array}$$

The product is 28.14. Compared to the estimate, the product is reasonable.

- 2** Find 1.6×0.09 . **Estimate** $1.6 \times 0.09 \rightarrow 2 \times 0$ or 0

$$\begin{array}{r}
 1.6 \quad \leftarrow \text{one decimal place} \\
 \times 0.09 \quad \leftarrow \text{two decimal places} \\
 \hline
 0.144 \quad \leftarrow \text{three decimal places}
 \end{array}$$

The product is 0.144. Compared to the estimate, the product is reasonable.

- 3 Your Turn** Multiply.

a. 5.7×2.8

b. 4.12×0.07

c. 0.014×3.7

READING in the Content Area

For strategies in reading this lesson, visit msmath1.net/reading.



msmath1.net/extra_examples

EXAMPLE**Evaluate an Expression**

1 ALGEBRA Evaluate $1.4x$ if $x = 0.067$.

$$1.4x = 1.4 \times 0.067 \quad \text{Replace } x \text{ with } 0.067.$$

$$\begin{array}{r} 0.067 \leftarrow \text{three decimal places} \\ \times 1.4 \leftarrow \text{one decimal place} \\ \hline \end{array}$$

$$\begin{array}{r} 268 \\ 67 \\ \hline \end{array}$$

$$0.0938 \quad \leftarrow \text{Annex a zero to make four decimal places.}$$

2 Your Turn Evaluate each expression.

d. $0.04t$, if $t = 3.2$ e. $2.6b$, if $b = 2.05$ f. $1.33c$, if $c = 0.06$

There are many real-life situations when you need to multiply two decimals.

EXAMPLE**Multiply Decimals to Solve a Problem**

1 TRAVEL Ryan and his family are traveling to Mexico. One U.S. dollar is worth 8.9 pesos. How many pesos would he receive for \$75.50?

Estimate $8.9 \times 75.50 \rightarrow 9 \times 80$ or 720

$$\begin{array}{r} 75.50 \leftarrow \text{two decimal places} \\ \times 8.9 \leftarrow \text{one decimal place} \\ \hline \end{array}$$

$$67950$$

$$60400$$

$$671950$$

The product has three decimal places. You can drop the zero at the end because $671.950 = 671.95$.

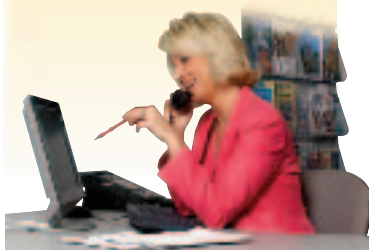
Ryan would receive 671 pesos.

REAL-LIFE CAREERS**How Does a Travel Agent Use Math?**

Travel agents use math skills to calculate the cost of trips and to compare prices.

**Research**

For information about a career as a travel agent, visit: msmath1.net/careers

**Skill and Concept Check**

- 1. OPEN ENDED** Write a multiplication problem in which the product has three decimal places.
- 2. NUMBER SENSE** Place the decimal point in the answer to make it correct. Explain your reasoning. $3.9853 \times 8.032856 = 32013341\dots$

GUIDED PRACTICE

Multiply.

3. 0.6×0.5

4. 1.4×2.56

5. 27.43×1.089

6. 0.3×2.4

7. 0.52×2.1

8. 0.45×0.053

9. **MONEY** Juan is buying a video game that costs \$32.99. The sales tax is found by multiplying the cost of the video game by 0.06. What is the cost of the sales tax for the video game?

Practice and Applications

Multiply.

- | | | |
|------------------------|--------------------------|-------------------------|
| 10. 0.7×0.4 | 11. 1.5×2.7 | 12. 0.4×3.7 |
| 13. 1.7×0.4 | 14. 0.98×7.3 | 15. 2.4×3.48 |
| 16. 6.2×0.03 | 17. 14.7×11.36 | 18. 0.28×0.08 |
| 19. 0.45×0.05 | 20. 25.24×6.487 | 21. 9.63×2.045 |

HOMESCHOOL HELP

| For Exercises | See Examples |
|---------------|--------------|
| 10–21 | 1, 2 |
| 22–25 | 3 |
| 26–28 | 4 |

Extra Practice
See pages 601, 627.

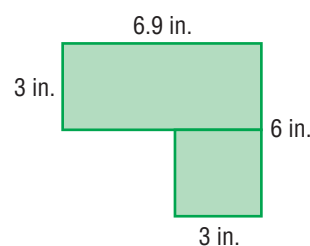
ALGEBRA Evaluate each expression if $a = 1.3$, $b = 0.042$, and $c = 2.01$.

22. $ab + c$ 23. $a \times 6.023 - c$ 24. $3.25c + b$ 25. abc

26. **TRAVEL** A steamboat travels 36.5 miles each day. How far will it travel in 6.5 days?

27. **ALGEBRA** Which of the numbers 9.2, 9.5, or 9.7 is the solution of $2.65t = 25.705$?

28. **GEOMETRY** To the nearest tenth, find the area of the figure at the right.



Tell whether each sentence is *sometimes*, *always*, or *never* true. Explain.

29. The product of two decimals less than one is less than one.
30. The product of a decimal greater than one and a decimal less than one is greater than one.

CRITICAL THINKING Evaluate each expression.

31. $0.3(3 - 0.5)$ 32. $0.16(7 - 2.8)$ 33. $1.06(2 + 0.58)$

Spiral Review with Standardized Test Practice

34. **MULTIPLE CHOICE** A U.S. dollar equals 0.623 English pound. About how many pounds will Dom receive in exchange for \$126?

- (A) 86 pounds (B) 79 pounds (C) 75 pounds (D) 57 pounds

35. **MULTIPLE CHOICE** Katelyn makes \$5.60 an hour. If she works 16.75 hours in a week, how much will she earn for the week?

- (F) \$9.38 (G) \$93.80 (H) \$938.00 (I) \$9380

Multiply. (Lesson 4-1)

36. 45×0.27 37. 3.2×109 38. 27×0.45 39. 2.94×16

40. What is the sum of 14.26 and 12.43? (Lesson 3-5)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Divide. (Page 590)

41. $21 \div 3$ 42. $81 \div 9$ 43. $56 \div 8$ 44. $63 \div 7$



4-3

Dividing Decimals by Whole Numbers

What You'll LEARN

Divide decimals by whole numbers.

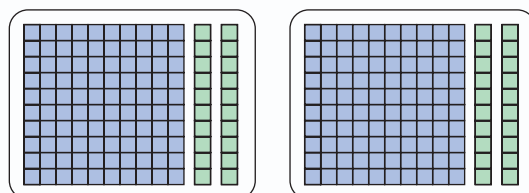
REVIEW Vocabulary

quotient: the solution in division

HANDS-ON Mini Lab

Work with a partner.

To find $2.4 \div 2$ using base-ten blocks, model 2.4 as 2 wholes and 4 tenths. Then separate into two equal groups.



There is one whole and two tenths in each group.
So, $2.4 \div 2 = 1.2$.

Use base-ten blocks to show each quotient.

1. $3.4 \div 2$
2. $4.2 \div 3$
3. $5.6 \div 4$

Find each whole number quotient.

4. $34 \div 2$
5. $42 \div 3$
6. $56 \div 4$
7. Compare and contrast the quotients in Exercises 1–3 with the quotients in Exercises 4–6.
8. **MAKE A CONJECTURE** Write a rule how to divide a decimal by a whole number.

Materials

- base-ten blocks
- markers

Dividing a decimal by a whole number is similar to dividing whole numbers.

EXAMPLE

Divide a Decimal by a 1-Digit Number

- 1** Find $6.8 \div 2$. **Estimate** $6 \div 2 = 3$

$$\begin{array}{r} 3.4 \\ 2 \overline{)6.8} \\ \underline{-6} \\ 08 \\ \underline{-8} \\ 0 \end{array}$$

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

Divide as with whole numbers.

$6.8 \div 2 = 3.4$ Compared to the estimate, the quotient is reasonable.

EXAMPLE Divide a Decimal by a 2-Digit Number

1 Find $7.49 \div 14$.

Estimate $10 \div 10 = 1$

Diagram illustrating the long division of 7.490 by 14, showing the placement of the decimal point and the process of annexing zeros.

Annotations:

- Place the decimal point.
- Annex a zero and continue.

The division steps shown are:

$$\begin{array}{r}
 0.535 \\
 14 \overline{) 7.490} \\
 \underline{-70} \\
 49 \\
 \underline{-42} \\
 70 \\
 \underline{-70} \\
 0
 \end{array}$$

$7.392 \div 14 = 0.535$ Compared to the estimate, the quotient is reasonable.

