9 Divide Decimals

DANGER ON THE SLOPES

Woodland, Utah **January 30, 1990**

It was a cold evening in January of 1990. The chairlift at Nordic Valley Ski Area in Utah's Wasatch Mountains had just opened, and the Baileys were among the first skiers to begin the ascent to the top of the gentle beginners' slope. As Chris Bailey and her five-year-old daughter, Angela, mounted the ski lift, the chair bumped Angela from behind and she lost her balance. Chris grabbed Angela by her arm and tried to pull her into the chair beside her. But she could not lift her high enough, and the ski lift moved on. Higher and higher the chair swung, with Angela still dangling below it. Chris gripped her by only one arm.

Shawn Durrant, one of the lift operators on duty, was walking toward the ski lodge when he heard a desperate cry. Looking up, he saw Angela dangling nearly twenty feet above the ground. Tears rolled down the little girl's terrified face. Her mother hung onto the back of the chair with her free arm to keep herself from being pulled out of her seat by her daughter's weight. Shawn yelled to the other lift operator to stop the lift. Then he thought quickly. The ski patrol was too far away; the woman would not be able to hang on long enough for them to arrive with evacuation gear. He would not be able to catch the girl if her mother dropped her. His eyes fell on the 30-foot-high lift tower several feet in front of the chair. Signaling his partner to move the chair up to that tower, he began to climb the ladder on the tower's side.

As Shawn climbed, he breathed deeply to calm his pounding heart. He reached the crossbeam, stood and balanced himself, and then tiptoed to the end of it. He still could not reach the chair. Not daring to look down, he grabbed the lift cable and hung from it, moving his hands slowly along it, closer and closer. At last he reached the metal bar that connected the chair to the cable, shimmied down, and landed in the chair beside Chris. He grabbed Angela's other arm and instructed Chris to pull with him. They lifted Angela in one swift motion. Seconds later, the little girl was settled safely in the chair between them.

Skiers wait to be rescued from a chairlift that malfunctioned at Alpine Valley Ski Area near Chesterland, Ohio.

The world's highest ski resort is located on Chacaltaya, a mountain in Bolivia with an elevation of 5421 meters (17,785 feet) above sea level. It was built on a glacier which has since melted.

The world's longest ski run is Vallee Blanche at Chamonix Ski Resort in France. The run is 22 kilometers (14.7 miles) long. It begins at an altitude of 3842 meters (12,605 feet) and runs down to the village of Chamonix.

The longest run in the United States is at Jackson Hole Ski Resort in Wyoming. It has a 4,139-foot drop.

Norway's Johan Remen Evensen set a new world record for the world's longest ski jump of 246.5 meters (808.73 feet) on February 11, 2011.

The largest ski lesson was held in Heizenberg, Switzerland, on February 23, 2008. Although the lesson was taught by one instructor, the 594 students had assistant instructors to help them ski the 1300-meter (4,265.09-foot) run. The lesson lasted only sixteen minutes.

Divide Decimals

Lesson	Topic	Lesson Objectives
79	Divide Decimals	• Divide a decimal by a 1-digit whole number • Estimate the quotient of a decimal division problem • Check a division problem using multiplication • Annex a zero to rename a decimal • Divide a decimal by a power of 10 using mental math
80	Estimate	• Divide a decimal by a 1- or a 2-digit whole number • Estimate the quotient of a decimal division problem • Divide a whole number by a whole number to find a decimal fraction in the quotient • Check a division problem using multiplication • Solve a decimal word problem
81	Repeating Decimals	• Divide a decimal by a 1- or a 2-digit whole number • Estimate the quotient of a decimal division problem • Develop an understanding of terminating decimals and repeating decimals • Recognize a repeating decimal in the quotient • Divide a whole number by a whole number to find a decimal fraction in the quotient • Write an equation for a word problem • Solve money word problems
82	Fractions as Decimals	• Rename a fraction as a decimal by renaming the denominator as a power of 10 • Rename a fraction as a decimal using division • Identify a quotient as a repeating decimal or a non-repeating, non-terminating decimal • Compare a decimal and a fraction
83	Divide by a Decimal	• Divide a whole number by a decimal • Write an equation for a word problem
84	More Dividing Decimals	• Divide a whole number by a decimal • Divide a decimal by a decimal • Solve money word problems • Complete an input/output table
85	Real Numbers	• Develop an understanding of real numbers • Apply addition and multiplication properties to real numbers
86	Chapter 9 Review	• Review
87	Chapter 9 Test Cumulative Review	• Solve word problems • Read a Venn diagram • Demonstrate an understanding of the parts of a circle • Find the perimeter of a square • Determine whether two polygons are congruent or similar • Find the unknown measure of an angle in a triangle • Identify a triangle according to its angles • Read and interpret a line graph

Chapter Materials

Teacher Manipulatives Packet:
- Place Value Kit
- Number Line

Instructional Aids (Teacher's Toolkit CD):
- Cumulative Review Answer Sheet (page IA9) for each student
- Input/Output Tables (page IA43)
- Input/Output Tables (page IA43) for each student
- Dividing Decimals (page IA44)
- Dividing Decimals (page IA44) for each student

Christian Worldview Shaping (Teacher's Toolkit CD):
- Pages 23–24

Other Teaching Aids:
- A calculator for each student

Math 6 Tests and Answer Key

Optional (Teacher's Toolkit CD):
- Fact Review pages
- Application pages
- Calculator Activities

As you prepare the lessons, you will want to refer to the corresponding Instructional Aids pages located on the Teacher's Toolkit CD. If a page is not specified for the student's or teacher's use in the Chapter Materials listed above, you should prepare the page for display.

The Charts and some of the visuals from the Math 4–6 Teacher Manipulatives Packet are located in the Teaching Visuals section of the Teacher's Toolkit CD. Copies of the visuals may be prepared by home educators or by classroom teachers for individual or classroom (group) use.

A Little Extra Help

Use the following to provide "a little extra help" for the student that is experiencing difficulty with the concepts taught in Chapter 9.

Determine the number of whole-number digits when estimating quotients—To guide the student in estimating a quotient, direct him to cover all but the first digit in the dividend so that he can see only the divisor and the first digit of the dividend. Instruct him to determine whether the first digit in the dividend can be divided by the divisor. If the digit can be divided, direct him to write a small *x* above the digit. If the digit cannot be divided, instruct him to uncover the next digit in the dividend and repeat the process. After the student has written an *x* above the first digit(s) that can be divided, instruct him to write a small *x* above each successive whole-number digit in the dividend. Guide him in estimating the quotient: use the basic facts to think of compatible numbers and annex one or more zeros if needed.

Use mental math to divide a decimal by a power of 10—Write the following equations and answer choices for display. Instruct the student to circle the answer for the first equation and then check his answer using a calculator. Repeat the procedure for the remaining equations. Provide the student with additional equations as needed. After he is successful in selecting correct answers, write similar equations for display and instruct the student to write the quotient. As the student is able, encourage him to read equations aloud and direct the student to write only the quotient.

32.4 ÷ 10 = 0.324 3.24 324

17.8 ÷ 1,000 = 1.78 0.178 0.0178

34.5 ÷ 100 = 3.45 0.345 0.0345

2,893 ÷ 1,000 = 2.893 28.93 289.3

Math Facts

Throughout this chapter, review fractions using Fact Review pages on the Teacher's Toolkit CD. Also review multiplication and division facts using Fact Review pages or a Fact Fun activity on the Teacher's Toolkit CD, or you may use flashcards.

Lesson 79

Student Text pp. 190–93
Daily Review p. 433a

Objectives
- Divide a decimal by a 1-digit whole number
- Estimate the quotient of a decimal division problem
- Check a division problem using multiplication
- Annex a zero to rename a decimal
- Divide a decimal by a power of 10 using mental math

Teacher Materials
- Place Value Kit: large red ones, orange tenths, and purple hundredths

Notes

Preview the Fact Review pages, the Application pages, and the Calculator Activities located on the Teacher's Toolkit CD.

Lessons 79–82 review concepts taught earlier to solidify the student's knowledge of dividing decimals before introducing him to dividing whole numbers and decimals by a decimal in Lessons 83–84.

Introduce the Lesson

Guide the students in reading aloud the story and facts on pages 190–91 of the Student Text (pages 188–89 of this Teacher's Edition).

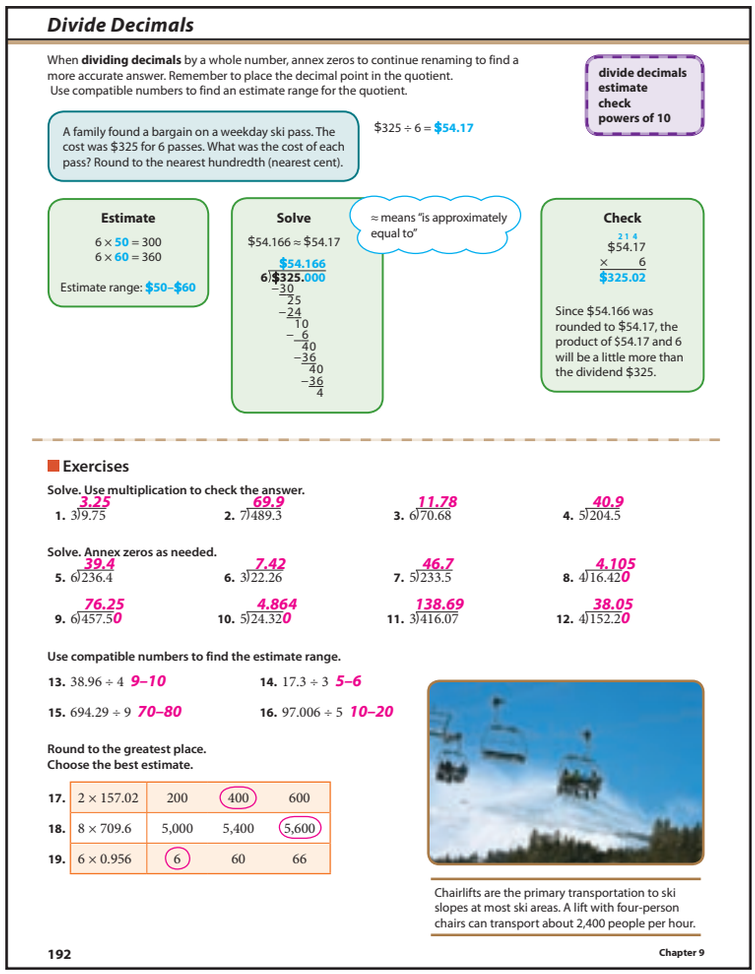
Teach for Understanding

Divide a decimal by a 1-digit whole number

1. Write 9.6 ÷ 3 and display 9 ones and 6 tenths from your Place Value Kit. Choose a student to divide the 9 ones into 3 equal sets. ***3 ones in each set***
   ➤ **What expression can you write to show the number of ones placed in each of the 3 sets?** ***9 ÷ 3*** Write (9 ÷ 3) below the problem.
   Select a student to divide the 6 tenths among the 3 sets. ***2 tenths in each set***
   ➤ **What expression can you write to show the number of tenths placed in each set?** ***0.6 ÷ 3*** Write + (0.6 ÷ 3) beside (9 ÷ 3).
   ➤ **What is 9.6 divided by 3?** ***3.2*** Complete the problem: 9.6 ÷ 3 = 3.2.
2. Write 9.6 ÷ 3 = in front of (9 ÷ 3) + (0.6 ÷ 3).
   ➤ **Is this equation a true statement? Why?** ***Yes; elicit that the value expressed on each side of the equation is 3.2.***
3. Write 9.6 ÷ 3 in a division frame for display. Remind the students that when dividing a decimal, they can estimate the quotient by determining the number of whole number digits that will be in the quotient and then they can think of the basic multiplication fact or the closest basic fact.
   ➤ **How many whole number digits will be in the quotient of this problem?** ***1*** Write a small *x* above the 9 in the Ones place of the dividend to mark the location of the first digit (the whole number) in the quotient.
   ➤ **What basic multiplication fact can you think of to determine an estimate range for the quotient?** ***3 × 3 = 9*** Remind the students that the numbers in the multiplication fact are compatible numbers.
   ➤ **What is the estimate range for the quotient of 9.6 ÷ 3? How do you know?** ***3–4; the quotient will be a little more than 3 because 9.6 is a little more than 9.***
4. Remind the students that dividing decimals by a whole number is similar to dividing whole numbers, but a decimal point must be written in the quotient.
   Choose a student to demonstrate dividing 9.6 by 3 without writing the decimal point. ***32***
   ➤ **How do you determine where to write the decimal point in the quotient?** ***Elicit that you write the decimal point between the 3 and the 2 because 9 ones divided by 3 is 3 ones. The decimal point separates the whole number (3) from the 2 tenths in the decimal fraction.***
   (***Note:*** To help the students remember to write the decimal point in the quotient, encourage them to consistently write the decimal point at the same time when solving division problems [either after completing the division, after dividing the ones and before dividing the tenths, or before starting to divide]. When guiding the students in dividing decimals, be consistent as to when you write the decimal point.)
5. Write 423.5 ÷ 7 in a division frame for display.
   ➤ **How many whole number digits will be in the quotient? How do you know?** ***2; elicit that the basic fact 7 × 6 = 42 can help you determine the estimate range and help you find the exact quotient.*** Write small *x*s above the 2 in the Tens place and the 3 in the Ones place of the dividend to mark the location of the whole number digits in the quotient.
   ➤ **What is the estimate range of the quotient? How do you know?** ***60–70; elicit that since the basic fact is 7 × 6 = 42 and the quotient has 2 digits, the compatible numbers are 7, 60, and 420; you must annex a zero in the Ones place of the estimated quotient. Because the dividend 423.5 is greater than 420 (42 tens), the quotient will be greater than 60; therefore, the estimate range is 60–70.***
6. Choose a student to demonstrate solving the division problem, explaining each step as he solves it. ***60.5***
   ➤ **Is 60.5 a reasonable answer? Why?** ***Yes; possible answers: it is within the estimate range of 60–70; it is slightly greater than 60.*** Remind the students that an estimate is an approximate answer that can help them determine whether their exact answer is reasonable. Estimating can be especially helpful when solving problems with decimals (e.g., determining the location of the decimal point in the quotient); however, checking a problem is the only way to know whether the exact answer is correct.
   Select a student to demonstrate checking the division problem with multiplication. ***7 × 60.5 = 423.5***
7. Direct the students to determine the estimate range and to solve each of the following problems. Discuss the estimate and the solution for each problem.
   45.66 ÷ 6 = ***7.61 (7–8)*** 16.1 ÷ 7 = ***2.3 (2–3)***

Annex a zero to rename a decimal

1. Write 6.6 ÷ 5 in a division frame and display 6 ones and 6 tenths. Choose a student to divide the ones and the tenths equally among 5 sets, renaming the remaining 1 one as 10 tenths. Select another student to simultaneously divide the ones and the tenths in the written problem, showing the renaming.
   ➤ **What is 6 ones ÷ 5?** ***1 in each set with 1 one remaining to divide*** **16 tenths divided by 5?** ***3 tenths in each set with 1 tenth remaining to divide***
   ➤ **How can you divide the remaining 1 tenth?** ***Elicit that you can rename the remaining 1 tenth as 10 hundredths by annexing***



Divide Decimals

When **dividing decimals** by a whole number, annex zeros to continue renaming to find a more accurate answer. Remember to place the decimal point in the quotient.
Use compatible numbers to find an estimate range for the quotient.

divide decimals
estimate
check
powers of 10

A family found a bargain on a weekday ski pass. The cost was $325 for 6 passes. What was the cost of each pass? Round to the nearest hundredth (nearest cent).

