

UNIT 2

Decimals

Chapter 3

Adding and Subtracting Decimals

Chapter 4

Multiplying and Dividing Decimals

Your study of math includes more than just whole numbers. In this unit, you will use decimals to describe many real-life situations and learn how to add, subtract, multiply, and divide with them in order to solve problems.

96-97 Alexander Walter/Getty Images



INTERDISCIPLINARY PROJECT

Down To The Last Penny!

Math and Finance On your mark, get set, SHOP! Being the cost-conscious shopper that you are, you have been asked to help a family make and maintain a grocery budget that will meet their needs. On this shopping adventure, you'll gather data about the cost of common grocery items, find their total cost, and compare this cost to the amount a family can spend on groceries. You'll also compare costs by calculating the unit cost of items. This family really needs your help, so put on your thinking cap and let's get shopping!



Log on to msmath1.net/webquest to begin your WebQuest.

Adding and Subtracting Decimals



“What does money have to do with math?”

Any time you spend money, you use decimals. If you need to find out how much money you earn over a period of time, you add decimals. If you need to know whether you have enough money when you reach the checkout counter, you round decimals. You use decimals almost every day of your life.

You will solve problems about money in Lessons 3-3, 3-4, and 3-5.

GETTING STARTED

► Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 3. Refer to the lesson or page number in parentheses for review.

Vocabulary Review

Complete each sentence.

- The four steps of the problem-solving plan are: Explore, ?, Solve, and Examine. (Lesson 1-1)
- To find the value of an algebraic expression, you must ? it for given values of the variables. (Lesson 1-6)
- The ? of a set of data is the sum of the data divided by the number of pieces of data. (Lesson 2-6)

Prerequisite Skills

Evaluate each expression if $a = 3$ and $b = 4$. (Lesson 1-6)

- | | |
|----------------|-------------|
| 4. $3a - 2b$ | 5. $5 + 2a$ |
| 6. $b - 1 + a$ | 7. $16 - b$ |

Add or subtract. (Page 589)

- | | |
|---------------|---------------|
| 8. $82 - 67$ | 9. $29 + 54$ |
| 10. $48 - 33$ | 11. $61 + 19$ |

Multiply or divide. (Pages 590)

- | | |
|------------------|------------------|
| 12. $36 \div 4$ | 13. 9×3 |
| 14. 6×5 | 15. $56 \div 8$ |

Round each number to the nearest tens place. (Page 592)

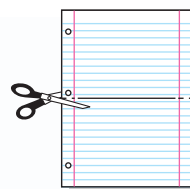
- | | |
|---------|---------|
| 16. 5 | 17. 75 |
| 18. 148 | 19. 156 |

FOLDABLESTM Study Organizer

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

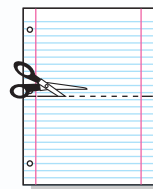
STEP 1 Fold and Cut One Sheet

Fold in half. Cut along fold from edges to margin.



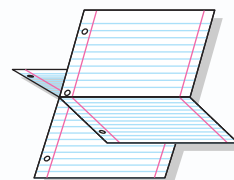
STEP 2 Fold and Cut the Other Sheet

Fold in half. Cut along fold between margins.



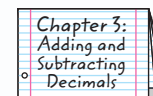
STEP 3 Fold

Insert first sheet through second sheet and along folds.



STEP 4 Label

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



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



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

Modeling Decimals

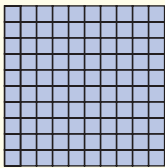
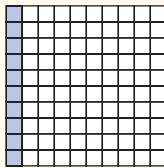
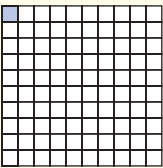
Decimal models can be used to represent decimals.

What You'll LEARN

Use models to represent, compare, order, add, and subtract decimals.

Materials

- centimeter grid paper

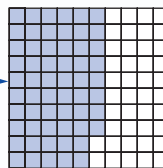
Ones (1)	Tenths (0.1)	Hundredths (0.01)
		
One whole 10-by-10 grid represents 1 or 1.0.	One whole grid is made up of 10 rows and 10 columns. Each row or column represents one tenth or 0.1.	One whole grid has 100 small squares. Each square represents one hundredth or 0.01.

ACTIVITIES

Work with a partner.

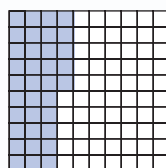
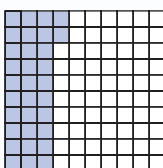
- Write the decimal shown by the model.

There are 58 small squares, or 58 hundredths, shaded.



The model represents 58 hundredths or 0.58.

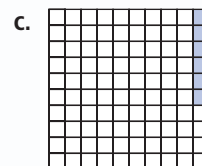
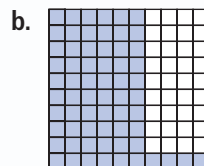
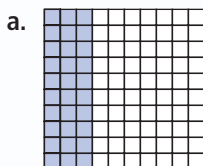
- Compare 0.35 and 0.32 by using models.



The model for 0.35 has more squares shaded than the model for 0.32.

So, 0.35 is greater than 0.32. That is, $0.35 > 0.32$.

- Your Turn** Write the decimal shown by each model.



Compare each pair of decimals using models.

d. 0.68 and 0.65

e. 0.2 and 0.28

f. 0.35 and 0.4

You can also use models to add and subtract decimals.

ACTIVITIES

Work with a partner.

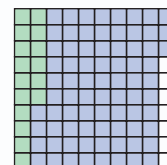
- 1 Find $0.16 + 0.77$ using decimal models.

STEP 1 Shade 0.16 green.

STEP 2 Shade 0.77 blue.

The sum is represented by the total shaded area.

So, $0.16 + 0.77 = 0.93$.



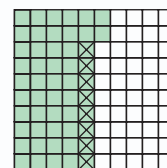
- 2 Find $0.52 - 0.08$ using decimal models.

STEP 1 Shade 0.52 green.

STEP 2 Use x's to cross out 0.08 from the shaded area.

The difference is represented by the amount of shaded area that does not have an x in it.

So, $0.52 - 0.08 = 0.44$.