 **Your Turn** Divide.

a. $3 \overline{)7.5}$

b. $7 \overline{)3.5}$

c. $3.49 \div 4$

Checking your answer To check that the answer is correct, multiply the quotient by the divisor. In Example 2, $0.535 \times 14 = 7.49$.

Usually, when you divide decimals the answer does not come out evenly. You need to round the quotient to a specified place-value position. Always divide to one more place-value position than the place to which you are rounding.

EXAMPLE Round a Quotient

1 GRID-IN TEST ITEM Seth purchased 3 video games for \$51.79, including tax. If each game costs the same amount, what was the price of each game in dollars?

Read the Test Item To find the price of one game, divide the total cost by the number of games. Round to the nearest cent, or hundredths place, if necessary.

Solve the Test Item

$$\begin{array}{r} 17.263 \\ 3 \overline{)51.790} \\ \underline{-3} \\ 21 \\ \underline{-21} \\ 07 \\ \underline{-06} \\ 19 \\ \underline{-18} \\ 10 \\ \underline{-9} \\ 1 \end{array}$$

To the nearest cent, the cost in dollars is 17.26.

Fill in the Grid

| | | | | |
|---|---|---|---|---|
| 1 | 7 | . | 2 | 6 |
| | | | | |
| | | | | |
| 0 | 0 | 0 | 0 | 0 |
| | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | | 2 |
| 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | |
| 7 | | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 |

Test-Taking Tip

Grid In

Write the answer in the answer boxes on the top line. Then grid in 17, the decimal point, and 26.

Skill and Concept Check

- Writing Math** Explain how you can use estimation to place the decimal point in the quotient $42.56 \div 22$.
- OPEN ENDED** Write a real-life problem that involves dividing a decimal by a whole number.
- NUMBER SENSE** Is the quotient $8.3 \div 10$ greater than one or less than one? Explain.
- FIND THE ERROR** Toru and Amber are finding $11.2 \div 14$. Who is correct? Explain.

$$\begin{array}{r} \text{Toru} \\ 8. \\ 14 \overline{)11.2} \\ \underline{-112} \\ 0 \end{array}$$

$$\begin{array}{r} \text{Amber} \\ 0.8 \\ 14 \overline{)11.2} \\ \underline{-112} \\ 0 \end{array}$$

GUIDED PRACTICE

Divide. Round to the nearest tenth if necessary.

- $3 \overline{)39.39}$
- $2 \overline{)9.6}$
- $6 \overline{)8.53}$
- $46 \overline{)1087.9}$
- $12.32 \div 22$
- $69.904 \div 34$
- MONEY** Brianna and 5 of her friends bought a six-pack of fruit juice after their lacrosse game. If the six-pack costs \$3.29, how much does each person owe to the nearest cent if the cost is divided equally?

Practice and Applications

Divide. Round to the nearest tenth if necessary.

- $2 \overline{)36.8}$
- $4 \overline{)3.6}$
- $5 \overline{)118.5}$
- $19 \overline{)11.4}$
- $10.22 \div 14$
- $55.2 \div 46$
- $7 \overline{)7.24}$
- $4 \overline{)6.27}$
- $6 \overline{)232.22}$
- $31 \overline{)336.75}$
- $751.2 \div 25$
- $48.68 \div 7$

- SPORTS** Four girls of a track team ran the 4-by-100 meter relay in a total of 46.8 seconds. What was the average time for each runner?

- MUSIC** Find the average time of a track on a CD from the times in the table.

| Time of Track (minutes) | | | | |
|-------------------------|------|------|------|------|
| 4.73 | 3.97 | 2.93 | 2.83 | 3.44 |

HOMEWORK HELP

| For Exercises | See Examples |
|---------------|--------------|
| 12–14, 24–26 | 1 |
| 15–17 | 2 |
| 18–23, 27–29 | 3 |

Extra Practice
See pages 601, 627.



Data Update What is the average time of all the tracks on your favorite CD? Visit msmath1.net/data_update to learn more.

- MONEY** Tyler's father has budgeted \$64.50 for his three children's monthly allowance. Assuming they each earn the same amount, how much allowance will Tyler receive?

27. **LANDMARKS** Each story in an office building is about 4 meters tall. The Eiffel Tower in Paris, France, is 300.51 meters tall. To the nearest whole number, about how many stories tall is the Eiffel Tower?
28. **MULTI STEP** A class set of 30 calculators would have cost \$4,498.50 in the early 1970s. However, in 2002, 30 calculators could be purchased for \$352.50. How much less was the average price of one calculator in 2002 than in 1970?
29. **FOOD** The spreadsheet shows the unit price for a jar of peanut butter. To find the unit price, divide the cost of the item by its size. Find the unit price for the next three items. Round to the nearest cent.
30. **SHARING** If 8 people are going to share a 2-liter bottle of soda equally, how much will each person get?

| | A | B | C | D |
|---|---------------|--------|-------|------------|
| | Item | Cost | Size | Unit Price |
| 1 | Peanut Butter | | | |
| 2 | Butter | \$2.99 | 12 oz | 0.25 |
| 3 | Bread | \$1.19 | 16 oz | |
| 4 | Orange Juice | \$0.89 | 8 oz | |
| 5 | Cereal | \$3.35 | 18 oz | |

Find the mean for each set of data.

31. 22.6, 24.8, 25.4, 26.9 32. 1.43, 1.78, 2.45, 2.78, 3.25
33. **CRITICAL THINKING** Create a division problem that meets all of the following conditions.
- The divisor is a whole number, and the dividend is a decimal.
 - The quotient is 1.265 when rounded to the nearest thousandth.
 - The quotient is 1.26 when rounded to the nearest hundredth.

Spiral Review with Standardized Test Practice

34. **MULTIPLE CHOICE** Three people bought pens for a total of \$11.55. How much did each person pay if they shared the cost equally?

(A) \$3.25 (B) \$3.45 (C) \$3.65 (D) \$3.85

35. **SHORT RESPONSE** The table shows how much money Halley made in one week for a variety of jobs. To the nearest cent, what was her average pay for these three jobs?

| Jobs | Pay in a week |
|--------------|---------------|
| baby-sitting | \$50.00 |
| pet sitting | \$10.50 |
| lawn work | \$22.50 |

Multiply. (Lesson 4-2)

36. 2.4×5.7 37. 1.6×2.3 38. $0.32(8.1)$ 39. $2.68(0.84)$
40. What is the product of 4.156 and 12? (Lesson 4-1)
41. Find the least prime number that is greater than 25. (Lesson 1-3)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Divide. (Page 590 and Lesson 4-3)

42. $5 \overline{)25}$ 43. $81 \div 9$ 44. $14 \overline{)114.8}$ 45. $516.06 \div 18$



msmath1.net/self_check_quiz

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **OPEN ENDED** Write a multiplication problem in which one factor is a decimal and the other is a whole number. The product should be less than 5. (Lesson 4-1)
2. **Explain** how to place the decimal point in the quotient when dividing a decimal by a whole number. (Lesson 4-3)

Skills and Applications

Multiply. (Lesson 4-1)

3. 4.3×5

4. 0.78×9

5. 1.4×3

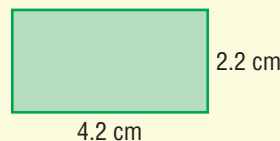
6. 5.34×3

7. 0.09×8

8. 4.6×5

9. **MONEY EXCHANGE** If the Japanese yen is worth 0.0078 of one U.S. dollar, what is the value of 3,750 yen in U.S. dollars? (Lesson 4-1)
10. **CAR PAYMENTS** Mr. Dillon will pay a total of \$9,100.08 for his car lease over a period of 36 months. How much are his payments each month? (Lesson 4-1)
11. **ALGEBRA** Evaluate $4.2y$ if $y = 0.98$. (Lesson 4-2)

12. **GEOMETRY** Find the area of the rectangle. (Lesson 4-2)



Divide. Round to the nearest tenth if necessary. (Lesson 4-3)

13. $4 \overline{)24.8}$

14. $9 \overline{)34.2}$

15. $24 \overline{)19.752}$

16. $48.6 \div 6$

17. $54.45 \div 55$

18. $2.08 \div 5$

Standardized Test Practice

19. **MULTIPLE CHOICE** Yoko wants to buy 3 necklaces that cost \$12.99 each. How much money will she need? (Lesson 4-1)

Ⓐ \$29.67 Ⓑ \$31.52
Ⓒ \$38.97 Ⓓ \$42.27
20. **SHORT RESPONSE** T-shirts are on sale at 3 for \$29.97. How much will Jessica pay for one T-shirt? (Lesson 4-3)

The Game Zone

A Place To Practice Your Math Skills

Decimos

● GET READY!

