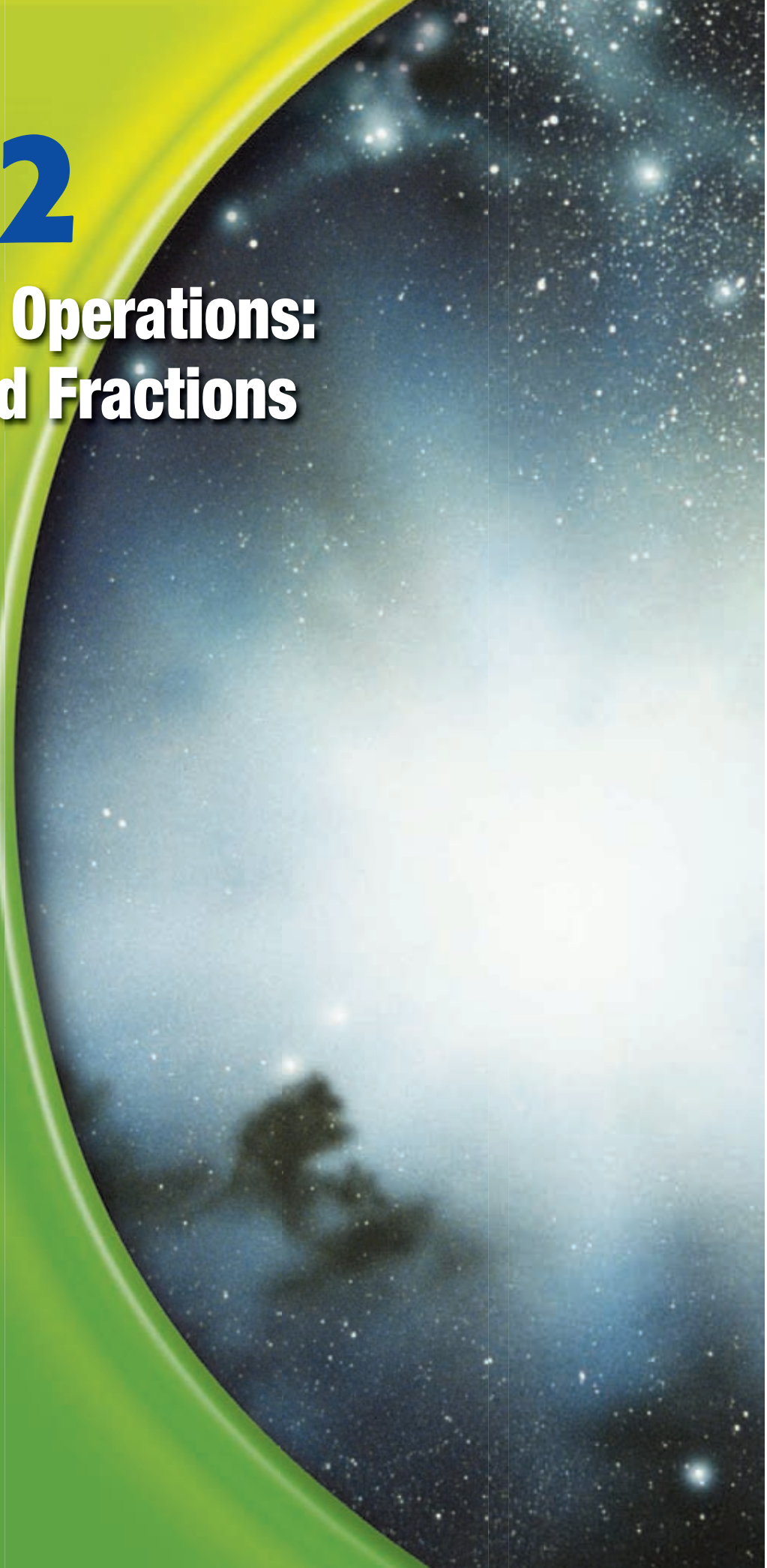
Unit 2

Number and Operations: Decimals and Fractions



Focus

Apply operations with decimals and fractions, including multiplication and division, to solve problems.

CHAPTER 3
Operations with Decimals

BIG Idea Understand, explain, and apply operations with decimals, including multiplication and division.

BIG Idea Multiply and divide decimals to solve problems.

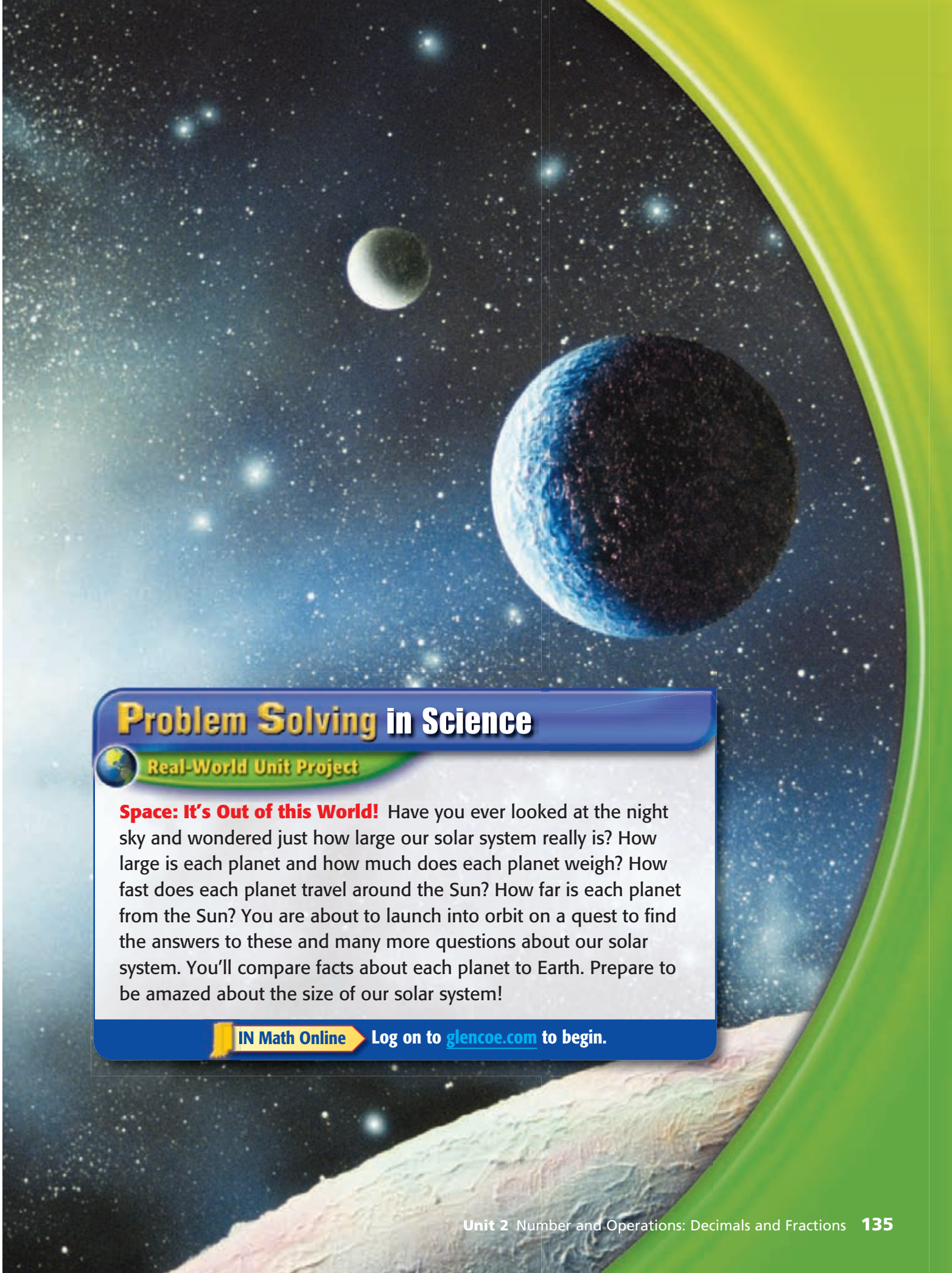
CHAPTER 4
Fractions and Decimals

BIG Idea Understand the relationship between fractions and decimals.

CHAPTER 5
Operations with Fractions

BIG Idea Understand, explain, and apply operations with fractions, including multiplication and division.

BIG Idea Multiply and divide fractions to solve problems.



Problem Solving in Science

Real-World Unit Project

Space: It's Out of this World! Have you ever looked at the night sky and wondered just how large our solar system really is? How large is each planet and how much does each planet weigh? How fast does each planet travel around the Sun? How far is each planet from the Sun? You are about to launch into orbit on a quest to find the answers to these and many more questions about our solar system. You'll compare facts about each planet to Earth. Prepare to be amazed about the size of our solar system!

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CHAPTER 3

Operations with Decimals

Indiana Academic Standards

6.1.1 Compare, order, and represent on a number line positive and negative integers, fractions, decimals (to hundredths), and mixed numbers. **6.1.6** Solve problems involving addition, subtraction, multiplication and division of positive fractions and decimals and explain why a particular operation was used for a given situation.

Key Vocabulary

clustering (p. 151)

equivalent decimals (p. 143)

front-end estimation (p. 151)

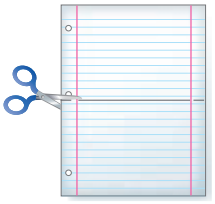
Real-World Link

Rodeos Average times of roping events at rodeos are measured in thousandths of a second. You can use place value to compare and order the average times of the rodeo participants.

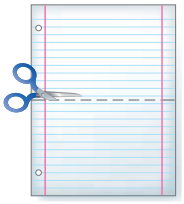
FOLDABLES Study Organizer

Operations with Decimals Make this Foldable to help you organize your notes. Begin with two sheets of notebook paper.

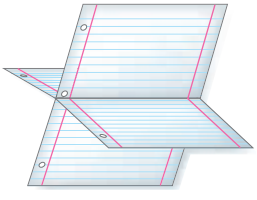
1. **Fold** one sheet in half. Cut along fold from edges to margin.



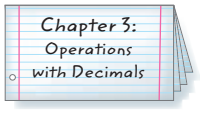
2. **Fold** the other sheet in half. Cut along fold between margins.



3. **Insert** first sheet through second sheet and along folds.



4. **Label** each side of each page with a lesson number and title.



GET READY for Chapter 3

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

IN Math Online Take the Online Readiness Quiz at glencoe.com.

Option 1

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

QUICK Quiz

Multiply. (Page 744)

1. 17×28
2. 31×6
3. 109×14
4. 212×62
5. 228×19
6. 547×31
7. **SLEEP** The average adult gets 8 hours of sleep each night. How many total hours of sleep does the average adult get in one year (365 days)?

Divide. (Page 744)

8. $186 \div 3$
9. $171 \div 9$
10. $238 \div 14$
11. $832 \div 26$
12. $4{,}356 \div 36$
13. $1{,}728 \div 6$
14. **TRAVEL** Four friends drove from Chicago to Florida and spent $188 on gasoline. If they split the cost evenly, how much does each owe?

Replace each ● with < or > to make a true sentence. (Prior Grade)

15. 302,788 ● 203,788
16. 54,300 ● 543,000
17. 64,935 ● 61,935
18. 892,341 ● 892,431

QUICK Review

Example 1

Find 52×81.

$$\begin{array}{r} 52 \\ \times\ 81 \\ \hline 52 \\ +\ 4160 \\ \hline 4212 \end{array}$$

So, $52 \times 81 = 4{,}212$.

Example 2

Find $945 \div 15$.

$$\begin{array}{r} 63 \\ 15\overline{)945} \\ -\ 90 \\ \hline 45 \\ -\ 45 \\ \hline 0 \end{array}$$

So, $945 \div 15 = 63$.

Example 3

Replace the ● in 71,238 ● 71,832 with < or > to make a true sentence.

Use place value.

71,238 Line up the digits.

71,832 Compare the hundreds place.

↑

Since $2 < 8$ in the hundreds place, $71{,}238 < 71{,}832$.

3-1 Representing Decimals

MAIN IDEA

Represent decimals in word form, standard form, and expanded form.

IN Academic Standards

6.1.1 Compare, order, and **represent** on a number line positive and negative integers, fractions, **decimals (to hundredths)**, and mixed numbers.

New Vocabulary

decimal
standard form
expanded form

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- Extra Examples
- Personal Tutor
- Self-Check Quiz
- Reading in the Content Area

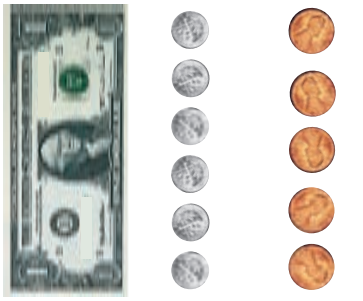
MINI Lab

The models below show some ways to represent the decimal 1.65.

Place-Value Chart

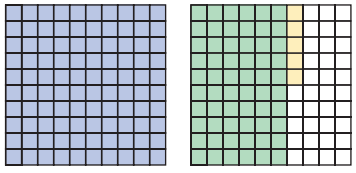
1,000	100	10	1	0.1	0.01	0.001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths
O	O	O	1	6	5	O

Money



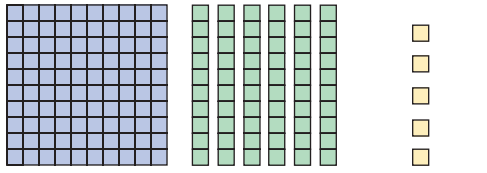
1 dollar 6 dimes 5 pennies

Decimal Model



one 65 hundredths

Base-Ten Blocks



1 one 6 tenths 5 hundredths

Model each decimal using a place-value chart, money, a decimal model, and base-ten blocks.

1. 1.56 2. 0.85 3. 0.08 4. $2.25

Decimals, like whole numbers, are based on the number ten. In a place-value chart, the place to the right of the ones place has a value of one tenth. The next place has a value of one hundredth. Numbers that have digits in the tenths place and beyond are called **decimals**.

Place-Value Chart

1,000	100	10	1	0.1	0.01	0.001	0.0001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths	ten-thousandths
O	O	O	1	6	5	O	O

whole number — decimal point — less than one

EXAMPLE 1 Write a Decimal in Word Form

Write 17.542 in word form.

Place-Value Chart

1,000	100	10	1	0.1	0.01	0.001	0.0001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths	ten-thousandths
0	0	1	7	5	4	2	0

The last digit, 2, is in the thousandths place.

seventeen — and — five hundred forty-two thousandths

17.542 is seventeen and five hundred forty-two thousandths.

CHECK Your Progress **Write each decimal in word form.**

a. 0.825 b. 16.08 c. 142.6

Reading Math

Decimal Point Use the word *and* only to read the decimal point. For example, read 0.235 as *two hundred thirty-five thousandths*. Read 235.035 as *two hundred thirty-five and thirty-five thousandths.*

Standard form is the usual way to write a number. **Expanded form** is a sum of the products of each digit and its place value.

word form	standard form	expanded form
twelve hundredths	0.12	$(1 \times 0.1) + (2 \times 0.01)$

EXAMPLE 2 Standard Form and Expanded Form

Write *thirty-five and ninety-six ten-thousandths* in standard form and in expanded form.

Place-Value Chart

1,000	100	10	1	0.1	0.01	0.001	0.0001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths	ten-thousandths
0	0	3	5	0	0	9	6

Standard form: 35.0096

Expanded form: $(3 \times 10) + (5 \times 1) + (0 \times 0.1) + (0 \times 0.01) + (9 \times 0.001) + (6 \times 0.0001)$

CHECK Your Progress

d. Write *three and eighty-five thousandths* in standard form and in expanded form.

CHECK Your Understanding

Example 1 (p. 139) **Write each decimal in word form.**

1. 0.7
2. 0.08
3. 5.32
4. 0.022
5. 34.542
6. 8.6284

Example 2 (p. 139) **Write each decimal in standard form and in expanded form.**

7. nine tenths
8. twelve thousandths
9. three and twenty-two hundredths
10. forty-nine and thirty-six ten-thousandths

Examples 1, 2 (p. 139)

11. **PACKAGING** A bag of dog food weighs 18.75 pounds. Write this number in two other forms.

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
12–23, 32, 33	1
24–31	2

Write each decimal in word form.

12. 0.4
13. 0.9
14. 3.56
15. 1.03
16. 7.17
17. 4.94
18. 0.068
19. 0.387
20. 78.023
21. 20.054
22. 0.0036
23. 9.0769

Write each decimal in standard form and in expanded form.