- 3 **Your Turn** Find each sum using decimal models.

g. $0.14 + 0.67$

h. $0.35 + 0.42$

i. $0.03 + 0.07$

Find each difference using decimal models.

j. $0.75 - 0.36$

k. $0.68 - 0.27$

l. $0.88 - 0.49$

Writing Math

1. **Explain** why 0.3 is equal to 0.30. Use a model in your explanation.
2. **MAKE A CONJECTURE** Explain how you could compare decimals without using models.
3. **Explain** how you can use grid paper to model the following.
 - a. $0.25 + 0.3$
 - b. $0.8 - 0.37$
4. **MAKE A CONJECTURE** Write a rule you can use to add or subtract decimals without using models.

3-1

Representing Decimals

HANDS-ON Mini Lab

What You'll LEARN

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

NEW Vocabulary

standard form
expanded form

Link to READING

Deci-: a prefix meaning tenth part

Materials

- base-ten blocks
- decimal models
- play money

Work with a partner.

The models below show some ways to represent the decimal 1.34.

Place-Value Chart						
1,000	100	10	1	0.1	0.01	0.001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths
0	0	0	1	3	4	0

Money



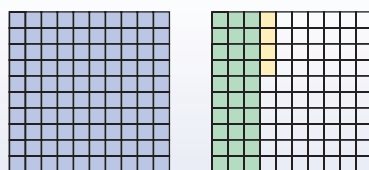
1 dollar



3 dimes

4 pennies

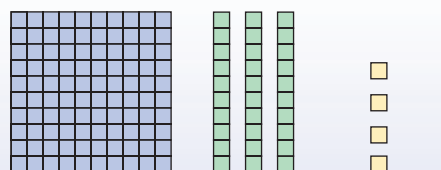
Decimal Model



one

34 hundredths

Base-Ten Blocks



1 one

3 tenths

4 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. The digits and the position of each digit determine the value of a decimal. The decimal point separates the whole number part of the decimal from the part that is less than one.

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	0	1	3	4	0	0

whole number

less than one

READING in the Content Area

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

You can use place value to write decimals in word form.

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*.

EXAMPLE

Write a Decimal in Word Form

1 Write 35.376 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	3	5	3	7	6	0

The last digit, 6, is in the thousandths place.

thirty-five and three hundred seventy-six thousandths

35.376 is thirty-five and three hundred seventy-six thousandths.

Decimals can be written in standard form and expanded form.

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

Standard Form and Expanded Form

1 Write *fifty-four and seven 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	5	4	0	0	0	7

Standard form: 54.0007

Expanded form: $(5 \times 10) + (4 \times 1) + (0 \times 0.1) + (0 \times 0.01) + (0 \times 0.001) + (7 \times 0.0001)$

Your Turn Write each decimal in word form.

a. 0.825

b. 16.08

c. 142.67

d. Write *twelve and four tenths* in standard form and in expanded form.



Skill and Concept Check

- Writing Math** Explain the difference between word form, standard form, and expanded form.
- OPEN ENDED** Draw a model that represents 2.75.
- Which One Doesn't Belong?** Identify the number that does not have the same value as the other three. Explain your reasoning.

0.75

seven and five
hundredths

$(7 \times 0.1) +$
 (5×0.01)

seventy-five
hundredths

GUIDED PRACTICE

Write each decimal in word form.

- | | | |
|----------|-----------|-----------|
| 4. 0.7 | 5. 0.08 | 6. 5.32 |
| 7. 0.022 | 8. 34.542 | 9. 8.6284 |

Write each decimal in standard form and in expanded form.

- | | |
|--|--|
| 10. nine tenths | 11. twelve thousandths |
| 12. three and twenty-two
hundredths | 13. forty-nine and thirty-six
ten-thousandths |

14. **FOOD** A bottle of soda contains 1.25 pints. Write this number in two other forms.

Practice and Applications

Write each decimal in word form.

- | | | | |
|------------|------------|------------|------------|
| 15. 0.4 | 16. 0.9 | 17. 3.56 | 18. 1.03 |
| 19. 7.17 | 20. 4.94 | 21. 0.068 | 22. 0.387 |
| 23. 78.023 | 24. 20.054 | 25. 0.0036 | 26. 9.0769 |

27. How is 301.0019 written in word form?
28. How is 284.1243 written in word form?

Write each decimal in standard form and in expanded form.

- | | |
|---|--|
| 29. five tenths | 30. eleven and three tenths |
| 31. two and five hundredths | 32. thirty-four and sixteen hundredths |
| 33. forty-one and sixty-two ten-thousandths | 34. one hundred two ten-thousandths |
| 35. eighty-three ten-thousandths | 36. fifty-two and one hundredths |
37. Write $(5 \times 0.1) + (2 \times 0.01)$ in word form.
38. Write $(4 \times 1) + (2 \times 0.1)$ in word form.
39. How is $(3 \times 10) + (3 \times 1) + (4 \times 0.1)$ written in standard form?
40. Write $(4 \times 0.001) + (8 \times 0.0001)$ in standard form.

HOMEWORK HELP

For Exercises	See Examples
15–28, 41	1
29–40, 44	2
Extra Practice See pages 599, 626.	

41. **WRITING CHECKS** To safeguard against errors, the dollar amount on a check is written in both standard form and word form. Write \$23.79 in words.

FOOD For Exercises 42–44, use the information at the right.

42. Which numbers have their last digit in the hundredths place?
43. How did you identify the hundredths place?
44. Write each of these numbers in expanded form.

Unpopped Popcorn Kernel	
Ingredient	Grams
water	0.125
fat	0.03
protein	0.105
carbohydrates	0.71
mineral water	0.02

Source: www.popcornpopper.com

45. **RESEARCH** Use the Internet or another source to find the definition of decimal. Then write two ways that decimals are used in everyday life.

CRITICAL THINKING For Exercises 46 and 47, use the following information.

A decimal is made using each digit 5, 8, and 2 once.

46. What is the greatest possible decimal greater than 5 but less than 8?
47. Find the least possible decimal greater than 0 but less than one.



48. **MULTIPLE CHOICE** Choose the decimal that represents *twelve and sixty-three thousandths*.

(A) 1,206.3 (B) 120.63 (C) 12.063 (D) 0.12063

49. **SHORT RESPONSE** Write 34.056 in words.