$325 ÷ 6 = $54.17

Estimate
6 × 50 = 300
6 × 60 = 360
Estimate range: $50–$60

Solve
$54.166 ≈ $54.17
$54.166
6)$325.000
−30
25
−24
10
−6
40
−36
40
−36
4

≈ means "is approximately equal to"

Check
2 1 4
$54.17
× 6
$325.02
Since $54.166 was rounded to $54.17, the product of $54.17 and 6 will be a little more than the dividend $325.

Exercises

Solve. Use multiplication to check the answer.

1. 3)9.75 — 3.25
2. 7)489.3 — 69.9
3. 6)70.68 — 11.78
4. 5)204.5 — 40.9

Solve. Annex zeros as needed.

5. 6)236.4 — 39.4
6. 3)22.26 — 7.42
7. 5)233.5 — 46.7
8. 4)16.420 — 4.105
9. 6)457.50 — 76.25
10. 5)24.320 — 4.864
11. 3)416.07 — 138.69
12. 4)152.20 — 38.05

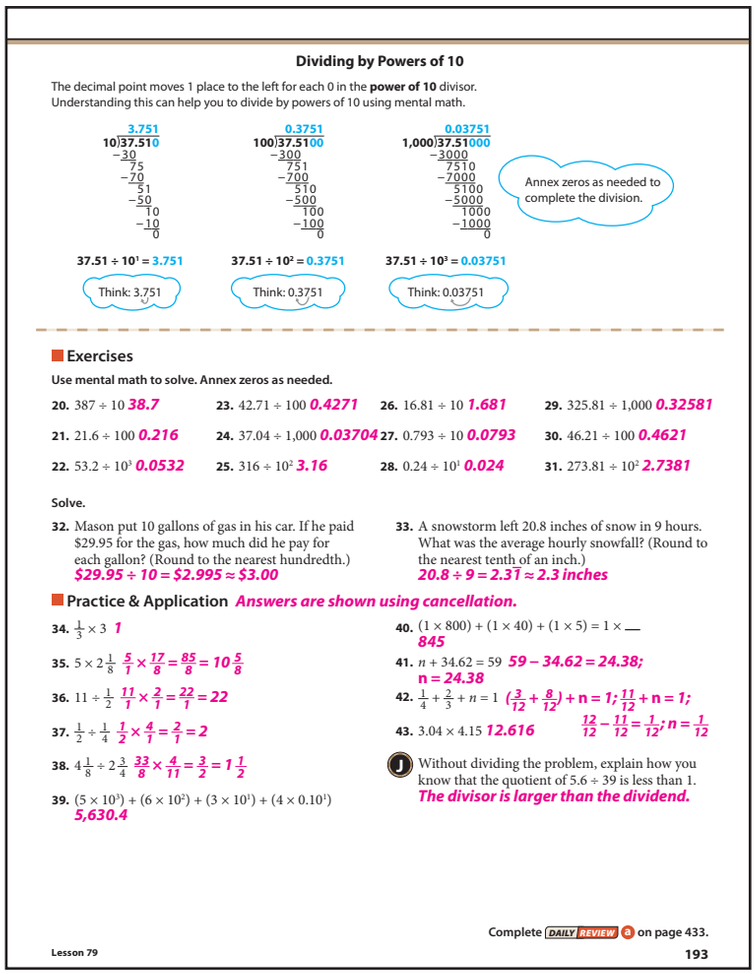
Use compatible numbers to find the estimate range.

13. 38.96 ÷ 4 — 9–10
14. 17.3 ÷ 3 — 5–6
15. 694.29 ÷ 9 — 70–80
16. 97.006 ÷ 5 — 10–20

Round to the greatest place.
Choose the best estimate.

17.	2 × 157.02	200	(400)	600
18.	8 × 709.6	5,000	5,400	(5,600)
19.	6 × 0.956	(6)	60	66

Chairlifts are the primary transportation to ski slopes at most ski areas. A lift with four-person chairs can transport about 2,400 people per hour.



Dividing by Powers of 10

The decimal point moves 1 place to the left for each 0 in the **power of 10** divisor.
Understanding this can help you to divide by powers of 10 using mental math.

3.751
10)37.510
−30
75
−70
51
−50
10
−10
0

0.3751
100)37.5100
−300
751
−700
510
−500
100
−100
0

0.03751
1,000)37.51000
−3000
7510
−7000
5100
−5000
1000
−1000
0

Annex zeros as needed to complete the division.

37.51 ÷ 10¹ = 3.751 — Think: 3.751
37.51 ÷ 10² = 0.3751 — Think: 0.3751
37.51 ÷ 10³ = 0.03751 — Think: 0.03751

Exercises

Use mental math to solve. Annex zeros as needed.

20. 387 ÷ 10 — 38.7
21. 21.6 ÷ 100 — 0.216
22. 53.2 ÷ 10³ — 0.0532
23. 42.71 ÷ 100 — 0.4271
24. 37.04 ÷ 1,000 — 0.03704
25. 316 ÷ 10² — 3.16
26. 16.81 ÷ 10 — 1.681
27. 0.793 ÷ 10 — 0.0793
28. 0.24 ÷ 10¹ — 0.024
29. 325.81 ÷ 1,000 — 0.32581
30. 46.21 ÷ 100 — 0.4621
31. 273.81 ÷ 10² — 2.7381

Solve.

32. Mason put 10 gallons of gas in his car. If he paid $29.95 for the gas, how much did he pay for each gallon? (Round to the nearest hundredth.)
$29.95 ÷ 10 = $2.995 ≈ $3.00

33. A snowstorm left 20.8 inches of snow in 9 hours. What was the average hourly snowfall? (Round to the nearest tenth of an inch.)
20.8 ÷ 9 = 2.3$\overline{1}$ ≈ 2.3 inches

Practice & Application

Answers are shown using cancellation.

34. $\frac{1}{3} \times 3$ — 1
35. $5 \times 2\frac{1}{8}$ — $\frac{5}{1} \times \frac{17}{8} = \frac{85}{8} = 10\frac{5}{8}$
36. $11 \div \frac{1}{2}$ — $\frac{11}{1} \times \frac{2}{1} = \frac{22}{1} = 22$
37. $\frac{1}{2} \div \frac{1}{4}$ — $\frac{1}{2} \times \frac{4}{1} = \frac{2}{1} = 2$
38. $4\frac{1}{8} \div 2\frac{3}{4}$ — $\frac{33}{8} \times \frac{4}{11} = \frac{3}{2} = 1\frac{1}{2}$
39. $(5 \times 10^3) + (6 \times 10^2) + (3 \times 10^1) + (4 \times 0.10^1)$ — 5,630.4
40. $(1 \times 800) + (1 \times 40) + (1 \times 5) = 1 \times$ ___ — 845
41. $n + 34.62 = 59$ — 59 − 34.62 = 24.38; n = 24.38
42. $\frac{1}{4} + \frac{2}{3} + n = 1$ — $(\frac{3}{12} + \frac{8}{12})$ + n = 1; $\frac{11}{12}$ + n = 1; $\frac{12}{12} - \frac{11}{12} = \frac{1}{12}$; n = $\frac{1}{12}$
43. 3.04×4.15 — 12.616

J Without dividing the problem, explain how you know that the quotient of 5.6 ÷ 39 is less than 1.
The divisor is larger than the dividend.

Complete DAILY REVIEW 3 on page 433.

a zero in the Hundredths place of the dividend (6.60) and in the Hundredths place of the new dividend, and then divide the 10 hundredths.

Choose one student to rename the remaining 1 tenth and to divide the 10 hundredths equally among the 5 sets and a second student to perform the renaming and the division in the written problem. *2 hundredths in each set*

➤ **Did annexing a zero in the Hundredths place of the dividend change the value of the decimal? Why?** *No; 6 tenths = 60 hundredths.* Remind the students that annexing a zero to the right of the last digit in a decimal renames a decimal fraction without changing its value and helps in finding a more accurate answer.

➤ **What does 6.6 ÷ 5 equal?** *1.32*

Choose a student to demonstrate checking the division problem. *1.32 × 5 = 6.60*

➤ **Is the division problem correct? How do you know?** *Yes; the original dividend 6.6 and the product 6.60 have the same value.*

2. Follow a similar procedure for 7.5 ÷ 2 = *3.75* and 11.53 ÷ 5 = *2.306*.

Divide a decimal by a power of 10

1. Write 10 × 32.15; 100 × 32.15; and 1,000 × 32.15 for display.

➤ **What do you know about the placement of the decimal point in the product when multiplying by a power of 10?** *Elicit that the decimal point moves 1 place to the right for each 0 in the power of 10, renaming each digit in the decimal factor as 10, 100, 1,000, . . . times its original value and resulting in a product that is 10, 100, 1,000, . . . times greater than the decimal factor.*

Select students to use mental math to solve the problems and to write the products. *321.5; 3,215; 32,150* Remind the students that sometimes it is necessary to annex a zero in the product in order to move the decimal point.

2. Write 32.15 ÷ 10; 32.15 ÷ 100; and 32.15 ÷ 1,000.

➤ **What do you predict about the placement of the decimal point in the quotient when you divide a decimal by a power of 10?** *Elicit that since division is the inverse operation of multiplication, the decimal point will move 1 place to the left for each 0 in the divisor, renaming each digit in the dividend as $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1,000}$, . . . of its original value and resulting in a quotient that is $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1,000}$, . . . of the value of the dividend.*

Choose students to use long division to solve the equations. *3.215; 0.3215; and 0.03215* Discuss the movement of the decimal point and the annexed zeros. Point out that understanding this pattern for dividing by powers of 10 is helpful when dividing decimals.

3. Write these equations for display. Direct the students to solve them mentally and to write only the quotients on paper.

5.3 ÷ 10 = *0.53* — 975 ÷ 100 = *9.75*
60.9 ÷ 1,000 = *0.0609* — 0.7 ÷ 100 = *0.007*

4. Follow a similar procedure for the following equations. Remind the students that the exponent indicates the number of times the base (10) is repeated as a factor. When the base is 10, the exponent indicates the number of zeros in the standard form of the number (e.g., $10^1 = 10$; $10^2 = 100$; $10^3 = 1,000$).

122.75 ÷ 10^2 = *1.2275* — 86.3 ÷ 10^3 = *0.0863*
0.04 ÷ 10^1 = *0.004* — 39.7 ÷ 10^2 = *0.397*

Student Text pp. 192–93

Lesson 80

Student Text pp. 194–95
Daily Review p. 433b

Objectives

- Divide a decimal by a 1- or a 2-digit whole number
- Estimate the quotient of a decimal division problem
- Divide a whole number by a whole number to find a decimal fraction in the quotient
- Check a division problem using multiplication
- Solve a decimal word problem

Teach for Understanding

Divide a decimal by a 1-digit whole number

1. Write 15.26 ÷ 7 in a division frame for display.

➤ **What is the estimate range for the division problem? How do you know?** ***2–3; elicit that there will be 1 whole number digit in the quotient and the compatible numbers are 7, 2, and 14 and 7, 3, and 21 (near multiplication facts are 7 × 2 = 14 and 7 × 3 = 21).***

➤ **Do you think the exact quotient will be closer to 2 or 3? Why?** ***2; elicit that the dividend is much closer to the product of 7 × 2 (14) than the product of 7 × 3 (21).***

Write a small *x* above the 5 in the Ones place of the dividend to mark the location of the whole number digit in the quotient; draw a think cloud and write 2 in it. Explain that thinking of an estimate range can help you determine what one estimate the exact answer will be closer to.

2. Choose a student to solve the problem. Instruct him to explain the division process as he solves the problem. ***2.18***

➤ **Was your prediction correct that the closer estimate would be 2?** ***yes***

Select a student to demonstrate checking the division problem. ***7 × 2.18 = 15.26***

3. Follow a similar procedure for 26.1 ÷ 6. Encourage the students to think of the closer or better estimate. When solving the problem, remind the students that sometimes it is necessary to annex one or more zeros in the dividend to complete the division. Annexing zeros renames the dividend without changing its value. ***1 whole number digit in the quotient; 4 (estimate range: 4–5); 4.35***

(***Note:*** For the remainder of this lesson, you may choose which division problems the students will check.)

Divide a decimal by a 2-digit whole number

1. Write 233.6 ÷ 32 in a division frame for display.

➤ **What do you know about dividing a decimal by a 2-digit whole number?** ***Elicit that dividing a decimal by a 2-digit whole number is similar to both dividing a decimal by a 1-digit whole number and dividing a whole number by a 2-digit divisor; round the divisor to the nearest ten and think of compatible numbers to divide each place.***

➤ **What is 32 rounded to the nearest 10?** ***30*** Write 30 above the divisor (32).

➤ **How many whole number digits will the quotient have? How do you know?** ***1; elicit that there are not enough hundreds (2) nor enough tens (23) to divide them into sets of 32 unless you rename the hundreds and the tens as ones; there are enough ones (233) to divide them into sets of 32.*** Write a small *x* above the 3 in the Ones place of the dividend.

➤ **What would you estimate the quotient to be? Why?** ***Accept 7 or 8; compatible numbers are 7, 30, and 210 or 8, 30, and 240 (near facts: 7 × 3 = 21 or 8 × 3 = 24).*** Point out that 7 is an underestimate and 8 is an overestimate.

2. Choose a student to solve the problem, explaining the division process as he solves it. ***7.3*** Select another student to compare the exact quotient to the estimate and to explain the reasonableness of the answer. Guide the explanation as needed.

3. Follow a similar procedure as you guide the students in solving these problems on paper. Point out that the better estimate for the second problem is $10.00 because 24 tens are being divided into sets of 24 or among 24 sets.

(20 or 30)	***($10.00 or $20.00)***	***(20 or 30)***
24.3	***$10.23***	***23.41***
19)461.7	24)$245.52	35)819.35

Divide a whole number by a whole number to find a decimal fraction

1. Write 1 ÷ 4 in a division frame for display.

➤ **When the dividend has a lesser value than the divisor, what will be true about the quotient?** ***The quotient will be less than 1.***

Select a student to demonstrate solving the problem, explaining the division process as he solves it. If necessary, guide the explanation to include annexing the zeros and renaming to tenths and hundredths. ***0.25***

➤ **How do you think you could estimate the quotient of 1 ÷ 4?** ***Elicit that you can think of the dividend as 10 tenths rather than 1 one and then think of the compatible numbers (near facts) to determine the estimate.***

2. Write 1.0 ÷ 4 in a division frame. Point out that estimating a quotient that is less than 1 (a decimal fraction) is similar to estimating a quotient that is a whole number, but the decimal point must be placed correctly in the estimated quotient.

➤ **What is the estimate range for 1.0 ÷ 4? How do you know?** ***0.2–0.3; elicit that the estimate is tenths because the 1 one was renamed as 10 tenths, and compatible numbers are 2, 4, and 8 and 3, 4, and 12 (the near facts); therefore, the estimate range is 0.2–0.3.*** Point out that either 0.2 or 0.3 is a good estimate because the exact quotient (0.25) is the halfway point between 0.2 and 0.3.