24. five tenths
25. eleven and three tenths
26. two and five hundredths
27. thirty-four and sixteen hundredths
28. forty-one and sixty-two ten-thousandths
29. one hundred two ten-thousandths
30. eighty-three ten-thousandths
31. fifty-two and one hundredth
32. **HIKING** A state park has 19.8 miles of hiking and biking trails. Write this number in two other forms.
33. **MONEY** When writing a check, it is necessary to write the amount in both standard form and word form. Write $34.67 in words.
34. **ANALYZE TABLES** In the table, which numbers have their last digit in the hundredths place? Explain your reasoning. Write each number in expanded form.
35. How is 301.0019 written in word form?
36. Write $(5 \times 0.1) + (2 \times 0.01)$ in word form.
37. Write $(4 \times 0.001) + (8 \times 0.0001)$ in standard form.

All Time MLS Leaders in Goals Scored Per Game*

Player	Scoring Average
Stern John	0.8
Carlos Ruiz	0.695
Taylor Twellman	0.65
Mamadou Diallo	0.635
Raul Diaz Arce	0.55

Source: ESPN
*as of 2006 season

Academic Standards • ISTEP+

Extra Practice, pp. 678, 708

H.O.T. Problems

CHALLENGE For Exercises 38 and 39, use the following information.
The digits 3, 9, and 2 make up a decimal number.

38. What is the greatest possible decimal that is greater than 3, but less than 9?

39. What is the greatest possible decimal that is greater that 0, but less than 1?

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

thirty-four hundredths	$(3 \times 0.1) + (4 \times 0.01)$	three and four hundredths	0.34

41. **WRITING IN MATH** Explain how reading or hearing the word form of a decimal can help you write its standard form.

ISTEP+ PRACTICE 6.1.1

42. The world's smallest vegetable is the snow pea. It measures about 0.25 inch in diameter. Which phrase correctly represents this value?

A twenty-five hundreds

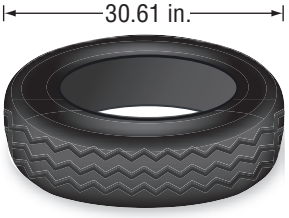
B twenty-five hundredths

C twenty-five tenths

D twenty-five thousandths

43. **SHORT RESPONSE** Write *two hundred eighty-four and twelve hundredths* in standard form.

44. Which of the following is another way to write the diameter of the tire in inches?



F $(3 \times 1) + (6 \times 0.1) + (1 \times 0.01)$

G $(3 \times 10) + (0 \times 1) + (1 \times 0.1) + (6 \times 0.01)$

H thirty and sixty-one tenths

J thirty and sixty-one hundredths

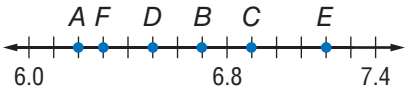
Spiral Review

45. **GEOGRAPHY** Jacksonville, Florida, is at sea level. Write this elevation as an integer. (Lesson 2-9)

46. **SURVEYS** Cheryl surveyed the students in her class to find their favorite type of music. What type of statistical display should Cheryl make to show the results? (Lesson 2-8)

GET READY for the Next Lesson

PREREQUISITE SKILL Choose the letter of the point that represents each decimal.



47. 6.3 48. 6.7 49. 6.2

50. 6.5 51. 7.2 52. 6.9

3-2 Comparing and Ordering Decimals

MAIN IDEA

Compare and order decimals.

IN Academic Standards

6.1.1 Compare, order, and represent on a number line positive and negative integers, fractions, **decimals (to hundredths)**, and mixed numbers.

New Vocabulary

inequality
equivalent decimals

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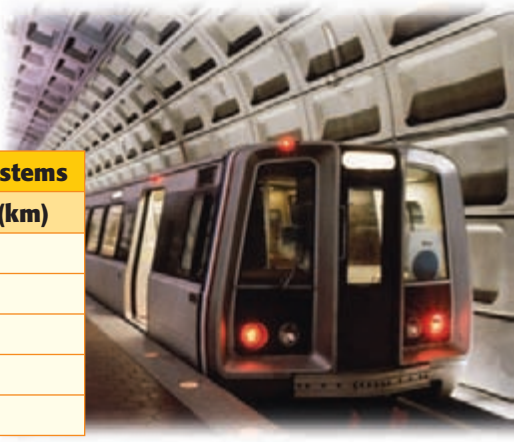
GET READY for the Lesson

SUBWAYS Refer to the table.



World's Longest Subway Systems	
City	**Length (km)**
London	4.15
Moscow	3.4
New York City	3.71
Seoul	2.78
Tokyo	2.81

Source: *Jane's Urban Transport Systems*

1. Which city has the longest subway system? Explain.

Comparing decimals is similar to comparing whole numbers. You can use the symbols > or < to write an **inequality**. An inequality is a mathematical sentence indicating that two quantities are not equal. One quantity will be greater than or less than the other quantity.

EXAMPLE 1 Compare Decimals

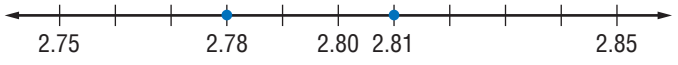
SUBWAYS Refer to the table above. Use > or < to compare Tokyo's subway length with Seoul's.

Use place value.

Tokyo: 2.81 First, line up the decimal points.

Seoul: 2.78 Then, starting at the left, find the first place the digits differ. Compare the digits.

Since 8 > 7, 2.81 > 2.78. Tokyo has a longer subway than Seoul.

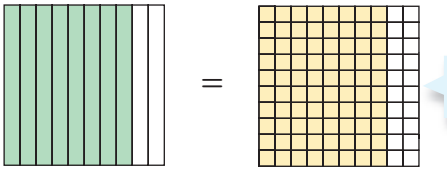


The number line shows that the answer is reasonable. Numbers to the right are greater than numbers to the left. So, 2.81 > 2.78.

CHECK Your Progress

a. **SUBWAYS** Use >, <, or = to compare New York City's subway length with Moscow's.

Decimals that name the same number are called **equivalent decimals**. Examples are 0.8 and 0.80.



When you *annex*, or place zeros to the right of the last digit in a decimal, the value of the decimal does not change. Annexing zeros is useful when ordering a group of decimals.

EXAMPLE 2 Order Decimals

Order 15, 14.95, 15.8, and 15.01 from least to greatest.

First, line up the decimal points. Next, annex zeros so all numbers have the same final place value. Finally, compare and order using place value.

15	→	15.00	14.95
14.95	→	14.95	15.00
15.8	→	15.80	15.01
15.01	→	15.01	15.80

The order from least to greatest is 14.95, 15, 15.01, and 15.8.

Study Tip
Check For Reasonableness
You can check the reasonableness of the order by using a number line.

CHECK Your Progress

b. Order 35.06, 35.7, 35.5, and 35.849 from greatest to least.

CHECK Your Understanding

Example 1 (p. 142)

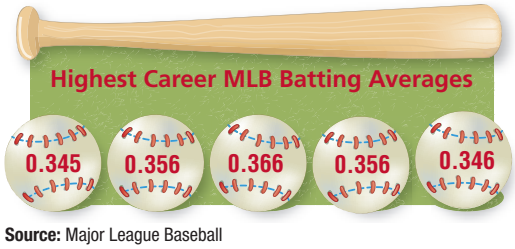
Use >, <, or = to compare each pair of decimals.

1. 0.4 ● 0.5
2. 0.38 ● 0.35
3. 2.7 ● 2.07
4. 25.5 ● 25.50

5. **POPULATION** Australia and Botswana are among the least populated countries in the world. In Australia, about 6.76 people live in each square mile, while 6.84 people live in each square mile in Botswana. Which country has the greater number of people per square mile?

Example 2 (p. 143)

6. **BASEBALL** The five highest career batting averages in Major League Baseball (MLB) are listed at the right. Order these averages from least to greatest.



Source: Major League Baseball

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
7–20	1
21–28	2

Use >, <, or = to compare each pair of decimals.

7. 0.2 ● 2.0
8. 3.3 ● 3.30
9. 0.08 ● 0.8
10. 0.4 ● 0.004
11. 6.02 ● 6.20
12. 5.51 ● 5.15
13. 9.003 ● 9.030
14. 0.204 ● 0.214
15. 7.107 ● 7.011
16. 23.88 ● 23.880
17. 0.0624 ● 0.0264
18. 2.5634 ● 2.5364

19. **OLYMPICS** In the 2004 Summer Olympics, Carly Patterson had a total score of 38.387 in the all-around gymnastics event. Svetlana Khorkina had a total score of 38.211 in the same event. Who had a higher score in this event?

20. **FOOTBALL** Peyton Manning averaged 7.89 passing yards per attempt in 2006 and Carson Palmer averaged 7.76. Who had the higher average?

Order each set of decimals from least to greatest.

21. 16, 16.2, 16.02, 15.99
22. 44.5, 45.01, 44.11, 45
23. 5.545, 4.45, 4.9945, 5.6
24. 9.27, 9.6, 8.995, 9.0599

Order each set of decimals from greatest to least.

25. 2.1, 2.01, 2.11, 2.111
26. 7.66, 7.6, 7.666, 7.06
27. 32.32, 32.032, 32.302, 3.99
28. 57.68, 57.057, 5.75, 57.57

29. **INVENTORY** To keep track of the inventory at his store's warehouse, Akio must arrange items on shelves according to their stock numbers. Arrange the numbers in order from least to greatest.

Stock Number
321.53
321.539
321.5

30. **ANALYZE TABLES** The following table shows the amount of money Antoine spent on lunch each day this week. Order the amounts from least to greatest and then find the median amount he spent on lunch.

Day	Mon.	Tues.	Wed.	Thurs.	Fri.
Amount Spent ($)	3.31	3.45	3.18	3.43	3.29

Academic Standards • ISTEP+

Extra Practice, pp. 678, 708

H.O.T. Problems

31. **SELECT A TECHNIQUE** The average annual snowfall in Syracuse, New York, is 115.6 inches. Takeetna, Alaska, gets an average of 115.4 inches of snow per year. Which of the following techniques might you use to find which city, on average, gets more snowfall during a 10-year time period? Justify your selection(s). Then use the technique(s) to solve the problem.

mental math | number sense | estimation

32. **OPEN ENDED** Give an example of a decimal equivalent to 0.76.

33. **FIND THE ERROR** Ryan and Mateo are ordering 0.4, 0.5, and 0.49 from least to greatest. Who is correct? Explain your reasoning.

34. **CHALLENGE** Lindsay's cat weighs more than Marissa's cat, but less than Nate's cat. Kate's cat weighs 0.2 pound more than Nate's cat. The weights of each cat are 10.22, 10.2, 10.42, and 10.02 pounds. Identify each cat with its weight.

35. **WRITING IN MATH** Refer to the table in Exercise 36. Create a problem that involves comparing the times of two of the runners.

ISTEP+ PRACTICE 6.1.1

36. The table shows the finishing times for four runners in a 100-meter race.

Runner	Time (s)
Kara	14.31
Ariel	13.84
Mika	13.97
Nelia	13.79

In what order did the runners cross the finish line?

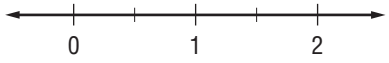
A Kara, Ariel, Mika, Nelia

B Nelia, Mika, Ariel, Kara

C Mika, Nelia, Ariel, Kara

D Nelia, Ariel, Mika, Kara

37. If Cheyenne correctly marked 1.005, 0.981, 0.899, and 0.93 on a number line, which number was closest to zero?



F 1.005 **H** 0.899

G 0.981 **J** 0.93

38. Which number is between 2.35 and 3.06?

A 2.315 **C** 3.084

B 2.571 **D** 3.628

Spiral Review

39. **TEMPERATURE** At the doctor, Clara's temperature was 101.5°F. Write this temperature in expanded form. (Lesson 3-1)

Graph each integer on a number line. (Lesson 2-9)

40. +3 41. −9 42. +2 43. −4

GET READY for the Next Lesson

PREREQUISITE SKILL **Identify each underlined place-value position.** (Page 738)

44. 14.0<u>6</u> 45. 3.<u>0</u>54 46. 0.4<u>2</u>78 47. 2.960<u>0</u>

3-3 Rounding Decimals

MAIN IDEA
Round decimals.

IN Academic Standards

Preparation for 6.1.6 Solve problems involving addition, subtraction, multiplication and division of positive fractions and decimals and explain why a particular operation was used for a given situation.

IN Math Online

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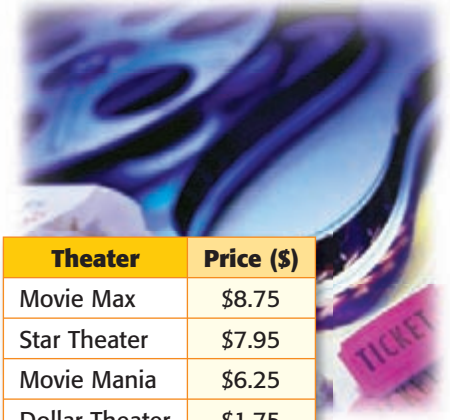
- Extra Examples
- Personal Tutor
- Self-Check Quiz

GET READY for the Lesson

MOVIES The prices of movie tickets from five different theaters are shown in the table.

1. Round each price to the nearest dollar.
2. How did you decide how to round each number?
3. Make a conjecture about how to round each price to the nearest dime.



Theater	Price ($)
Movie Max	$8.75
Star Theater	$7.95
Movie Mania	$6.25
Dollar Theater	$1.75
Cine-mart	$9.60

You can round decimals just as you round whole numbers.

Round Decimals

Key Concept

To round a decimal, first underline the digit to be rounded. Then look at the digit to the right of the place being rounded.

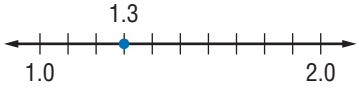
- If the digit is 4 or less, the underlined digit remains the same.
- If the digit is 5 or greater, add 1 to the underlined digit.
- After rounding, drop all digits after the underlined digit.

EXAMPLES Round Decimals

1 **Round 1.324 to the nearest whole number.**

Underline the digit to be rounded. → 1.324 ← Since 3 is less than 5, the digit 1 remains the same.

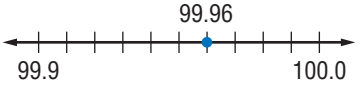
On the number line, 1.3 is closer to 1.0 than to 2.0. To the nearest whole number, 1.324 rounds to 1.



2 **Round 99.96 to the nearest tenth.**

Underline the digit to be rounded. → 99.96 ← Since the digit is 6, add one to the underlined digit.

On the number line, 99.96 is closer to 100.0 than to 99.9. To the nearest tenth, 99.96 rounds to 100.0.



CHECK Your Progress

Round each decimal to the indicated place-value position.

a. 13.419; hundredths

b. 0.27838; ten-thousandths

Real-World EXAMPLE

3 **PEANUTS** **Refer to the information at the left. To the nearest cent, how much did U.S. farmers receive for each pound of peanuts produced in 2006?**

There are 100 cents in a dollar. So, rounding to the nearest cent means to round to the nearest hundredth.

Underline the digit in the hundredths place.

0.17**9**

Then look at the digit to the right. The digit is greater than 5. So, add one to the underlined digit.

To the nearest cent, the average price is $0.18.

Real-World Link

On average, U.S. farmers received $0.179 for each pound of peanuts they produced in 2006.

Source: Farm Service Agency

CHECK Your Progress

c. **PASTA** A box of uncooked spaghetti costs $0.1369 per ounce. How much is this to the nearest cent?

d. **ANIMALS** An Arabian camel averages 3.45 meters tall. Round 3.45 to the nearest meter.

CHECK Your Understanding

Examples 1, 2 (p. 146) **Round each decimal to the indicated place-value position.**

1. 0.329; tenths
2. 1.75; ones
3. 45.522; hundredths
4. 0.5888; thousandths
5. 7.67597; ten-thousandths
6. 34.59; ten

Example 3 (p. 147)

7. **ANALYZE TABLES** The 100-meter dash times for the Jackson Middle School boys' track team are shown in the table. To the nearest tenth, what is the time for each runner?

Runner	Time (s)
Jacob	11.92
Marquez	11.96
Alan	11.84
Tyrese	11.87

Example 3 (p. 147)

8. **GASOLINE** On May 15, 2007, the average price of a gallon of unleaded gasoline in North Carolina was $2.969. How much is this to the nearest cent?