50. **FOOTBALL** Would the mean be misleading in describing the average football scores in the table? Explain. (Lesson 2-8)

Hayes Middle School Football Scores	
Game 1	20
Game 2	27
Game 3	22
Game 4	13
Game 5	30

51. **SCHOOL** Find the median for the set of Tim's history test scores: 88, 90, 87, 91, 49. (Lesson 2-7)

Find the value of each expression. (Lesson 1-5)

52. $45 \div 3 \times 3 - 7 + 12$

53. $5 \times 6 + 6 - 12 \div 2$

GETTING READY FOR THE NEXT LESSON

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

54. 6.3

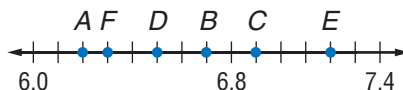
55. 6.7

56. 6.2

57. 6.5

58. 7.2

59. 6.9



What You'll LEARN

Write numbers using Roman and Egyptian numerals.

Other Number Systems**INVESTIGATE** *Work with a partner.*

At the very end of a movie, you'll find the year the movie was made. However, instead of seeing the year 2005, you'll usually see it written using Roman numerals as MMV.

The Roman numeral system uses combinations of seven letters to represent numbers. These letters are shown in the table at the right.

All other numbers are combinations of these seven letters. Several numbers and their Roman numerals are shown below.

Roman Numeral	Number
I	1
V	5
X	10
L	50
C	100
D	500
M	1,000

Number	2	3	4	6	7	8	9
Roman Numeral	II	III	IV	VI	VII	VIII	IX
Number	14	16	20	40	42	49	90
Roman Numeral	XIV	XVI	XX	XL	XLII	XLIX	XC

Writing Math

- MAKE A CONJECTURE** Study the patterns in the table. Write a sentence or two explaining the rule for forming Roman numerals.

Write each number using Roman numerals.

- 6
- 40
- 23
- 15
- 55

Write the number for each Roman numeral.

- XLIX
- C
- XCVIII
- XXIV
- XVIII

- The page numbers at the front of your math book are written using Roman numerals. Write the number for the greatest Roman numeral you find there.
- Describe** a disadvantage of using Roman numerals.
- True or False?* The Roman numeral system is a place-value system. Explain.

INVESTIGATE *Work with a partner.*

The ancient Egyptian numbering system was very straightforward. A unique symbol represented each decimal place value in the whole number system.

The ancient Egyptian numeral system uses combinations of seven symbols. These symbols are shown in the table at the right.

All other numbers are combinations of these seven symbols. Several numbers and their Ancient Egyptian numerals are shown below.

Ancient Egyptian Numerals	Number
I	1
∩	10
⋈	100
↓	1,000
⤵	10,000
𐍌	100,000
𐍎	1,000,000

Number	2	4	12	110
Egyptian Numeral	II	IIII	∩II	⋈∩
Number	1,200	11,110	221,100	1,111,000
Egyptian Numeral	↓⋈⋈	⤵↓⋈∩	⤵⤵⤵↓⋈	𐍌𐍌𐍌𐍌↓

Writing Math

15. **Compare and contrast** our decimal number system with the ancient Egyptian numbering system.

Write each number using Egyptian numerals.

16. 4
17. 20
18. 112
19. 1,203

Write the number for each Egyptian numeral.

20. IIIII
21. ∩
22. ⋈∩∩∩
23. ↓⋈⋈⋈

24. **Describe** a disadvantage of using Egyptian numerals.
25. **Identify** any similarities between the Roman numeral system and the ancient Egyptian numbering system.
26. **MAKE A CONJECTURE** How do you think you would add numbers written with Egyptian numerals? How is it similar to adding in a place-value system?

3-2

Comparing and Ordering Decimals

What You'll LEARN

Compare and order decimals.

NEW Vocabulary

equivalent decimals

MATH Symbols

< less than
> greater than

WHEN am I ever going to use this?

SNOWBOARDING The table lists the top five finishers at the 2002 Olympic Games Men's Halfpipe.

Men's Halfpipe Results		
Snowboarders	Country	Score
Danny Kass	USA	42.5
Giacomo Kratter	Italy	42.0
Takaharu Nakai	Japan	40.7
Ross Powers	USA	46.1
Jarret Thomas	USA	42.1

Source: www.mountainzone.com



1. Which player had the highest score? Explain.

Comparing decimals is similar to comparing whole numbers. You can use place value or a number line to compare decimals.

EXAMPLE Compare Decimals

1 SNOWBOARDING Refer to the table above. Use > or < to compare Danny Kass' score with Jarret Thomas' score.

Method 1 Use place value.

Danny Kass: 42.5

Jarret Thomas: 42.1

First, line up the decimal points.

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

Since $5 > 1$, $42.5 > 42.1$. So, Danny Kass's score was higher than Jarret Thomas's score.

Method 2 Use a number line.



Numbers to the right are greater than numbers to the left. Since 42.5 is to the right of 42.1, $42.5 > 42.1$.

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

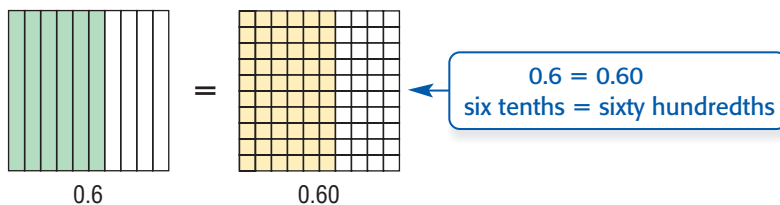
a. 5.67 • 5.72

b. 0.293 • 0.253

STUDY TIP

< and > Recall that the symbol always points toward the lesser number.

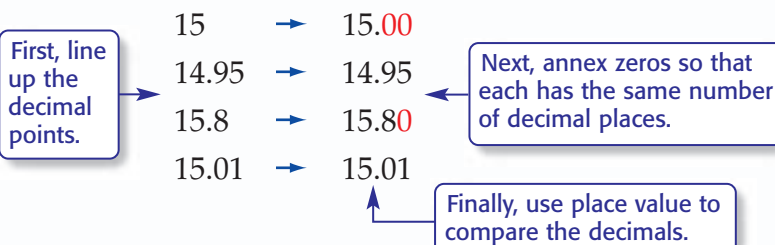
Decimals that name the same number are called **equivalent decimals**. Examples are 0.6 and 0.60.



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 Order Decimals

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



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

Your Turn

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

Checking Reasonableness

You can check the reasonableness of the order by using a number line.

Skill and Concept Check

- Draw a number line to show the order of 2.5, 2.05, 2.55, and 2.35 from least to greatest.
- OPEN ENDED** Write a decimal that is equivalent to 0.4. Then draw a model to show that your answer is correct.
- FIND THE ERROR** Mark and Carlos are ordering 0.4, 0.5, and 0.49 from least to greatest. Who is correct? Explain.