3. Write 12 ÷ 50 in a division frame for display.

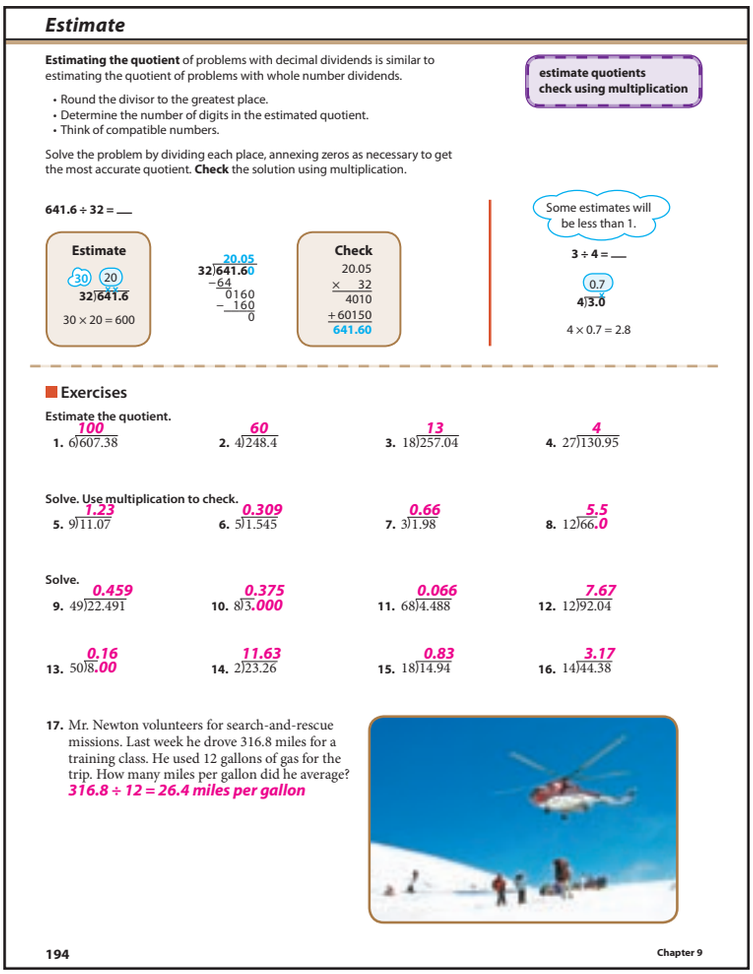
➤ **Will the quotient of this problem be greater than or less than 1?** ***less than 1*** **What does knowing that the quotient will be less than 1 tell you about the estimate?** ***The estimate will be less than 1.***

➤ **What do you think is the estimate range for 12 ÷ 50? Why?** ***Elicit that the estimate range is 0.2–0.3 because the dividend (12) is less than the divisor (50) and 12 ones are renamed as 120 tenths; compatible numbers are 2, 50, and 100 and 3, 50, and 150.*** Write 0.2–0.3 above the problem.

➤ **Do you think the exact quotient will be closer to 0.2 or 0.3? Why?** ***Answers will vary.*** Explain that since 0.2 is an underestimate and 0.3 is an overestimate, either estimate gives a good approximation of what the exact quotient will be.

4. Direct the students to solve the problem. ***0.24*** Compare the exact quotient to the estimate range and discuss the reasonableness of the answer.

5. Follow a similar procedure for 5.92 ÷ 32 = ***0.185 (0.1–0.2)*** and 22.491 ÷ 49 = ***0.459 (0.4–0.5)***.



Estimate

Estimating the quotient of problems with decimal dividends is similar to estimating the quotient of problems with whole number dividends.

- Round the divisor to the greatest place.
- Determine the number of digits in the estimated quotient.
- Think of compatible numbers.

Solve the problem by dividing each place, annexing zeros as necessary to get the most accurate quotient. **Check** the solution using multiplication.

estimate quotients
check using multiplication

641.6 ÷ 32 = ___

Estimate
(30) (20)
32|641.6
30 × 20 = 600

20.05
32|641.60
−64
0160
−160
0

Check
20.05
× 32
4010
+60150
641.60

Some estimates will be less than 1.

3 ÷ 4 = ___

0.7
4|3.0

4 × 0.7 = 2.8

Exercises

Estimate the quotient.

1. 100 — 6|607.38
2. 60 — 4|248.4
3. 13 — 18|257.04
4. 4 — 27|130.95

Solve. Use multiplication to check.

5. 1.23 — 9|11.07
6. 0.309 — 5|1.545
7. 0.66 — 3|1.98
8. 5.5 — 12|66.0

Solve.

9. 0.459 — 49|22.491
10. 0.375 — 8|3.000
11. 0.066 — 68|4.488
12. 7.67 — 12|92.04
13. 0.16 — 50|8.00
14. 11.63 — 2|23.26
15. 0.83 — 18|14.94
16. 3.17 — 14|44.38

17. Mr. Newton volunteers for search-and-rescue missions. Last week he drove 316.8 miles for a training class. He used 12 gallons of gas for the trip. How many miles per gallon did he average?
316.8 ÷ 12 = 26.4 miles per gallon

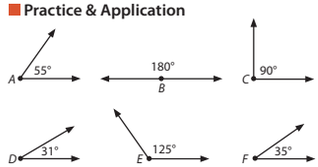
Choose the best estimate. Write the equation using ≈.

18.	161.39 ÷ 20	0.8	(8)	80	*161.39 ÷ 20 ≈ 8*
19.	5.8 ÷ 10	(0.6)	6	60	*5.8 ÷ 10 ≈ 0.6*
20.	4.086 ÷ 49	8	0.8	(0.08)	*4.086 ÷ 49 ≈ 0.08*

Estimate to determine the correct quotient. Write the equation.

21.	115.92 ÷ 56	0.207	20.7	(2.07)	*115.92 ÷ 56 = 2.07*
22.	9.108 ÷ 36	2.53	(0.253)	25.3	*9.108 ÷ 36 = 0.253*
23.	1 ÷ 4	25	2.5	(0.25)	*1 ÷ 4 = 0.25*

Practice & Application



24. Which angle is a right angle? *C*
25. Name the measures of the acute angles. *55°, 31°, 35°*
26. Name the measure of the obtuse angle. *125°*
27. What type of angle is angle *B*? *straight*
28. Supplementary angles equal 180°. Which two angles are supplementary? *A and E*
29. Complementary angles equal 90°. Which two angles are complementary? *A and F*

30. $7 - 3\frac{1}{8}$ — $6\frac{8}{8} - 3\frac{1}{8} = 3\frac{7}{8}$
31. $9\frac{1}{8} - 5\frac{7}{8}$ — $\frac{73}{8} - \frac{47}{8} = \frac{26}{8} = 3\frac{1}{4}$
32. $7\frac{1}{2} - 1\frac{3}{4}$ — $6\frac{6}{4} - 1\frac{3}{4} = 5\frac{3}{4}$
33. $\frac{1}{2} + \frac{3}{8} + \frac{3}{4}$ — $\frac{4}{8} + \frac{3}{8} + \frac{6}{8} = \frac{13}{8} = 1\frac{5}{8}$
34. $\frac{5}{12} + \frac{5}{6} + \frac{2}{3}$ — $\frac{5}{12} + \frac{10}{12} + \frac{8}{12} = \frac{23}{12} = 1\frac{11}{12}$
35. $\frac{15}{16} \times \frac{8}{21}$ — $\frac{5}{14}$
36. $\frac{12}{17} \times \frac{7}{20}$ — $\frac{21}{85}$
37. $2 \times (3.14 + 2.89)$ — *12.06*
38. $(7.83 - 2.59) \div 8$ — *5.24 ÷ 8 = 0.655*
39. $3.9 \times 2^3 \times 7$ — *3.9 × 8 × 7 = 218.4*
40. $5 \div \frac{3}{8}$ — $5 \times \frac{8}{3} = \frac{40}{3} = 13\frac{1}{3}$
41. Draw a picture to solve $3\frac{3}{8} \div 1\frac{1}{8}$.

$\frac{27}{8} \div \frac{9}{8} = 3$

Complete DAILY REVIEW b on page 433.

Solve a decimal word problem

The grocery bill for 4 weeks for the Carter family was $603.70. What was the average amount spent by the family for groceries each week? *$150.93*

➤ **How could you solve the word problem?** *Divide the total amount spent on groceries ($603.70) by the number of weeks (4).*

1. Direct the students to solve the word problem. Remind them that when you divide money, you are dividing a decimal. If there is a remainder after dividing the Hundredths place, you annex a zero in the One-Thousandths place, divide, and round the quotient to the nearest hundredth or cent. An approximate sign (≈) should be written in the final equation if the quotient has been rounded to the nearest cent. *$603.70 ÷ 4 = $150.925 ≈ $150.93*

➤ **What was the average amount of money the Carter family spent on groceries each week?** *$150.93*

Colin ran 2.3 miles on Monday, 5.6 miles on Tuesday, 4.1 miles on Wednesday, and 3.4 miles on Thursday. To the nearest tenth of a mile, what was the average distance he ran per day? *3.9 miles*

➤ **How can you solve the word problem?** *Elicit that you must first find the total number of miles that Colin ran during the 4 days and then divide by 4 to find the average distance he ran per day.*

➤ **What decimal place must you divide to in order to find the average distance Colin ran to the nearest tenth of a mile?** *Hundredths place*

2. Instruct the students to solve the word problem. Select a student to write his solution for display. Discuss the solution as needed. *possible solution: 2.3 + 5.6 + 4.1 + 3.4 = 15.4; 15.4 ÷ 4 = 3.85 ≈ 3.9 miles*

➤ **Using the Order of Operations, what one equation could you write for this word problem?** *Elicit (2.3 + 5.6 + 4.1 + 3.4) ÷ 4 = 3.85 ≈ 3.9 miles.* Elicit that since the Order of Operations tells you to perform the addition and the subtraction in an equation last, parentheses must be placed around the four addends because you first need to find the total distance Colin ran during the 4 days.

Student Text pp. 194–95

Lesson 81

Student Text pp. 196–97
Daily Review p. 434c

Objectives

- Divide a decimal by a 1- or a 2-digit whole number
- Estimate the quotient of a decimal division problem
- Develop an understanding of terminating decimals and repeating decimals
- Recognize a repeating decimal in the quotient
- Divide a whole number by a whole number to find a decimal fraction in the quotient
- Write an equation for a word problem
- Solve money word problems

Note

Throughout this lesson, you may choose which division problems the students will check.

Teach for Understanding

Divide a decimal by a 1- or a 2-digit whole number

1. Write 834.75 ÷ 21 in a division frame for display.

➤ **What do you estimate the quotient of this problem to be? How do you know?** ***40; elicit that there will be 2 digits in the whole number of the quotient because 83 tens can be divided by 21, and 83 divided by the rounded divisor (20) gives you an estimated quotient of 4 tens or 40; compatible numbers are 20, 40, 800.*** Point out that since the product in the next set of compatible numbers is 1,000 (20, 50, 1,000), you can know that 800 is the closer estimate of the exact quotient.

2. Direct the students to solve the problem. Choose a student to write his solution for display and explain it. Guide the explanation as needed; it should include that the quotient needed to be adjusted down to 3 tens when the 83 tens was divided because 21 × 4 tens = 84 tens. ***39.75***

➤ **Is 39.75 a reasonable answer? Why?** ***Yes; the answer is very close to the estimate 40.***

3. Repeat the procedure for 3 ÷ 8. Elicit that the estimate will be a decimal fraction (tenths) because the exact quotient will be less than 1. ***Accept an estimate of 0.3 or 0.4 as correct, but guide the students to the conclusion that 0.4 would be the closer estimate; 0.375.*** Guide the explanation to include that 2 zeros were annexed in the dividend to complete the division.

4. Explain that quotients such as 39.75 and 0.375 are *terminating decimals*; they are decimals that end.

5. Follow a similar procedure for these problems. Since some students may have difficulty determining the closer estimate, accept either estimate as correct.

(7 or 8)	*(0.2 or 0.3)*	*(30 or 40)*	*(0.2 or 0.3)*
7.56	*0.226*	*39.895*	*0.253*
6)45.36	3)0.678	16)638.320	36)9.108

Recognize a repeating decimal in the quotient

1. Write 10 ÷ 3 in a division frame and select a student to solve the problem until he has divided to the One-Thousandths place. ***3.333***

➤ **What digit do you think will be in the Ten-Thousandths place? Why?** ***3; elicit that the remainder is 1, the same as when you divided the ones, tenths, hundredths, and one thousandths; the new dividend will again be 10.***

2. Remind the students that when they are dividing, the quotient may not always be exact. It may have a digit or digits that repeat endlessly, or the digits may continue without end in a random order.

3. Direct attention to the repeating 3s in the quotient. Explain that a decimal that ends with a digit or a group of digits that repeats endlessly is a *repeating decimal*.

$$\begin{array}{r} 3.\overline{333} \\ 3\overline{)10.000} \\ -9 \\ \hline 10 \\ -9 \\ \hline 10 \\ -9 \\ \hline 10 \\ -9 \\ \hline 1 \end{array}$$

Point out the repeated remainder 1 and the new dividend in the problem. Explain that it is important to find the pattern for a repeating decimal; the pattern is known when the new dividend is the same as the original dividend or the remainder is the same as a previous remainder.

Draw a bar above the 3 in the Tenths place and erase the 3s in the Hundredths and the One-thousandths place. Explain that when you know the pattern indicates that the quotient is a repeating decimal, the final answer is written with a bar over the first digit or digits that repeat to indicate that the digit or digits continue to repeat without end; it is not necessary to write the repeating digits after the bar.

Zoe has 9 yards of ribbon. She needs to cut equal lengths of the ribbon to make bows for 11 Christmas gifts. What will be the length of each piece of ribbon? ***approximately 0.82 of a yard***

➤ **How could you solve this word problem?** ***Divide the 9 yards of ribbon by 11 to find the length of each piece of ribbon.***

4. Write 9 ÷ 11 in a division frame for display.

➤ **What do you estimate the quotient to be? How do you know?** ***0.8; elicit that since there are not enough ones to divide, the quotient will be less than 1, so you can estimate the quotient to the nearest tenth. The compatible numbers 8, 11, and 88 give you a much closer estimate than 9, 11, and 99, so the estimate is 0.8.***

Demonstrate solving the problem as you guide the students in solving it on paper, dividing to the Hundredths place: 0.81.

➤ **What do you notice about the remainder after dividing the hundredths?** ***The remainder is the same as the original dividend (9).***

➤ **What does the repetition of the original dividend in the remainder tell you about the quotient?** ***The quotient is a repeating decimal.***

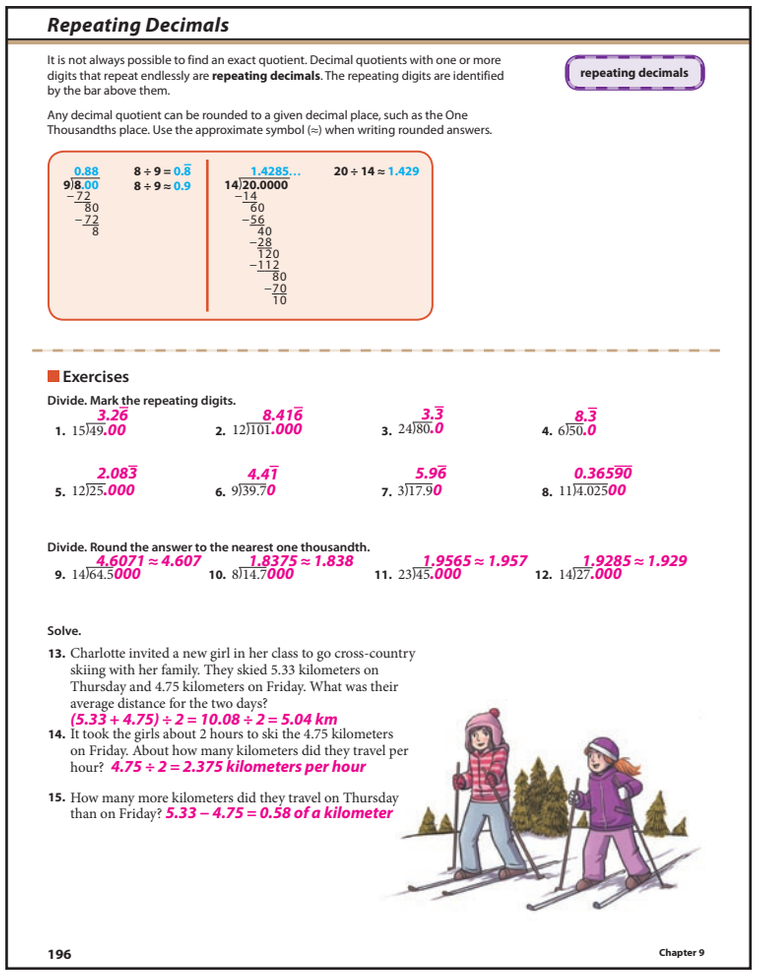
➤ **What do you think the remainder would be if you divided to the One-Thousandths place? Why?** ***Elicit that the remainder would be 2 because 90 ÷ 11 is 8, and you would again be subtracting 88 from 90.***

$$\begin{array}{r} 0.\overline{81} \\ 11\overline{)9.000} \\ -88 \\ \hline 20 \\ -11 \\ \hline 90 \end{array}$$

Draw a bar over the 81 hundredths. Point out that since you know the quotient is a repeating decimal, you do not need to continue to divide.