Players: two, three, or four

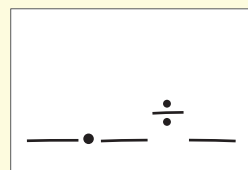
Materials: spinner, index cards

Math Skill
Dividing
Decimals by
Whole Numbers



● GET SET!

- Each player makes game sheets like the one shown at the right.
- Make a spinner as shown.



● GO!

- The first person spins the spinner. Each player writes the number in one of the blanks on his or her game sheet.

The second person spins and each player writes that number in a blank.

The next person spins and players fill in their game sheets. A zero cannot be placed as the divisor.



- All players find their quotients. The player with the greatest quotient earns one point. In case of a tie, those players each earn one point.
- **Who Wins?** The first person to earn 5 points wins.

What You'll LEARN

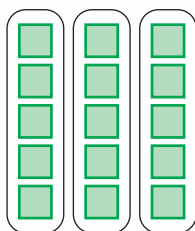
Use models to divide a decimal by a decimal.

Materials

- base-ten blocks

Dividing by Decimals

The model below shows $15 \div 3$.



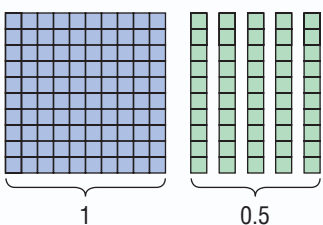
If 15 is divided into three equal sets, there are 5 in each set.

Dividing decimals is similar to dividing whole numbers. In the Activity below, 1.5 is the *dividend* and 0.3 is the *divisor*.

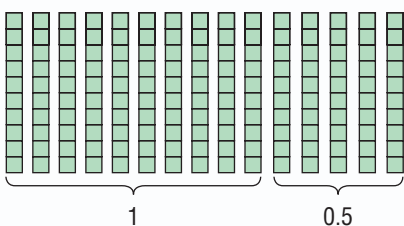
- Use base-ten blocks to model the dividend.
- Replace any ones block with tenths.
- Separate the tenths into groups represented by the divisor.
- The quotient is the number of groups.

ACTIVITY

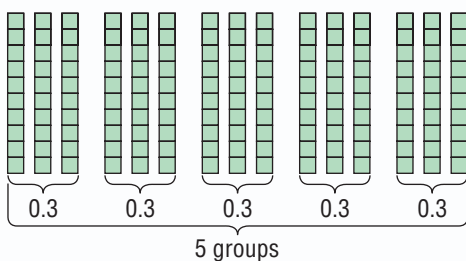
Work with a partner.

1 Model $1.5 \div 0.3$.

Place one and 5 tenths in front of you to show 1.5.



Replace the ones block with tenths. You should have a total of 15 tenths.



Separate the tenths into groups of three tenths to show dividing by 0.3.

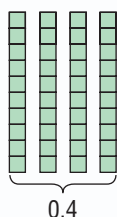
There are five groups of three tenths in 1.5. So, $1.5 \div 0.3 = 5$.

You can use a similar model to divide by hundredths.

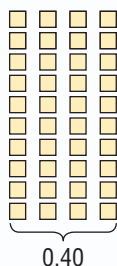
ACTIVITY

Work with a partner.

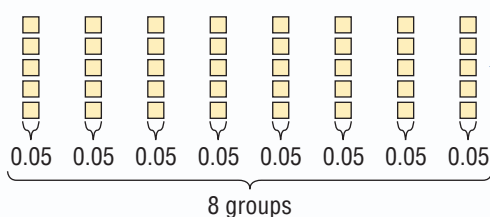
1 Model $0.4 \div 0.05$.



Model 0.4 with base-ten blocks.



Replace the tenths with hundredths since you are dividing by hundredths.



Separate the hundredths into groups of five hundredths to show dividing by 0.05.

There are eight groups of five hundredths in 0.4.

So, $0.4 \div 0.05 = 8$.

Your Turn Use base-ten blocks to find each quotient.

a. $2.4 \div 0.6$

b. $1.2 \div 0.4$

c. $1.8 \div 0.6$

d. $0.9 \div 0.09$

e. $0.8 \div 0.04$

f. $0.6 \div 0.05$

Writing Math

- Explain** why the base-ten blocks representing the dividend must be replaced or separated into the smallest place value of the divisor.
- Tell** why the quotient $0.4 \div 0.05$ is a whole number. What does the quotient represent?
- Determine** the missing divisor in the sentence $0.8 \div \underline{\quad} = 20$. Explain.
- Tell** whether $1.2 \div 0.03$ is *less than*, *equal to*, or *greater than* 1.2. Explain your reasoning.

4-4

Dividing by Decimals

HANDS-ON Mini Lab

Materials

- calculator

What You'll LEARN

Divide decimals by decimals.

REVIEW Vocabulary

power: numbers expressed using exponents (Lesson 1-4)

Work with a partner.

Patterns can help you understand how to divide a decimal by a decimal.

Use a calculator to find each quotient.

- | | |
|----------------------|-----------------------|
| 1. $0.048 \div 0.06$ | 2. $0.0182 \div 0.13$ |
| $0.48 \div 0.6$ | $0.182 \div 1.3$ |
| $4.8 \div 6$ | $1.82 \div 13$ |
| $48 \div 60$ | $18.2 \div 130$ |

3. Which of the quotients in Exercises 1 and 2 would be easier to find *without* a calculator? Explain your reasoning.

Rewrite each problem so you can find the quotient without using a calculator. Then find the quotient.

- | | | |
|--------------------|--------------------|--------------------|
| 4. $0.42 \div 0.7$ | 5. $1.26 \div 0.3$ | 6. $1.55 \div 0.5$ |
|--------------------|--------------------|--------------------|

When dividing by decimals, change the divisor into a whole number. To do this, multiply both the divisor and the dividend by the same power of 10. Then divide as with whole numbers.

EXAMPLE Divide by Decimals

- 1 Find $14.19 \div 2.2$. **Estimate** $14 \div 2 = 7$

Multiply by 10 to make a whole number.

$$\begin{array}{r} 2.2 \overline{)14.19} \end{array}$$

Multiply by the same number, 10.

$$\begin{array}{r} 6.45 \\ 22 \overline{)141.90} \\ \underline{-132} \\ 99 \\ \underline{-88} \\ 110 \\ \underline{-110} \\ 0 \end{array}$$

Place the decimal point.
Divide as with whole numbers.

Annex a zero to continue.

14.19 divided by 2.2 is 6.45. Compare to the estimate.

Check $6.45 \times 2.2 = 14.19$ ✓

Your Turn Divide.

- | | | |
|---------------------------|-----------------------------|------------------------|
| a. $1.7 \overline{)54.4}$ | b. $0.36 \overline{)8.424}$ | c. $0.0063 \div 0.007$ |
|---------------------------|-----------------------------|------------------------|

EXAMPLES

Zeros in the Quotient and Dividend

1 Find $52.8 \div 0.44$.

$$0.44 \overline{)52.80}$$

Multiply each by 100.

$$\text{So, } 52.8 \div 0.44 = 120.$$

Check $120 \times 0.44 = 52.8$ ✓

$$\begin{array}{r} 120. \\ 44 \overline{)5280.} \\ \underline{-44} \\ 88 \\ \underline{-88} \\ 00 \end{array}$$

Place the decimal point.
Divide.

Write a zero in the ones place of the quotient because $0 \div 44 = 0$.

1 Find $0.09 \div 1.8$.

$$1.8 \overline{)0.09}$$

Multiply each by 10.

$$\text{So, } 0.09 \div 1.8 \text{ is } 0.05.$$

Check $0.05 \times 1.8 = 0.09$ ✓

$$\begin{array}{r} 0.05 \\ 18 \overline{)0.90} \\ \underline{-0} \\ 09 \\ \underline{-00} \\ 90 \\ \underline{-90} \\ 0 \end{array}$$

Place the decimal point.

18 does not go into 9, so write a 0 in the tenths place.

Annex a 0 in the dividend and continue to divide.

Your Turn Divide.

d. $0.014 \overline{)5.6}$

e. $0.002 \overline{)62.4}$

f. $0.4 \div 0.0025$

There are times when it is necessary to round the quotient.

EXAMPLE

Round Quotients

INTERNET How many times more Internet subscribers are there in the U.S. than in the U.K.? Round to the nearest tenth.

$$\text{Find } 70.0 \div 13.1.$$

$$\begin{array}{r} 5.34 \\ 13.1 \overline{)70.0} \rightarrow 131 \overline{)700.00} \\ \underline{-655} \\ 450 \\ \underline{-393} \\ 570 \\ \underline{-524} \\ 46 \end{array}$$

To the nearest tenth, $70.0 \div 13.1 = 5.3$. So there are about 5.3 times more Internet subscribers in the U.S. than in the U.K.