Mark
0.4, 0.5, 0.49

Carlos
0.4, 0.49, 0.5

GUIDED PRACTICE

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

4. $2.7 \bullet 2.07$

5. $0.4 \bullet 0.5$

6. $25.5 \bullet 25.50$

7. Order 0.002, 0.09, 0.2, 0.21, and 0.19 from least to greatest.



Practice and Applications

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

- | | | |
|----------------------------|-----------------------------|-----------------------------|
| 8. $0.2 \bullet 2.0$ | 9. $3.3 \bullet 3.30$ | 10. $0.08 \bullet 0.8$ |
| 11. $0.4 \bullet 0.004$ | 12. $6.02 \bullet 6.20$ | 13. $5.51 \bullet 5.15$ |
| 14. $9.003 \bullet 9.030$ | 15. $0.204 \bullet 0.214$ | 16. $7.107 \bullet 7.011$ |
| 17. $23.88 \bullet 23.880$ | 18. $0.0624 \bullet 0.0264$ | 19. $2.5634 \bullet 2.5364$ |

Order each set of decimals from least to greatest.

- | | |
|----------------------------|------------------------------|
| 20. 16, 16.2, 16.02, 15.99 | 21. 5.545, 4.45, 4.9945, 5.6 |
|----------------------------|------------------------------|

Order each set of decimals from greatest to least.

- | | |
|----------------------------|---------------------------------|
| 22. 2.1, 2.01, 2.11, 2.111 | 23. 32.32, 32.032, 32.302, 3.99 |
|----------------------------|---------------------------------|

24. **AUTO RACING** In 1994, Sterling Marlin drove 156.931 miles per hour to win the Daytona 500. In 2004, Dale Earnhardt Jr. won, driving 156.345 miles per hour. Who was faster?

25. **BOOKS** Most library books are placed on shelves so that their call numbers are ordered from least to greatest. Use the information at the right to find the order the books should be placed on the shelf.



Book	Number
Baleen Whales	599.52
The Blue Whale	599.5248
The Whale	599.5

26. **CRITICAL THINKING** Della has more money than Sara but less money than Eric. Halley has 10¢ more than Hector. The amounts are \$0.89, \$1.70, \$1.18, \$0.79, and \$1.07. How much does each person have?

Spiral Review with Standardized Test Practice

27. **MULTIPLE CHOICE** Which number is between 3.18 and 4.03?
- | | | | |
|-----------|-----------|-----------|-----------|
| (A) 3.082 | (B) 3.205 | (C) 4.052 | (D) 4.352 |
|-----------|-----------|-----------|-----------|

28. **MULTIPLE CHOICE** Which of these decimals is least?
- | | | | |
|----------|----------|----------|-----------|
| (F) 94.7 | (G) 98.5 | (H) 99.7 | (I) 101.1 |
|----------|----------|----------|-----------|

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

- | | |
|------------------------------|----------------------------------|
| 29. thirty-seven thousandths | 30. nine and sixteen thousandths |
|------------------------------|----------------------------------|
31. **STATISTICS** Is the mode a misleading measure of central tendency for the set of data 21, 20, 19, 13, 21, 18, 12, and 21? Explain. (Lesson 2-8)
32. Determine whether 315 is divisible by 2, 3, 5, or 10. (Lesson 1-2)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Identify each underlined place-value position.
(Lesson 3-1)

- | | | | |
|--------------------|--------------------|---------------------|---------------------|
| 33. 14. <u>0</u> 6 | 34. 3. <u>0</u> 54 | 35. 0.42 <u>7</u> 8 | 36. 2.96 <u>0</u> 0 |
|--------------------|--------------------|---------------------|---------------------|

3-3

Rounding Decimals

What You'll LEARN

Round decimals.

WHEN am I ever going to use this?

SCHOOL The Jackson Middle School lunch menu is shown at the right.

1. Round each cost to the nearest dollar.
2. How did you decide how to round each number?
3. **MAKE A CONJECTURE** about how to round each cost to the nearest dime.

Lunch Menu	
Item	Cost
Pizza	\$1.20
Salad	\$2.65
Taco	\$1.30
Soda	\$0.85
Milk	\$0.75
Fruit	\$1.25



You can round decimals just as you round whole numbers.

Noteables™

Key Concept: Round Decimals

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.

EXAMPLES

Round Decimals

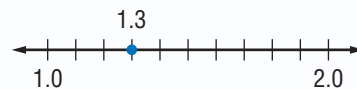
- 1 Round 1.324 to the nearest whole number.

Underline the digit to be rounded. In this case, the digit is in the ones place.

1.324

Then look at the digit to the right. 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 1.0.



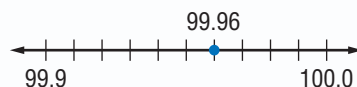
- 1 Round 99.96 to the nearest tenth.

Underline the digit to be rounded. In this case, the digit is in the tenths place.

99.96

Then look at the digit to the right. 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.



Rounding is often used in real-life problems involving money.

EXAMPLE

Use Rounding to Solve a Problem

- 1 FOOD** A bag of potato chips costs \$0.2572 per ounce. How much is this to the nearest cent?

To round to the nearest cent, round to the nearest hundredths place.

Underline the digit in the hundredths place.

\$0.2572

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 cost is \$0.26 per ounce.

- Your Turn** Round each decimal to the indicated place-value position.

a. 0.27853; ten-thousandths b. \$5.8962; cent

Skill and Concept Check

- Writing Math** Draw a number line to show why 3.47 rounded to the nearest tenth is 3.5. Write a sentence explaining the number line.
- OPEN ENDED** Give an example of a number that when rounded to the nearest hundredth is 45.39.
- Which One Doesn't Belong?** Identify the decimal that is not the same as the others when rounded to the nearest tenth. Explain.

34.62

34.59

34.49

34.56

GUIDED PRACTICE

Round each decimal to the indicated place-value position.

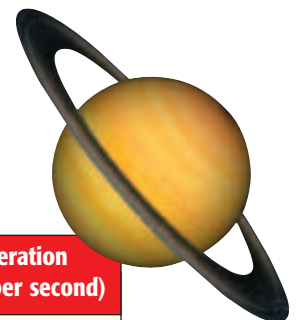
- 0.329; tenths
- 45.522; hundredths
- 7.67597; ten-thousandths
- 1.75; ones
- 0.5888; thousandths
- \$34.59; tens

- 10. SCIENCE** The table shows the rate of acceleration due to gravity for a few of the planets. To the nearest tenth, what is the rate of acceleration due to gravity for each planet?