5. Explain that since the digits in the quotient begin repeating in the One-Thousandths place, you round the quotient to the nearest hundredth to answer the question in the word problem.

Choose a student to write for display an equation for the word problem while the other students write it on paper.



Repeating Decimals

repeating decimals

It is not always possible to find an exact quotient. Decimal quotients with one or more digits that repeat endlessly are **repeating decimals**. The repeating digits are identified by the bar above them.

Any decimal quotient can be rounded to a given decimal place, such as the One Thousandths place. Use the approximate symbol (≈) when writing rounded answers.

0.88 ; $9\overline{)8.00}$; -72 ; 80 ; -72 ; 8

$8 \div 9 = 0.\overline{8}$

$8 \div 9 \approx 0.9$

$1.4285\ldots$; $14\overline{)20.0000}$; -14 ; 60 ; -56 ; 40 ; -28 ; 120 ; -112 ; 80 ; -70 ; 10

$20 \div 14 \approx 1.429$

Exercises

Divide. Mark the repeating digits.

1. $15\overline{)49.00}$; $3.2\overline{6}$
2. $12\overline{)101.000}$; $8.41\overline{6}$
3. $24\overline{)80.0}$; $3.\overline{3}$
4. $6\overline{)50.0}$; $8.\overline{3}$
5. $12\overline{)25.000}$; $2.08\overline{3}$
6. $9\overline{)39.70}$; $4.4\overline{1}$
7. $3\overline{)17.90}$; $5.9\overline{6}$
8. $11\overline{)4.02500}$; $0.365\overline{90}$

Divide. Round the answer to the nearest one thousandth.

9. $14\overline{)64.5000}$; $4.6071 \approx 4.607$
10. $8\overline{)14.7000}$; $1.8375 \approx 1.838$
11. $23\overline{)45.000}$; $1.9565 \approx 1.957$
12. $14\overline{)27.000}$; $1.9285 \approx 1.929$

Solve.

13. Charlotte invited a new girl in her class to go cross-country skiing with her family. They skied 5.33 kilometers on Thursday and 4.75 kilometers on Friday. What was their average distance for the two days?
    $(5.33 + 4.75) \div 2 = 10.08 \div 2 = 5.04$ km
14. It took the girls about 2 hours to ski the 4.75 kilometers on Friday. About how many kilometers did they travel per hour? $4.75 \div 2 = 2.375$ kilometers per hour
15. How many more kilometers did they travel on Thursday than on Friday? $5.33 - 4.75 = 0.58$ of a kilometer

Solve.

16. The Jensens' power bills totaled $1,650.24 for the year. What was the average cost per month?
    $1,650.24 \div 12 = \$137.52$

17. Find the repeating digits for $\frac{5}{7}$. $0.\overline{714285}$

Solve. Use multiplication to check.

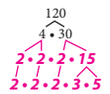
18. $21\overline{)98.28}$; 4.68
19. $48\overline{)17.376}$; 0.362
20. $39\overline{)104.13}$; 2.67

Divide. Mark the repeating digits.
Round the non-repeating decimals to the nearest thousandth.

21. $55\overline{)350.000}$; $6.3\overline{6}$
22. $17\overline{)95.17000}$; $5.5982 \approx 5.598$
23. $9\overline{)39.70}$; $4.4\overline{1}$
24. $\frac{13}{20}$ 0.65

Practice & Application

25. Name the figure. parallelogram
26. Name the parallel lines using the symbol ∥.
    red ∥ blue; green ∥ brown
27. Explain why this figure has no right angles.
    There are no perpendicular lines.
28. If 3 angles in the figure above measure 114°, 66°, and 114°, what is the unknown measure of the fourth angle? $360° - (114° + 114° + 66°) = 360° - 294° = 66°$
29. Complete the factor tree. Write the prime factorization using exponents. $2^3 \cdot 3 \cdot 5$

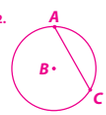


30. What factor does n represent in $4n = 88$?
    $n = 22$
31. What factor does n represent in $40 \times 176 = (40 \times n) + (40 \times 70) + (40 \times 6)$? $n = 100$
32. Draw and label circle B. Draw a chord that is *not* a diameter. Label the chord $\overline{AC}$.

33. $13\frac{1}{2} \times 7\frac{1}{2}$ $\frac{27}{2} \times \frac{15}{2} = \frac{405}{4} = 101\frac{1}{4}$
34. $172.26 \div 18$ 9.57
35. Write the decimal equivalent for $\frac{5}{8}$. 0.625
36. Simplify $\frac{129}{21}$ as a mixed number. $6\frac{1}{7}$
37. Solve $2^3 \cdot 3^2 \cdot 10^4$. $720{,}000$

J Explain which number is more exact: $\frac{1}{12}$ or $0.08\overline{3}$.
$\frac{1}{12}$ is more exact; $0.08\overline{3}$ divides endlessly; it is a repeating decimal.

32.



Complete DAILY REVIEW C on page 434.

Remind them to use an approximate sign (≈) in their equation. $9 \div 11 \approx 0.82$ of a yard

6. Follow a similar procedure for the following word problem. Explain that a batting average is found by dividing a player's number of hits by his number of times at bat and rounding the quotient to the nearest thousandth.

   Guide the students to the conclusion that the quotient is a non-repeating, non-terminating decimal.

In 1924, Rogers Hornsby went to bat 536 times. He hit the ball 227 times. What was his batting average? $227 \div 536 \approx 0.424$ (0.4 or 0.5)

(***Note:*** Explain that although decimal fractions are usually written with a 0 in the Ones place, a batting average is written without the 0. Rogers Hornsby's batting average of .424 is read as *four twenty-four.*)

7. Guide the students in solving these problems on paper. Instruct them to round quotients with a non-repeating decimal to the nearest thousandth.

$9\overline{)7.00}$; $0.\overline{7}$

$7)52.0000$; $7.4285 \approx 7.429$

$22\overline{)3.0000}$; $0.1\overline{36}$

Solve money word problems

Direct the students to solve these word problems. Instruct them to estimate each quotient and to write a final equation for each problem. Remind them that since money is a decimal, any remainder should be rounded to the nearest cent (hundredth).

Annalisa purchased 3 cans of pumpkin for $2.37. What was the price per can? $\$2.37 \div 3 = \$0.79$ ($0.70)

Samantha has $69.00 to spend on Christmas presents for 12 family members. She wants to spend the same amount of money on each person. What is the greatest amount of money she can spend for each gift? $\$69.00 \div 12 = \$5.75$ ($6.00) [BAT: 5b Giving]

Student Text pp. 196–97

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 82

Student Text pp. 198–99
Daily Review p. 434d

Objectives
- Rename a fraction as a decimal by renaming the denominator as a power of 10
- Rename a fraction as a decimal using division
- Identify a quotient as a repeating decimal or a non-repeating, non-terminating decimal
- Compare a decimal and a fraction

Teacher Materials
- Place Value Kit: Hundredths Mat (white); tenths; hundredths

Teach for Understanding

Rename a fraction as a decimal

1. Display a Hundredths Mat from your Place Value Kit and write $\frac{6}{10}$ for display. Choose a student to display 6 tenths on the hundredths mat and to write the decimal fraction that is equivalent to $\frac{6}{10}$. ***0.6***
2. Follow a similar procedure for $\frac{17}{100}$ and $\frac{4}{100}$. ***0.17 and 0.04***
3. Write $\frac{137}{1{,}000}$; $\frac{64}{1{,}000}$; and $\frac{8}{1{,}000}$ for display and choose students to write the equivalent decimals below the fractions. ***0.137; 0.064; and 0.008***
   - **Why is it easy to write a fraction in decimal form when the denominator is a power of 10 or a factor of a power of 10?** ***Answers may vary, but elicit that the decimal place values are based on our base 10 number system.***
4. Write $\frac{1}{4}$ for display.
   - **Is the denominator in $\frac{1}{4}$ a power of 10?** ***no*** **Is it a factor of a power of 10? How do you know?** ***Yes; elicit that $4 \times 25 = 100$, a power of 10.***
   - **What could you do to write $\frac{1}{4}$ as a decimal?** ***Some students may know that $\frac{1}{4} = 0.25$, but elicit that you can rename $\frac{1}{4}$ as hundredths (higher terms) by multiplying $\frac{1}{4} \times \frac{25}{25}$ (a name for 1).***

   Write $\frac{1}{4} \times \frac{25}{25}$ below $\frac{1}{4}$.
   - **What does $\frac{1}{4} \times \frac{25}{25}$ equal?** $\frac{25}{100}$ Write $= \frac{25}{100}$ beside $\frac{1}{4}$: $\frac{1}{4} = \frac{25}{100}$.
   - **How do you write $\frac{25}{100}$ as a decimal?** ***0.25*** Write $= 0.25$ beside $\frac{1}{4} = \frac{25}{100}$.

   Remind the students that when the denominator of any fraction is a factor of a power of 10, renaming the denominator as a power of 10 will help them write the fraction as a decimal.
5. Write $\frac{1}{4}$ again.
   - **Besides "one-fourth," how else can you read this fraction? Why?** ***Elicit that it can be read "1 divided by 4" because the fraction line means "divided by."***
   - **Besides renaming $\frac{1}{4}$ as a power of 10, what method could you use to rename $\frac{1}{4}$ as a decimal?** ***Elicit that you can divide the numerator (1) by the denominator (4).***

   Choose a student to write $\frac{1}{4}$ in a division frame for display and solve it while the other students write the problem and solve it on paper. ***0.25*** Point out that dividing a fraction such as $\frac{1}{4}$ is similar to dividing a whole number by a greater whole number to find a quotient that is less than 1.
6. Follow a similar procedure for $\frac{1}{2}$. ***The denominator (2) is a factor of a power of 10; $\frac{1}{2} \times \frac{5}{5} = \frac{5}{10}$; $\frac{1}{2} = \frac{5}{10} = 0.5$; $1 \div 2 = 0.5$.***
7. Remind the students that an amount of money is written in decimal form; the cents are written to the right of the decimal point and represent hundredths (a part) of a dollar. Point out that your knowledge of money can help you use mental math to determine an equivalent decimal for some fractions.
   - **What is $\frac{1}{2}$ of 1 dollar?** ***50 cents*** **What equivalent decimal can you write for $\frac{1}{2}$?** ***Elicit 0.50 and 0.5.***

   Point out that 0.50 renamed to lowest terms is 0.5; the decimal form of $\frac{50}{100}$ renamed to lowest terms ($\frac{1}{2}$).
   - **What coin represents $\frac{1}{4}$ of a dollar?** ***a quarter***
   - **What is the value of $\frac{1}{4}$ of 1 dollar written in decimal form?** ***$0.25***
   - **What is the value of $\frac{3}{4}$ of 1 dollar written in decimal form?** ***$0.75*** $\frac{2}{4}$ **of a dollar?** ***$0.50***
   - **What equivalent decimal can you write for $\frac{2}{4}$?** ***0.5***
8. Choose students to demonstrate dividing $\frac{2}{4}$ and $\frac{3}{4}$ to find the equivalent decimals. Point out that using division to rename a fraction as a decimal gives you the decimal in lowest terms.
9. Write the following fractions for display. Direct the students to find the equivalent decimal for each fraction and to write the answer on paper. Encourage them to use mental math to determine the equivalent decimal for fractions with a denominator that is a power of 10 or a factor of a power of 10. Allow students who have difficulty finding the decimal mentally to use division.

$\frac{1}{10} =$ ***0.1***	$\frac{7}{8} =$ ***0.875***	$\frac{3}{100} =$ ***0.03***	$\frac{1}{5} =$ ***0.2***
$\frac{4}{5} =$ ***0.8***	$\frac{5}{8} =$ ***0.625***	$\frac{7}{20} =$ ***0.35***	$\frac{3}{16} =$ ***0.1875***

Identify a quotient as a repeating decimal or a non-repeating, non-terminating decimal

1. Write $\frac{1}{3}$ for display.
   - **Is the denominator in $\frac{1}{3}$ a power of 10?** ***no*** **a factor of a power of 10?** ***no***
   - **How could you rename $\frac{1}{3}$ as a decimal? Why?** ***Divide 1 by 3; answers may vary, but elicit that 3 is not a power of 10 or a factor of a power of 10.***
2. Write $1 \div 3$ in a division frame and direct the students to write it on paper. Guide them in dividing the 10 tenths. ***0.3***

$$\begin{array}{r} 0.\overline{3} \\ 3\overline{)1.0} \\ -\ 9 \\ \hline 1 \end{array}$$

   - **What do you notice about the remainder?** ***Elicit that the remainder (1) is the same as the original dividend.***

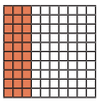
   Remind the students that when a remainder is equal to the original dividend or a previous remainder, the quotient is a repeating decimal. Point out that when the remainder indicates a repeating decimal in the quotient, you can stop dividing.
   - **How do you show a repeating decimal?** ***Elicit that you draw a bar over the digit or digits that repeat.*** Instruct the students to draw a bar over the 3 in the quotient of the problem.
3. Follow a similar procedure for the following fractions. Remind the students that a decimal may begin to repeat at any place, that more than 1 digit may form a repeating pattern, and that some decimals do not repeat or terminate. Non-repeating, non-terminating decimals can be rounded to a given place for an approximate answer. (e.g., the decimal equivalent for $\frac{3}{7}$ is rounded to the nearest thousandth.)

Fractions as Decimals

Some fractions have an exact equivalent decimal. Other fractions result in a repeating decimal that divides endlessly. All decimals can be rounded to a given place.

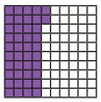
rename a fraction as a decimal

If the denominator is a power of 10, the fraction names the decimal.



$\frac{3}{10} = 0.3$

three tenths



$\frac{42}{100} = 0.42$

forty-two hundredths

If the denominator is a factor of a power of 10, rename the fraction. The fraction will name the decimal.

5 is a factor of 10. ×2 ×2

$\frac{3}{5} = \frac{6}{10} = 0.6$

six tenths

4 is a factor of 100. ×25 ×25

$\frac{3}{4} = \frac{75}{100} = 0.75$

seventy-five hundredths

If the denominator is not a power of 10 or a factor of a power of 10, divide the numerator by the denominator. The quotient is the equivalent decimal.

$\frac{1}{6} = 1 \div 6 = 0.1\overline{6}$

$\frac{1}{6} \approx 0.17$

$$6\overline{)1.000} = 0.166$$
$$-6$$
$$40$$
$$-36$$
$$40$$
$$-36$$
$$4$$

$\frac{9}{23} = 9 \div 23 \approx 0.391$

$$23\overline{)9.00000} = 0.3913\ldots$$
$$-69$$
$$210$$
$$-207$$
$$30$$
$$-23$$
$$70$$
$$-69$$
$$10$$

Exercises

Write the fraction as a decimal.

1. $\frac{7}{10}$ *0.7*
2. $\frac{19}{100}$ *0.19*
3. $\frac{3}{100}$ *0.03*
4. $\frac{5}{1{,}000}$ *0.005*
5. $\frac{8}{10}$ *0.8*
6. $\frac{27}{1{,}000}$ *0.027*

Rename the denominator as a power of 10.
Write the fraction as a decimal.