Practice and Problem Solving

HOMEWORK HELP	
For Exercises	See Examples
9–16	1, 2
17–20	3

Round each decimal to the indicated place-value position.

9. 7.445; tenths
10. 7.999; tenths
11. 5.68; ones
12. 10.49; ones
13. 2.499; hundredths
14. 40.458; hundredths
15. 5.4572; thousandths
16. 45.0189; thousandths

17. **RACING** The winner of the 2007 Indianapolis 500, Dario Franchitti, had an average speed of 151.774 miles per hour. Round 151.774 miles per hour to the nearest ten miles per hour.

18. **CELL PHONES** In the U.S., there are 48.81 cell phones for every 100 people. Round 48.81 to the nearest whole number.

19. **MONEY MATTERS** The price of a 12-pack of soda is $4.39. How much is this to the nearest dollar?

20. **CURRENCY** Fifty Japanese yen are equal to $0.475441 U.S. dollars. Round this amount of U.S. dollars to the nearest cent.

CALCULATOR A calculator will often show the results of a calculation with a very long decimal. Round each of the numbers on the calculator displays to the nearest thousandth.

21. .2491666667
22. 1054.677828
23. 21.25103904

Round each decimal to the indicated place-value position.

24. 9.56303; hundredths
25. 988.08055; thousandths
26. 87.09; tens
27. 1,567.893; ten-thousandths

28. **CYCLING** The table shows the average winning speeds in the Tour de France from 2000–2005. Will it help to round these average speeds before listing them in order from least to greatest? Explain.

Tour de France Average Winning Speeds

Winner	Year	Average Speed (km/h)
Lance Armstrong	2005	41.654
Lance Armstrong	2004	40.553
Lance Armstrong	2003	40.94
Lance Armstrong	2002	39.93
Lance Armstrong	2001	40.02
Lance Armstrong	2000	38.57

Source: ESPN

Academic Standards • ISTEP+

Extra Practice, pp. 678, 708

H.O.T. Problems

29. **OPEN ENDED** Give an example of a decimal that when rounded to the nearest tenth is 15.0 and to the nearest hundredth is 15.00.

30. **Which One Doesn't Belong?** Identify the decimal that does not belong with the other three. Explain your reasoning.

11.23 11.26 11.19 11.24

31. **CHALLENGE** A number rounded to the nearest tenth is 6.1. The same number rounded to the nearest hundredth is 6.08 and rounded to the nearest thousandth is 6.083. Draw a conclusion as to what the original number could be.

32. **SELECT A TECHNIQUE** On four different days of walking on a treadmill, Mansi burned 149.6, 150.1, 150.4, and 149.8 Calories. Which of the following techniques might Mansi use to find the average number of Calories she burned to the nearest whole number over those four days? Justify your selection. Then use the technique to solve the problem.

mental math | number sense | estimation

33. **WRITING IN MATH** Use a model to show why 6.73 rounded to the nearest tenth is 6.7. Explain your reasoning.

ISTEP+ PRACTICE Preparation for 6.1.6

34. The average annual precipitations for certain cities are given in the table.

City	Precipitation (in.)
Omaha, NE	30.22
Pittsburgh, PA	37.85
Kansas City, MO	37.98

What is the annual precipitation for Kansas City to the nearest tenth?

A 40.0 **C** 37.9

B 38.0 **D** 37.8

35. On July 28, 1976, a Lockheed SR–71A set the record for jet speed at 2,193.167 miles per hour. What is this speed rounded to the nearest mile per hour?

F 2,190

G 2,192

H 2,193

J 2,194

Spiral Review

Use >, <, or = to compare each pair of decimals. (Lesson 3-2)

36. 8.64 ● 8.065 37. 2.5038 ● 25.083 38. 12.004 ● 12.042

39. Write *thirty-two and five hundredths* in standard form. (Lesson 3-1)

40. **ZOOS** Admission to a zoo is $21 for adults and $14 for children. Define variables and write an expression to find the total cost of 2 adult tickets and 3 children's tickets. Then, find the value of the expression. (Lesson 1-4)

GET READY for the Next Lesson

PREREQUISITE SKILL **Add or subtract.** (Page 743)

41. 43 + 15 42. 68 + 37 43. 85 − 23 44. 52 − 29

3-4 Estimating Sums and Differences

MAIN IDEA

Estimate sums and differences of decimals.

IN Academic Standards

Preparation for 6.1.6 Solve problems involving addition, subtraction, multiplication and division of positive fractions and decimals and explain why a particular operation was used for a given situation. **P.6.1 Know and apply appropriate methods for estimating the results of computations.** *Also addresses P.6.2, P.6.3, P.6.5, P.6.6.*

New Vocabulary

clustering
front-end estimation

IN Math Online

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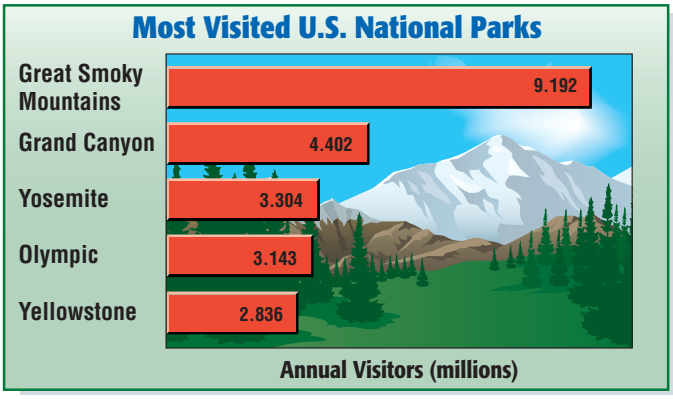
- Personal Tutor
- Self-Check Quiz

GET READY for the Lesson

PARKS The table shows the five most visited national parks in the United States.



Source: *National Park Service*

1. Round the number of visitors to each park to the nearest million.
2. About how many more people visit the Great Smoky Mountains National Park each year than Yosemite National Park?

To estimate sums and differences of decimals, you can use the same methods you used for whole numbers.

EXAMPLES Use Estimation to Solve Problems

1 **Estimate the total number of annual visitors to Yellowstone and Olympic National Parks.**

Round each number to the nearest unit for easier adding.

$$\begin{array}{rcrl} 2.836 & \rightarrow & 3 & \text{2.836 rounds to 3.} \\ +\ 3.143 & \rightarrow & +\ 3 & \text{3.143 rounds to 3.} \\ & & 6 & \end{array}$$

About 6 million visitors visit these two parks annually.

2 **Estimate how many more annual visitors visit the Grand Canyon National Park than Yosemite.**

$$\begin{array}{rcrl} 4.402 & \rightarrow & 4 & \text{4.402 rounds to 4.} \\ +\ 3.304 & \rightarrow & -\ 3 & \text{3.304 rounds to 3.} \\ & & 1 & \end{array}$$

About 1 million more visitors visit the Grand Canyon National Park.

CHECK Your Progress

a. Estimate the sum of 4.37 and 6.75 using rounding.

b. Estimate the difference of 42.18 and 17.25 using rounding.

When estimating a sum in which all of the addends are close to the same number, you can use **clustering.** Check to see if the addends are all close to one number. If so, round each addend to the same number. Then multiply.

ISTEP+ EXAMPLE **Preparation for 6.1.6, P.6.1**

3 Julia is going on a hiking trip with her father. The table shows the prices of different items needed for the trip. Which is closest to the amount spent on the items?

Item	Price ($)
backpack	52.95
hiking boots	51.25
sleeping bag	48.75
food	45.50

A $100

B $175

C $200

D $250

Test-Taking Tip

Clustering Clustering is good for problems in which the addends are close together.

Read the Item

The addends are clustered around $50. Round each price to $50.

$52.95 → $50

$51.25 → $50

$48.75 → $50

$45.50 → $50

Solve the Item

Multiplication is repeated addition. So, a good estimate of the total cost of the hiking supplies is 4 × 50, or $200. The answer is C.

CHECK Your Progress

c. The table shows the number of miles Jaime ran last week. Estimate the total number of miles Jaime ran last week.

Day	Miles
Wednesday	5.1
Thursday	5.3
Friday	4.8
Saturday	5.0

F 10 miles

G 15 miles

H 20 miles

J 25 miles

Another type of estimation is front-end estimation. When you use **front-end estimation,** add or subtract the values of the digits in the front place or left-most place-value. Front-end estimation usually gives a sum that is less than the actual sum.

Study Tip

Estimation You can still use front-end estimation when the addends have a different number of digits. For example, to estimate 113 + 42, add the values in both the hundreds and tens place. So, an estimate of 113 + 42 is 110 + 40 or 150.

EXAMPLE 4 Use Front-End Estimation

Estimate 34.6 + 55.3 using front-end estimation.

$$\begin{array}{rcr} 34.6 & \rightarrow & 30.0 \\ +\ 55.3 & \rightarrow & +\ 50.0 \\ \hline & & 80.0 \end{array}$$

Add the front digits.

Using front-end estimation, 34.6 + 55.3 is about 80.0.

CHECK Your Progress **Estimate using front-end estimation.**

d. 22.35 − 11.14 **e.** $47.92 − $21.62

Estimation Methods

Concept Summary

Rounding	Estimate by rounding each decimal to the nearest whole number that is easy for you to add or subtract mentally.
Clustering	Estimate by rounding a group of close addends to the same number. Then multiply.
Front-End Estimation	Estimate by adding or subtracting the values of the digits in the front place or front-most places.

CHECK Your Understanding

Example 1 (p. 150) **Estimate each sum using rounding.**

1. 0.36 + 0.83
2. $15.24 + $32.10

Example 2 (p. 150) **Estimate each difference using rounding.**

3. 4.44 − 2.79
4. 57.05 − 23.82

Example 3 (p. 151) **Estimate using clustering.**

5. 5.32 + 4.78 + 5.42
6. $0.95 + $0.79 + $1.02

7. **MULTIPLE CHOICE** The amount of time Omar spent on his homework each week last month is shown in the table.

Time Spent on Homework				
Week	1	2	3	4
Time (h)	11.24	9.47	12.36	10.38

Which is closest to the total time spent on homework?

A 30 hours **B** 35 hours **C** 40 hours **D** 50 hours

Example 4 (p. 152) **Estimate using front-end estimation.**

8. 109.4 + 513.8
9. $442.50 − $126.73

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–17	1, 2
18–23, 37, 38	3
24–29	4

Estimate using rounding.

10. 49.59 + 16.22
11. 33.15 + 86.85
12. 41.59 − 19.72
13. 62.61 − 13.05
14. 2.33 + 4.88 + 5.5
15. 9.05 + 1.42 + 6.79

16. **SHOPPING** Sandra bought a pair of shoes for $24.75 and a dress for $46.55. About how much did Sandra spend on the shoes and dress?

17. **MAGAZINES** Jackson and Lana each sold magazines. Jackson collected $432.17 and Lana collected $378.64. About how much more did Jackson collect than Lana?

Estimate using clustering.

18. 6.99 + 6.59 + 7.02 + 7.44
19. $3.33 + $3.45 + $2.78 + $2.99
20. 5.45 + 5.3948 + 4.7999
21. $55.49 + $54.99 + $55.33
22. 10.33 + 10.45 + 10.89 + 9.79
23. 99.8 + 100.2 + 99.5 + 100.4

Real-World Link . . .
The current capacity for Fenway Park, home of the Boston Red Sox, is 36,108 for night games and 35,692 for day games.
Source: Major League Baseball

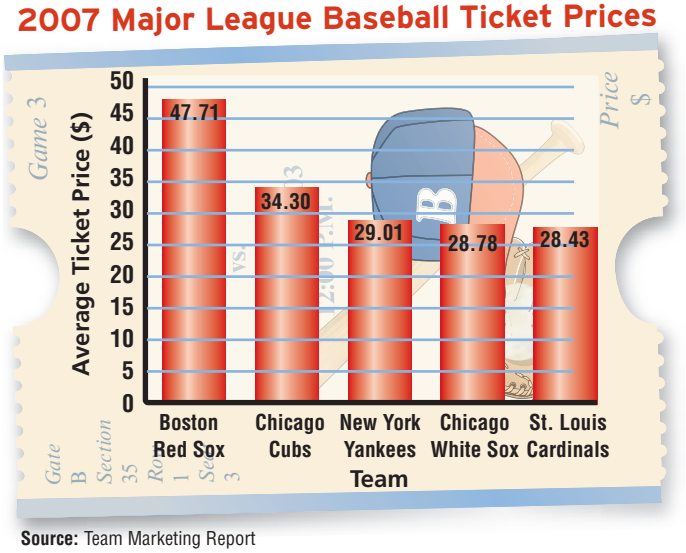
Estimate using front-end estimation.

24. 75.45 − 15.23
25. 27.9 − 12.5
26. 28.65 + 71.53
27. 124.8 + 264.9
28. $315.65 + $130.42
29. $50.96 + $19.28

30. **MUSIC** The best-selling musician has sold 168.5 million albums. About how many more albums will need to be sold to reach 175 million?

31. **TUNNELS** The Flathead rail tunnel in Montana is 7.78 miles long. Colorado's Moffat rail tunnel is 6.21 miles long. About how much longer is the Flathead rail tunnel than the Moffat rail tunnel using rounding? If you use front-end estimation, would the estimate be the same? Why or why not?

ANALYZE GRAPHS **For Exercises 32 and 33, use the graph.**



Source: Team Marketing Report

32. Use clustering to estimate the mean ticket cost for one game each of the St. Louis Cardinals, New York Yankees, and Chicago White Sox.

33. If the average price for a soda and hot dog at a New York Yankees game is $6.25, about how much would a family pay for four tickets, four sodas, and four hot dogs?

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Extra Practice, pp. 679, 708

H.O.T. Problems

34. **NUMBER SENSE** How do you know that the sum of 7.4, 2.8, and 4.2 is less than 15?

35. **CHALLENGE** Donovan bought six identical hats for his friends. Based on rounding, the total estimate was $90. Decide what the maximum and minimum price of each hat could be.

36. **WRITING IN MATH** Explain the advantages and disadvantages of finding an approximate answer.

ISTEP+ PRACTICE

Preparation for 6.1.6, P.6.1

37. A school lunch menu is shown.

Estimate how much money you will need to buy a slice of pizza, a taco, and a soda.

A a little less than $2

B a little more than $2

C a little more than $3

D a little less than $3

38. Refer to the table that shows the attendance in a recent year for the most popular theme parks in the United States.

Park	Attendance (millions)
Magic Kingdom	16.2
Disneyland	14.5
Epcot Center	9.9
Disney-MGM Studios	8.6
Disney's Animal Kingdom	8.2

Source: Coaster Grotto

Which is the best estimate for the total number of people that visited the parks?

F 55 million

G 58 million

H 60 million

J 65 million

Spiral Review

39. **GEMSTONES** The Hope Diamond has a weight of 45.52 carats. Round this amount to the nearest tenth. (Lesson 3-3)

40. **ANALYZE TABLES** The table at the right lists five common elements. List them in order from least to greatest according to their atomic masses. (Lesson 3-2)

Common Elements		
Element	**Symbol**	**Atomic Mass**
Argon	Ar	39.948
Calcium	Ca	40.078
Chlorine	Cl	35.453
Potassium	K	39.0983
Titanium	Ti	47.867

Source: *The Time Almanac*

GET READY for the Next Lesson

PREREQUISITE SKILL Add or subtract. (Page 743)

41. $\begin{array}{r} 278 \\ +\ 199 \\ \hline \end{array}$

42. $\begin{array}{r} 1{,}297 \\ +\ 86 \\ \hline \end{array}$

43. $\begin{array}{r} 700 \\ -\ 235 \\ \hline \end{array}$

44. $\begin{array}{r} 1{,}252 \\ -\ 79 \\ \hline \end{array}$

Explore 3-5

Math Lab
Adding and Subtracting Decimals Using Models

MAIN IDEA

Use models to add and subtract decimals.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, multiplication and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.2.3, P.5.1, P.5.2, P.5.3.*

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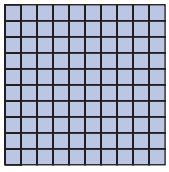
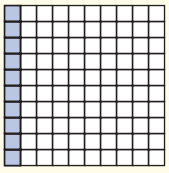
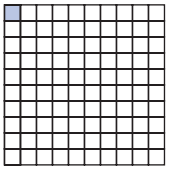
Decimal models can be used to add and subtract decimals.