Planet	Acceleration (meters per second)
Jupiter	23.12
Saturn	8.96
Uranus	8.69
Mars	3.69

Source: Science Scope



Practice and Applications

Round each decimal to the indicated place-value position.

11. 7.445; tenths
12. 7.999; tenths
13. \$5.68; ones
14. 10.49; ones
15. 2.499; hundredths
16. 40.458; hundredths
17. 5.4572; thousandths
18. 45.0099; thousandths
19. 9.56303; ten-thousandths
20. 988.08055; ten-thousandths
21. \$87.09; tens
22. 1,567.893; tens

23. Round \$67.37 to the nearest dollar.

24. What is 67,234.63992 rounded to the nearest thousandth?

25. **FOOD** The United States is considered the “Ice Cream Capital of the World.” Each person eats an average of nearly 5.75 gallons per year. Round 5.75 gallons to the nearest gallon.

26. **MEDIA** Disc jockeys often refer to a radio station by rounding its call number to the nearest whole number. What number would DJs use to refer to a radio station whose call number is 102.9?

27. **CRITICAL THINKING** Write three different decimals that round to 10.0 when rounded to the nearest tenth.

HOMEWORK HELP

For Exercises See Examples

11–24

1, 2

25–26

3

Extra Practice
See pages 600, 626.

Spiral Review with Standardized Test Practice

28. **MULTIPLE CHOICE** The atomic weights of certain elements are given in the table. What is the atomic weight of sodium to the nearest tenth?

(A) 22.98

(B) 22.99

(C) 23.0

(D) 23.1

Element	Atomic Weight
Sodium	22.9898
Neon	20.180
Magnesium	24.305

Source: www.webelements.com

29. **SHORT RESPONSE** Round 1,789.8379 to the nearest thousandth.

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

30. 8.64 • 8.065

31. 2.5038 • 25.083

32. 12.004 • 12.042

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

34. Find the prime factorization of 40. (Lesson 1-3)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Add or subtract. (Page 589)

35. $43 + 15$

36. $68 + 37$

37. $85 - 23$

38. $52 - 29$



msmath1.net/self_check_quiz

CONTENTS

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **Explain** how to write a decimal in word form. (Lesson 3-1)
2. **State** the rule used for rounding decimals. (Lesson 3-3)

Skills and Applications

3. Write 12.65 in word form. (Lesson 3-1)
4. Write *four and two hundred thirty-two thousandths* in standard form and in expanded form. (Lesson 3-1)

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

5. $0.06 \bullet 0.6$ 6. $6.3232 \bullet 6.3202$ 7. $2.15 \bullet 2.150$

Order each set from least to greatest. (Lesson 3-2)

8. 8.2, 8.02, 8.025, 8.225 9. 0.001, 0.101, 0.0101, 0.011

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

10. 8.236; tenths 11. 10.0879; thousandths
12. 7.84; ones 13. 431; hundreds

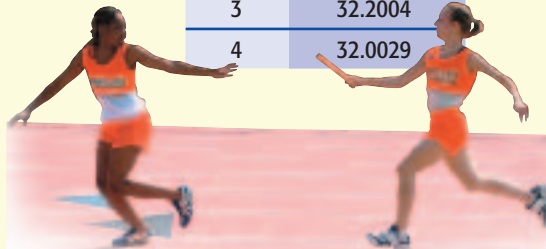
Standardized Test Practice

14. **MULTIPLE CHOICE** The finish times for runners in a relay race are shown in the table. Which of the following is the order of the times from least to greatest?

(Lesson 3-2)

- (A) 32.2004, 32.02, 32.0029, 31.95
(B) 32.02, 32.0029, 32.2004, 31.95
(C) 31.95, 32.0029, 32.02, 32.2004
(D) 31.95, 32.2004, 32.0029, 32.02

Runner	Finish Time (s)
1	32.02
2	31.95
3	32.2004
4	32.0029

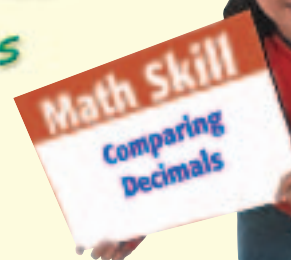


15. **MULTIPLE CHOICE** The cost per gallon of gasoline is often listed as a decimal in thousandths. To the nearest cent, what would you pay for a gallon of gasoline that costs \$1.239? (Lesson 3-3)

- (F) \$1.25 (G) \$1.24 (H) \$1.23 (I) \$1.22

The Game Zone

A Place To Practice Your Math Skills



Decimal War

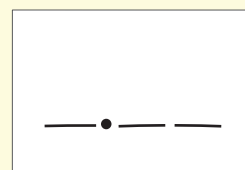
● GET READY!

Players: two

Materials: spinner with digits 0 through 9, paper

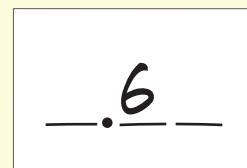
● GET SET!

- Each player creates ten game sheets like the one shown at the right, one for each of ten rounds.
- Make a spinner as shown.



● GO!

- One player spins the spinner.
- Each player writes the number in one of the blanks on his or her game sheet.
- The other player spins the spinner, and each player writes the number in a blank.
- Play continues once more so that all blanks are filled.
- The person with the greater decimal scores 1 point.
- Repeat for ten rounds.
- **Who Wins?** The person with the greater number of points after ten rounds is the winner.



Estimating Sums and Differences

What You'll LEARN

Estimate sums and differences of decimals.

NEW Vocabulary

front-end estimation
clustering

WHEN am I ever going to use this?

TRAVEL The graph shows about how many passengers travel through the busiest United States airports.

1. Round each number to the nearest million.
2. About how many more people travel through Hartsfield Atlanta than San Francisco?

USA TODAY Snapshots®

Atlanta busiest U.S. airport

Passengers (in millions of per year):

Hartsfield Atlanta International 80.2

Chicago-O'Hare International 72.1

Los Angeles International 68.5

Dallas-Fort Worth International 60.7

San Francisco International 41.2

Source: Department of Transportation, Federal Aviation Administration, Airports Council International

By Lori Joseph and Dave Merrill, USA TODAY

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 amount of passengers that travel through Dallas-Fort Worth and Los Angeles.