7. $\frac{1}{2}$ $\frac{5}{10} = 0.5$
8. $\frac{2}{5}$ $\frac{4}{10} = 0.4$
9. $\frac{7}{25}$ $\frac{28}{100} = 0.28$
10. $\frac{1}{4}$ $\frac{25}{100} = 0.25$
11. $\frac{7}{20}$ $\frac{35}{100} = 0.35$
12. $\frac{37}{50}$ $\frac{74}{100} = 0.74$

Divide. Write the fraction as a decimal.
Mark the repeating digits with a bar (–).
Round the non-repeating decimals to the nearest thousandth.

13. $\frac{5}{6}$ *0.8$\overline{3}$*
14. $\frac{4}{15}$ *0.2$\overline{6}$*
15. $\frac{7}{11}$ *0.$\overline{63}$*
16. $\frac{21}{40}$ *0.525*
17. $\frac{3}{8}$ *0.375*
18. $\frac{3}{19}$ *0.1578 ≈ 0.158*
19. $\frac{5}{9}$ *0.$\overline{5}$*
20. $\frac{2}{7}$ *0.2857 ≈ 0.286*
21. $\frac{3}{5}$ *0.6*
22. $\frac{11}{15}$ *0.7$\overline{3}$*
23. $\frac{7}{12}$ *0.58$\overline{3}$*
24. $\frac{18}{25}$ *0.72*

Write the equivalent decimal of the fraction.

25. $\frac{1}{3}$ *0.$\overline{3}$*
26. $\frac{2}{3}$ *0.$\overline{6}$*
27. $\frac{1}{2}$ *0.5*
28. $\frac{1}{4}$ *0.25*
29. $\frac{3}{4}$ *0.75*

0.25 0.5 0.$\overline{6}$ 0.75 0.$\overline{3}$

Write a comparison sentence using > or < .

30. 0.25 *<* $\frac{1}{3}$
31. $\frac{1}{2}$ *>* 0.$\overline{3}$
32. $\frac{7}{20}$ *<* 0.75
33. 0.975 *>* $\frac{7}{8}$
34. $\frac{3}{5}$ *>* 0.59

Solve. Use multiplication to check.

35. $20\overline{)19.00}$ *0.95*
36. $5\overline{)294.30}$ *58.86*
37. $2\overline{)3.0}$ *1.5*
38. $34\overline{)27.098}$ *0.797*

Practice & Application *Answers are shown using cancellation.*

39. Which fractions are equivalent to $\frac{1}{3}$?

$\frac{2}{7}$ $\frac{3}{9}$ $\frac{4}{12}$ *$\frac{3}{9}$, $\frac{4}{12}$*

40. What is the greatest common factor of 18 and 45? *9*
41. What is the value of $2^3 \cdot 3^2 \cdot 5$? *(2 • 2 • 2) • (3 • 3) • 5 = 8 • 9 • 5 = 360*
42. 17,000 – 12,570 *4,430*
43. 245 – 40.87 *204.13*
44. 21 × 583 *12,243*
45. 37.84 × 8 *302.72*
46. 5,000 ÷ 25 *200*
47. Write and solve an addition equation for $6 \times \frac{7}{8}$.
48. $\frac{3}{4} \times 15$ *$\frac{3}{4} \times \frac{15}{1} = \frac{45}{4} = 11\frac{1}{4}$*
49. $\frac{1}{2} \div \frac{1}{4}$ *$\frac{1}{2} \times \frac{4}{1} = \frac{2}{1} = 2$*
50. $\frac{6}{7} \div 2$ *$\frac{6}{7} \times \frac{1}{2} = \frac{3}{7}$*

40. *18: 1, 2, 3, 6, 9, 18*
45: 1, 3, 5, 9, 15, 45

47. *$\frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8} = \frac{42}{8} = 5\frac{2}{8} = 5\frac{1}{4}$*

51. $\frac{3}{8} + \frac{3}{4}$ *$\frac{3}{8} + \frac{6}{8} = \frac{9}{8} = 1\frac{1}{8}$*
52. $5\frac{1}{2} - \frac{7}{8}$ *$5\frac{4}{8} - \frac{7}{8} = 4\frac{12}{8} - \frac{7}{8} = 4\frac{5}{8}$*
53. ___ ÷ 2 = 26.5 *26.5 × 2 = 53*
54. Mark the repeating digits.
0.32999… *0.32$\overline{9}$* 0.12323… *0.1$\overline{23}$*

J The improper fraction $\frac{22}{7}$ can be used to determine pi (π). *Pi* is used to find the circumference of a circle. Rename $\frac{22}{7}$ as a decimal. Round to the nearest hundredth. *$\frac{22}{7} = 3.142 \approx 3.14$*

Complete DAILY REVIEW 4 on page 434.

$\frac{2}{3}$ *0.6$\overline{}$*
3)2.0
– 18
2

$\frac{5}{12}$ *0.416$\overline{}$*
12)5.0000
– 48
20
– 12
80
– 72
80

$\frac{10}{11}$ *0.90$\overline{}$*
11)10.000
– 99
100

$\frac{15}{23}$ *0.6521 . . . ≈ 0.652*
23)15.0000
– 138
120
– 115
50
– 46
40

$\frac{3}{7}$ *0.4285 . . . ≈ 0.429*
7)3.0000
– 28
20
– 14
60
– 56
40

(***Note:*** You may choose to continue dividing $\frac{3}{7}$ to show the students that the quotient in this problem is actually a repeating decimal, beginning with the seventh digit [the Ten-Millionths place]: *0.428571*. Explain that you usually do not divide that many decimal places to determine whether a decimal repeats or terminates. Unless it is necessary to work with very small numbers [fractional parts], it is usually sufficient to round the quotient to the nearest tenth, hundredth, or thousandth.)

Compare a decimal and a fraction

1. Write the following comparisons for display and discuss strategies the students could use to complete the comparisons. Elicit that they can either think of the equivalent fraction for the decimal or rename the decimal as a fraction so that they are comparing either two decimals or two fractions.

$0.6 > \frac{1}{2}$ $\frac{3}{4} < 0.907$ $\frac{1}{8} < 0.35$ $\frac{4}{5} > 0.75$

2. Choose students to complete the comparisons using mental math. Select other students to prove the comparisons by renaming the fraction as a decimal.

Student Text pp. 198–99

Lesson 83

Student Text pp. 200–201
Daily Review p. 435e

Objectives
- Divide a whole number by a decimal
- Estimate the quotient of a decimal division problem
- Write an equation for a word problem

Teach for Understanding

Divide a whole number by a decimal

1. Write 24 ÷ 6 in a division frame for display.

➤ **What is the quotient of 24 ÷ 6?** ***4*** Continue to display the problem.

Choose a student to write the problem again, multiplying the divisor and the dividend by 10. ***240 ÷ 60***

➤ **What does 240 ÷ 60 equal?** ***4*** Continue to display the problem.

Select a student to write the problem a third time, multiplying the divisor (6) and dividend (24) by 100. ***2,400 ÷ 600***

➤ **What is 2,400 ÷ 600?** ***4***

➤ **What do you notice about the quotients in these problems?** ***All of the quotients are 4.***

2. Explain that you can use compensation to multiply (or divide) the divisor and the dividend in a division problem by the same number without changing the quotient.

> Sam has 36 yards of molding to make picture frames. He needs 0.9 of a yard to make 1 frame. How many frames can he make? ***40 frames***

➤ **How could you solve this word problem? Why?** ***Divide 36 by 0.9; you need to find how many lengths of 0.9 of a yard are in 36 yards.***

3. Write 36 ÷ 0.9 in a division frame for display.

➤ **How is this division problem different from the division problems you have previously solved?** ***The divisor is a decimal.***

Explain that when the divisor is a decimal, you must make the divisor a whole number in order to divide.

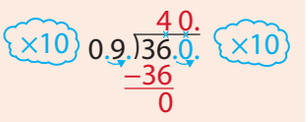
➤ **How do you think you can you make the divisor 0.9 a whole number?** ***Elicit that you can multiply the divisor by 10 to make it the whole number 9.***

Draw an arrow to show the movement of the decimal point in the divisor and write a decimal point, renaming the 9 tenths as 9 ones. Write × 10 in a think cloud beside the divisor. Remind the students that multiplying a number by 10 moves the decimal point one place to the right.

➤ **When you multiply the divisor by 10, what do you think you must do to the dividend? Why?** ***Elicit that you must also multiply the dividend by 10 so that the quotient remains the same.*** Write × 10 in a think cloud beside the dividend.

➤ **What is 10 × 36?** ***360***

Show the multiplication in the dividend; write the decimal point and draw an arrow as pictured in the example. Explain that when you multiplied the whole number 36 by 10, you needed to annex a 0 in the dividend before you could move the unseen decimal point one place to the right.



➤ **How many whole number digits will be in the quotient? How do you know?** ***2; elicit that 36 tens are divisible by 9.***

Write small *x*s above the 6 in the Tens place and the 0 in the Ones place of the dividend to mark the location of the whole number digits in the quotient. Demonstrate solving the problem using the long division process.

➤ **What does 360 ÷ 9 equal?** ***40***

4. Read the word problem aloud again.

➤ **Since 360 ÷ 9 = 40, what equation can you write for the word problem? Why?** ***Elicit 36 ÷ 0.9 = 40 frames; answers will vary, but guide the students to the conclusion that since division is the inverse of multiplication, they can divide the divisor 9 and the dividend 360 by 10 (move the decimal point one place to the left) without changing the quotient.***

5. Follow a similar procedure for the following word problem.

> Ean's gasoline can holds 5 gallons. The gasoline tank on his lawn mower holds 1.5 gallons. How many times can Ean fill the lawn mower's gasoline tank from the can of gasoline? ***3 times; 5 ÷ 1.5 = $3.\overline{3}$; 50 ÷ 15 = $3.\overline{3}$***

➤ **What does the repeating 3 tenths in the quotient of the division problem represent?** ***Elicit that it represents a small amount of gasoline that will remain in the gasoline can after Ean has filled the mower's tank 3 times.***

6. Repeat the procedure for this word problem. Elicit that when there are hundredths in the divisor, the divisor and the dividend must be multiplied by the same power of 10 (100), moving the decimal point 2 places to the right.

> Makayla is making bookshelves to sell at the town craft fair. She has 6 cans of wood stain. If she uses 0.35 of a can of stain for each bookcase, how many bookcases can she stain? ***17 bookcases; 6 ÷ 0.35 ≈ 17.143; 600 ÷ 35 = 17.1428 . . .***

7. Write 75 ÷ 0.25 in a division frame for display. Demonstrate each step as you guide the students in solving the problem on paper. Allow students to draw arrows to move the decimal point when multiplying the divisor and the dividend by a power of 10. ***300; 7,500 ÷ 25 = 300***

8. Guide the students in estimating and solving the following problems on paper, rounding non-repeating and non-terminating decimals to the nearest thousandth. For the problems with a decimal as the divisor, direct the students to move the decimal point in each divisor and in each dividend before determining the estimate. Emphasize the importance of annexing the correct number of zeros when multiplying a whole number dividend by a power of 10 in order to move the decimal point.

22 ÷ 0.3 = ***$73.\overline{3}$ (70)***	12 ÷ 2.8 = 4.2857 . . . ≈ ***4.286 (4)***
4 ÷ 0.09 = ***$44.\overline{4}$ (40)***	150 ÷ 0.75 = ***200 (200)***
55 ÷ 0.125 = ***440 (500)***	7.42 ÷ 67 = 0.1107 . . . ≈ ***0.111 (0.1)***

Divide by a Decimal

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

decimal divisors

32 ÷ 4 = 8

Multiply the dividend and the divisor by 10. 320 ÷ 40 = 8 3,200 ÷ 400 = 8 Multiply the dividend and the divisor by 100.

When the divisor is a decimal, multiply the divisor by the power of 10 that will make the divisor a whole number. Multiply the dividend by the same power of 10. Divide to find the quotient.

× 10 × 10

12.5 175.0

$$\begin{array}{r} 14 \\ 125\overline{)1{,}750} \\ -125 \\ \hline 500 \\ -500 \\ \hline 0 \end{array}$$

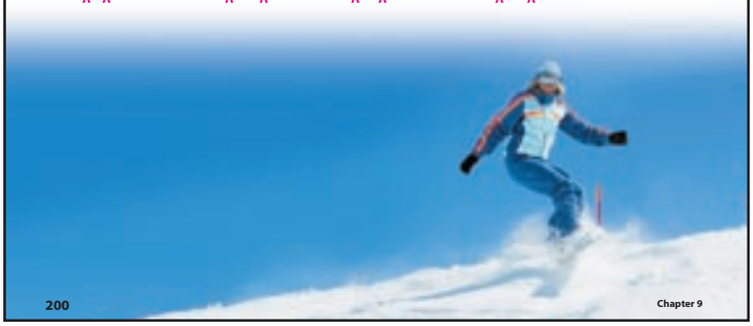
175 ÷ 12.5 = 14

Multiply 12.5 by 10 to make a whole-number divisor.
10 × 12.5 = 125
Multiply the dividend, 175, by 10 also.
10 × 175 = 1,750

Exercises

Divide. Mark the repeating digits.
Round the non-repeating decimals to the nearest thousandth.

1. 0.3)90 → 30
2. 0.15)7500 → 500
3. 1.2)300 → 25
4. 1.6)90000 → 5.625
5. 0.5)160 → 32
6. 3.5)800000 → 2.2857 ≈ 2.286
7. 0.7)1300000 → 18.5714 ≈ 18.571
8. 0.32)6400 → 200
9. 6.2)600000 → 0.9677 ≈ 0.968
10. 0.4)300 → 7.5
11. 0.09)8000 → 88.$\overline{8}$
12. 2.5)150 → 6
13. 3.2)800 → 25
14. 0.05)3900 → 780
15. 5.21)42000000 → 8.0614 ≈ 8.061
16. 12.4)4960 → 40
17. 0.12)4000 → 33.$\overline{3}$
18. 3.5)420 → 12
19. 0.3)800 → 26.$\overline{6}$
20. 0.3)2760 → 920



Solve.

21. Mr. Griffin is teaching a class on how to tie knots. The rope he plans to purchase is 8 meters long. He will cut the rope into 0.4-meter pieces so that his 28 students can practice. Will 8 meters of rope be enough? Explain your answer.
No; 8 ÷ 0.4 = 20

22. Mrs. Griffin is preparing snacks for the class. She can get $2\frac{1}{2}$ servings out of each bag of popcorn. How many bags of popcorn will she need to pop to serve the 28 students?
$28 \div 2\frac{1}{2} = 28 \times \frac{2}{5} = \frac{56}{5} = 11\frac{1}{5}$;
12 bags of popcorn are needed.

23. Find the average amount of snowfall for the 3 days listed in the chart. Rename the fractions as decimals. Round the quotient to the nearest hundredth of an inch. *(0.75 + 1.5 + 2.125) ÷ 3 = 4.375 ÷ 3 = 1.458$\overline{3}$ ≈ 1.46 in.*

Day	Snowfall
Sunday	$\frac{3}{4}$ in.
Monday	$1\frac{1}{2}$ in.
Tuesday	$2\frac{1}{8}$ in.