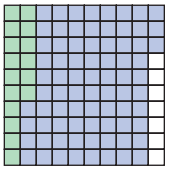
Ones (1)	Tenths (0.1)	Hundredths (0.01)
		
One whole 10-by-10 grid represents 1 or 1.0.	Each row or column represents one tenth or 0.1.	Each square represents one hundredth or 0.01.

ACTIVITIES

1 **Find 0.16 + 0.77 using decimal models.**

STEP 1 Shade 0.16 green.

STEP 2 Shade 0.77 blue. The sum is the total shaded area.

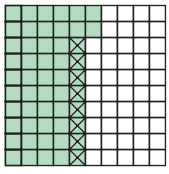


So, $0.16 + 0.77 = 0.93$.

2 **Find 0.52 − 0.08 using decimal models.**

STEP 1 Shade 0.52 green.

STEP 2 Use ×s to cross out 0.08 from the shaded area. The difference is the amount of shaded area with no ×s.



So, $0.52 - 0.08 = 0.44$.

CHECK Your Progress

Find each sum or difference using decimal models.

a. $0.14 + 0.67$ b. $0.35 + 0.42$ c. $0.03 + 0.07$

d. $0.75 - 0.36$ e. $0.68 - 0.27$ f. $0.88 - 0.49$

Analyze the Results

1. Explain how you can use grid paper to model $0.8 - 0.37$.
2. **MAKE A CONJECTURE** Write a rule you can use to add or subtract decimals without using models.

3-5 Adding and Subtracting Decimals

MAIN IDEA

Add and subtract decimals.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, multiplication and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.6.2.*

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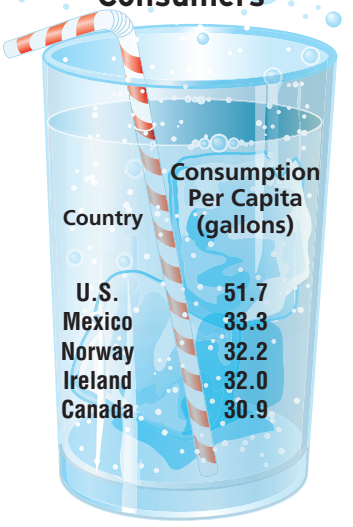
GET READY for the Lesson

SOFT DRINKS The table shows the top five consumers of carbonated soft drinks.

1. Estimate the sum of the top two countries.
2. Add the digits in the same place-value position for the top two countries.
3. Compare the estimate with the actual sum. Place the decimal point in the sum.
4. Make a conjecture about how to add decimals.

Carbonated Soft Drink Consumers



Source: Top 10 of Everything

To add or subtract decimals, line up the decimal points. Then, add or subtract digits in the same place-value position.

EXAMPLES Add and Subtract Decimals

1 **Find the sum of 23.1 and 5.8.**

Estimate $23.1 + 5.8 \approx 23 + 6$ or 29

$$\begin{array}{r} 23.1 \\ +\ 5.8 \\ \hline 28.9 \end{array}$$

Line up the decimal points.

Add as with whole numbers.

The sum of 23.1 and 5.8 is 28.9.

Compare the answer to the estimate. Since 28.9 is close to 29, the answer is reasonable.

2 **Find 5.774 − 2.371.**

Estimate $5.774 - 2.371 \approx 6 - 2$ or 4

$$\begin{array}{r} 5.774 \\ -\ 2.371 \\ \hline 3.403 \end{array}$$

Line up the decimal points.

Subtract as with whole numbers.

So, $5.774 - 2.371 = 3.403$. **Check for Reasonableness** $3.403 \approx 4$ ✔

CHECK Your Progress

Find each sum or difference.

a. $54.7 + 21.4$ b. $14 + 23.5$ c. $17.3 + 33.5$

d. $9.543 - 3.67$ e. $18.4 - 12.9$ f. $\$50.62 - \$39.81$

Sometimes it is necessary to annex zeros before you subtract.

EXAMPLE Annex Zeros

3 **Find 6 − 4.78.**

Estimate 6 − 4.78 ≈ 6 − 5 or 1

$$\begin{array}{r} 6.00 \\ -\ 4.78 \\ \hline 1.22 \end{array}$$

Annex zeros so that both numbers have the same place value.

So, 6 − 4.78 = 1.22. **Check for Reasonableness** 1.22 ≈ 1 ✔

CHECK Your Progress

Find each difference.

g. 2 − 1.78 **h.** 14 − 9.09 **i.** 23 − 4.216

Real-World Career . . .
How Does a Forensic Scientist Use Math?
Forensic scientists use math to analyze biological, chemical, or physical samples of evidence from a crime scene.

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Real-World EXAMPLE

4 **BONES** **The table shows the average length of the three longest bones in the human body. How much longer is the average femur than the average tibia?**

Longest Bones in the Human Body	
Bone	**Length (in.)**
Femur (upper leg)	19.88
Tibia (inner lower leg)	16.94
Fibula (outer lower leg)	15.94

Source: *The Top 10 of Everything*

Estimate 19.88 − 16.94 ≈ 20 − 17 or 3

$$\begin{array}{r} 19.88 \\ -\ 16.94 \\ \hline 2.94 \end{array}$$

Line up the decimal points.

Subtract as with whole numbers.

So, the average femur is 2.94 inches longer than the average tibia. **Check for Reasonableness** 2.94 ≈ 3 ✔

CHECK Your Progress

j. **SWIMMING** The table shows the top three times for the women's 100-meter butterfly event in a recent Summer Olympics. What is the difference between Petria Thomas' time and Inge de Bruijn's time?

Women's 100-Meter Butterfly		
Swimmer	**Country**	**Time (s)**
Petria Thomas	Australia	57.72
Otylia Jedrzejczak	Poland	57.84
Inge de Bruijn	Netherlands	57.99

Source: ESPN

You can also use decimals to evaluate algebraic expressions.

EXAMPLE 5 Evaluate an Expression

ALGEBRA Evaluate $x + y$ if $x = 2.85$ and $y = 17.975$.

$x + y = 2.85 + 17.975$ Replace x with 2.85 and y with 17.975.

Estimate $2.85 + 17.975 \approx 3 + 18$ or 21

$$\begin{array}{r} 2.850 \\ +\,17.975 \\ \hline 20.825 \end{array}$$

Line up the decimal points. Annex a zero.

Add as with whole numbers.

The value is 20.825.

Check for Reasonableness $20.825 \approx 21$ ✔

CHECK Your Progress

Evaluate each expression if $a = 2.56$ and $b = 28.96$.

k. $3.23 + a$ **l.** $68.96 - b$ **m.** $b - a$

CHECK Your Understanding

Example 1 (p. 156) **Find each sum.**

1. $5.5 + 3.2$ **2.** $72.4 + 12.5$ **3.** $9 + 29.34$

Example 2 (p. 156) **Find each difference.**

4. $0.40 - 0.20$ **5.** $9.67 - 2.35$ **6.** $42.28 - 1.52$

Example 3 (p. 157) **Find each difference.**

7. $8 - 5.78$ **8.** $15 - 6.24$ **9.** $36 - 7.3$

Example 4 (p. 157)

10. ANALYZE TABLES Use the table to find out how many more people there are per square mile in Iowa than in Colorado.

11. MAGAZINES In a recent year, *National Geographic* had an average paid circulation of 6.6 million magazines, and *Time* had an average paid circulation of 4.1 million magazines. What is the difference in circulation of these two magazines?

Population Density

State	People Per Square Mile
Colorado	41.5
Iowa	52.4
Arkansas	51.3
Oklahoma	50.3

Source: U.S. Census Bureau

Example 5 (p. 158)

12. ALGEBRA Evaluate $s - t$ if $s = 8$ and $t = 4.25$.

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
13–18	1
19–24	2, 3
25, 26	4
27–30	5

Find each sum.

13. $7.2 + 9.5$
14. $4.9 + 3.0$
15. $1.34 + 2$
16. $0.796 + 13$
17. $54.5 + 48.51$
18. $15.63 + 24.36$

Find each difference.

19. $5.6 - 3.5$
20. $19.86 - 4.94$
21. $97 - 16.98$
22. $82 - 67.18$
23. $58.67 - 28.72$
24. $14.39 - 12.16$

25. **RODEO** The table shows the top three finishers in barrel racing at the Livestock Show and Rodeo. What is the time difference between first place and second place?

Barrel Racing Results	
Rider	Time (s)
Denise	15.87
Angela	16.00
Liz	16.03

26. **MONEY** You decide to buy a hat for $10.95 and a T-shirt for $14.20. How much change will you receive if you pay with a $50 bill?

ALGEBRA **Evaluate each expression if $a = 128.9$ and $d = 22.035$.**

27. $a - 11.25$
28. $75 + a$
29. $a - d$
30. $d + a$

Use the order of operations to find the value of each expression.

31. $2 \cdot 6 + 0.073$
32. $3.4 + 5 \cdot 3$
33. $6 - 4.304 + 2.5$
34. $11.8 - 2^2$
35. $8 + 6.3 - 3.9$
36. $4^2 - 1.67$

37. **POPULATION** If the world's population is 6.3 billion people and grows by 2.6 billion by 2050, how many people will there be in 2050?

38. **ANALYZE TABLES** The table shows the top e-mail services in a recent year. How many more million people used the top three services than the bottom two? Do you believe that the services chosen from year to year would be the same? Explain your reasoning.

Top Five E-Mail Services	
Service	Number of People (millions)
Yahoo!	51.9
AOL	32.1
MSN	29.4
Google	7.3
BellSouth	2.5

Source: Nielsen Ratings

39. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would add more than two decimals.

Academic Standards • ISTEP+

Extra Practice, pp. 679, 708

40. **SHOPPING** You have $10 to buy art supplies. Can you buy construction paper that costs $2.69, a glue stick that costs $1.59, and markers that cost $5.15? Explain your reasoning.

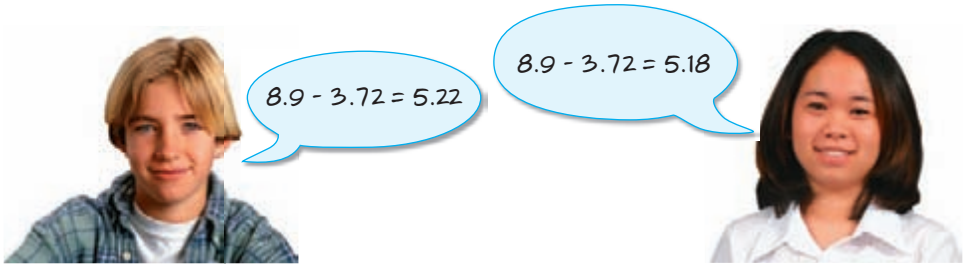
H.O.T. Problems

41. **CHALLENGE** Using each of the digits 1–8 only once, find two decimals that are each less than one and whose sum is the greatest possible value.

42. **REASONING** Find a counterexample for the following statement.

If two decimals each have their last nonzero digit in the hundredths place, their sum also has its last nonzero digit in the hundredths place.

43. **FIND THE ERROR** Noah and Yoko are finding 8.9 − 3.72. Who is correct? Explain your reasoning.



44. **WRITING IN MATH** Explain how you would find the difference of 3 and 2.89.

ISTEP+ PRACTICE 6.1.6

45. Jamal took $15.00 to spend at a sports card store. Baseball cards cost $1.75 per pack, and hockey cards cost $0.99 per pack. If Jamal buys 6 packs of baseball cards for $10.50, how can he determine how much money he has left to spend on hockey cards?

A Subtract $10.50 from $15.00

B Add $1.75 and $0.99

C Subtract $0.99 from $1.75

D Add $0.99 and $10.50

46. **SHORT RESPONSE** The table lists the average number of persons per square mile for several states.

State	Population
Florida	296.4
Indiana	169.5
Kentucky	101.7
North Carolina	165.2

Source: *The World Almanac 2007*

How many more people per square mile are in Florida than in Kentucky?

Spiral Review

Estimate. (Lesson 3-4)

47. 4.231 + 3.98

48. 3.945 + 1.92 + 3.55

49. 9.345 − 6.625

50. Round 28.561 to the nearest tenth. (Lesson 3-3)

GET READY for the Next Lesson

51. **PREREQUISITE SKILL** In a recent year, there were 45,033 beagles registered with the American Kennel Club. If there were 3 times as many labradors registered in the same year, find the number of registered labradors. (Page 744)

CHAPTER 3

Mid-Chapter Quiz

Lessons 3-1 through 3-5

IN Academic Standards
6.1.1, 6.1.6

Write each decimal in word form. (Lesson 3-1)

1. 0.6
2. 12.65
3. 3.0091
4. 0.25

Write each decimal in standard form and in expanded form. (Lesson 3-1)

5. four tenths
6. fifteen and seventy-two hundredths

7. **SKIING** Bianca's speed while cross-country skiing was 2.5 miles per hour. Write this number in two other forms. (Lesson 3-1)

Use >, <, or = to compare each pair of decimals. (Lesson 3-2)

8. 0.06 ● 0.6
9. 8.04 ● 8.0004
10. 6.3232 ● 6.3202
11. 2.15 ● 2.150

12. **ANIMALS** The table shows the length of two of the world's smallest animals. Which animal is smaller? (Lesson 3-2)

Animal	Length (inches)
Brazilian Frog	0.33
Dwarf Goby Fish	0.30

Source: *The World Almanac for Kids*

13. Order 0.101, 0.0101, 0.011, 1.00001 from least to greatest. (Lesson 3-2)

14. **MULTIPLE CHOICE** Ruben recorded the lengths of his model airplanes in inches. Which list shows the lengths in order from greatest to least? (Lesson 3-2)

A 7.2, 7.35, 8.01, 8.10
B 7.35, 7.2, 8.01, 8.10
C 8.01, 8.10, 7.2, 7.35
D 8.10, 8.01, 7.35, 7.2

Round each decimal to the indicated place-value position. (Lesson 3-3)

15. 8.236; tenths
16. 10.0879; thousandths
17. 2.38141; ten-thousandths

18. **SPIDERS** The *Tegenaria atrica* spider can travel at a speed of 20.592 inches per second. What is the speed rounded to the nearest tenth? (Lesson 3-3)

Estimate using rounding, clustering, or front-end estimation. (Lesson 3-4)

19. 18.89 − 4.42
20. 42.33 + 13.48
21. 11.94 + 12.21 + 11.88 + 12.08

22. **MULTIPLE CHOICE** The table shows the weights of four packages that Martin is mailing to his cousin in New Jersey. Estimate the total weight of the packages. (Lesson 3-4)

Package	Weight (oz)
1	3.94
2	14.81
3	11.27
4	7.65

F 42 ounces
G 38 ounces
H 34 ounces
J 32 ounces

Find each sum or difference. (Lesson 3-5)

23. 67.13 + 31.7
24. 51.2 − 12.94

25. **RESTAURANTS** Andrea has a coupon for $1.75 off her next purchase of a deli sandwich. If the sandwich originally costs $5.65, how much will it cost with the coupon? (Lesson 3-5)

Explore 3-6

Math Lab
Multiplying Decimals by Whole Numbers

MAIN IDEA

Use models to multiply a decimal by a whole number.

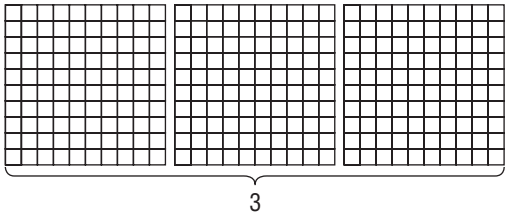
IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, **multiplication** and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.5.1, P.5.2, P.5.3.*

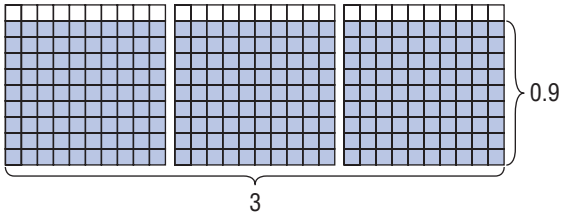
You can use decimal models to multiply a decimal by a whole number. Recall that a 10-by-10 grid represents the number one.

ACTIVITY

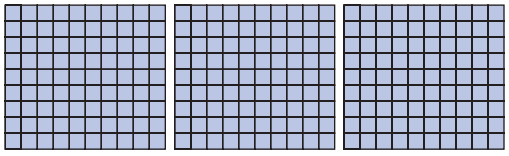
Model 0.9 × 3 using decimal models.