Internet Subscribers in 2002 (millions)

| | |
|-------------|------|
| U.S. | 70.0 |
| Japan | 29.6 |
| Germany | 15.0 |
| U.K. | 13.1 |
| South Korea | 10.8 |

Source: www.digitaldelivery.com

STUDY TIP

Rounding You can stop dividing when there is a digit in the hundredths place.



Skill and Concept Check

- Writing Math** Explain why $1.92 \div 0.51$ should be about 4.
- OPEN ENDED** Write a division problem with decimals in which it is necessary to annex one or more zeros to the dividend.
- Which One Doesn't Belong?** Identify the problem that does not have the same quotient as the other three. Explain your reasoning.

$$0.5 \overline{)0.35}$$

$$5 \overline{)3.5}$$

$$0.05 \overline{)0.035}$$

$$5 \overline{)35}$$

GUIDED PRACTICE

Divide. Round to the nearest hundredth if necessary.

- $0.3 \overline{)3.69}$
- $0.8 \overline{)9.92}$
- $0.3 \overline{)0.45}$
- $3.4 \overline{)0.68}$
- $0.0025 \overline{)0.4}$
- $4.27 \div 0.35$
- $0.464 \div 0.06$
- $0.321 \div 0.4$
- $8.4 \div 2.03$

- GARDENING** A flower garden is 11.25 meters long. Mrs. Owens wants to make a border along one side using bricks that are 0.25 meter long. How many bricks does she need?

Practice and Applications

Divide.

- $0.5 \overline{)4.55}$
- $0.9 \overline{)2.07}$
- $0.14 \overline{)16.24}$
- $2.7 \overline{)1.08}$
- $0.42 \overline{)96.6}$
- $0.03 \overline{)13.5}$
- $1.3 \overline{)0.0338}$
- $3.4 \overline{)0.16728}$
- $1.44 \div 0.4$
- $29.12 \div 1.3$
- $0.12 \div 0.15$
- $0.242 \div 0.4$

- Find 10.272 divided by 2.4.
- What is $6.24 \div 0.00012$?
- CARPENTRY** If a board 7.5 feet long is cut into 2.5 foot-pieces, how many pieces will there be?

Divide. Round each quotient to the nearest hundredth.

- $0.4 \overline{)0.231}$
- $0.7 \overline{)1.32}$
- $0.26 \overline{)0.249}$
- $0.71 \overline{)0.24495}$
- $0.07625 \div 2.5$
- $2.582 \div 34.2$
- $6.453 \div 12.8$
- $3.792 \div 4.25$

- TRAVEL** The Vielhaber family drove 315.5 miles for a soccer tournament and used 11.4 gallons of gas. How many miles did they get per gallon of gas to the nearest hundredth? Estimate the answer before calculating.

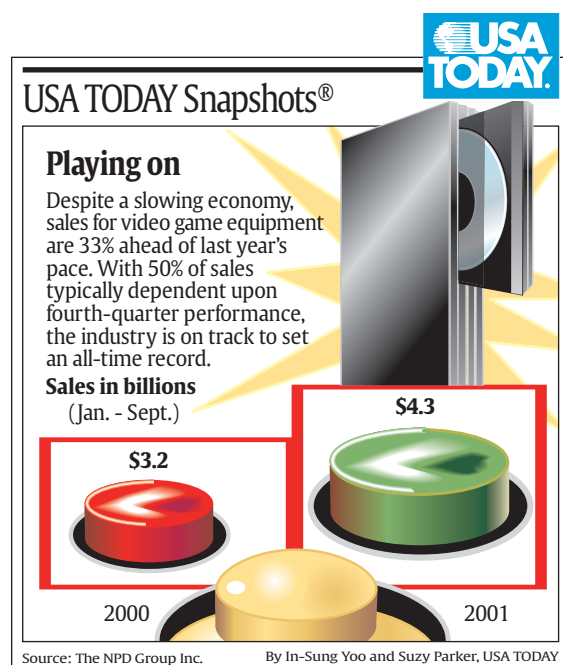
HOMEWORK HELP

| For Exercises | See Examples |
|---------------|--------------|
| 14–17, 22–28 | 1 |
| 18–19 | 2 |
| 20–21 | 3 |
| 29–40 | 4 |

Extra Practice
See pages 602, 627.

TECHNOLOGY For Exercises 38 and 39, use the information in the graphic. Estimate your answers first.

38. The 2001 sales are how many times as great as the 2000 sales? Round to the nearest tenth.
39. If the sales were to increase the same amount in 2002, what would be the predicted amount for 2002?
40. **RESEARCH** Use the Internet or another source to find the average speed of Ward Burton's car in the 2002 Daytona 500 race. If a passenger car averages 55.5 mph, how many times as fast was Ward's car, to the nearest hundredth?



41. If a decimal greater than 0 and less than 1 is divided by a lesser decimal, would the quotient be *always*, *sometimes*, or *never* less than 1? Explain.
42. **SCIENCE** Sound travels through air at 330 meters per second. How long will it take a bat's cry to reach its prey and echo back if the prey is 1 meter away?
43. **CRITICAL THINKING** Replace each ■ with digits to make a true sentence.
 $■.8■3 \div 0.82 = 4.6■$

Spiral Review with Standardized Test Practice

44. **MULTIPLE CHOICE** To the nearest tenth, how many times greater was the average gasoline price on March 8 than on January 12?
- (A) 0.9 (B) 1.1 (C) 1.2 (D) 1.3

| Date | Average U.S. Gasoline Price (per gallon) |
|------------------|--|
| January 12, 2004 | \$1.56 |
| March 8, 2004 | \$1.74 |

Source: Energy Information Administration

45. **GRID IN** Solve $z = 20.57 \div 3.4$.
46. Find the quotient when 68.52 is divided by 12. (Lesson 4-3)

Multiply. (Lesson 4-2)

47. 19.2×2.45 48. 7.3×9.367 49. 8.25×12.42 50. 9.016×51.9

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Evaluate each expression. (Lesson 1-5)

51. $2(1) + 2(3)$ 52. $2(18) + 2(9)$ 53. $2(3) \times 2(5)$ 54. $2(36) + 2(20)$



msmath1.net/self_check_quiz



Problem-Solving Strategy

A Follow-Up of Lesson 4-4

Determine Reasonable Answers

What You'll LEARN

Determine if an answer is reasonable.

For our science project we need to know how much a gray whale weighs in pounds. I found a table that shows the weights of whales in tons.

Well, I know there are 2,000 pounds in one ton. Let's use this to **find a reasonable answer**.

| Explore | We know the weight in tons. We need to find a reasonable weight in pounds. | Whale | Weight (tons) |
|---------|--|----------|---------------|
| Plan | One ton equals 2,000 pounds. So, estimate the product of 38.5 and 2,000 to find a reasonable weight. | Blue | 151.0 |
| Solve | $2,000 \times 38.5 \rightarrow 2,000 \times 40$ or 80,000 A reasonable weight is 80,000 pounds. | Bowhead | 95.0 |
| Examine | Since $2,000 \times 38.5 = 77,000$, 80,000 pounds is a reasonable answer. | Fin | 69.9 |
| | | Gray | 38.5 |
| | | Humpback | 38.1 |

Source: Top 10 of Everything

Analyze the Strategy

1. **Explain** when you would use the strategy of determining reasonable answers to solve a problem.
2. **Describe** a situation where determining a reasonable answer would help you solve a problem.
3. **Write** a problem using the table above that can be solved by determining a reasonable answer. Then tell the steps you would take to find the solution of the problem.

Apply the Strategy

Solve. Use the **determine reasonable answers** strategy.

4. **BASEBALL** In 2002, 820,590 people attended 25 of the Atlanta Braves home games. Which is a more reasonable estimate for the number of people that attended each game: 30,000 or 40,000? Explain.
5. **MONEY MATTERS** Courtney wants to buy 2 science fiction books for \$3.95 each, 3 magazines for \$2.95 each, and 1 bookmark for \$0.39 at the school book fair. Does she need to bring \$20 or will \$15 be enough? Explain.

Mixed Problem Solving

Solve. Use any strategy.