Practice & Application

24. 253 ÷ 10^3 *0.253*
25. 16)36.1200 → *2.2575*
26. 42 ÷ 3.9 (Round to the nearest thousandth.) *10.769*
27. 278 ÷ 0.4 *695*
28. $\frac{10}{13} \times \frac{5}{16}$ *$\frac{25}{104}$*
29. What is the decimal equivalent for $\frac{3}{5}$? *0.6*
30. Write 100,942,067 in expanded form.
31. Write the value of 3 in 103,295,100 in standard form. *3,000,000*
32. Write the number that is 10,000 *more than* 5,293,600. *5,303,600*
33. What is 15 more than 129? *129 + 15 = 144*
34. Write 3 related equations for 17.8 + 16.04 = 33.84.
35. What is 3,000 less than 42,900?
42,900 – 3,000 = 39,900
36. Find the estimate range for the quotient of 1,687 miles traveled in 3 days. *500 – 600*
37. Solve problem 36 to find the average miles traveled in 3 days. *562.$\overline{3}$ miles*
38. What is the cost of 2 pounds of grapes at $1.89 per pound? *2 × $1.89 = $3.78*
39. Find the measure of the unknown angle.
180° – (60° + 60°) = 60°

40. Draw two lines that are parallel.
41. What type of angle is formed at the intersection of perpendicular lines? *right angle*

J If the divisor of a division problem or the denominator of a fraction is 2, 5, or 10, will the quotient be a repeating decimal? Solve these problems to help you explain your answer.
2)9.70 → *4.85* 23 ÷ 5 *4.6* $\frac{9}{10}$ *0.9*
No, because you can annex zeros to solve division problems, and all numbers ending in zero are multiples of 2, 5, and 10.

30. *100,000,000 + 900,000 + 40,000 + 2,000 + 60 + 7*
34. *16.04 + 17.8 = 33.84; 33.84 – 16.04 = 17.8; 33.84 – 17.8 = 16.04*

Complete DAILY REVIEW 6 on page 435.

(*Note:* Although the transition from dividing by a whole number to dividing by a decimal may be easy for your students, the reason for moving the decimal points in the divisor and dividend may be unclear. You may choose to lead a discussion about the following example for renaming $\frac{36}{0.9}$.)

9. Elicit that a division problem can be written in fraction form and that the Identity Property of Multiplication allows you

$$\frac{36}{0.9} = \frac{36 \times 10}{0.9 \times 10} = \frac{360}{9}$$

to multiply a fraction by a name for 1 without changing its value. Remind the students that although the renamed fraction appears different, its value is the same as the original fraction. Point out that the division problem is now a whole number divided by a whole number.

Choose a student to mentally divide $\frac{360}{9}$ and tell the quotient of $\frac{36}{0.9}$. *40*

Student Text pp. 200–201

Lesson 84

Student Text pp. 202–3
Daily Review p. 435f

Objectives
- Divide a whole number by a decimal
- Divide a decimal by a decimal
- Estimate the quotient of a decimal division problem
- Solve money word problems
- Complete an input/output table

Teacher Materials
- Place Value Kit: a large red one; tenths
- Input/Output Tables, page IA43 (CD)
- Christian Worldview Shaping, pages 23–24 (CD)

Student Materials
- Input/Output Tables, page IA43 (CD)

Preparation
Prepare three tables on the Input/Output Tables page by writing the rules above the tables and the corresponding values in the input columns. (Refer to Student Text page 202.)

1. *Rule:* ÷ 2; 4.8; 6.4; 10.6 2. *Rule:* ÷ 2.5; 10; 12; 16
3. *Rule:* ÷ 2.4; 3.12; 7.2; 8.8

You may choose to write the rules and the input values on one Input/Output Tables page and make a copy for each student, or you may distribute blank Input/Output Tables pages and instruct the students to write the rules and the input values as shown on your page.

Teach for Understanding

Divide a whole number by a decimal and a decimal by a decimal

1. Write 21 ÷ 0.3 in a division frame for display.

➤ **What do you do when the divisor is a decimal?** ***Make the divisor a whole number by multiplying it by a power of 10 and then multiplying the dividend by the same power of 10.***

Choose a student to demonstrate solving the equation. Instruct him to use arrows to show the movement of the decimal points. If necessary, remind him to annex a zero in the dividend before moving the decimal point. ***70***

2. Display the large red one and 8 tenths from the Place Value Kit.

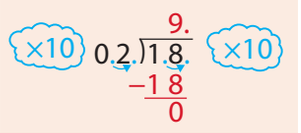
➤ **What decimal is displayed?** ***1.8***

➤ **How can you make sets of 2 tenths from 1.8?** ***Elicit that you can rename the 1 one as 10 tenths and add them to the 8 tenths. Then you can distribute the 18 tenths into sets of 2 tenths.***

Select a student to distribute the 18 tenths into sets of 0.2.

➤ **How many sets of 2 tenths are there?** ***9***

➤ **What division equation can you write for this distribution of the 1 one and 8 tenths ?** ***1.8 ÷ 0.2 = 9***



3. Write 1.8 ÷ 0.2 in a division frame and use the long division process to demonstrate solving it. Remind the students that dividing decimals is similar to dividing whole numbers. Point out that they need to divide by a whole number. If the divisor is a decimal, you must multiply it by a power of 10 to make it a whole number and then multiply the dividend by the same power of 10. Emphasize the importance of carefully aligning the digits when solving the problem and placing the decimal point correctly in the quotient.

➤ **What is the quotient of 1.8 ÷ 0.2?** ***9***

4. Write 2.16 ÷ 0.52 in a division frame for display.

➤ **What must you do to the divisor in order to divide?** ***Elicit that you must multiply 0.52 by 100 to move the decimal point 2 places to the right, making the divisor a whole number, 52.***

➤ **What must you do to the dividend? Why?** ***Elicit that you must also multiply the dividend by 100, moving the decimal point 2 places to the right and making the dividend 216; when you use compensation, the quotient remains the same.***

Choose a student to demonstrate solving the problem, dividing to the thousandths. ***4.153***

➤ **What do you notice about this division problem?** ***Answers will vary; but elicit that you could continue to divide because the decimal has not terminated and a repeating pattern has not been established.***

➤ **What is the quotient rounded to the nearest hundredth?** ***4.15***

➤ **Is 4.15 an exact or an approximate answer? Why?** ***Elicit that it is an approximate answer because the decimal in the quotient did not terminate; you rounded the quotient to the nearest hundredth.***

Explain that when you divide, it is not unusual for a decimal quotient such as 4.153 . . . to terminate or begin to repeat in the millionths, ten millionths, or other decimal place of lesser value (4.153 . . . begins to repeat in the Ten-Millionths place). Remind the students that unless it is necessary to work with very small numbers, it is sufficient to round the quotient to a given decimal place such as the nearest tenth, hundredth, or thousandth.

Solve money word problems

A dozen eggs are on sale for $1.20. Ella has $6.00. How many dozens of eggs can she purchase? ***5 dozen***

➤ **How could you solve this word problem? Why?** ***Divide $6.00 by $1.20; you need to find how many sets of $1.20 are in $6.00.***

1. Write $6.00 ÷ $1.20 in a division frame for display.

➤ **How do you solve a money division problem? How do you know?** ***Elicit that you divide the same way as you divide a decimal because an amount of money is written in decimal form; the cents are written in the Tenths and Hundredths places, and the dollar sign ($) is the label.***

➤ **What will the quotient represent?** ***dozens of eggs***

Select a student to solve the problem, explaining each step as he solves it. Guide the explanation as needed.

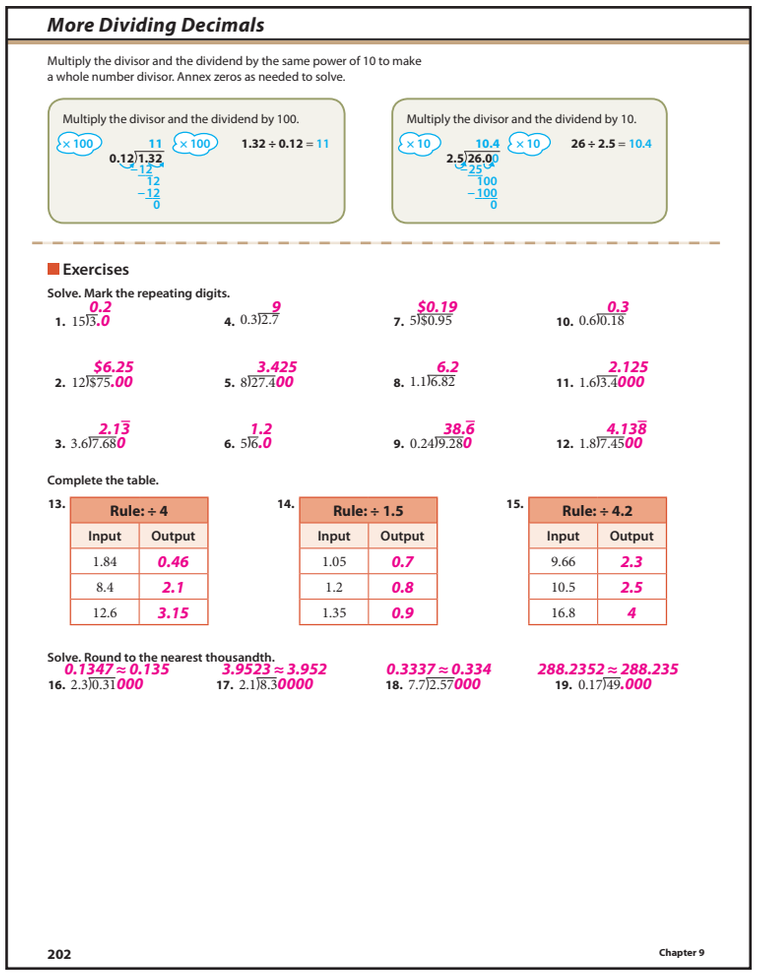
➤ **How many dozens of eggs can Ella purchase?** ***5 dozen***

(***Note:*** Advanced students may notice the correlation between $6.00 ÷ $1.20 and 60 ÷ 12.)

Abigail is comparing the prices of two different kinds of toothpaste to help her decide which toothpaste to purchase. A 3.5 ounce tube of one kind of toothpaste sells for $0.97. Another kind of toothpaste costs $1.89 for a 7.4 ounce tube. Which toothpaste is the better buy? ***the 7.4 ounce tube of toothpaste***

➤ **What is the question asking you to find?** ***which toothpaste is the better buy***

➤ **How can you find the answer to the question?** ***Elicit that this is a multi-step problem. You need to divide the price of each tube of toothpaste by the amount of toothpaste in the tube to find the***



More Dividing Decimals

Multiply the divisor and the dividend by the same power of 10 to make a whole number divisor. Annex zeros as needed to solve.

Multiply the divisor and the dividend by 100.

$\times 100$ $\times 100$ **1.32 ÷ 0.12 = 11**

$0.12\overline{)1.32}$ → $12\overline{)132}$

11
12 | 132
−12
12
−12
0

Multiply the divisor and the dividend by 10.

$\times 10$ $\times 10$ **26 ÷ 2.5 = 10.4**

$2.5\overline{)26.0}$ → $25\overline{)260}$

10.4
25 | 260
100
−100
0

Exercises

Solve. Mark the repeating digits.

1. $15\overline{)3.0}$ *0.2*
2. $12\overline{)\$75.00}$ *$6.25*
3. $3.6\overline{)7.680}$ *2.13̄*
4. $0.3\overline{)2.7}$ *9*
5. $8\overline{)27.400}$ *3.425*
6. $5\overline{)6.0}$ *1.2*
7. $5\overline{)\$0.95}$ *$0.19*
8. $1.1\overline{)6.82}$ *6.2*
9. $0.24\overline{)9.280}$ *38.6̄*
10. $0.6\overline{)0.18}$ *0.3*
11. $1.6\overline{)3.4000}$ *2.125*
12. $1.8\overline{)7.4500}$ *4.138̄*

Complete the table.

13.

Rule: ÷ 4	
Input	Output
1.84	*0.46*
8.4	*2.1*
12.6	*3.15*

14.

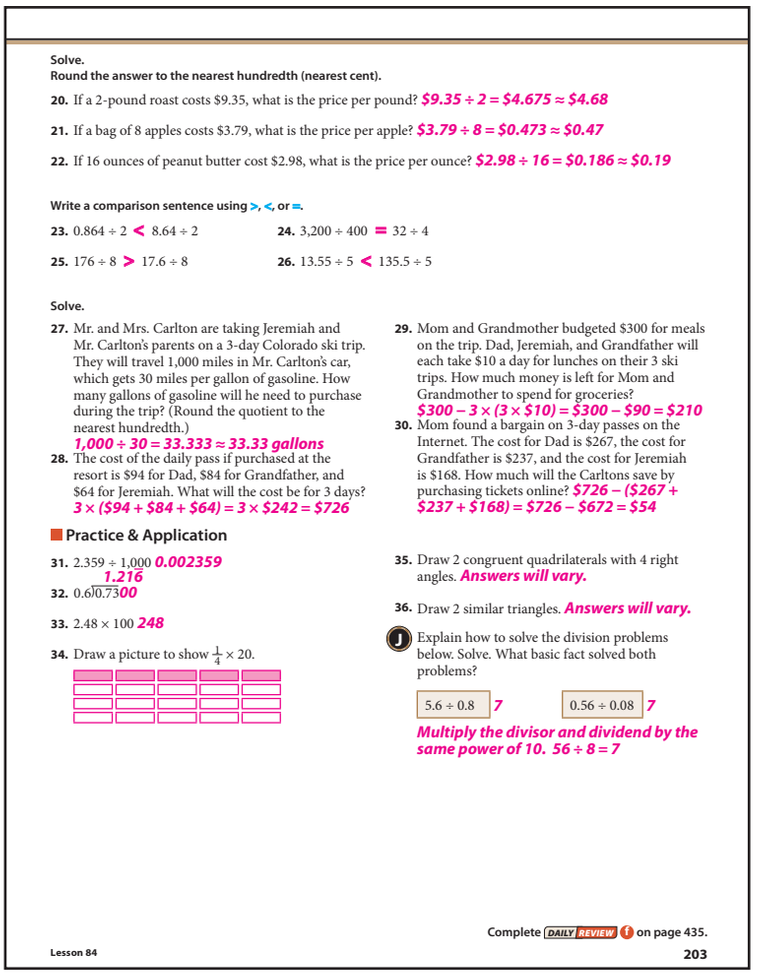
Rule: ÷ 1.5	
Input	Output
1.05	*0.7*
1.2	*0.8*
1.35	*0.9*

15.

Rule: ÷ 4.2	
Input	Output
9.66	*2.3*
10.5	*2.5*
16.8	*4*

Solve. Round to the nearest thousandth.

16. $2.3\overline{)0.31000}$ *0.1347 ≈ 0.135*
17. $2.1\overline{)8.30000}$ *3.9523 ≈ 3.952*
18. $7.7\overline{)2.57000}$ *0.3337 ≈ 0.334*
19. $0.17\overline{)49.000}$ *288.2352 ≈ 288.235*



Solve.
Round the answer to the nearest hundredth (nearest cent).

20. If a 2-pound roast costs $9.35, what is the price per pound? *$9.35 ÷ 2 = $4.675 ≈ $4.68*
21. If a bag of 8 apples costs $3.79, what is the price per apple? *$3.79 ÷ 8 = $0.473 ≈ $0.47*
22. If 16 ounces of peanut butter cost $2.98, what is the price per ounce? *$2.98 ÷ 16 = $0.186 ≈ $0.19*

Write a comparison sentence using >, <, or =.

23. 0.864 ÷ 2 **<** 8.64 ÷ 2
24. 3,200 ÷ 400 **=** 32 ÷ 4
25. 176 ÷ 8 **>** 17.6 ÷ 8
26. 13.55 ÷ 5 **<** 135.5 ÷ 5

Solve.