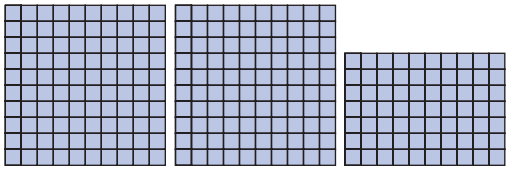
Draw three 10-by-10 decimal models to show the factor 3.



Shade nine rows of each decimal model to represent 0.9.



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



The product is *two and seven tenths.*

So, 0.9 × 3 = 2.7.

CHECK Your Progress

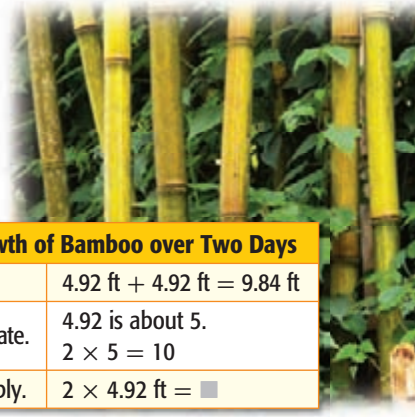
Use decimal models to show each product.

a. 3 × 0.5 b. 2 × 0.7 c. 0.8 × 4

Analyze the Results

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

3-6 Multiplying Decimals by Whole Numbers



MAIN IDEA

Estimate and find the product of decimals and whole numbers.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, **multiplication** and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation.

IN Math Online

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- Extra Examples
- Personal Tutor
- Self-Check Quiz

GET READY for the Lesson

PLANTS Bamboo can grow about 4.92 feet in height per day. The table shows different ways to find the total height a bamboo plant can grow in two days.

Growth of Bamboo over Two Days	
Add.	4.92 ft + 4.92 ft = 9.84 ft
Estimate.	4.92 is about 5. $2 \times 5 = 10$
Multiply.	2×4.92 ft = ■

1. Use the addition problem and the estimate to find 2×4.92.
2. Write an addition problem, an estimate, and a multiplication problem to find the total growth over 3 days, 4 days, and 5 days.
3. **MAKE A CONJECTURE** about how to find 5.35×4.

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

EXAMPLES Multiply Decimals

1 **Find 14.2×6.**

METHOD 1 **Use estimation.**

Round 14.2 to 14.

$14.2 \times 6 \longrightarrow 14 \times 6$ or 84

$$\begin{array}{r} {\scriptstyle 21} \\ 14.2 \\ \times\ 6 \\ \hline 85.2 \end{array}$$

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

METHOD 2 **Count decimal places.**

$$\begin{array}{r} {\scriptstyle 21} \\ 14.2 \\ \times\ 6 \\ \hline 85.2 \end{array}$$

one decimal place

Count one decimal place from the right.

2 **Find 9×0.83.**

METHOD 1 **Use estimation.**

Round 0.83 to 1.

$9 \times 0.83 \longrightarrow 9 \times 1$ or 9

$$\begin{array}{r} {\scriptstyle 2} \\ 0.83 \\ \times\ 9 \\ \hline 7.47 \end{array}$$

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

METHOD 2 **Count decimal places.**

$$\begin{array}{r} {\scriptstyle 2} \\ 0.83 \\ \times\ 9 \\ \hline 7.47 \end{array}$$

two decimal places

Count two decimal places from the right.

CHOOSE Your Method **Multiply.**

a. 3.4×5 b. 11.4×8 c. 7×2.04

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

EXAMPLES Annex Zeros in the Product

3 **Find 2×0.018.**

$$\begin{array}{r} {\scriptstyle 1} \\ 0.018 \\ \times \quad 2 \\ \hline 0.036 \end{array}$$

three decimal places

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

Vocabulary Link

Annex

Everyday Use to add something

Math Use to annex a zero means to add a zero at the beginning or end of a decimal

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

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

$$\begin{array}{r} {\scriptstyle 2} \\ 0.0027 \\ \times \quad 4 \\ \hline 0.0108 \end{array}$$

four decimal places

Annex a zero to make four decimal places.

CHECK Your Progress **Multiply.**

d. 3×0.02 **e.** 0.12×8 **f.** 11×0.045

g. **ALGEBRA** Evaluate $7x$ if $x = 0.03$.

You can use paper and pencil or mental math to multiply a decimal by 10, 100, or 1,000.

EXAMPLE Multiply by 10, 100, or 1,000

Real-World Link

The temperature of the surface of the Sun, in degrees Celsius, can be found by multiplying 5.7 by 1,000.

Source: *Solar Week*

5 **SCIENCE** **Find $5.7 \times 1{,}000$.**

METHOD 1 **Use paper and pencil.**

$$\begin{array}{r} 1{,}000 \\ \times \quad 5.7 \\ \hline 7000 \\ 50000 \\ \hline 5{,}700.0 \end{array}$$

one decimal place

one decimal place

METHOD 2 **Use mental math.**

Move the decimal point to the right the same number of zeros that are in 1,000, or 3 places.

$5.7 \times 1{,}000 = 5.700$ or 5,700.

CHOOSE Your Method

h. $7.9 \times 1{,}000$ **i.** 4.13×10 **j.** 2.3×100

CHECK Your Understanding

Examples 1, 2 (p. 163)

Multiply.

1. 2.7×6
2. 1.4×4
3. 0.52×3
4. $\$0.83 \times 6$

Examples 3, 4 (p. 164)

5. 5×0.09
6. 4×0.012
7. 0.065×18
8. 0.015×23

9. **ALGEBRA** Evaluate $14t$ if $t = 2.9$.

Example 5 (p. 164)

10. **MOON** The approximate radius of the Moon, in kilometers, can be found by multiplying 17.36 by 10. Find the Moon's radius.

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
11–18, 33, 34	1, 2
19–22	3
23, 24	4
25–32, 35, 36	5

Multiply.

11. 1.2×7
12. 1.7×5
13. 0.7×9
14. 0.9×4
15. 2×1.3
16. 2.4×8
17. 0.8×9
18. 3×0.5
19. 3×0.02
20. 7×0.012
21. 0.0036×19
22. 0.0198×75

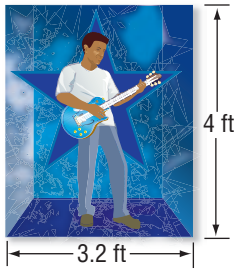
23. **ALGEBRA** Evaluate $3.05n$ if $n = 27$.

24. **ALGEBRA** Evaluate $80.44w$ if $w = 2$.

Multiply.

25. 5.2×10
26. 4.8×100
27. $1.5 \times 1{,}000$
28. 9.3×100
29. 2.5×10
30. 1.26×100
31. $3.45 \times 1{,}000$
32. 2.17×10

33. **MEASUREMENT** Asher recently bought the poster shown at the right. What is its area?



34. **SCHOOL SUPPLIES** Sharon buys 14 folders for \$0.75 each. How much do they cost altogether?

35. **MEASUREMENT** The height of Mount Everest, in meters, can be found by multiplying 8.85 by 1,000. Find the height of Mount Everest.

36. **TEMPERATURE** The hottest temperature recorded in the world, in degrees Fahrenheit, can be found by multiplying 13.46 by 10. Find this temperature.

Use the order of operations to find the value of each expression.

37. $2 \times 3.8 + 1.5$
38. $7 - 4 \times 0.8$
39. $3 \times 2.14 \times 10$
40. $5 + 2.6 \times 1{,}000$
41. $11 \times 7.85 + 33$
42. $19 + 0.4 \times 100$

43. **MEASUREMENT** The thickness of each type of coin is shown in the table. How much thicker is a stack of a dollar's worth of nickels than a dollar's worth of quarters?

Coin	Thickness (mm)
penny	1.55
nickel	1.95
dime	1.35
quarter	1.75

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Extra Practice, pp. 679, 708

H.O.T. Problems

44. **OPEN ENDED** Create a problem about a real-world situation involving multiplication by a decimal factor. Then solve the problem.

45. **CHALLENGE** Discuss two different ways to find the value of the expression $5.4 \times 1.17 \times 100$ that do not require you to first multiply 5.4×1.17.

46. **WRITING IN MATH** Summarize how to use mental math to multiply a decimal by a power of 10.

ISTEP+ PRACTICE 6.1.6

47. A recipe for a batch of cookies calls for one 5.75-ounce package of coconut. How many ounces of coconut are needed for 5 batches of cookies?

A 20.50 oz

B 25.25 oz

C 28.75 oz

D 29.75 oz

48. The table shows the admission prices to an amusement park.

Admission Prices	One-Day Pass	Two-Day Pass
Adult	$39.59	$43.99
Child (ages 3–9)	$30.59	$33.99

What is the total price of one-day passes for two adults and three children?

F $140.36

G $170.95

H $179.95

J $189.95

Spiral Review

For Exercises 49 and 50, refer to the table that shows the music sales in the United States in a recent year that were devoted to different types of music. (Lesson 3-5)

Total Music Sales	
Type of Music	**Sales (millions of $)**
rock	3,864.89
rap/hip-hop	1,631.84
R&B/urban	1,251.49
country	1,533.69
pop	993.83
other	2,785.18

Source: Recording Industry of America

49. What were the total sales for rock and country?

50. How much more money came from rap/hip-hop than pop?

51. **FUNDRAISING** During a fundraiser at her school, Careta sold $78.35 worth of candy. Diego sold $59.94 worth of candy. Use front-end estimation to find about how much more Careta sold. (Lesson 3-4)

Use >, <, or = to compare each pair of decimals. (Lesson 3-2)

52. 14.05 ● 14.5

53. 61.32 ● 61.23

54. 7.71 ● 7.17

GET READY for the Next Lesson

PREREQUISITE SKILL **Find the value of each expression.** (Page 744)

55. 43×25

56. 126×13

57. 18×165

Explore 3-7

Math Lab
Multiplying Decimals

MAIN IDEA

Use decimal models to multiply decimals.

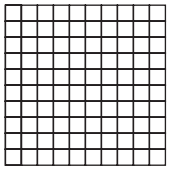
IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, **multiplication** and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.5.1, P.5.2, P.5.3.*

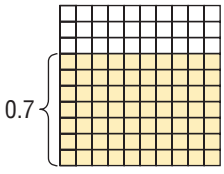
In the lab on page 162, you used decimal models to multiply a decimal by a whole number. You can use similar models to multiply a decimal by a decimal.

ACTIVITY

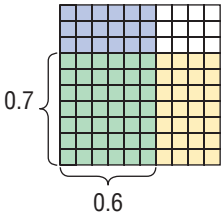
1 **Model 0.7×0.6 using decimal models.**



Draw a 10-by-10 decimal model. Recall that each small square represents 0.01.



Shade seven rows of the model yellow to represent the first factor, 0.7.



Shade six columns of the model blue to represent the second factor, 0.6.

There are *forty-two hundredths* in the region that is shaded green. So, $0.7 \times 0.6 = 0.42$.

CHECK Your Progress

Use decimal models to show each product.

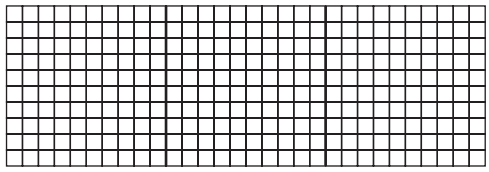
a. 0.3×0.3 **b.** 0.4×0.9 **c.** 0.9×0.5

Analyze the Results

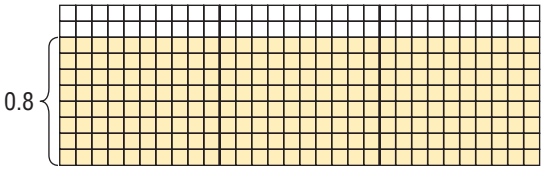
1. Tell how many decimal places are in each factor and in each product of Exercises a–c above.
2. **MAKE A CONJECTURE** Use the pattern you discovered in Exercise 1 to find 0.6×0.2. Check your conjecture with a model or a calculator.
3. Find two decimals with a product of 0.24.

ACTIVITY

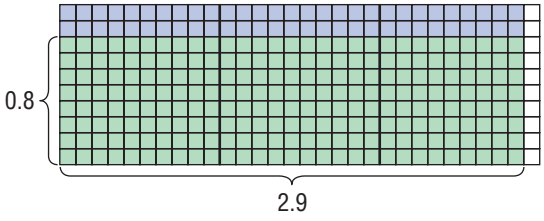
2 **Model 0.8 × 2.9 using decimal models.**



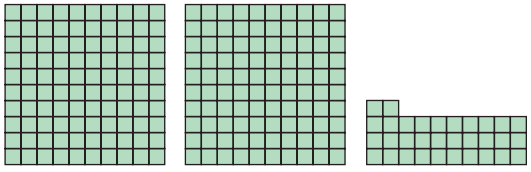
Draw three 10-by-10 decimal models.



Shade 8 rows to represent 0.8.



Shade 2 large squares and 9 columns of the next large square to represent 2.9.



Cut off the squares that are shaded twice and rearrange them to form 10-by-10 grids.

There are *two and thirty-two hundredths* in the region that are shaded green. So, 0.8 × 2.9 = 2.32.

Study Tip

Arranging Squares
Arrange the squares to form as many whole decimal models as possible. Then arrange the remaining squares into as many rows of 10 as possible to make counting them easier.

CHECK Your Progress

Use decimal models to show each product.

d. 1.5 × 0.7 **e.** 0.8 × 2.4 **f.** 1.3 × 0.3

Analyze the Results

4. **MAKE A CONJECTURE** How does the number of decimal places in the product relate to the number of decimal places in the factors?

5. Analyze each product.

   a. Explain why the first product is less than 0.6.

   b. Explain why the second product is equal to 0.6.

   c. Explain why the third product is greater than 0.6.

First Factor		Second Factor		Product
0.9	×	0.6	=	0.54
1.0	×	0.6	=	0.60
1.5	×	0.6	=	0.90

3-7 Multiplying Decimals

MAIN IDEA

Multiply decimals by decimals.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, **multiplication** and division **of** positive fractions and **decimals** and explain why a particular operation was used for a given situation.

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- Self-Check Quiz

GET READY for the Lesson

PYRAMIDS The largest of the Great Pyramids at Giza, in Egypt, contains 2.3 million blocks in its base.

1. The average weight of each block is 2.5 tons. The expression 2.3×2.5 can be used to find the total weight, in millions of tons, of the blocks in the pyramid's base. Estimate the product of 2.3 and 2.5.
2. Multiply 23 by 25.
3. **MAKE A CONJECTURE** about how you can use your answers in Exercises 2 and 3 to find the product of 2.3 and 2.5.
4. What is the total weight of the blocks in the pyramid's base?
5. Use your conjecture in Exercise 3 to find 1.7×5.4. Explain each step.

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

EXAMPLES Multiply Decimals

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

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

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

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

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

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

CHECK Your Progress

a. 5.7×2.8 b. 4.12×0.07 c. 0.014×3.7

EXAMPLE Evaluate an Expression

3 **ALGEBRA** **Evaluate $1.4x$ if $x = 0.067$.**

$1.4x = 1.4 \times 0.067$ Replace x with 0.067.

$$\begin{array}{r} 0.067 \\ \times\ 1.4 \\ \hline 268 \\ +\ 67 \\ \hline 0.0938 \end{array}$$

← three decimal places
← one decimal place
← Annex a zero to make four decimal places.

CHECK Your Progress **Evaluate each expression.**

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

Real-World EXAMPLE

4 **CARS** **A certain car can travel 28.45 miles with one gallon of gasoline. The gasoline tank can hold 11.5 gallons. How many miles can this car travel on a full tank of gas?**

Estimate $28.45 \times 11.5 \rightarrow 30 \times 12$ or 360

$$\begin{array}{r} 28.45 \\ \times\ 11.5 \\ \hline 14225 \\ 2845 \\ +\ 2845 \\ \hline 327.175 \end{array}$$

← two decimal places
← one decimal place
← The product has three decimal places.

The car could travel 327.175 miles.

Real-World Link
A car that can travel 20 miles on one gallon of gasoline will cost about $600 per year more, in gasoline costs alone, than a car that can travel 30 miles on one gallon of gasoline.
Source: Federal Trade Commission

CHECK Your Progress

g. **NUTRITION FACTS** A nutrition label indicates that one serving of apple crisp oatmeal has 2.5 grams of fat. How many grams of fat are there in 3.75 servings?