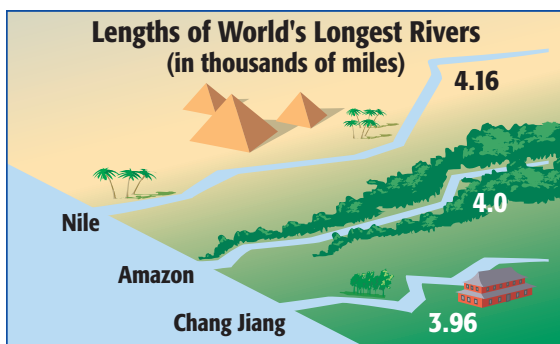
6. **PATTERNS** What are the next two figures in the pattern?



7. **ENTERTAINMENT** In music, a gold album award is presented to an artist who has sold at least 500,000 units of a single album or CD. If an artist has 16 gold albums, what is the minimum number of albums that have been sold?

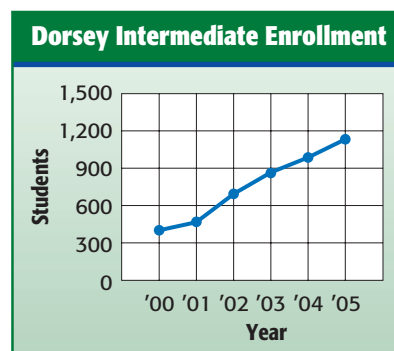
8. **AGES** Erin's mother is 4 times as old as Erin. Her grandmother is twice as old as Erin's mother. The sum of their three ages is 104. How old is Erin, her mother, and her grandmother?

9. **GEOGRAPHY** The graphic below shows the lengths in miles of the longest rivers in the world. About how many total miles long are the three rivers?



Source: The World Almanac

10. **EDUCATION** Use the graph below to predict the population of Dorsey Intermediate School in 2006.



11. Estimate the product of 56.2 and 312.
12. **EDUCATION** The high school gym will hold 2,800 people and the 721 seniors who are graduating. Is it reasonable to offer each graduate four tickets for family and friends? Explain.
13. **BIRTHDAYS** Suppose a relative matches your age with dollars each birthday. You are 13 years old. How much money have you been given over the years by this relative?
14. **STANDARDIZED TEST PRACTICE**
The median price of five gifts was \$17. The least amount spent was \$11, and the most was \$22.50. Which amount is a reasonable total for what was spent?

(A) \$65.80
(B) \$77.25

(C) \$88.50
(D) \$98.70

Geometry: Perimeter

HANDS-ON Mini Lab

What You'll LEARN

Find the perimeters of rectangles and squares.

NEW Vocabulary

perimeter

Materials

- ruler
- grid paper

Work with a partner.

What is the distance around the front cover of your textbook?

STEP 1 Use the ruler to measure each side of the front cover. Round to the nearest inch.

STEP 2 Draw the length and width of the book on the grid paper. Label the length ℓ and the width w .

1. Find the distance around your textbook by adding the measures of each side.
2. Can you think of more than one way to find the distance around your book? If so, describe it.

The distance around any closed figure is called its **perimeter**.

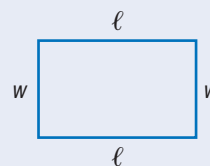
Noteables™

Key Concept: Perimeter of a Rectangle

Words The perimeter P of a rectangle is the sum of the lengths and widths. It is also two times the length ℓ plus two times the width w .

Symbols $P = \ell + w + \ell + w$
 $P = 2\ell + 2w$

Model



EXAMPLE Find the Perimeter

1 Find the perimeter of the rectangle.

Estimate $10 + 4 + 10 + 4 = 28$

$$P = 2\ell + 2w$$

Write the formula.

$$P = 2(10.2) + 2(3.9)$$

Replace ℓ with 10.2 and w with 3.9.

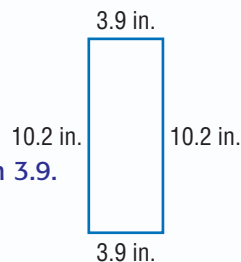
$$P = 20.4 + 7.8$$

Multiply.

$$P = 28.2$$

Add.

The perimeter is 28.2 inches. Compare to the estimate.



Your Turn Find the perimeter of each rectangle.

a. 2 ft by 3 ft

b. 6 in. by 10 in.

c. 15 mm by 12 mm

Since each side of a square has the same length, you can multiply the measure of any of its sides s by 4 to find its perimeter.

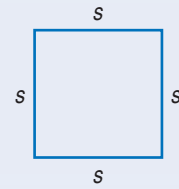
Noteables™

Key Concept: Perimeter of a Square

Words The perimeter P of a square is four times the measure of any of its sides s .

Symbols $P = 4s$

Model



EXAMPLE

Find the Perimeter of a Square

- 1 ANIMALS** The sleeping quarters for a bear at the zoo is a square that measures 4 yards on each side. What is the perimeter of the sleeping area?

Words

Perimeter of a square is equal to four times the measure of any side.

Variables

$$P = 4s$$

Equation

$$P = 4(4)$$

$$P = 4(4) \quad \text{Write the equation.}$$

$$P = 16 \quad \text{Multiply.}$$

The perimeter of the bear's sleeping area is 16 yards.

Skill and Concept Check

- OPEN ENDED** Draw a rectangle that has a perimeter of 14 inches.
- NUMBER SENSE** What happens to the perimeter of a rectangle if you double its length and width?
- FIND THE ERROR** Crystal and Luanda are finding the perimeter of a rectangle that is 6.3 inches by 2.8 inches. Who is correct? Explain.

Crystal

$$6.3 \times 2.8 = 17.64 \text{ in.}$$

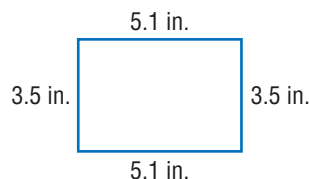
Luanda

$$6.3 + 6.3 + 2.8 + 2.8 = 18.2 \text{ in.}$$

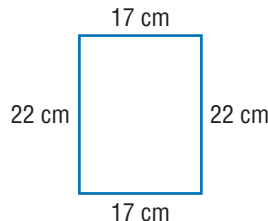
GUIDED PRACTICE

Find the perimeter of each figure.

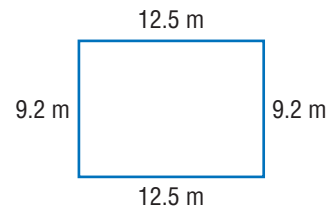
4.



5.

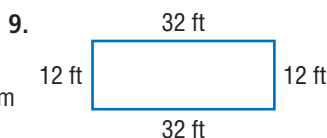
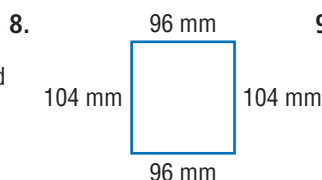
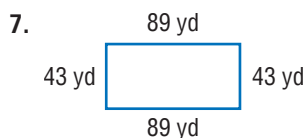


6.



Practice and Applications

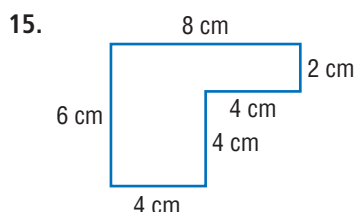
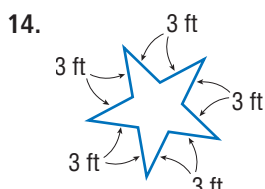
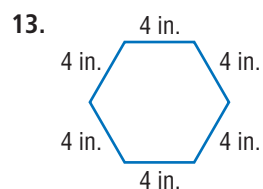
Find the perimeter of each figure.



10. 12.4 cm by 21.6 cm

11. 11.4 m by 12.9 m

12. 9.5 mi by 11.9 mi

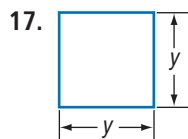
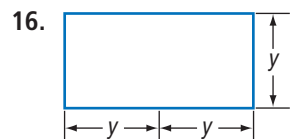


HOMEWORK HELP

For Exercises 7–15 See Examples 1, 2

Extra Practice See pages 602, 627.

How many segments y units long are needed for the perimeter of each figure?



18. **BASKETBALL** A basketball court measures 26 meters by 14 meters. Find the perimeter of the court.

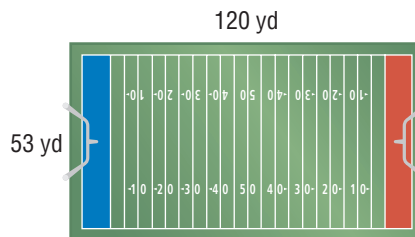
19. **CRITICAL THINKING** Refer to Exercise 18. Suppose 10 meters of seating is added to each side of the basketball court. Find the perimeter of the seating area.

Spiral Review with Standardized Test Practice

20. **MULTIPLE CHOICE** The perimeter of a rectangular playground is 121.2 feet. What is the length if the width is 25.4 feet?