27. Mr. and Mrs. Carlton are taking Jeremiah and Mr. Carlton's parents on a 3-day Colorado ski trip. They will travel 1,000 miles in Mr. Carlton's car, which gets 30 miles per gallon of gasoline. How many gallons of gasoline will he need to purchase during the trip? (Round the quotient to the nearest hundredth.) *1,000 ÷ 30 = 33.333 ≈ 33.33 gallons*
28. The cost of the daily pass if purchased at the resort is $94 for Dad, $84 for Grandfather, and $64 for Jeremiah. What will the cost be for 3 days? *3 × ($94 + $84 + $64) = 3 × $242 = $726*
29. Mom and Grandmother budgeted $300 for meals on the trip. Dad, Jeremiah, and Grandfather will each take $10 a day for lunches on their 3 ski trips. How much money is left for Mom and Grandmother to spend for groceries? *$300 − 3 × (3 × $10) = $300 − $90 = $210*
30. Mom found a bargain on 3-day passes on the Internet. The cost for Dad is $267, the cost for Grandfather is $237, and the cost for Jeremiah is $168. How much will the Carltons save by purchasing tickets online? *$726 − ($267 + $237 + $168) = $726 − $672 = $54*

Practice & Application

31. 2.359 ÷ 1,000 *0.002359*
32. $0.6\overline{)0.7300}$ *1.216̄*
33. 2.48 × 100 *248*
34. Draw a picture to show $\frac{1}{4} \times 20$.

35. Draw 2 congruent quadrilaterals with 4 right angles. *Answers will vary.*
36. Draw 2 similar triangles. *Answers will vary.*

J Explain how to solve the division problems below. Solve. What basic fact solved both problems?

5.6 ÷ 0.8 *7* 0.56 ÷ 0.08 *7*

Multiply the divisor and dividend by the same power of 10. 56 ÷ 8 = 7

Complete DAILY REVIEW 1 on page 435.

cost per ounce (the unit price). Then you compare the unit prices to determine which toothpaste is the better buy.

- **What problems can you write to find the unit price for each tube of toothpaste?** *$0.97 ÷ 3.5; $1.89 ÷ 7.4*
- **What will each quotient represent?** *Elicit that each quotient will represent an amount of money: the price per ounce for the tube of toothpaste.*
- **If there is a remainder, what decimal place will you need to divide to?** *You will need to divide to the One-Thousandths place and round to the nearest hundredth (the nearest cent).*

2. Choose two students to write and solve the two division problems for display while the other students solve the problems on paper. *$0.97 ÷ 3.5 = 0.277 ≈ $0.28; $1.89 ÷ 7.4 = 0.255 ≈ $0.26*
   - **What is the price per ounce for the smaller tube?** *about $0.28 ($0.28 per ounce rounded to the nearest cent)*
   - **What is the price per ounce for the larger tube?** *about $0.26 ($0.26 per ounce rounded to the nearest cent)*
   - **Which toothpaste is the better buy? Why?** *The larger tube (7.4 ounces) is the better buy because it is $0.02 less per ounce.*
3. Guide the students in estimating and solving the following problems on paper, rounding non-repeating, non-terminating decimals to the nearest thousandth. Remind the students to move the decimal point in the divisor and in the dividend before determining the estimate. Also, remind them of the importance of carefully aligning the digits and correctly placing the decimal point in the quotient. For the first problem, point out that although the quotient terminates in the Tenths place, they must continue to divide (either divide to the hundredths or annex a zero to rename the 5 tenths as 50 hundredths) because the quotient represents an amount of money.

$6.65 ÷ 0.7 = *$9.50 ($9)*
$201.25 ÷ 4.5 = *44.722 ≈ $44.72 ($40)*
12 ÷ 0.52 = *23.0769 ≈ 23.077 (20)*
7 ÷ 0.6 = *11.6̄ (11)*
10.73 ÷ 0.9 = *11.92̄ (11)*
5.244 ÷ 0.38 = *13.8 (10)*

4. **Christian Worldview Shaping (CD)**

Complete an input/output table

Display and distribute the Input/Output Tables page. Guide the students in completing the tables or allow them to complete the tables independently. Discuss the answers and the solutions as needed.

(***Note:*** You may choose to challenge the students to use mental math to determine the output values for Table 1.)

Table 1: *2.4; 3.2; 5.3*
Table 2: *4; 4.8; 6.4*
Table 3: *1.3; 3; 3.6̄*

Student Text pp. 202–3

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 85

Student Text pp. 204–5
Daily Review p. 436g

Objectives
- Develop an understanding of real numbers
- Apply addition and multiplication properties to real numbers

Teacher Materials
- Number Line

Student Materials
- A calculator

Preparation
Prepare for display Student Text pages 204 and 205.

Note
The calculators used by the students in this lesson should not truncate decimals.

Teach for Understanding

Develop an understanding of real numbers

1. Display the prepared Student Text page 204 and instruct each student to turn to page 204 in his Student Text. Direct attention to the diagram and tell the students that they will be learning about *real numbers*. Point out that there are two kinds of real numbers: *rational numbers* and *irrational numbers*.
2. Guide a discussion about rational numbers, classifying the types of numbers in the order given below. Use the diagram to point out that each sub-category of rational numbers is included in the next classification (i.e., whole numbers include natural numbers, integers include whole numbers, rational numbers include integers). Choose students to give examples of each type of number.

   natural numbers: These are all the counting numbers, 1, 2, 3, 4, . . .

   whole numbers: These are all the natural numbers (counting numbers) and zero.

   integers: These are all the whole numbers and their negative opposites, numbers that are less than zero.

   Continue to display the diagram.
3. Display the Number Line and review natural numbers, whole numbers, and integers on the Number Line.
4. Direct attention to the diagram again.

➤ **What numbers have not yet been included?** ***Elicit that fractions and decimals have not been mentioned.***

Explain that *rational numbers* include all integers, fractions, and decimals that repeat or terminate. Remind the students that fractions and decimals are between each number (integer) on the number line.

Choose students to mark on or above the number line the approximate location of $\frac{1}{2}$, $3\frac{3}{4}$, and $4\frac{1}{4}$ and to label each mark. Select other students to write for display the decimal equivalents of the fractions that are marked on the number line.

$\frac{1}{2} = 0.5$; $3\frac{3}{4} = 3.75$; $4\frac{1}{4} = 4.25$

(***Note:*** Allow students who do not recall the equivalent decimals to use a calculator to find the answers.)

➤ **What do you notice about all of the equivalent decimals?** ***Elicit that they all terminate.***

5. Guide the students in finding the decimal form for $8\frac{7}{11}$. ***$8.\overline{63}$***. Choose a student to mark the approximate location on the Number Line. ***a little past the halfway point between 8 and 9***

➤ **What do you notice about this decimal?** ***Elicit that it is a repeating decimal.***

6. Explain that, just as natural numbers have negative opposites, fractions and decimals also have negative opposites. Select students to mark on the Number Line, and label the negative opposites of the numbers that have already been plotted. ***$-\frac{1}{2}$; $-3\frac{3}{4}$; $-4\frac{1}{4}$; $-8\frac{7}{11}$***
7. Summarize rational numbers: every natural number is a whole number, every whole number is an integer, every integer is a rational number, and every rational number is a real number.
8. Direct attention to the numbers outside the circles in the diagram. Explain that real numbers that cannot be classified as rational numbers are *irrational numbers*. The decimal form of irrational numbers neither repeats nor terminates. Irrational numbers cannot be written as fractions because they do not have an exact value.
9. Instruct the students to divide $\frac{22}{7}$ using their calculators. ***3.142857 . . .***

   Write $\frac{22}{7} = 3.\overline{142857}$ for display. Explain that if you continued to divide $\frac{22}{7}$, the students would see the repeating pattern in the decimal. Point out that both the fraction ($\frac{22}{7}$) and the decimal ($3.\overline{142857}$) are rational numbers.

   Explain that both the decimal value 3.14 and the fraction $\frac{22}{7}$ are used to approximate pi (π); however, π is an irrational number because it does not have an exact value. Explain that people have approximated the value of π to more than a trillion decimal places. Its infinite value shows the greatness of God and the limited nature of human intellect. Because people have not been able to determine an exact value for π, numbers such as $\frac{22}{7}$, 3.14, $3.\overline{142857}$, and 3.14159 . . . (the value for π shown in the real numbers diagram) are all acceptable approximations for the value of π.

➤ **Why is the square root of 2 an irrational number?** ***It is a non-repeating and non-terminating decimal.***

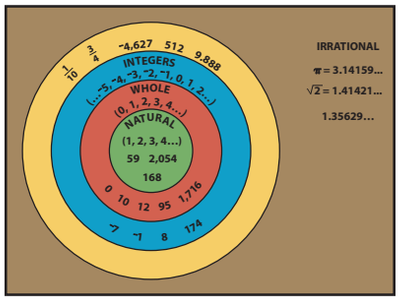
10. Write 0.212112111 . . . for display. Explain that although a pattern is seen in this number, the same pattern is not repeated (e.g., 0.383838 . . .). Therefore, 0.212112111 . . . is not a repeating decimal; it is an irrational number.
11. Direct the students to complete the exercises on page 204. Give guidance as needed.

Apply addition and multiplication properties to real numbers

1. Display the prepared Student Text page 205. Tell the students that addition and multiplication properties can be applied to all real numbers. Direct them to examine the examples in the charts in their Student Text. Remind them that a variable can be used to represent any number.

Real Numbers

Real Numbers



- **Real numbers** include all rational and irrational numbers.
- **Irrational numbers** are decimals that do not repeat or terminate.
- **Rational numbers** include all integers, fractions, and decimals that repeat or terminate.
- **Integers** include all whole numbers and their negative opposites.
- **Whole numbers** include all natural numbers and zero.
- **Natural numbers** are the counting numbers.

Exercises

Draw and label a real-number diagram like the one above.
Write the given number in the most precise category on the chart.

1. $\frac{1}{12}$
2. $0.\overline{2}$
3. $-\frac{8}{10}$
4. 92
5. 0.8333
6. $0.\overline{96}$
7. 0.275
8. $^{-}11$
9. 3
10. 0
11. $\frac{4}{8}$
12. 0.354354435444…

Write true or false.

13. $^{-}17$ is an integer and a whole number. ***false***
14. 5,267 is a whole number. ***true***
15. $\frac{1}{5}$ is an irrational number. ***false***
16. 37 is an integer. ***true***
17. The sum of 15 and $^{-}6$ is an integer. ***true***
18. The sum of 8 and $^{-}8$ is a whole number. ***true***
19. The sum of $\frac{1}{4}$ and $\frac{9}{12}$ is a whole number. ***true***
20. Explain your answers for statements 13 and 15.

MEET THE MATHEMATICIAN

Sophie Germain (1776–1831) had to overcome several hurdles in her study of mathematics. First, her parents did not think mathematics was a suitable study for girls. After they realized how much mathematics meant to her, they changed their minds and supported her efforts.

Also, because she was a woman, Sophie was denied entrance to the university in France; so she studied the notes made available to her from the classes. She even submitted a paper to the professor under the name M. Leblanc and received excellent marks on it. In 1816, Sophie won a distinguished French award for her work in the field of the mathematics of elasticity and became a recognized leader in mathematical thought.

20. ***Number 13: Whole numbers do not include negative numbers. Number 15: The decimal equivalent for $\frac{1}{5}$ is 0.2; 0.2 is a rational number.***

Addition and Multiplication Properties can be used with all real numbers.

Addition Properties

Commutative	Associative	Identity
$a + b = b + a$	$(a + b) + c = a + (b + c)$	$a + 0 = a$
$\frac{1}{2} + \frac{4}{6} = \frac{4}{6} + \frac{1}{2}$	$(1.76 + 3.2) + 5 = 1.76 + (3.2 + 5)$	$\frac{18}{25} + 0 = \frac{18}{25}$

Multiplication Properties

Commutative	Associative	Identity
$a \times b = b \times a$	$(a \times b) \times c = a \times (b \times c)$	$a \times 1 = a$
$^{-}2 \times 5 = 5 \times {}^{-}2$	$(1.3 \times {}^{-}4) \times 10 = 1.3 \times ({}^{-}4 \times 10)$	$6.735 \times 1 = 6.735$

Zero	Distributive
$a \times 0 = 0$	$a(b + c) = (a \times b) + (a \times c)$
$-\frac{15}{32} \times 0 = 0$	$^{-}3(5 + 6) = ({}^{-}3 \times 5) + ({}^{-}3 \times 6)$

Exercises

Use a property to complete the equation.
Name the property used.

21. $\frac{17}{2} + 4 = 4 + \_\_$ ***$\frac{17}{2}$***
Commutative Property of Addition
22. $^{-}5.6 \times 0 = \_\_$ ***0***
Zero Property of Multiplication
23. $\frac{15}{4}(87 + 56) = (\_\_ \times 87) + (\frac{15}{4} \times 56)$ ***$\frac{15}{4}$***
Distributive Property
24. $\frac{8}{13} \times -\frac{7}{12} = \_\_ \times \frac{8}{13}$ ***$-\frac{7}{12}$***
Commutative Property of Multiplication
25. $(0.769 + 4.9) + 37 = 0.769 + (\_\_ + \_\_)$ ***4.9; 37***
Associative Property of Addition
26. $({}^{-}300 \times 40) \times {}^{-}20 = \_\_ \times (\_\_ \times {}^{-}20)$ ***$^{-}300$; 40***
Associative Property of Multiplication

Practice & Application *Answers are shown using cancellation.*

27. Adam had $\frac{3}{4}$ of a ton of gravel. He separated it into piles that were $\frac{1}{16}$ of a ton each. How many piles of gravel did he have?
$\frac{3}{4} \div \frac{1}{16} = \frac{3}{4} \times \frac{16}{1} = \frac{12}{1} = 12$ piles
28. A basketball team bought 3 basketballs at a cost of $23.95 each. If 5 boys shared the cost equally, how much did each boy pay?
$(3 \times \$23.95) \div 5 = \$71.85 \div 5 = \$14.37$
29. Keira bought 10.7 pounds of ground turkey. She decided to divide it by putting 0.75 of a pound of meat into each freezer bag. How many bags will she use? ***$10.7 \div 0.75 = 14.2\overline{6}$; 15 bags***
30. For lunch, Eden ate a 300-calorie cheeseburger, a 165-calorie salad, and an 85-calorie apple. How many total calories were in her lunch?
300 + 165 + 85 = 550 calories
31. Mr. Hall had 100 cards to be put into envelopes. Six cards were to be put into each envelope, and the extra cards were to be returned to the school office. How many cards were returned to the office?
$100 \div 6 = 16$ r4 or $16\frac{4}{6}$; 4 cards were returned.

Complete DAILY REVIEW 9 on page 436.

2. Choose students to define each property based on the examples given. Possible definitions and explanations are given below.

(***Note:*** Negative numbers are included in some of the examples to show the application of the properties to all real numbers. Tell the students that they will learn about multiplying negative numbers later in the year.)

Commutative Property of Addition ***The order of the addends can be changed without changing the sum. The sum of $\frac{1}{2} + \frac{4}{6}$ is equal to the sum of $\frac{4}{6} + \frac{1}{2}$.***

Associative Property of Addition ***The grouping of the addends can be changed without changing the sum. The sum of $(1.76 + 3.2) + 5$ is equal to the sum of $1.76 + (3.2 + 5)$.***

Identity Property of Addition ***When 0 is added to an addend, the sum is the other addend; $\frac{18}{25} + 0$ is equal to $\frac{18}{25}$.***

Commutative Property of Multiplication ***The order of the factors can be changed without changing the product. The product of $^{-}2 \times 5$ is equal to the product of $5 \times {}^{-}2$.***

Associative Property of Multiplication ***The grouping of the factors can be changed without changing the product. The product of $(1.3 \times {}^{-}4) \times 10$ is equal to the product of $1.3 \times ({}^{-}4 \times 10)$.***

Identity Property of Multiplication ***When 1 is a factor, the product is the other factor; 6.735×1 is equal to 6.735.***

Zero Property of Multiplication ***When 0 is a factor, the product is 0; $-\frac{15}{32} \times 0$ is equal to 0.***

Distributive Property of Multiplication over Addition ***Guide the explanation to include that the product of 2 factors [$(b + c)$ represent a second factor] can be found by renaming 1 factor as addends and multiplying each addend by the other factor; $^{-}3(5 + 6)$ is equal to $({}^{-}3 \times 5) + ({}^{-}3 \times 6)$. Elicit that both $^{-}3(5 + 6)$ and $({}^{-}3 \times 5) + ({}^{-}3 \times 6)$ are equal to $^{-}3 \times 11$.***

3. Assign each student one addition property and one multiplication property. Direct them to use real numbers to write one equation for each property. Give guidance as needed. For each property, select a student to write his equation for display and explain it.