Round each number to the nearest ten for easier adding.

$$\begin{array}{r} 60.7 \rightarrow 60 \\ + 68.5 \rightarrow + 70 \\ \hline 130 \end{array} \quad \begin{array}{l} 60.7 \text{ rounds to } 60. \\ 68.5 \text{ rounds to } 70. \end{array}$$

There are about 130 million passengers.

- 2** Estimate how many more passengers travel through Hartsfield Atlanta than through Chicago-O'Hare.

$$\begin{array}{r} 80.2 \rightarrow 80 \\ - 72.1 \rightarrow - 70 \\ \hline 10 \end{array} \quad \begin{array}{l} 80.2 \text{ rounds to } 80. \\ 72.1 \text{ rounds to } 70. \end{array}$$

There are about 10 million more passengers.

STUDY TIP

Using estimation

There is no one correct answer when estimating. To estimate means to find an approximate value. However, *reasonableness* is important.

Another type of estimation is front-end estimation. When you use **front-end estimation**, add or subtract the front digits. Then add or subtract the digits in the next place value position.

EXAMPLE Use Front-End Estimation

1 Estimate $34.6 + 55.3$ using front-end estimation.

Add the front digits.

Then add the next digits.

$$\begin{array}{r} 34.6 \\ + 55.3 \\ \hline 8 \end{array}$$

→

$$\begin{array}{r} 34.6 \\ + 55.3 \\ \hline 89 \end{array}$$

Using front-end estimation, $34.6 + 55.3$ is about 89.

2 **Your Turn** Estimate using front-end estimation.

a.
$$\begin{array}{r} 22.35 \\ - 11.14 \\ \hline \end{array}$$

b.
$$\begin{array}{r} 5.45 \\ + 0.57 \\ \hline \end{array}$$

c. $\$37.92 - \21.62

When estimating a sum in which all of the addends are close to the same number, you can use **clustering**.



EXAMPLE Use Clustering

1 **MULTIPLE-CHOICE TEST ITEM** Use the information in the table to estimate the total number of hours worked in the four months.

(A) 210

(B) 280

(C) 350

(D) 420

Month	Hours Worked
May	72.50
June	68.50
July	69.75
August	71.75

Read the Test Item The addends are clustered around 70.

$$\begin{array}{rcl} 72.50 & \rightarrow & 70 \\ 68.50 & \rightarrow & 70 \\ 69.75 & \rightarrow & 70 \\ + 71.75 & \rightarrow & + 70 \\ \hline & & 280 \end{array}$$

Solve the Test Item Multiplication is repeated addition. So, a good estimate is 4×70 , or 280. The answer is B.

Test-Taking Tip

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

Concept Summary

Estimation Methods

Rounding	Estimate by rounding each decimal to the nearest whole number that is easy for you to add or subtract mentally.
Front-End Estimation	Estimate by first adding or subtracting the front digits. Then add or subtract the next digits.
Clustering	Estimate by rounding a group of close numbers to the same number.



Skill and Concept Check

- Writing Math** Explain how you would estimate $1.843 - 0.328$.
- OPEN ENDED** Describe a situation where it makes sense to use the clustering method to estimate a sum.
- NUMBER SENSE** How do you know that the sum of 5.4, 6.3, and 9.6 is greater than 20?

GUIDED PRACTICE

Estimate using rounding.

- $0.36 + 0.83$
- $4.44 - 2.79$

Estimate using front-end estimation.

- $179 + 188 + 213$
- $\$442 - \126

Estimate using clustering.

- $5.32 + 4.78 + 5.42$
- $0.95 + 0.79 + 1.02$

- PHONE COSTS** Use the information in the table.
Estimate the total cost of the phone calls using clustering.

Phone Calls				
Minutes	8.7	9.1	9.0	8.9
Amount (\$)	1.04	1.09	1.08	1.07

Practice and Applications

Estimate using rounding.

- $49.59 + 16.22$
- $\$41.59 - \19.72
- $2.33 + 4.88 + 5.5$
- $\$102.55 - \52.77
- $0.36 + 0.83$
- $0.7 - 0.6363$
- About how much more is $\$74.50$ than $\$29.95$?
- Estimate the sum of $2.456 + 1.925 + 2.395 + 1.695$.

Estimate using front-end estimation.

- $$\begin{array}{r} 75.45 \\ - 5.23 \\ \hline \end{array}$$
- $$\begin{array}{r} 27.09 \\ - 12.05 \\ \hline \end{array}$$
- $$\begin{array}{r} 28.65 \\ + 71.53 \\ \hline \end{array}$$
- $$\begin{array}{r} 124.82 \\ + 64.98 \\ \hline \end{array}$$
- $$\begin{array}{r} \$315.65 \\ + 30.42 \\ \hline \end{array}$$
- $$\begin{array}{r} 186.25 \\ - 86.49 \\ \hline \end{array}$$
- $$\begin{array}{r} 116.22 \\ - 14.67 \\ \hline \end{array}$$
- $$\begin{array}{r} 50.96 \\ + 19.28 \\ \hline \end{array}$$

- RECYCLING** Two classes recycled paper. One class earned $\$16.52$. The other class earned $\$28.80$. About how much more did the second class earn?

Estimate using clustering.

- $6.99 + 6.59 + 7.02 + 7.44$
- $\$3.33 + \$3.45 + \$2.78 + \2.99
- $5.45 + 5.3948 + 4.7999$
- $\$55.49 + \$54.99 + \$55.33$
- $10.33 + 10.45 + 10.89 + 9.79$
- $99.8 + 100.2 + 99.5 + 100.4$

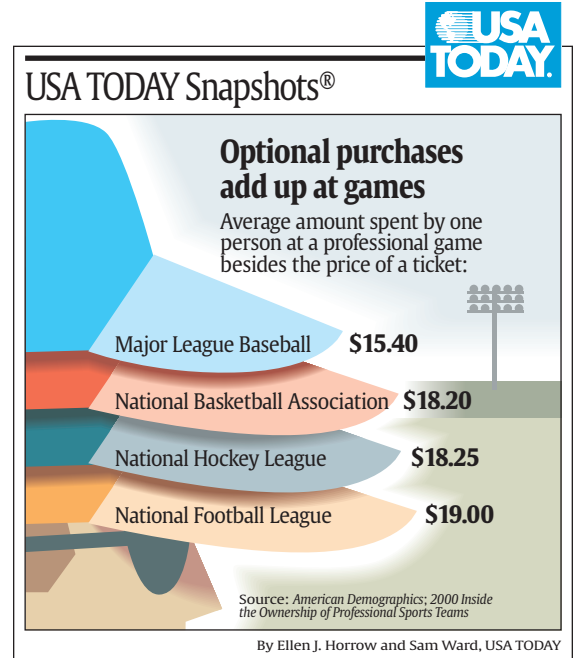
HOMEWORK HELP

For Exercises	See Examples
11–18, 34	1, 2
19–27	3
28–33, 35	4

Extra Practice
See pages 600, 626.