- (A) 41.7 ft (B) 38.6 ft (C) 35.2 ft (D) 30.6 ft

21. **SHORT RESPONSE** Find the distance around the football field.



Divide. (Lesson 4-4)

22. $16.4 \overline{)94.3}$

23. $4.9 \overline{)14.798}$

24. $95.5 \div 0.05$

25. $21.112 \div 5.2$

26. Five people share 8.65 ounces of juice equally. How much does each receive? (Lesson 4-3)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Multiply. (Lesson 4-2)

27. 17×23

28. 28×42

29. 6.4×5.8

30. 3.22×6.7



What You'll LEARN

Find the circumference of circles.

NEW Vocabulary

circle
center
diameter
circumference
radius

MATH Symbols

π (pi) ≈ 3.14

HANDS-ON Mini Lab

Work with a partner.

The Olympic rings are made from circles. In this Mini Lab, you'll look for a relationship between the distance around a circle (circumference) and the distance across the circle (diameter).

**Materials**

- string
- ruler
- calculator
- jar lid
- other circular objects

STEP 1 Cut a piece of string the length of the distance around a jar lid C . Measure the string. Copy the table and record the measurement.

STEP 2 Measure the distance across the lid d . Record the measurement in the table.

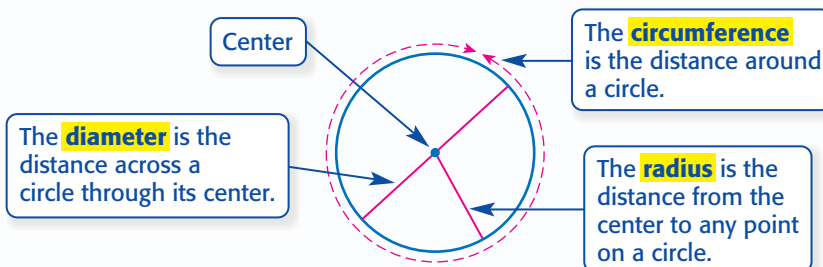
STEP 3 Repeat steps 1 and 2 for several circular objects.

STEP 4 Use a calculator to divide the distance around each circle by the distance across the circle. Record the quotient in the table

| Object | C | d | $\frac{C}{d}$ |
|--------|-----|-----|---------------|
| | | | |
| | | | |
| | | | |

1. What do you notice about each quotient?
2. What conclusion can you make about the circumference and diameter of a circle?
3. Predict the distance around a circle that is 4 inches across.

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



In the Mini Lab, you discovered that the circumference of a circle is a little more than three times its diameter. The exact number of times is represented by the Greek letter π (pi).

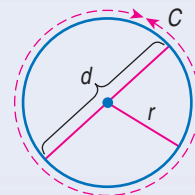
Noteables™

Key Concept: Circumference

Words The circumference of a circle is equal to π times its diameter or π times twice its radius.

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

Model



READING Math

The symbol \approx means approximately equal to.

Use a calculator to find the real value of π . $\pi = 3.1415926\ldots$. The real value of π never ends. We use 3.14 as an approximation. So, $\pi \approx 3.14$.

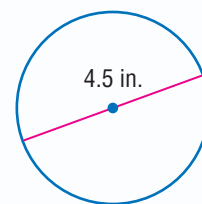
EXAMPLE Find the Circumference of a Circle

- 1 Find the circumference of a circle whose diameter is 4.5 inches. Round to the nearest tenth.

You know the diameter. Use $C = \pi d$.

$$\begin{aligned} C &= \pi d && \text{Write the formula.} \\ &\approx 3.14 \times 4.5 && \text{Replace } \pi \text{ with } 3.14 \text{ and } d \text{ with } 4.5. \\ &\approx 14.13 && \text{Multiply.} \end{aligned}$$

The circumference is about 14.1 inches.



Your Turn

- a. Find the circumference of a circle whose diameter is 15 meters. Round to the nearest tenth.

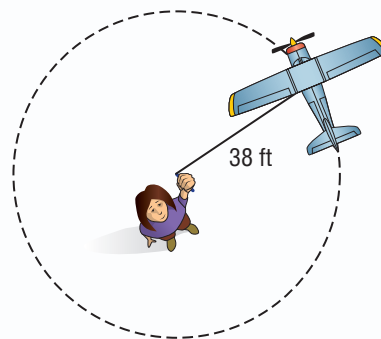
EXAMPLE Use Circumference to Solve a Problem

- 1 **HOBBIES** Ashlee likes to fly model airplanes. The plane flies in circles at the end of a 38-foot line. What is the circumference of the largest circle in which the plane can fly?

You know the radius of the circle.

$$\begin{aligned} C &= 2\pi r && \text{Write the formula.} \\ &\approx 2 \cdot 3.14 \cdot 38 && \pi \approx 3.14, r = 38 \\ &\approx 238.64 && \text{Multiply.} \end{aligned}$$

To the nearest tenth, the circumference is 238.6 feet.



- 2 **Your Turn** Find the circumference of each circle. Round to the nearest tenth.

- b. $r = 23$ in. c. $r = 4.5$ cm d. $r = 6.5$ ft

Skill and Concept Check

1. **Draw** a circle and label the center, a radius, and a diameter.
2. **OPEN ENDED** Draw and label a circle whose circumference is more than 5 inches, but less than 10 inches.
3. **FIND THE ERROR** Alvin and Jerome are finding the circumference of a circle whose radius is 2.5 feet. Who is correct? Explain.

Alvin
 $C \approx 2 \times 3.14 \times 2.5$

Jerome
 $C \approx 3.14 \times 2.5$

4. **Writing Math** Without calculating, will the circumference of a circle with a radius of 4 feet be greater or less than 24 feet? Explain your answer.

GUIDED PRACTICE

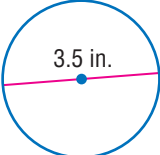
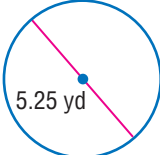


Find the circumference of each circle shown or described. Round to the nearest tenth.

5.  21 ft
6.  4 in.
7. $d = 0.875$ yard

8. Find the circumference of a circle with a radius of 0.75 meter.

Practice and Applications

Find the circumference of each circle shown or described. Round to the nearest tenth.

9.  3.5 in.
10.  5.25 yd
11.  6.2 m
12.  10.7 km

13. $d = 6$ ft
14. $d = 28$ cm
15. $r = 21$ mm
16. $r = 2.25$ in.
17. Find the circumference of a circle whose diameter is 4.8 inches.
18. The radius of a circle measures 3.5 kilometers. What is the measure of its circumference?

ENTERTAINMENT For Exercises 19–21, refer to the table. How far do passengers travel on each revolution? Round to the nearest tenth.

19. The Big Ferris Wheel
20. London Eye
21. Texas Star

| Ferris Wheel | Diameter (feet) |
|----------------------|-----------------|
| The Big Ferris Wheel | 250 |
| London Eye | 442.9 |
| Texas Star | 213.3 |

HOMEWORK HELP

| For Exercises | See Examples |
|---------------|--------------|
| 9–10, 13–14 | 1 |
| 19–22 | |
| 11–12, 15–16 | 2 |

Extra Practice
 See pages 602, 627.



msmath1.net/self_check_quiz



22. **MULTI STEP** The largest tree in the world has a diameter of about 26.5 feet at 4.5 feet above the ground. If a person with outstretched arms can reach 6 feet, how many people would it take to reach around the tree?
23. **GEOMETRY** You can find the diameter of a circle if you know its circumference. To find the circumference, you *multiply* π times the diameter. So, to find the diameter, *divide* the circumference by π .
- Find the diameter of a circle with circumference of 3.14 miles.
 - Find the diameter of a circle with circumference of 15.7 meters.
24. **CRITICAL THINKING** How would the circumference of a circle change if you doubled its diameter?
25. **CRITICAL THINKING** Suppose you measure the diameter of a circle to be about 12 centimeters and use 3.14 for π . Is it reasonable to give 37.68 as the exact circumference? Why or why not?

EXTENDING THE LESSON A *chord* is a segment whose endpoints are on a circle. A diameter is one example of a chord.

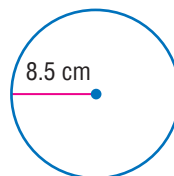
26. Draw a circle. Draw an example of a chord that is *not* a diameter.

Spiral Review with Standardized Test Practice

27. **MULTIPLE CHOICE** Find the circumference of the circle to the nearest tenth.

(A) 26.7 cm
(C) 78.1 cm

(B) 53.4 cm
(D) 106.8 cm



28. **MULTIPLE CHOICE** Awan rode his mountain bike in a straight line for a total of 565.2 inches. If his tires have a diameter of 12 inches, about how many times did the tires revolve?