CHECK Your Understanding

Examples 1, 2 (p. 169) **Multiply.**

1. 0.6×0.5
2. 1.4×2.56
3. 27.43×1.089
4. 0.3×2.4
5. 0.52×2.1
6. 0.45×0.053

Example 3 (p. 170) **ALGEBRA** **Evaluate each expression if $n = 1.35$.**

7. $2.7n$
8. $5.343 + 0.5n$
9. $0.02n + 0.016$

Example 4 (p. 170)

10. **MEASUREMENT** A mile is approximately equal to 1.609 kilometers. How many kilometers is 2.5 miles?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
11–22	1, 2
23–28	3
29–30	4

Multiply.

11. 0.7×0.4
12. 1.5×2.7
13. 0.4×3.7
14. 3.1×0.8
15. 0.98×7.3
16. 2.4×3.48
17. 6.2×0.03
18. 5.04×3.2
19. 14.7×11.36
20. 27.4×33.68
21. 0.28×0.08
22. 0.45×0.05

ALGEBRA Evaluate each expression if $x = 8.6$, $y = 0.54$, and $z = 1.18$.

23. $2.7x$
24. $6.34y$
25. $3.45x + 7.015$
26. $1.8y + 0.6z$
27. $9.1x - 4.7y$
28. $0.096 + 2.28y$

29. **ANIMALS** A giraffe can run up to 46.93 feet per second. How far could a giraffe run in 1.8 seconds?

30. **MEASUREMENT** Katelyn has a vegetable garden that measures 16.75 feet in length and 5.8 feet in width. Find the area of the garden.

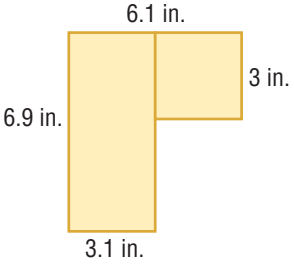
Multiply.

31. 25.04×3.005
32. 1.03×1.005
33. 5.12×4.001

ALGEBRA Use the order of operations to evaluate each expression if $a = 1.3$, $b = 0.042$, and $c = 2.01$.

34. $ab + c$
35. $a \times 6.023 - c$
36. $3.25c + b$
37. abc

38. **MEASUREMENT** Find the area of the figure at the right. Justify your answer.



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

40. **GROCERY SHOPPING** Pears cost \$0.98 per pound, and apples cost \$1.05 per pound. Mr. Bonilla bought 3.75 pounds of pears and 2.1 pounds of apples. How much did he pay for the pears and apples?

41. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would multiply decimals.

Academic Standards • ISTEP+

Extra Practice, pp. 680, 708

For each statement below, find two decimals a and b that make the statement true. Then find two decimals a and b that make the statement false. Explain your reasoning.

42. If $a > 1$ and $b < 1$, then $ab < 1$.
43. If $ab < 1$, then $a < 1$ and $b < 1$.

H.O.T. Problems

CHALLENGE **Evaluate each expression.**

44. $0.3(3 - 0.5)$ **45.** $0.16(7 - 2.8)$ **46.** $1.06(2 + 0.58)$

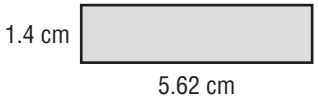
47. **OPEN ENDED** Write a multiplication problem in which the product is between 0.05 and 0.75.

48. **NUMBER SENSE** Place the decimal point in the answer to make it correct. Explain your reasoning. $3.9853 \times 8.032856 = 32013341...$

49. **WRITING IN MATH** Describe two methods for determining where to place the decimal point in the product of two decimals.

ISTEP+ PRACTICE 6.1.6

50. What is the area of the rectangle?



A 14.04 cm^2

B 10.248 cm^2

C 8.992 cm^2

D 7.868 cm^2

51. Josefina took her grandmother to lunch. Josefina's lunch was $6.70, her grandmother's lunch was $7.25, and they split a dessert that cost $3.50. If there was an 8.75% tax on the food, which procedure could be used to find the amount of tax Josefina paid for their lunch?

F Add the prices of the food items.

G Add the prices of the food items to the tax rate.

H Multiply the tax rate by the price of the most expensive food item.

J Multiply the tax rate by the sum of the prices of the food items.

Spiral Review

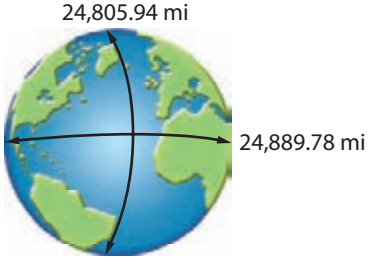
Multiply. (Lesson 3-6)

52. 45×0.27 **53.** 3.2×109 **54.** 27×0.45 **55.** 2.94×16

For Exercises 56 and 57, use the information below. The distance around Earth at the equator is about 24,889.78 miles. The distance around Earth through the North Pole and South Pole is about 24,805.94 miles. (Lesson 3-5)

56. How much greater is the distance at the equator than through the poles?

57. The mean distance around Earth is 24,847.86 miles. How much greater is the distance at the equator than the mean distance?



GET READY for the Next Lesson

PREREQUISITE SKILL **Divide.** (Page 744)

58. $21 \div 3$ **59.** $81 \div 9$ **60.** $56 \div 8$ **61.** $63 \div 7$

3-8 Dividing Decimals by Whole Numbers

MAIN IDEA

Divide decimals by whole numbers.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, multiplication and **division of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.5.1, P.5.2, P.5.3.*

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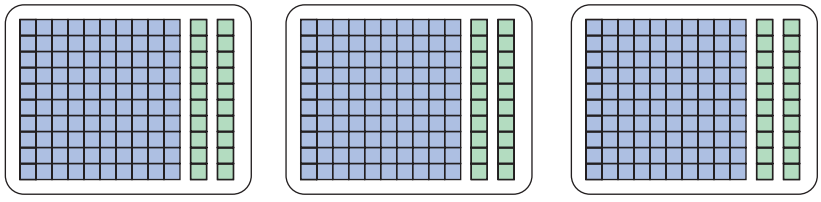
MINI Lab

To find 3.6 ÷ 3 using base-ten blocks, model 3.6 as 3 wholes and 6 tenths. Then separate into three equal groups.



There is one whole and two tenths in each group.

So, 3.6 ÷ 3 = 1.2.

Use base-ten blocks to show each quotient.

1. 3.4 ÷ 2
2. 4.2 ÷ 3
3. 5.6 ÷ 4

Find each whole number quotient.

4. 34 ÷ 2
5. 42 ÷ 3
6. 56 ÷ 4
7. Compare and contrast the quotients in Exercises 1–3 with the quotients in Exercises 4–6.
8. **MAKE A CONJECTURE** Write a rule for dividing a decimal by a whole number.

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

EXAMPLE 1 Divide a Decimal by a 1-Digit Number

Find 6.8 ÷ 2. **Estimate** 6 ÷ 2 = 3

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

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

6.8 ÷ 2 = 3.4 Compared to the estimate, the quotient is reasonable.

CHECK Your Progress

Divide.

a. 7.5 ÷ 3
b. 3.5 ÷ 7
c. 9.8 ÷ 2

EXAMPLE 2 Divide a Decimal by a 2-Digit Number

Find $7.7 \div 14$. Estimate $10 \div 10 = 1$

$$\begin{array}{r} 0.55 \\ 14\overline{)7.70} \\ -70 \\ \hline 70 \\ -70 \\ \hline 0 \end{array}$$

← Place the decimal point.

Annex a zero and continue dividing.

$7.7 \div 14 = 0.55$ Compared to the estimate, the quotient is reasonable.

Study Tip

Checking Your Answer
To check that the answer is correct, multiply the quotient by the divisor. In Example 2, $0.55 \times 14 = 7.7$.

CHECK Your Progress **Divide.**

d. $9.48 \div 15$ e. $3.49 \div 4$ f. $55.08 \div 17$

If the answer does not come out evenly, round the quotient to a specified place-value position.

ISTEP+ EXAMPLE 3 6.1.6

CONSTRUCTED RESPONSE Michelle bought a dozen blueberry muffins for $14.92. If each muffin costs the same amount, find the price of each muffin in dollars. Estimate $15 \div 12$

Read the Item

To find the price of one muffin, divide the total cost by the number of muffins. Round to the nearest cent, or hundredths place.

Solve the Item

$$\begin{array}{r} 1.243 \\ 12\overline{)14.920} \\ -12 \\ \hline 29 \\ -24 \\ \hline 52 \\ -48 \\ \hline 40 \\ -36 \\ \hline 4 \end{array}$$

Place the decimal point.

Divide until you place a digit in the thousandths place.

To the nearest cent, the cost in dollars is 1.24.

Test-Taking Tip

Dividing Decimals
Be sure to place the decimal point in the quotient when dividing.

CHECK Your Progress

g. **SHORT RESPONSE** A bag of 12 bagels costs $7.50. To the nearest cent, find the cost of each bagel.

CHECK Your Understanding

Examples 1, 2 (pp. 173–174)

Divide. Round to the nearest tenth if necessary.

1. $3.6 \div 4$
2. $9.6 \div 2$
3. $8.53 \div 6$
4. $1087.9 \div 46$
5. $12.32 \div 22$
6. $69.904 \div 34$

Example 3 (p. 174)

7. **TEST PRACTICE** A light-year, the distance that light travels in one year, is 5.88 trillion miles. How many trillion miles will light travel in one month?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
8–13, 20, 21	1
14–19	2
31–32	3

Divide. Round to the nearest tenth if necessary.

8. $39.39 \div 3$
9. $36.8 \div 2$
10. $118.5 \div 5$
11. $124.2 \div 9$
12. $7.24 \div 7$
13. $6.27 \div 4$
14. $11.4 \div 19$
15. $10.22 \div 14$
16. $55.2 \div 46$
17. $59.84 \div 32$
18. $336.75 \div 31$
19. $751.2 \div 25$

20. **INSURANCE** Aurelia pays $414.72 per year for auto insurance. Suppose she makes 4 equal payments a year. How much does she pay every three months?

21. **BUILDINGS** Find the average height of the buildings shown in the table.

World's Tallest Buildings (thousands of feet)				
1.667	1.483	1.483	1.451	1.381

22. **MEASUREMENT** Mr. Jamison will stain the deck in his backyard. The deck has an area of 752.4 square feet. If the deck is 33 feet long, how wide is it?

23. **FOOD** The Student Council is raising money by selling bottled water at a band competition. The table shows the prices for different brands. Which brand is the best buy? Explain your reasoning.

Cost of Bottled Water (20-oz bottles)		
Brand A	6-pack	$3.45
Brand B	12-pack	$5.25
Brand C	24-pack	$10.99

24. **MEASUREMENT** The Verrazano-Narrows Bridge in New York City is 4.26 thousand feet long and is the seventh longest suspension bridge in the world. There are 3 feet in a yard. How long is the bridge in yards?

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STATISTICS Find the mean for each set of data.

25. 22.6, 24.8, 25.4, 26.9
26. 1.43, 1.78, 2.45, 2.78, 3.25

Extra Practice, pp. 680, 708

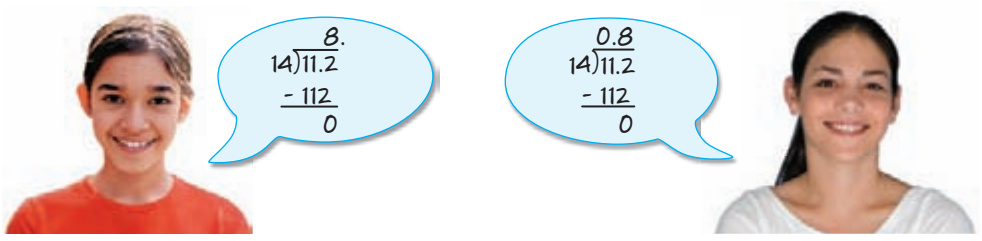
H.O.T. Problems

27. **OPEN ENDED** Create a set of data for which the mean is 5.5.

28. **CHALLENGE** **Find each of the following quotients. Then find a pattern and explain how you can use this pattern to mentally divide 0.0096 by 3.**

$844 \div 2$ $0.844 \div 2$ $84.4 \div 2$ $0.0844 \div 2$ $8.44 \div 2$ $0.00844 \div 2$

29. **FIND THE ERROR** Felisa and Tabitha are finding 11.2 ÷ 14. Who is correct? Explain your reasoning.



Felisa Tabitha

30. **WRITING IN MATH** Explain how you can use estimation to place the decimal point in the quotient 42.56 ÷ 22.

ISTEP+ PRACTICE 6.1.6

31. **CONSTRUCTED RESPONSE** Tanner and three neighborhood friends are buying a basketball hoop that costs $249.84. If the cost is divided equally, how much will each person pay in dollars?

32. The table shows the number of subscribers to several Internet providers.

Internet Provider	Subscribers (millions)
Company A	2.45
Company B	3.12
Company C	2.8

What is the mean number of subscribers for these Internet providers?

A 2.9 million **C** 2.79 million

B 2.84 million **D** 2.52 million

Spiral Review

Multiply. (Lesson 3-7)

33. 2.4 × 5.7 34. 1.6 × 2.3 35. 0.32(8.1) 36. 2.68(0.84)

37. What is the product of 4.156 and 12? (Lesson 3-7)

For Exercises 38–40, write each power as a product of the same factor. Then find the value. (Lesson 1-3)

38. Carlos' great-grandmother is 3^4 years old.

39. James ran the 220-yard dash in 6^2 seconds.

40. Monique saved 5^3 dollars by the end of eight weeks.

GET READY for the Next Lesson

PREREQUISITE SKILL **Divide.** (Page 744 and Lesson 3-8)

41. 25 ÷ 5 42. 81 ÷ 9 43. 114.8 ÷ 14 44. 516.06 ÷ 18

Explore 3-9

Math Lab
Dividing by Decimals

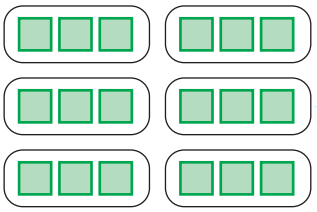
MAIN IDEA

Use models to divide a decimal by a decimal.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, multiplication and **division of** positive fractions and **decimals** and explain why a particular operation was used for a given situation. *Also addresses P.5.1, P.5.2, P.5.3.*

The model below shows 18 ÷ 6.

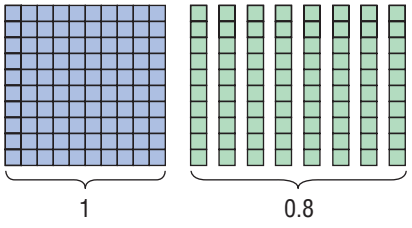


Dividing decimals is similar to dividing whole numbers. In the Activity below, 1.8 is the *dividend* and 0.6 is the *divisor*.

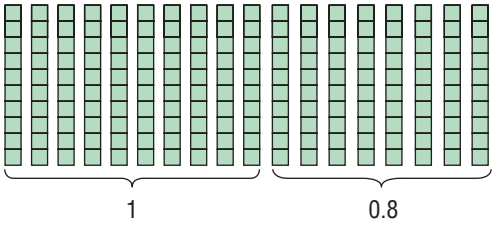
- Use base-ten blocks to model the dividend.
- Replace any ones block with tenths.
- Separate the tenths into groups represented by the divisor.
- The quotient is the number of groups.

ACTIVITY

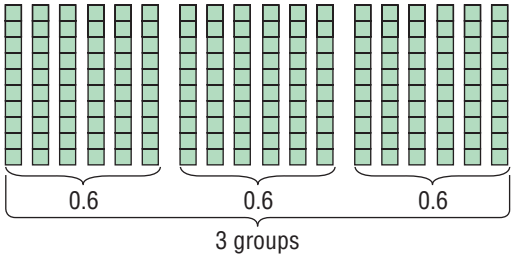
1 **Model 1.8 ÷ 0.6.**



Place one and 8 tenths in front of you to show 1.8.



Replace the ones block with tenths. You should have a total of 18 tenths.



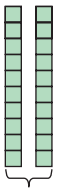
Separate the tenths into groups of six tenths to show dividing by 0.6.

There are three groups of six tenths in 1.8. So, 1.8 ÷ 0.6 = 3.

You can use a similar model to divide by hundredths.

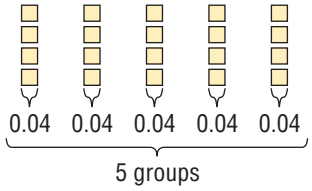
ACTIVITY

2 **Model 0.2 ÷ 0.04.**



Model 0.2 with base-ten blocks.

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



Separate the hundredths into groups of four hundredths to show dividing by 0.04.

There are five groups of four hundredths in 0.2.

So, $0.2 \div 0.04 = 5$.