SPORTS For Exercises 34–37, use the graph.

34. About how much more would you expect to pay for purchases at a National Football League game than at a Major League Baseball game?
35. Use clustering to estimate the total cost for purchases at a National Basketball Association, National Hockey League, and a National Football League game.
36. **MULTI STEP** Suppose the average price of one ticket for a Major League Baseball game is \$35.00. About how much would a family of four pay for four tickets and optional purchases?
37. **WRITE A PROBLEM** Write and solve a problem using the information in the graph. Then solve your problem using estimation.
38. **CRITICAL THINKING** Five same-priced items are purchased. Based on rounding, the estimate of the total was \$15. What is the maximum and minimum price the item could be?



Spiral Review with Standardized Test Practice

39. **MULTIPLE CHOICE** 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 (B) \$70 (C) \$120 (D) \$160
40. **MULTIPLE CHOICE** Refer to the table. Which is the best estimate for the total number of acres of land burned?
- (F) 25 million (G) 30 million
(H) 35 million (I) 40 million
41. **WEATHER** Washington, D.C., has an average annual precipitation of 35.86 inches. Round this amount to the nearest tenth. (Lesson 3-3)
42. Order the decimals 27.025, 26.98, 27.13, 27.9, and 27.131 from least to greatest. (Lesson 3-2)

Land Burned in Wildfires	
Year	Acres Burned (millions)
2000	8.4
1996	6.7
1988	7.4
1969	6.7
1963	7.1

Source: www.nife.gov

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Add or subtract. (Page 589)

43.
$$\begin{array}{r} 278 \\ + 199 \\ \hline \end{array}$$

44.
$$\begin{array}{r} 1,297 \\ + 86 \\ \hline \end{array}$$

45.
$$\begin{array}{r} 700 \\ - 235 \\ \hline \end{array}$$

46.
$$\begin{array}{r} 1,252 \\ - 79 \\ \hline \end{array}$$

47.
$$\begin{array}{r} 2,378 \\ - 195 \\ \hline \end{array}$$



Study Skill

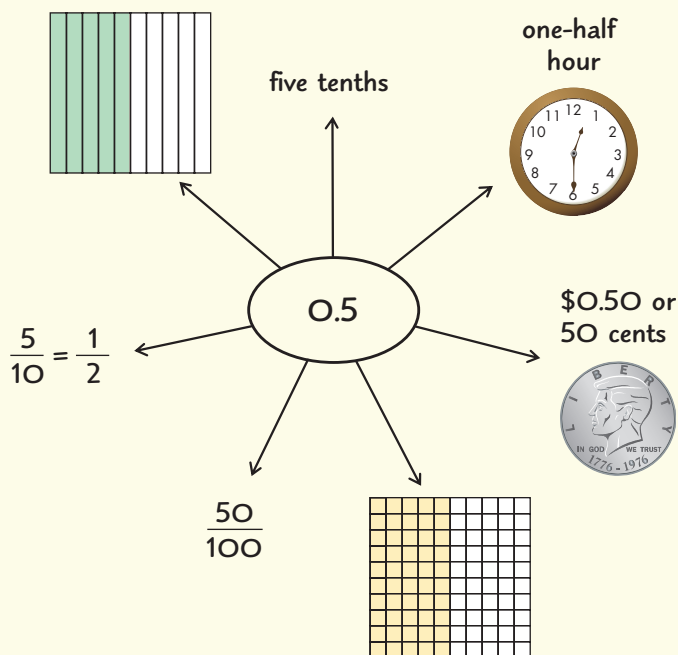
Use a Number Map

Taking Good Notes

Have you heard the expression *a picture is worth a thousand words*? Sometimes the best notes you take in math class might be in the form of a drawing.

Just as a road map shows how cities are related to each other, a *number map* can show how numbers are related to each other. Start by placing a number in the center of the map.

Below is a number map that shows various meanings of the decimal 0.5. Notice that you can add both mathematical meanings and everyday meanings to the number map.



SKILL PRACTICE

Make a number map for each number. (*Hint: For whole numbers, think of factors, prime factors, divisibility, place value, and so on.*)

- 0.75
- 0.1
- 0.01
- 1.25
- 2.5
- 25
- 45
- 60
- 100
- Refer to Exercise 1. Explain how each mathematical or everyday meaning on the number map relates to the decimal 0.75.

3-5

Adding and Subtracting Decimals

What You'll LEARN

Add and subtract decimals.

REVIEW Vocabulary

evaluate: find the value of an expression by replacing variables with numerals
(Lesson 1-6)

WHEN am I ever going to use this?

MOVIES The table shows the top five movies based on gross amount earned in a weekend.

Movie	Money Earned (millions)
#1	\$25.0
#2	\$23.1
#3	\$13.1
#4	\$10.0
#5	\$5.5

1. Estimate the total amount of money earned by the top five movies.
2. Add the digits in the same place-value position. Use estimation to place the decimal point in the sum.

To add or subtract decimals, add or subtract digits in the same place-value position. Be sure to line up the decimal points before you add or subtract.

EXAMPLE Add Decimals

- 1 Find the sum of 23.1 and 5.8.

Estimate $23.1 + 5.8 \rightarrow 23 + 6 = 29$

23.1 Line up the decimal points.

+ 5.8

28.9 Add as with whole numbers.

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

The sum of 23.1 and 5.8 is 28.9.

EXAMPLE Subtract Decimals

- 1 Find $5.774 - 2.371$.

Estimate $5.774 - 2.371 \rightarrow 6 - 2 = 4$

5.774 Line up the decimal points.

- 2.371

3.403 Subtract as with whole numbers.

So, $5.774 - 2.371 = 3.403$. Compare to the estimate.