(F) 180 (G) 15 (H) 13 (I) 12

Find the perimeter of each rectangle with the dimensions given. (Lesson 4-5)

- 3.8 inches by 4.9 inches
- 15 feet by 17.5 feet
- 17 yards by 24 yards
- 1.25 miles by 4.56 miles
- Find the quotient if 160.896 is divided by 12.57. (Lesson 4-4)

INTERDISCIPLINARY PROJECT

Down to the Last Penny!

Math and Finance It's time to complete your project. Use the information and data you have gathered about grocery costs for your family to prepare a spreadsheet. Be sure to include all the required calculations with your project.



msmath1.net/webquest

What You'll LEARN

Use a spreadsheet to plan a budget.

Spreadsheet Basics

Spreadsheets allow users to perform many calculations quickly and easily. They can be used to create a budget.

**ACTIVITY**

The Hoffman children are planning budgets for their allowances. Megan receives \$30 per week, Alex, \$25, and Kevin, \$20. This money is to be used for snacks, entertainment, and savings. Each child has decided what part of his or her allowance will be placed in each category. This information is summarized below.

| | Snacks | Entertainment | Savings |
|--------------|-------------|---------------|-------------|
| Megan | 25% or 0.25 | 60% or 0.60 | 15% or 0.15 |
| Alex | 30% or 0.30 | 60% or 0.60 | 10% or 0.10 |
| Kevin | 15% or 0.15 | 55% or 0.55 | 30% or 0.30 |

A spreadsheet can be used to find how much money the children have for snacks, entertainment, and savings each week. Each child's allowance and the decimal part for each category are entered into the spreadsheet. Copy the information below into your spreadsheet.

| Budgeting Allowances | | | | | | | | |
|----------------------|-------|-----------|--------|---------------|---------|---|--------|---------------|
| | A | B | C | D | E | F | G | H |
| 1 | Child | Allowance | Snacks | Entertainment | Savings | | Snacks | \$ Allotted |
| 2 | Megan | 30 | 0.25 | 0.6 | 0.15 | | =B2*C2 | Entertainment |
| 3 | Alex | 25 | 0.3 | 0.6 | 0.1 | | =B3*C3 | Savings |
| 4 | Kevin | 20 | 0.15 | 0.55 | 0.3 | | =B4*C4 | |
| 5 | | | | | | | | |

**EXERCISES**

1. Explain each of the formulas in column G.
2. Complete the formulas for columns H and I. Place these formulas in your spreadsheet.
3. How much money will Alex put into savings? How long will it take Alex to save \$50.00?
4. Add an extra row into the spreadsheet and insert your name. Enter a reasonable allowance. Then select the portion of the allowance you would put in each category. Find how much money you would actually have for each category by adding formulas for each category.

Vocabulary and Concept Check

center (p. 161)
circle (p. 161)
circumference (p. 161)

diameter (p. 161)
perimeter (p. 158)

radius (p. 161)
scientific notation (p. 136)

Choose the correct term or number to complete each sentence.

- To find the circumference of a circle, you must know its (radius, center).
- When (multiplying, dividing) two decimals, count the number of decimal places in each factor to determine the number of decimal places in the answer.
- To check your answer for a division problem, you can multiply the quotient by the (dividend, divisor).
- The number of decimal places in the product of 6.03 and 0.4 is (5, 3).
- The (perimeter, area) is the distance around any closed figure.
- The (radius, diameter) of a circle is the distance across its center.
- To change the divisor into a whole number, multiply both the divisor and the dividend by the same power of (10, 100).
- When dividing a decimal by a whole number, place the decimal point in the quotient directly (below, above) the decimal point found in the dividend.

Lesson-by-Lesson Exercises and Examples

4-1 Multiplying Decimals by Whole Numbers (pp. 135–138)

Multiply.

- 1.4×6
- 0.82×4
- 5×0.48
- 6×6.65
- 3×9.95
- 12.9×7
- 24.7×3
- 2.6×8
- SHOPPING** Three pairs of shoes are priced at \$39.95 each. Find the total cost for the shoes.
- MONEY** If you work 6 hours at \$6.35 an hour, how much would you make?

Example 1 Find 6.45×7 .

Method 1 Use estimation.

Round 6.45 to 6.

$6.45 \times 7 \rightarrow 6 \times 7$ or 42

$$\begin{array}{r} 33 \\ 6.45 \\ \times 7 \\ \hline 45.15 \end{array}$$
 Since the estimate is 42, place the decimal point after the 5.

Method 2 Count decimal places.

$$\begin{array}{r} 33 \\ 6.45 \\ \times 7 \\ \hline 45.15 \end{array}$$
 There are two decimal places to the right of the decimal in 6.45. Count the same number of places from right to left in the product.

4-2 Multiplying Decimals (pp. 141–143)

Multiply.

19. 0.6×1.3 20. 8.74×2.23
21. 0.04×5.1 22. 2.6×3.9
23. 4.15×3.8 24. 0.002×50.5
25. Find the product of 0.04 and 0.0063.

26. **GEOMETRY** Find the area of the rectangle.

5.4 in.



Example 2 Find 38.76×4.2 .

$$\begin{array}{r} 38.76 \leftarrow \text{two decimal places} \\ \times 4.2 \leftarrow \text{one decimal place} \\ \hline 7752 \\ 15504 \\ \hline 162.792 \leftarrow \text{three decimal places} \end{array}$$

4-3 Dividing Decimals by Whole Numbers (pp. 144–147)

Divide.

27. $12.24 \div 36$ 28. $32 \overline{)203.84}$
29. $35 \overline{)136.5}$ 30. $14 \overline{)37.1}$
31. $4.41 \div 5$ 32. $8 \overline{)26.96}$
33. **SPORTS BANQUET** The cost of the Spring Sports Banquet is to be divided equally among the 62 people attending. If the cost is \$542.50, find the cost per person.

Example 3 Find the quotient $16.1 \div 7$.

$$\begin{array}{r} 2.3 \leftarrow \text{Place the decimal point.} \\ 7 \overline{)16.1} \leftarrow \text{Divide as with whole numbers.} \\ \underline{-14} \\ 21 \\ \underline{-21} \\ 0 \end{array}$$

4-4 Dividing by Decimals (pp. 152–155)

Divide.

34. $0.96 \div 0.6$ 35. $11.16 \div 6.2$
36. $0.276 \div 0.6$ 37. $5.88 \div 0.4$
38. $0.5 \overline{)18.45}$ 39. $0.08 \overline{)5.2}$
40. $2.6 \overline{)0.65}$ 41. $0.25 \overline{)0.155}$
42. **SPACE** The Aero Spacelines Super Guppy, a converted Boeing C-97, can carry 87.5 tons. Tanks that weigh 4.5 tons each are to be loaded onto the Super Guppy. What is the most number of tanks it can transport?

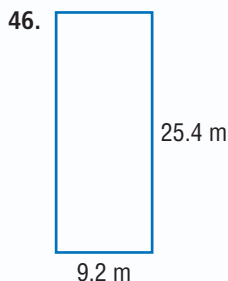
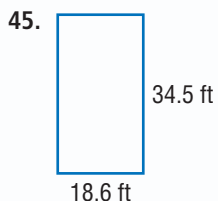
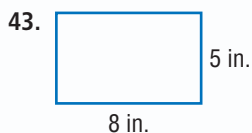
Example 4 Find $11.48 \div 8.2$.

$$\begin{array}{r} 8.2 \overline{)11.48} \leftarrow \text{Multiply the divisor and the dividend by 10 to move the decimal point one place to the right so that the divisor is a whole number.} \\ \underline{64} \\ 508 \\ \underline{576} \\ 328 \\ \underline{328} \\ 0 \end{array}$$

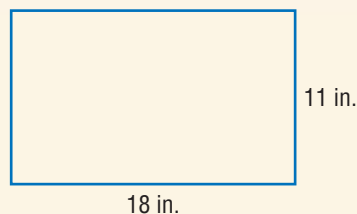
1.4 Place the decimal point.
Divide as with whole numbers.

Mixed Problem SolvingFor mixed problem-solving practice,
see page 627.**4-5 Geometry: Perimeter** (pp. 158–160)

Find the perimeter of each rectangle.



47. Find the perimeter of a rectangle that measures 10.4 inches wide and 6.4 inches long.

Example 5 Find the perimeter of the rectangle.