CHECK Your Progress

Use base-ten blocks to find each quotient.

a. $2.4 \div 0.6$ **b.** $1.2 \div 0.4$ **c.** $1.8 \div 0.6$

d. $0.9 \div 0.09$ **e.** $0.8 \div 0.04$ **f.** $0.6 \div 0.05$

Analyze the Results

1. Explain why the base-ten blocks representing the dividend must be replaced or separated into the smallest place value of the divisor.
2. Tell why the quotient $0.2 \div 0.04$ is a whole number. What does the quotient represent?
3. Determine the missing divisor in the sentence $0.8 \div \blacksquare = 20$. Explain.
4. **MAKE A CONJECTURE** Tell whether $1.2 \div 0.03$ is *less than*, *equal to*, or *greater than* 1.2. Explain your reasoning.

3-9 Dividing by Decimals

MAIN IDEA

Divide decimals by decimals.

IN Academic Standards

6.1.6 Solve problems involving addition, subtraction, multiplication and **division of** positive fractions and **decimals** and explain why a particular operation was used for a given situation.

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MINI Lab

Use a calculator to copy and complete the table.

Division Problem	Quotient
36 ÷ 9	4
Set A	
36 ÷ 0.9	
36 ÷ 0.09	
36 ÷ 0.009	
Set B	
3.6 ÷ 9	
0.36 ÷ 9	
0.036 ÷ 9	
Set C	
3.6 ÷ 0.9	
0.36 ÷ 0.09	
0.036 ÷ 0.009	

1. Describe a pattern among the division problems and their quotients for each set.
2. Use the pattern in Set A to find 36 ÷ 0.0009 without a calculator.
3. Use the pattern in Set B to find 0.0036 ÷ 9 without a calculator.
4. Use the pattern in Set C to find 0.0036 ÷ 0.0009 without a calculator.
5. How could you find 0.042 ÷ 0.07 without a calculator?

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

EXAMPLE 1 Divide by Decimals

Find 14.19 ÷ 2.2. **Estimate** 14 ÷ 2 = 7

Multiply by 10 to make a whole number.

Multiply by the same number, 10.

$$2.2\overline{)14.19} \rightarrow 22\overline{)141.90}$$

Place the decimal point.

Divide as with whole numbers.

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

Annex a zero to continue.

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

Check 6.45 × 2.2 = 14.19 ✔

CHECK Your Progress **Divide.**

a. 54.4 ÷ 1.7 b. 8.424 ÷ 0.36 c. 0.0063 ÷ 0.007

EXAMPLES Zeros in the Quotient and Dividend

2 **Find 52 ÷ 0.4.**

$0.4\overline{)52.0}$

Multiply each by 10.

$$\begin{array}{r} 130. \\ 4\overline{)520.} \\ -\ 4 \\ \hline 12 \\ -\ 12 \\ \hline 00 \end{array}$$

Place the decimal point.

Write a zero in the ones place of the quotient because 0 ÷ 4 = 0.

So, 52 ÷ 0.4 = 130.

Check 130 × 0.4 = 52 ✔

3 **Find 0.09 ÷ 1.8.**

$1.8\overline{)0.09}$

Multiply each by 10.

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

Place the decimal point.

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

Annex a 0 in the dividend and continue to divide.

So, 0.09 ÷ 1.8 is 0.05.

Check 0.05 × 1.8 = 0.09 ✔

CHECK Your Progress **Divide.**

d. 5.6 ÷ 0.014 **e.** 62.4 ÷ 0.002 **f.** 0.4 ÷ 0.0025

EXAMPLE Round Quotients

4 **INTERNET How many times more Internet users are there in Japan than in Spain? Round to the nearest tenth.**

Find 86.3 ÷ 19.8.

$19.8\overline{)86.3} \rightarrow 198\overline{)863.}$

$$\begin{array}{r} 4.35 \\ 198\overline{)863.} \\ -\ 792 \\ \hline 710 \\ -\ 594 \\ \hline 1{,}160 \\ -\ 990 \\ \hline 170 \end{array}$$

To the nearest tenth, 86.3 ÷ 19.8 = 4.4. So, there are about 4.4 times more Internet users in Japan than in Spain.

Internet Users in 2006 (millions)	
U.S.	211.1
China	137.0
Japan	86.3
France	30.8
Canada	22.0
Spain	19.8

Source: Internet World Stats

Study Tip

Rounding When rounding to the nearest tenth, you can stop dividing when there is a digit in the hundredths place.

CHECK Your Progress

g. **INTERNET** How many times more Internet users are there in the U.S. than in France? Round to the nearest tenth.

CHECK Your Understanding

Divide.

Example 1 (p. 179)

1. $3.69 \div 0.3$
2. $9.92 \div 0.8$

Examples 2, 3 (p. 180)

3. $0.45 \div 0.3$
4. $13.95 \div 3.1$
5. $0.6 \div 0.0024$
6. $0.462 \div 0.06$
7. $0.321 \div 0.4$
8. $2.943 \div 2.7$

Example 4 (p. 180)

9. **MEASUREMENT** Alicia bought 5.75 yards of fleece fabric to make blankets for a charity. She needs 1.85 yards of fabric for each blanket. How many blankets can Alicia make with the fabric she bought?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–13, 22–23	1
14–21	2, 3
24, 25	4

Divide.

10. $1.44 \div 0.4$
11. $0.68 \div 3.4$
12. $16.24 \div 0.14$
13. $2.07 \div 0.9$
14. $0.0338 \div 1.3$
15. $0.16728 \div 3.4$
16. $96.6 \div 0.42$
17. $1.08 \div 2.7$
18. $13.5 \div 0.03$
19. $8.4 \div 0.02$
20. $0.12 \div 0.15$
21. $0.242 \div 0.4$

22. **MEASUREMENT** A submarine sandwich 1.5 feet long is cut into 0.25-foot pieces. How many pieces will there be?

23. **MEASUREMENT** The average person's *stride length,* the distance covered by one step, is approximately 2.5 feet long. How many steps would the average person take to travel 50 feet?

Real-World Link . . .
The population of China is about 20% of the world's total population. So, one in every five people on Earth is a resident of China.

24. **POPULATION** The table shows the five most populated countries in the world. How many times more people live in China than in the United States? Round to the nearest tenth if necessary.

Most Populated Countries

Country	Approximate Population (billions)
China	1.322
India	1.13
United States	0.301
Indonesia	0.235
Brazil	0.19

Source: Central Intelligence Agency

25. **GEOGRAPHY** Alaska has the longest coastline in the United States, at about 6.64 thousand miles. Florida has about 1.35 thousand miles of coastline. How many times more coastline does Alaska have than Florida? Round to the nearest tenth if necessary.

26. **MEASUREMENT** Lake Superior, along the U.S.-Canadian border, has a maximum depth of 1.333 thousand feet. There are 5,280 feet in one mile. How deep is Lake Superior in miles? Round to the nearest hundredth if necessary.

ALGEBRA Use the order of operations to evaluate each expression if $m = 88.2$, $n = 3$, and $p = 17.5$. Round to the nearest tenth if necessary.

27. $\frac{m}{n}$
28. $\frac{mp}{n}$
29. $\frac{mn}{p}$
30. $\frac{m}{p}$
31. $\frac{p}{n}$
32. $\frac{m - p}{n}$
33. $\frac{p + n}{n}$
34. $\frac{m + n + p}{p}$

CARS For Exercises 35 and 36, use the table that shows the most popular sports car colors in a recent year in North America.

Most Popular Sports Car Colors	
Color	**Portion of Responses**
Silver	0.2
Gray	0.17
Blue	0.16
Black	0.14
White	0.1
Red	0.09
Green	0.06
Other	0.08

35. How many times more respondents chose silver than red? Round to the nearest tenth if necessary.

36. How many times more respondents chose either silver or black than red? Round to the nearest tenth if necessary.

37. **MEASUREMENT** The longest vehicle tunnel in the world is the Laerdal Tunnel in Norway with a length of 15.2 miles. How many vehicles could fit in the tunnel bumper to bumper if the average vehicle length is 0.004 mile?

Academic Standards • ISTEP+

Extra Practice, pp. 680, 708

38. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would divide decimals.

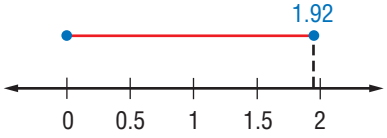
H.O.T. Problems

39. **CHALLENGE** Find two positive decimals a and b that make the following statement true. Then find two positive decimals a and b that make the statement false.

$$\text{If } a < 1 \text{ and } b < 1, \text{ then } a \div b < 1.$$

40. **OPEN ENDED** Write a division problem with decimals in which it is necessary to annex one or more zeros to the dividend. Then solve the problem. Round to the nearest tenth if necessary.

41. **NUMBER SENSE** Use the number line below to determine if the quotient of $1.92 \div 0.5$ is closest to 2, 3, or 4. Do not calculate. Explain your reasoning.



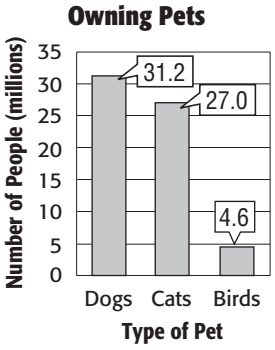
42. **Which One Doesn't Belong?** Identify the problem that does not have the same quotient as the other three. Explain your reasoning.

49 ÷ 7	4.9 ÷ 7	0.49 ÷ 0.7	0.049 ÷ 0.07

43. **WRITING IN MATH** Refer to the table in Exercise 24 on the world's most populated countries. Write and solve a problem in which you would divide decimals. Include instructions for rounding in your problem.

ISTEP+ PRACTICE 6.1.6

44. To the nearest tenth, how many times more people in the U.S. own dogs than own birds?



Source: *Statistical Abstract of the United States*

A 6.8
B 12.2
C 26.6
D 35.8

45. The table shows the approximate number of people in the world who speak either Spanish or French.

Language	Speakers (billions)
Spanish	0.425
French	0.129

To the nearest tenth, how many times more people speak Spanish than French?

F 0.054 billion
G 0.296 billion
H 0.304 billion
J 3.295 billion

Spiral Review

46. Find the quotient when 68.52 is divided by 12. (Lesson 3-8)

Multiply. (Lesson 3-7)

47. 19.2×2.45
48. 8.25×12.42
49. 9.016×51.9

Write an integer to represent each piece of data. (Lesson 2-9)

50. Miguel deposited $45 into his savings account.
51. Mrs. Bezant descended four flights of stairs.
52. The football team gained 16 yards.
53. Suki set her watch back by one hour.

54. GEOGRAPHY The four largest islands in the world are shown in the table. Find the mean and median number of square miles for these data. (Lesson 2-7)

World's Largest Islands	
Island	**Approximate Area (square miles)**
Greenland	840,000
New Guinea	309,000
Borneo	287,300
Madagascar	227,000

GET READY for the Next Lesson

55. PREREQUISITE SKILL A number is multiplied by 8. Next, 4 is subtracted from the product. Then, 12 is added to the difference. If the result is 32, what is the number? Use the *guess and check* strategy. (Lesson 1-7)

3-10 Problem-Solving Investigation

MAIN IDEA: Determine reasonable answers to solve problems.

Academic Standards **P.2.1 Recognize reasoning and proof as fundamental aspects of mathematics. P.2.2 Make and investigate mathematical conjectures.** *Also addresses P.1.1, P.1.4, P.2.1, P.2.2, P.2.3, P.2.4, P.6.2.*

P.S.I. TEAM +

e-Mail: REASONABLE ANSWERS

STEPHANIE: I am burning a CD. I have picked out the first 5 songs. If the CD's capacity is 72 minutes, which is a more reasonable estimate for the number of minutes left on the CD: 40 minutes, 50 minutes, or 60 minutes?

Song	1	2	3	4	5
Length (min)	5.20	4.60	5.75	4.40	4.50

YOUR MISSION: Determine a reasonable estimate.

Understand	You know the lengths of the first 5 songs and the capacity of the CD. You need to determine a reasonable estimate for the remaining minutes on the CD.
Plan	Estimate the length of each song. Then add the estimated lengths. Finally, subtract that amount from 72, the capacity of the CD.
Solve	Song 1 → 5.20 → 5 Song 2 → 4.60 → 5 Song 3 → 5.75 → 6 Song 4 → 4.40 → 4 Song 5 → 4.50 → + 5 25 Since $72 - 25 = 47$, a reasonable estimate for the number of minutes left is 50.
Check	Since $5.20 + 4.60 + 5.75 + 4.40 + 4.50 = 24.25$ and $72 - 24.25 = 47.55$, 50 minutes is a reasonable estimate.

Analyze The Strategy

1. Describe a situation where determining a reasonable answer would help you solve a problem.
2. WRITING IN MATH Write a problem that can be solved by determining a reasonable answer. Then tell the steps you would take to solve the problem.

Mixed Problem Solving

Academic Standards • ISTEP+

Extra Practice, pp. 681, 708

Determine reasonable answers for Exercises 3–5.

3. **CLOTHES** Annie wants to buy 2 pairs of capris for $34.99 each and 3 pairs of flip-flops for $7.99 each. Does she need to save $150, or is $100 enough?

4. **DONATIONS** Mario collected donations for the American Red Cross. He kept a record of the donations.

Donations	
Monday	$92.33
Tuesday	$107.08
Wednesday	$75.98
Thursday	$63.01
Friday	$111.64

Which is a more reasonable estimate for the amount of money Mario will collect next week if he doubles this week's donations: $700 or $800?

5. **PLAYGROUND** The length of a playground is 88.5 yards. Which is a more reasonable estimate for the length of the playground in feet: 240 or 270?

Use any strategy to solve Exercises 6–12. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES
- Make a table.
- Guess and check.

6. **CONCERT** In how many ways can 4 people stand in line at a concert if Terrez and Missy must stand next to each other?

7. **SHOPPING** An online store sells personalized magnets for $3.25 each and personalized keychains for $5.79 each. If Mrs. Anderson spent $56.78 on magnets and keychains, how many of each did she buy?

For Exercises 8 and 9, use the table below that shows the number of CD singles that were shipped for sale from 2001 to 2005.

Year	CD Singles Shipped (millions)
2001	17.3
2002	4.5
2003	8.3
2004	3.1
2005	2.8

8. Which year had about 3 times as many CD singles as in 2005?

9. Which year had about 5 million less CDs shipped than 2003?

10. **CHICKENS** The most eggs a chicken has ever laid in one day is 7. At this rate, how many eggs will a chicken lay in 8 years?

11. **NUMBERS** John wrote down two numbers. The product of the numbers is 48 and the difference between the two numbers is 8. What are the two numbers John wrote down?

12. **WHALES** The table below shows the weight of whales. Is the weight of a blue whale about 3 times, 4 times, or 5 times more than the weight of a gray whale?

Whale	Weight (tons)
Blue	151.0
Bowhead	95.0
Fin	69.9
Gray	38.5
Humpback	38.1

Source: *Top 10 of Everything*

CHAPTER 3

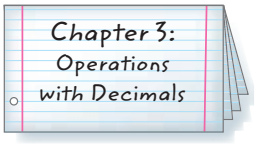
Study Guide and Review

IN Math Online glencoe.com
- STUDY TO GO
- Vocabulary Review

FOLDABLES Study Organizer

GET READY to Study

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



BIG Ideas

Estimation (Lesson 3-4)

- Rounding: Estimate by rounding each decimal to the nearest whole number that is easy for you to add or subtract mentally.
- Clustering: Estimate by rounding a group of close numbers to the same number.
- Front-End Estimation: Estimate by adding or subtracting the values of the digits in the front place or left-most place value.

Adding and Subtracting Decimals (Lesson 3-5)

- To add or subtract decimals, line up the decimal points. Then add or subtract as with whole numbers. Annex zeros if needed when subtracting.

Multiplying and Dividing Decimals

(Lessons 3-8 and 3-9)

- To multiply decimals, multiply as with whole numbers. The product has the same number of decimal places as the sum of the number of decimal places in each factor.
- To divide a decimal by a whole number, place the decimal point directly above the decimal point in the dividend. Then divide as with whole numbers.
- To divide a decimal by a decimal, change the divisor into a whole number by multiplying both the dividend and the divisor by the same power of ten. Then divide.