Student Text pp. 204–5

Lesson 86 **Student Text** pp. 206–7

Chapter Review

Objectives

- Divide a decimal by a power of 10 using mental math
- Rename a fraction as a decimal
- Compare a decimal and a fraction
- Divide a decimal by a 1- or a 2-digit whole number
- Divide a whole number or a decimal by a decimal
- Estimate the quotient of a decimal division problem
- Solve a decimal word problem

Teacher Materials

- Dividing Decimals, page IA44 (CD)

Student Materials

- Dividing Decimals, page IA44 (CD)

Note

This lesson reviews the concepts presented in Chapter 9 to prepare the students for the Chapter 9 Test. Student Text pages 206–7 provide the students with an excellent study guide.

Teach for Understanding

Divide a decimal by a power of 10

1. Write these equations for display.

$36.4 \div 10 =$ ***3.64***	$40 \div 10 =$ ***4***
$5.7 \div 100 =$ ***0.057***	$0.32 \div 100 =$ ***0.0032***
$1{,}589.1 \div 1{,}000 =$ ***1.5891***	$673.5 \div 1{,}000 =$ ***0.6735***
$319 \div 10^2 =$ ***3.19***	$26.8 \div 10^3 =$ ***0.0268***
$0.247 \div 10^1 =$ ***0.0247***	$103.4 \div 10^2 =$ ***1.034***

➤ **What do you know about the placement of the decimal point in the quotient when you divide by a power of 10?** ***Elicit that the decimal point moves 1 place to the left for each 0 in the divisor, renaming each digit in the dividend as $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1{,}000}$, . . . of its original value and resulting in a quotient that is $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1{,}000}$, . . . of the value of the dividend.***

2. Direct the students to solve the equations using mental math and to write the quotients on paper. Remind them that the exponent in the divisor indicates the number of times the base (10) is repeated as a factor and the number of zeros in the standard form of the number.

   Choose students to complete the equations written for display. Discuss the answers as needed.

Rename a fraction as a decimal

1. Write $\frac{4}{5}$, $\frac{10}{25}$, and $\frac{9}{20}$ for display. Remind the students that when a denominator is a factor of a power of 10, you can rename the fraction to higher terms so that the denominator is a power of 10 and then you can write the equivalent decimal.

   Select students to write for display the fractions renamed to higher terms and the equivalent decimals. $\frac{8}{10} =$ ***0.8;*** $\frac{40}{100} =$ ***0.40 or 0.4;*** $\frac{45}{100} =$ ***0.45***

2. Write $\frac{3}{8}$, $\frac{7}{9}$, and $\frac{5}{12}$ for display.

➤ **Can any of these denominators be renamed so that the denominator is a power of 10?** ***no*** **How can you find the decimal form for each fraction?** ***Divide the numerator by the denominator.***

Select students to demonstrate dividing the fractions and to explain each step as they solve the problems. Remind them that a repeating decimal in the quotient is indicated when the new dividend is the same as the original dividend or the remainder is the same as a previous remainder. Give guidance as needed. ***0.375; $0.\overline{7}$; $0.41\overline{6}$***

Compare a decimal and a fraction

Use a procedure similar to the one used in Lesson 82 to guide the students in completing these comparisons.

$\frac{1}{2} > 0.\overline{4}$ $\quad 0.5 > \frac{3}{7}$ $\quad 0.195 < \frac{1}{5}$ $\quad \frac{2}{3} < 0.75$

Estimate and solve decimal division problems

(***Note:*** You may choose the problems for your students to estimate. Although the estimates given are closer to the exact answer, accept as correct other estimates within the estimate range.)

Display and distribute the Dividing Decimals page. Select students to solve the problems on the displayed page as the other students solve the problems on their page. Remind them to draw a bar over repeating digits in the quotient and to round non-repeating, non-terminating decimals to the nearest thousandth. Discuss the solutions as needed.

1. ***70.91*** ***(70)***	2. ***12.4828 ≈ 12.483*** ***(12)***	3. ***$0.2\overline{5}$*** ***(0.2)***
4. ***$17.\overline{3}$*** ***(20)***	5. ***15.3146 ≈ 15.315*** ***(10 or 20)***	6. ***0.9047 ≈ 0.905*** ***(0.9)***
7. ***56.25*** ***(50 or 60)***	8. ***$1.0\overline{2}$*** ***(1)***	9. ***33.9523 ≈ 33.952*** ***(30)***

Solve a decimal word problem

Guide the students in solving this word problem.

> Zale went for a drive in the countryside. He traveled 265.4 miles in $5\frac{1}{2}$ hours. To the nearest tenth of a mile, what was his average speed? ***265.4 ÷ 5.5 = 48.25 ≈ 48.3 miles per hour***

CHAPTER 9 REVIEW

Use mental math to solve.

1. 47.6 ÷ 1,000 *0.0476*
2. 75.9 ÷ 100 *0.759*
3. 213.4 ÷ 1,000 *0.2134*
4. 61.43 ÷ 100 *0.6143*
5. 784.14 ÷ 10 *78.414*
6. 566 ÷ 10^3 *0.566*
7. 258.4 ÷ 10^2 = *2.584*
8. 26.3 ÷ 10^1 *2.63*
9. 141.3 ÷ 10^2 *1.413*

Rename the denominator as a power of 10. Write the fraction as a decimal.

10. $\frac{4}{5}$ $\frac{8}{10}$ = *0.8*
11. $\frac{3}{20}$ $\frac{15}{100}$ = *0.15*
12. $\frac{1}{2}$ $\frac{5}{10}$ = *0.5*
13. $\frac{15}{25}$ $\frac{60}{100}$ = *0.60*

Solve. Mark the repeating digits.

14. $6\overline{)379.38}$ *63.23*
15. $4\overline{)\$1.48}$ *$0.37*
16. $0.2\overline{)90}$ *45*
17. $1.5\overline{)6.50}$ *4.3̄*
18. $0.3\overline{)5.20}$ *17.3̄*
19. $0.28\overline{)700}$ *25*
20. $0.5\overline{)120}$ *24*
21. $0.12\overline{)1.5800}$ *13.16̄*
22. $27\overline{)\$14.58}$ *$0.54*

Solve. Round to the nearest thousandth.

23. $14\overline{)51.10}$ *3.65*
24. $76\overline{)32.1400}$ *0.4228 ≈ 0.423*
25. $16\overline{)21.5000}$ *1.3437 ≈ 1.344*

Ski areas sometimes use snow-making machines to resurface their ski trails.

Divide. Write the fraction as a decimal. Mark the repeating digits.

26. $\frac{8}{9}$ *0.8̄*
27. $\frac{7}{10}$ *0.7*
28. $\frac{2}{3}$ *0.6̄*
29. $\frac{5}{6}$ *0.83̄*

Write a comparison sentence using > or <.

30. $\frac{1}{2}$ *<* 0.6̄
31. $\frac{95}{100}$ *>* 0.75
32. $\frac{2}{3}$ *>* 0.3̄
33. 0.125 *<* $\frac{5}{8}$

Estimate the quotient.

34. $7.7\overline{)25.6}$ *3*
35. $0.6\overline{)73.5}$ *120*
36. $1.8\overline{)20.44}$ *10*
37. $5.9\overline{)418.6}$ *70*

Solve. *Answers are shown using cancellation.*

38. Mrs. McKenzie bought canned food for the food bank. She bought 10 cans of green beans that cost $0.96 each and 10 cans of corn that cost $0.78 each. How much did she spend for canned vegetables? *(10 × $0.96) + (10 × $0.78) = $9.60 + $7.80 = $17.40*

39. Brandon ordered a set of 4 books about mountain climbing. The books weighed 9.2 pounds. What was the average weight of each book? *9.2 ÷ 4 = 2.3 pounds*

40. The cost of snow tubing on the mountain is $20 per hour for each person. How much would it cost for Brody and Chase to snow tube for $1\frac{1}{2}$ hours? *$2 \times (1\frac{1}{2} \times \$20) = 2 \times (\frac{3}{2} \times \frac{\$20}{1}) = 2 \times \$30 = \$60$*

41. Mrs. Thomas brought $2\frac{1}{2}$ cases of juice boxes for the class party. There are 10 juice boxes in each case. How many drinks does she have for her class? *$2\frac{1}{2} \times 10 = \frac{5}{2} \times \frac{10}{1} = \frac{25}{1} = 25$ drinks*

42. Mr. Jackson bought lunch for his 4 children. Two of the children each ordered a meal that cost $4.95. The third child ordered a meal that cost $3.75, and the fourth child ordered a meal that cost $2.79. What was the total cost of the meals? *(2 × $4.95) + $3.75 + $2.79 = $16.44 or $4.95 + $4.95 + $3.75 + $2.79 = $16.44*

43. Peter stops for a cup of coffee every 200 miles that he travels. If coffee costs about $1.60 a cup, about how much will he spend on coffee during an 800-mile trip? *(800 ÷ 200) × $1.60 = 4 × $1.60 = $6.40*

Student Text pp. 206–7

Lesson 87

Student Text pp. 208–11

Chapter 9 Test

Cumulative Review

For a list of the skills reviewed in the Cumulative Review, see the Lesson Objectives for Lesson 87 in the Chapter 9 Overview on page 190 of this Teacher's Edition.

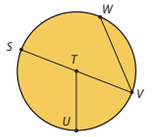
Student Materials

- Cumulative Review Answer Sheet, page IA9 (CD)

Use the Cumulative Review on Student Text pages 208–10 to review previously taught concepts and to determine which students would benefit from your reteaching of the concepts. To prepare the students for the format of achievement tests, instruct them to work on a separate sheet of paper, if necessary, and to mark the answers on the Cumulative Review Answer Sheet.

Use the Exploring Ideas on Student Text page 211 (page 209 of this Teacher's Edition) any time after this chapter.

Use the circle to find the answer.



9. Name the diameter.

A. $\overline{WV}$ C. $\overline{SV}$

B. $\overline{TU}$ D. $\overline{TV}$

10. If $\overline{TU} = 8$ cm, then ___.

A. $\overline{WV} = 8$ cm C. $\overline{TV} = 16$ cm

B. $\overline{TS} = 16$ cm D. $\overline{SV} = 16$ cm

11. $\angle UTV$

A. acute angle C. straight angle

B. obtuse angle D. complementary angles

12. Which angle measures 180°?

A. $\angle STU$ C. $\angle SVW$

B. $\angle STV$ D. $\angle UTV$

13. What is $\overline{WV}$?

A. chord C. diameter

B. radius D. supplementary

Use the figure to find the answer.

14.

The perimeter of the square is ___.

A. 12.6 mm C. 37.8 mm

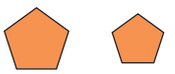
B. 25.2 mm D. 50.4 mm

15.

A. similar C. scalene

B. congruent D. obtuse

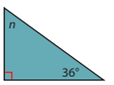
16.



A. similar C. octagon

B. congruent D. parallel

17.



A. $n = 30°$ C. $n = 50°$

B. $n = 45°$ D. $n = 54°$

18.

A. right triangle C. acute triangle

B. obtuse triangle D. equilateral triangle

CUMULATIVE REVIEW

Test Prep

Mark the answer.

1. The holiday candy bars are specially priced: 4 for $1.00. How many can Brooklyn buy if she has $17.25?

A. 57 C. 85

B. 69 D. 100

2. A flat of 10 tomato plants costs $5.50. Individual plants cost $0.75. How much would it cost to purchase 35 plants?

A. $9.25 C. $13.25

B. $11.00 D. $20.25

3. Mr. Hudson needs $190\frac{1}{2}$ feet of fencing to put around the perimeter of his square garden. What is the measure of each side?

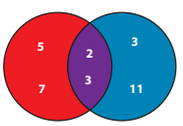
A. $47\frac{1}{2}$ feet C. $48\frac{3}{8}$ feet

B. $47\frac{5}{8}$ feet D. $49\frac{1}{4}$ feet

4. The mountain rescue team responded to 6 calls in April. They responded to $3\frac{1}{2}$ times as many calls in July. How many calls did the team respond to in July?

A. 21 C. 36

B. 25 D. 42



5. What product is represented by the factors in the blue circle?

A. 33 C. 280

B. 198 D. 330

6. What product is represented by the factors in the red circle?

A. 35 C. 297

B. 210 D. 310

7. What is the greatest common factor of the two products?

A. 6 C. 14

B. 12 D. 35

8. What statement is true of the numbers in the red and blue circles?

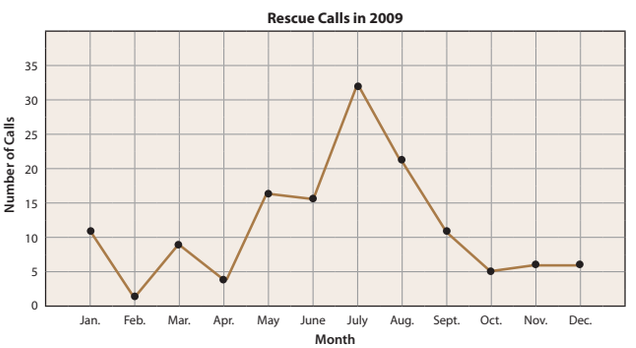
A. They are prime numbers.

B. They are multiples of the number they represent.

C. They have a product of 35.

D. The product of the factors is a prime number.

Use the data from the line graph to find the answer.



19. Which month had the fewest calls?

A. February

B. April

C. October

20. Which statement is true of the months of July to October?

A. The number of calls increased.

B. The number of calls decreased.

C. The number of calls was about the same.

21. How many rescue calls were made in November and December?

A. 5

B. 12

C. 20

22. Where is the greatest increase of calls shown?

A. from April to May

B. from June to July

C. from July to August

23. Which two months together had about the same number of calls as the month of July?

A. November and December

B. February and August

C. May and June

24. Estimate the number of calls for the year.

A. greater than 200, but less than 300

B. less than 100, but greater than 50

C. greater than 100, but less than 200

Logic

Using Logic to Solve a Problem

1. Read the problem to find clues.
2. Examine each clue.
3. Draw a chart to help solve the problem.

Use logic to solve the problems. Copy the chart.
Read the clue and write yes or no in each box to solve.

1. A post office, a grocery store, a park, and a school are all in a row. Complete the chart to find the position of each place.

- The school is not first.
- The grocery store is between the post office and the park.
- The post office is between the school and the grocery store.

	1	2	3	4
post office	*no*	*no*	*yes*	*no*
grocery store	*no*	*yes*	*no*	*no*
park	*yes*	*no*	*no*	*no*
school	*no*	*no*	*no*	*yes*

2. Lauren, Kayla, Ian, and Blake are 9, 10, 12, and 14 years old. Complete the chart to find each person's age.

- Ian is older than Blake and younger than Lauren.
- Kayla is younger than Ian and older than Blake.

	9	10	12	14
Lauren	*no*	*no*	*no*	*yes*
Kayla	*no*	*yes*	*no*	*no*
Ian	*no*	*no*	*yes*	*no*
Blake	*yes*	*no*	*no*	*no*

3. The last names of Ava, Isaac, Bella, and Wyatt are Candler, Miller, Beals, and Buckley. Complete the chart to match up the first and last names.

- Beals is Buckley's grandfather. He is not related to Ava.
- Isaac is eight years old.
- Isaac is not related to Wyatt or Miller.

	Candler	Miller	Beals	Buckley
Ava	*no*	*yes*	*no*	*no*
Isaac	*yes*	*no*	*no*	*no*
Bella	*no*	*no*	*no*	*yes*
Wyatt	*no*	*no*	*yes*	*no*