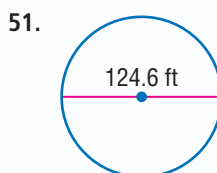
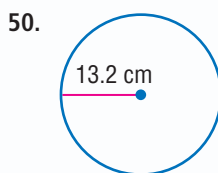
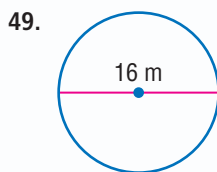
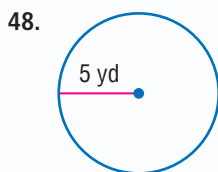
$$P = 2\ell + 2w \quad \text{Write the formula.}$$

$$P = 2(18) + 2(11) \quad \ell = 18; w = 11$$

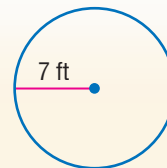
$$P = 36 + 22 \quad \text{Multiply.}$$

$$P = 58 \quad \text{Simplify.}$$

The perimeter is 58 inches.

4-6 Geometry: Circumference (pp. 161–164)Find the circumference of each circle.
Round to the nearest tenth.

52. **SWIMMING** The radius of a circular pool is 10 feet. Find the circumference of the pool. Round to the nearest tenth.
53. **SCIENCE** A radio telescope has a circular dish with a diameter of 112 feet. What is the circumference of the circular dish? Round to the nearest tenth.

Example 6 Find the circumference of the circle. Round to the nearest tenth.

$$C = 2\pi r \quad \text{Write the formula.}$$

$$\approx 2(3.14)(7) \quad \pi \approx 3.14; r = 7$$

$$\approx 43.96 \quad \text{Multiply.}$$

$$\approx 44.0 \quad \text{Round to the nearest tenth.}$$

The circumference is 44.0 feet.

Example 7 Find the circumference of the circle whose diameter is 26 meters. Round to the nearest tenth.

$$C = \pi d \quad \text{Write the formula.}$$

$$\approx (3.14)(26) \quad \pi \approx 3.14; d = 26$$

$$\approx 81.64 \quad \text{Multiply.}$$

$$\approx 81.6 \quad \text{Round to the nearest tenth.}$$

The circumference is 81.6 meters.

Practice Test

Vocabulary and Concepts

1. Explain the counting method for determining where to place the decimal when multiplying two decimals.
2. Define *perimeter*.

Skills and Applications

Multiply.

- | | | |
|---------------------|----------------------|----------------------|
| 3. 2.3×9 | 4. 4×0.61 | 5. 5.22×12 |
| 6. 0.6×2.3 | 7. 3.05×2.4 | 8. 2.9×0.16 |

9. **MONEY MATTERS** David wants to purchase a new baseball glove that costs \$49.95. The sales tax is found by multiplying the price of the glove by 0.075. How much sales tax will David pay? Round to the nearest cent.

Divide.

- | | | |
|----------------------------|--------------------------|------------------------------|
| 10. $19.36 \div 44$ | 11. $9 \overline{)37.8}$ | 12. $60.34 \div 7$ |
| 13. $1.4 \overline{)3.29}$ | 14. $93.912 \div 4.3$ | 15. $0.02 \overline{)0.015}$ |

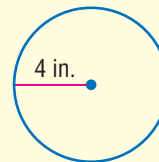
16. **SPORTS** At the 1996 Olympics, American sprinter Michael Johnson set a world record of 19.32 seconds for the 200-meter dash. A honeybee can fly the same distance in 40.572 seconds. About how many times faster than a honeybee was Michael Johnson?

Find the circumference of each circle. Round to the nearest hundredth.

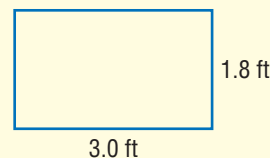
17.



18.



19. Find the perimeter of the rectangle.



Standardized Test Practice

20. Tony ordered a pizza with a circumference of 44 inches. To the nearest whole number, what is the radius of the pizza?

- (A) 7 in. (B) 7.1 in. (C) 14 in. (D) 41 in.



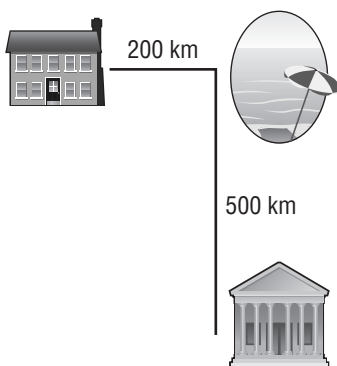
PART 1 Multiple Choice

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

1. What is $3,254 \times 6$? (Prerequisite Skill, p. 590)

(A) 18,524 (B) 19,524
(C) 19,536 (D) 24,524

2. For their vacation, the Borecki family drove from their house to the beach in 4 hours. Driving at the same rate, the Boreckis drove from the beach to a historical site.



Which expression finds the total amount of time it took them to drive from the beach to the historical site? (Lesson 1-1)

(F) $500 - 200$
(G) $500 \div 4$
(H) $(500 + 200) \div 4$
(I) $500 \div (200 \div 4)$

3. Which of the following is the greatest? (Lesson 3-1)

(A) four thousand
(B) four hundred
(C) four-thousandths
(D) four and one-thousandth

4. What is 12×0.4 ? (Lesson 4-1)

(F) 0.0048 (G) 0.048
(H) 0.48 (I) 4.8

5. You can drive your car 19.56 miles with one gallon of gasoline. How many miles can you drive with 11.86 gallons of gasoline? (Lesson 4-2)

(A) 210.45 mi (B) 231.98 mi
(C) 280.55 mi (D) 310.26 mi

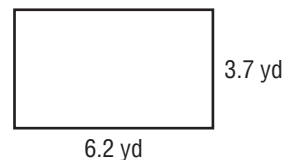
6. Ron paid \$6.72 for 40 sheets of stickers. What was the average price of each sheet of stickers rounded to the nearest cent? (Lesson 4-3)

(F) \$0.17 (G) \$0.28
(H) \$0.39 (I) \$0.59

7. What is the value of $8.7 \div 0.6$? (Lesson 4-4)

(A) 0.00145 (B) 0.145
(C) 1.45 (D) 14.5

8. Which of the following is the perimeter of the rectangle? (Lesson 4-5)



(F) 6.5 yd (G) 9.4 yd
(H) 12.2 yd (I) 19.8 yd

TEST-TAKING TIP

Question 8 Use estimation to eliminate any unreasonable answers. For example, eliminate answer F because one of the sides by itself is almost 6.5 yards.

PART 2 Short Response/Grid In

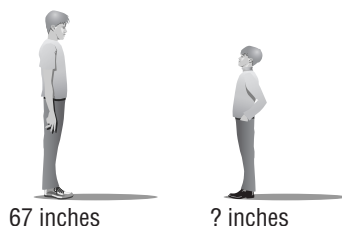
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

9. Jillian was planning a party and told 2 friends. The next day, each of those friends told 2 more friends. Then those friends each told 2 more friends.

| | |
|-------|----|
| Day 1 | 3 |
| Day 2 | 7 |
| Day 3 | 15 |
| Day 4 | 31 |
| Day 5 | ? |

If the pattern continues, how many people will know about the party by Day 5? (Lesson 1-1)

10. What is the value of $2^4 + 3^2$? (Lesson 1-5)
11. The height of each student in a class was measured and recorded. The range in heights was 13 inches. The tallest and shortest students are shown below.



What is the height of the shortest student? (Lesson 2-7)

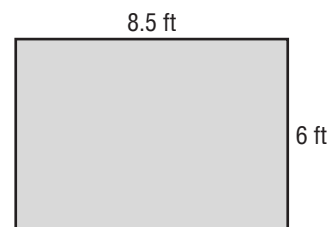
12. Yvette is training for a local run. Her goal is to run 30 miles each week. So far this week, she has run 6.5 miles, 5.2 miles, 7.8 miles, 3 miles, and 6.9 miles. How many more miles does Yvette need to run this week to reach her 30-mile goal? (Lesson 3-5)
13. Florida's population in 2025 is projected to be about 2.08×10^7 . Write the number in standard form. (Lesson 4-1)

14. Impulses in the human nervous system travel at a rate of 188 miles per hour. Find the speed in miles per minute. Round to the nearest hundredth. (Lesson 4-3)
15. The streets on Trevor's block form a large square with each side measuring 0.3 mile. If he walks around the block twice, how far does he go? (Lesson 4-5)

PART 3 Extended Response

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

16. The dimensions of a rectangle are shown below. (Lesson 4-1)



- a. What is the area of the rectangle?
- b. What is the perimeter of the rectangle?
- c. How does the perimeter and area change if each dimension is doubled? Explain.
17. Use the circle graph to find how many times more CD albums were sold than cassette singles. Round to the nearest tenth. (Lesson 4-4)

**Music Sales at Music Hut
(percent of total)**