Key Vocabulary

clustering (p. 151)
decimal (p. 138)
equivalent decimals (p. 143)
expanded form (p. 139)
front-end estimation (p. 151)
inequality (p. 142)
standard form (p. 139)

Vocabulary Check

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

1. Standard form is a sum of the products of each digit and its place value.
2. The product of 0.423×100 is 42.3.
3. In 643.082, the digit 2 names the number two hundredths.
4. *Seven hundred and nine thousandths* written as a decimal is 0.079.
5. Estimation in which all of the decimals are close to the same number is called front-end estimation.
6. The product of 0.09×10 will have two decimal places.
7. The number 245 written in expanded form is two hundred forty-five.
8. The quotient of $4.5 \div 0.9$ is the same as the quotient of $45 \div 9$.
9. The symbol $>$ means less than.
10. Clustering can be used to estimate the sum of 119.3, 122.7, 118.9, 121.4, and 123.2 by rounding each number to 120 and multiplying 120 by 5.

Lesson-by-Lesson Review

3-1 Representing Decimals (pp. 138–141)

6.1.1

Write each decimal in standard form and in expanded form.

11. thirteen hundredths
12. six and five tenths
13. eighty-three and five thousandths
14. **NATURE** The largest sunflower head ever grown was *eighty-one and twenty-eight hundredths* centimeters across. Write this length in standard form.

Example 1 **Write 21.62 in word form.**

21.62 is twenty-one and sixty-two hundredths.

Example 2 **Write three hundred forty-six thousandths in standard form and in expanded form.**

Standard form: 0.346

Expanded form:

$(3 \times 0.1) + (4 \times 0.01) + (6 \times 0.001)$

3-2 Comparing and Ordering Decimals (pp. 142–145)

6.1.1

Use >, <, or = to compare each pair of decimals.

15. 0.35 ● 0.3
16. 6.024 ● 6.204
17. 0.10 ● 0.1
18. 8.34 ● 9.3

Order each set of decimals from least to greatest.

19. 9.501, 0.9051, 90.51, 0.0951
20. 7.403, 0.0743, 7.743, 74.43
21. **MONEY** The costs of four items are \$9, \$0.99, \$9.99, and \$19.99. Order these costs from least to greatest.

Example 3 **Order 17.89, 0.17, 1.879, 10.789 from least to greatest.**

17.89 ⟶ 17.890
0.17 ⟶ 0.170
1.879 ⟶ 1.879
10.789 ⟶ 10.789

Line up the decimal points and annex zeros so that each has the same number of decimal places.

Use place value to compare the decimals. The order from least to greatest is 0.17, 1.879, 10.789, and 17.89.

3-3 Rounding Decimals (pp. 146–149)

6.1.6

Round each decimal to the indicated place-value position.

22. 5.031; hundredths
23. 0.00042; ten-thousandths
24. 2.29; tenths
25. **AREA** The area of Hamilton County is 50.4 square miles. Round 50.4 to the nearest square mile.

Example 4 **Round 8.0314 to the hundredths place.**

8.0314 Underline the digit to be rounded.

8.0314 Then look at the digit to the right. Since 1 is less than 5, the digit 3 stays the same.

So, 8.0314 rounds to 8.03.

3-4 Estimating Sums and Differences (pp. 150–154)

6.1.6

Estimate using rounding.

26. $37.82 + 14.24$
27. $\$72.18 - \$29.93$
28. $6.8 + 4.2 + 3.5$
29. $129.6 - 9.7$

Estimate using clustering.

30. $12.045 + 11.81 + 12.3 + 11.56$
31. $\$6.45 + \$5.88 + \$5.61 + \$6.03$

Estimate using front-end estimation.

32. $31.29 + 58.07$
33. $93.65 - 62.13$
34. $145.91 + 131.65$
35. $87.25 - 63.97$

36. **SHOPPING** Jodie buys a sweater for \$24.35, a bracelet for \$17.62, and a pair of earrings for \$11.19. If she uses front-end estimation to estimate the sum of her purchases, about how much does she spend?

Example 5 Estimate $38.61 - 14.25$ using rounding.

$38.61 \longrightarrow 39$
$-\ 14.25 \longrightarrow -\ 14$
25

Round to the nearest whole number.

Example 6 Estimate $8.12 + 7.65 + 8.31 + 8.08$ using clustering.

All addends of the sum are close to 8. So, an estimate is 4×8 or 32.

Example 7 Estimate $24.6 + 35.1$ using front-end estimation.

$24.6 + 35.1$ Add the front digits to get 5.

An estimate is 50.

3-5 Adding and Subtracting Decimals (pp. 156–160)

6.1.6

Find each sum or difference.

37. $18.35 + 23.61$
38. $148.93 - 121.36$
39. $1.325 + 0.081$
40. $248 - 131.28$

41. **RELAY** The times for each leg of a 4×100-meter relay are 14.75, 14.49, 14.56, and 14.32 seconds. What was the total time of the relay team?

42. **MONEY** Coral has \$40 to buy a backpack. If the backpack costs \$35.99, how much money will she have left?

Example 8 Find the sum of 48.23 and 11.65.

Estimate $48.23 + 11.65 \approx 48 + 12 = 60$

48.23 Line up the decimals.
$+\ 11.65$ Add as with whole numbers.
59.88

The sum is 59.88.

Check for Reasonableness $59.88 \approx 60$ ✔

Example 9 Find the difference between 57.68 and 34.64.

Estimate $58 - 35 \approx 23$

57.68 Line up the decimals.
$-\ 34.64$ Subtract as with whole numbers.
23.04

The difference is 23.04.

Check for Reasonableness $23.04 \approx 23$ ✔

Mixed Problem Solving
For mixed problem-solving practice, see page 708.

3-6 Multiplying Decimals by Whole Numbers (pp. 163–166)

6.1.6

Multiply.

43. 1.4×6
44. 3×9.95
45. 0.082×17
46. 12.09×19
47. 5×0.048
48. 24.7×31
49. 16×6.65
50. 2.6×38

51. **GROCERIES** A loaf of bread costs $1.79. How much would five loaves of bread cost?

52. **ANIMALS** The average hamster weighs 0.3125 ounce. How much would 8 hamsters weigh altogether?

Example 10 Find 6.45×7.

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

$$\begin{array}{r} {\scriptstyle 3\ 3} \\ 6.45 \\ \times\ 7 \\ \hline 45.15 \end{array}$$

There are two decimal places to the right of the decimal in 6.45.

Count the same number of places from right to left in the product.

3-7 Multiplying Decimals (pp. 169–172)

6.1.6

Multiply.

53. 0.6×1.3
54. 8.74×2.23
55. 0.04×5.1
56. 2.6×3.9
57. 0.002×50
58. 0.04×0.0063

59. **MEASUREMENT** A rectangular tomato garden measures 5.8 feet by 12.6 feet. What is the area of the garden?

Example 11 Find 38.76×4.2.

$$\begin{array}{r} 38.76 \\ \times\ 4.2 \\ \hline 7752 \\ +\ 15504 \\ \hline 162.792 \end{array}$$

← two decimal places
← one decimal place
← three decimal places

3-8 Dividing Decimals by Whole Numbers (pp. 173–176)

6.1.6

Divide.

60. $12.24 \div 36$
61. $203.84 \div 32$
62. $136.5 \div 35$
63. $37.1 \div 14$
64. $4.41 \div 5$
65. $26.96 \div 8$

66. **MONEY** In one year, Marcy made $214.68 in interest from her savings account. If she made the same amount of interest each month, how much did she make each month?

Example 12 Find the quotient of $16.1 \div 7$.

$$\begin{array}{r} 2.3 \\ 7\overline{)16.1} \\ -\ 14 \\ \hline 21 \\ -21 \\ \hline 0 \end{array}$$

Place the decimal point.
Divide as with whole numbers.

3-9 Dividing by Decimals (pp. 179–183)

6.1.6

Divide.

67. $0.96 \div 0.6$
68. $11.16 \div 6.2$
69. $0.276 \div 0.6$
70. $5.88 \div 0.4$
71. $18.45 \div 0.5$
72. $0.155 \div 0.25$

73. **MARATHONS** A marathon race is 26.2 miles long. David ran the marathon in 3.6 hours. On average, how many miles did he run per hour? Round to the nearest tenth.

Example 13 Find $11.48 \div 8.2$.

$8.2\overline{)11.48}$ Multiply the divisor and the dividend by 10 to move the decimal point one place to the right so that the divisor is a whole number.

$$\begin{array}{r} 1.4 \\ 82\overline{)114.8} \\ -82 \\ \hline 32\,8 \\ -32\,8 \\ \hline 0 \end{array}$$

Place the decimal point.
Divide as with whole numbers.

3-10 PSI: Reasonable Answers (pp. 184–185)

P.2.1, P.2.2

Determine reasonable answers for Exercises 74 and 75.

74. **HEIGHT** Evan is 5.75 feet tall. His sister, Cindy, is 0.8 times his height. Which is a reasonable height for Cindy: about 4 feet, 4.5 feet, or 6 feet? Explain your reasoning.

75. **MONEY** Derek has $23.80 in his pocket. He spent about 0.67 of this amount on a CD. Would $8, $16, or $20 be a reasonable price of the CD?

Example 14 **There are 24 students in the Spanish club. If the number of students in the school is 19 times this amount, would about 400, 500, or 600 be a reasonable number of students in the school?**

24×19 is about 25×20 or 500. So, 500 is a reasonable number of students in the school.

CHAPTER 3

Practice Test

IN Math Online glencoe.com
• Chapter Test

Write each decimal in word form.

1. 0.07
2. 8.051

Write each decimal in standard form and in expanded form.

3. six tenths
4. two and twenty-one thousandths

5. **SCIENCE** The mass of a particular chemical sample is given as 4.0023 grams. Write the mass in word form.

Use >, <, or = to compare each pair of decimals.

6. 2.03 ● 2.030
7. 7.960 ● 7.906

8. **MULTIPLE CHOICE** Dion recorded the daily high temperatures for Phoenix, Arizona, over five days in the table below.

Day	Temperature (°F)
Monday	109.8
Tuesday	108.9
Wednesday	111.08
Thursday	108.92
Friday	111.0

Which of the following shows the daily high temperatures in order from least to greatest?

A 108.9°F, 108.92°F, 109.8°F, 111.0°F, 111.08°F
B 108.92°F, 108.9°F, 109.8°F, 111.0°F, 111.08°F
C 108.9°F, 108.92°F, 109.8°F, 111.08°F, 111.0°F
D 108.92°F, 108.9°F, 109.8°F, 111.08°F, 111.0°F

Round each decimal to the indicated place-value position.

9. 27.35; tens
10. 3.4556; thousandths

Estimate each sum or difference using the indicated method.

11. 38.23 + 11.84; rounding
12. $75.38 − $22.04; front-end estimation
13. 6.72 + 7.09 + 6.6; clustering

Find each sum or difference.

14. 43.28 + 31.45
15. 392.802 − 173.521

Multiply.

16. 7.8 × 6
17. 0.92 × 4
18. 12 × 0.034
19. 4.56 × 9.7

20. **MULTIPLE CHOICE** Armando and his 3 friends ordered a 4-foot sub for $25.99, 4 large drinks for $1.79 each, and a salad for $5.89. Which of the following represents the total cost, not including tax?

A $134.68
B $39.04
C $37.25
D $33.67

Divide. Round to the nearest tenth if necessary.

21. 7.2 ÷ 3
22. 0.45 ÷ 15
23. 36.08 ÷ 8.2
24. 10.79 ÷ 4.15

25. **ANIMALS** The greyhound can run as fast as 39.35 miles per hour. Without calculating, would about 12, 14, or 16 be a reasonable answer for the number of miles a greyhound could run at this rate in 0.4 hour? Explain your reasoning.

CHAPTER 3

ISTEP+ Practice

Cumulative, Chapters 1–3

IN Math Online glencoe.com
• Test Practice

PART 1 Multiple Choice

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

1. Laura recorded the lengths in inches of a litter of newborn puppies. Which lists the lengths in order from least to greatest?

   A 8.42 in., 8.45 in., 8.9 in., 8.5 in., 8.64 in.

   B 8.42 in., 8.45 in., 8.5 in., 8.64 in., 8.9 in.

   C 8.9 in., 8.64 in., 8.5 in., 8.45 in., 8.42 in.

   D 8.42 in., 8.45 in., 8.64 in., 8.5 in., 8.9 in.

2. The table below shows Mr. Coughlin's monthly heating bills for November through February. He estimated that the heating cost a total of $800 over these four months. Which best describes his estimate?

Monthly Heating Bill	
Month	**Bill ($)**
November	196.43
December	214.89
January	204.58
February	222.76

   F More than the actual amount because he rounded to the nearest $10.

   G Less than the actual amount because he rounded to the nearest $10.

   H More than the actual amount because he rounded to the nearest $100.

   J Less than the actual amount because he rounded to the nearest $100.

3. Zack plans on buying 4 shirts. The cost of each shirt ranges from $19.99 to $35.99. What would be a reasonable total cost for the shirts?

   A $60 **C** $120

   B $70 **D** $160

4. On Monday, 75 adults and 250 children visited the science museum. On Tuesday, 65 adults and 200 children visited the museum. The cost of a ticket is $7.50 for an adult and $5.25 for a child. Read the problem-solving steps below. Arrange the steps in order to find how much money the museum took in on these two days. Which list shows the steps in the correct order?

   Step K: Add the two products together.

   Step L: Multiply the cost of an adult ticket by the number of adults.

   Step M: Write down the number of adults and the number of children.

   Step N: Multiply the cost of a child's ticket by the number of children.

   F L, K, M, N **H** M, N, K, L

   G L, M, N, K **J** M, N, L, K

5. The table shows the maximum speeds of winds in the U.S. for certain cities. What is the mean of the data?

Place	Maximum Wind Speed (mph)
Atlanta, GA	60
Houston, TX	51
Miami, FL	86
Mobile, AL	63
New York, NY	40

Source: *The World Almanac*

   A 46 mph **C** 60 mph

   B 58 mph **D** 86 mph

6. The number of hours that people studied for a Spanish test were 3, 2, 1, 0, 2, 1, 3, 5, 3, and 4. What is the mode of these hours?

   F 1 **H** 3

   G 2 **J** 5

Preparing for ISTEP+
For test-taking strategies and practice, see pages 718–735.

7. Kenny recorded the heights of his tomato plants. Choose the group of numbers that lists the heights in order from least to greatest.

   A 3.28 ft, 3.29 ft, 3.06 ft, 3.41 ft

   B 4.15 ft, 4.10 ft, 4.10 ft, 4.01 ft

   C 3.23 ft, 3.30 ft, 3.35 ft, 3.53 ft

   D 2.89 ft, 2.98 ft, 2.99 ft, 2.88 ft

8. Danielle purchased 4 concert tickets. Each ticket was on sale for $5.95 off the original price. If the original price of each ticket was $29.95, which equation can be used to find t, the total price of the 4 tickets Danielle purchased?

   F $t = 4(5.95) - 4(29.95)$

   G $t = 29.95 - 5.95$

   H $t = 5.95 - 29.95$

   J $t = 4(29.95) - 4(5.95)$

TEST-TAKING TIP

Question 8 Read the question carefully to check that you answered the question that was asked. In question 8, you are asked to write an equation, not to find the answer.

9. A student arranged some books on the shelf using the Dewey Decimal System. Choose the group of book numbers that is listed in order from least to greatest.

   A 749, 749.01, 749.21, 749.11

   B 109.012, 109.021, 109.001, 109.3

   C 456.076, 465.076, 465.189, 465.2

   D 688.89, 687.9, 688.91, 688.95

PART 2 Short Response/Grid In

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

10. The temperature at 6:30 A.M. was 58.7°F. By 1:00 P.M., it was 92.6°F. Find the difference between the two temperatures in degrees Fahrenheit.

11. Before buying furniture, Sharon's mom had $7,420.60 in her checkbook. Afterward, the balance was $4,684.90. How much did Sharon's mom spend on her shopping trip?

PART 3 Extended Response

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

12. Alexandra went to the mall on Saturday and bought the items in the table. Each item was on sale for the price shown.

Item	Original Price ($)	Sale Price ($)
bracelet	25.75	19.50
hat	19.95	15.00
movie	14.50	10.25
shirt	22.75	18.75

   a. How much did the items cost altogether?

   b. How much did Alexandra save?

   c. Explain how you determined how much she saved.

NEED EXTRA HELP?

If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson...	3-2	3-4	3-4	1-4	2-6	2-7	3-2	1-8	3-2	3-5	3-5	3-5
IN Academic Standards	P.1.1	P.1.1	6.2.3	P.1.1	7.1.3	P.1.1	6.2.2	6.2.5	P.1.1	P.1.1	6.2.3	6.2.2