Your Turn Add or subtract.

a. $54.7 + 21.4$

b. $9.543 - 3.67$

c. $72.4 + 125.82$



Sometimes it is necessary to annex zeros before you subtract.

EXAMPLE Annex Zeros

1 Find $6 - 2.38$.

Estimate $6 - 2.38 \rightarrow 6 - 2 = 4$

$$\begin{array}{r} 6.00 \\ - 2.38 \\ \hline 3.62 \end{array}$$

So, $6 - 2.38 = 3.62$. Compare to the estimate.

Your Turn Subtract.

d. $2 - 1.78$

e. $14 - 9.09$

f. $23 - 4.216$

REAL-LIFE CAREERS

How Does A Personal Trainer Use Math?

Personal trainers use statistics and geometry in their work. They also keep records of time improvements for their clients.



Research

For information about a career as a personal trainer, visit msmath1.net/careers



EXAMPLE Use Decimals to Solve a Problem

1 **SPEED SKATING** The table shows the top three times for the speed skating event in the 2002 Winter Olympics. What is the time difference between first place and third place?

1,000-Meter Women's Speed Skating	
Skater	Time (s)
Chris Witty	73.83
Sabine Volker	73.96
Jennifer Rodriguez	74.24

Source: www.sportsillustrated.cnn

Estimate $74.24 - 73.83 \rightarrow 74 - 74 = 0$

$$\begin{array}{r} 74.24 \\ - 73.83 \\ \hline 0.41 \end{array}$$

So, the difference between first place and third place is 0.41 second.



You can also use decimals to evaluate algebraic expressions.

EXAMPLE Evaluate an Expression

5 **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 $2.85 + 17.975 \rightarrow 3 + 18 = 21$

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

The value is 20.825. This value is close to the estimate. So, the answer is reasonable.

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

g. $3.23 + a$

h. $68.96 - b$

i. $b - a$

Skill and Concept Check

- Writing Math** Explain how you would find the sum of 3.3 and 2.89.
- OPEN ENDED** Write a subtraction problem in which it is helpful to annex a zero.
- FIND THE ERROR** Ryan and Akiko are finding $8.9 - 3.72$. Who is correct? Explain.

Ryan
 $8.9 - 3.72 = 5.22$

Akiko
 $8.9 - 3.72 = 5.18$

- NUMBER SENSE** Pick five numbers from the list below whose sum is 10.2. Use each number only once.

1.9 3 2.7 3.9 2.4 0.6 1.1 3.1 0.15

GUIDED PRACTICE

Add or subtract.

5. $\begin{array}{r} 5.5 \\ + 3.2 \\ \hline \end{array}$

6. $\begin{array}{r} 5.78 \\ - 5 \\ \hline \end{array}$

7. $\begin{array}{r} 9.67 \\ + 2.35 \\ \hline \end{array}$

8. $\begin{array}{r} 0.40 \\ - 0.20 \\ \hline \end{array}$

9. $5.5 - 1.24$

10. $1.254 + 0.3 + 4.15$

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

Practice and Applications

Add or subtract.

12. $\begin{array}{r} 7.2 \\ + 9.5 \\ \hline \end{array}$

13. $\begin{array}{r} 4.9 \\ + 3.0 \\ \hline \end{array}$

14. $\begin{array}{r} 1.34 \\ + 2 \\ \hline \end{array}$

15. $\begin{array}{r} 0.796 \\ + 13 \\ \hline \end{array}$

16. $\begin{array}{r} 5.6 \\ - 3.5 \\ \hline \end{array}$

17. $\begin{array}{r} 19.86 \\ - 4.94 \\ \hline \end{array}$

18. $\begin{array}{r} 97 \\ - 16.98 \\ \hline \end{array}$

19. $\begin{array}{r} 82 \\ - 67.18 \\ \hline \end{array}$

20. $58.67 - 28.72$

21. $14.39 - 12.16$

22. $2.649 + 0.75 + 1.784$

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

23. $a - d$

24. $d + a$

25. $a - 11.25 - d$

26. $75 + d + a$

Find the value of each expression.

27. $2.3 + 6 \times 2$

28. $15.3 - 3^2$

29. $3 + 6.5 - 2.8$

30. $2^2 - 1.58 + 6.5$

- STATISTICS** Use the table to find out how many more students per teacher there are in California than in Nevada.

- MONEY** How much change would you receive if you gave a cashier \$20 for a purchase that costs \$18.74?

Student-per-Teacher Ratio	
State	Ratio
Washington	19.9
Oregon	19.6
Nevada	18.7
California	21

Source: National Center for Education Statistics



For Exercises 33 and 34, find a counterexample for each statement.

33. The sum of two decimals having their last nonzero digit in the hundredths place also has its last nonzero digit in the hundredths place.
34. The difference of two decimals having their last nonzero digits in the tenths place also has its last nonzero digit in the tenths place.
35. **WRITE A PROBLEM** Write about a real-life situation that can be solved using addition or subtraction of decimals.

CARS For Exercises 36–39, use the information and the table. The top five choices for every 100 people are listed in the table.

36. Find the total number of people per 100 who chose the top five most popular colors.
37. How many more people per 100 chose black over white?
38. **MULTI STEP** How many more people per 100 chose the top three colors than the last two?
39. Do you believe that the colors chosen from year to year would be the same? Explain your reasoning.

Favorite Color for a Sport Compact Car	
Silver	25.4
Black	14.5
Med./Dk. Blue	11.3
White	9.8
Med. Red	7.4

Source: infoplease.com

40. **ALGEBRA** What is the value of $a + b$ if $a = 126.68$ and $b = 1,987.9$?
41. **CRITICAL THINKING** Arrange the digits 1, 2, 3, 4, 5, 6, 7, and 8 into two decimals so that their difference is as close to 0 as possible. Use each digit only once.

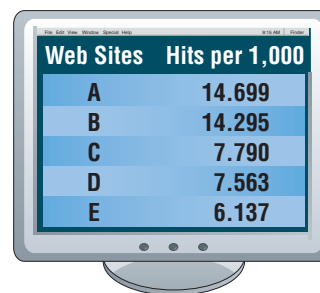
Spiral Review with Standardized Test Practice

42. **MULTIPLE CHOICE** The table shows the daily hits per 1,000 for the top five Web sites for a recent month. What was the number of daily hits per 1,000 for all of the Web sites?

- Ⓐ 48.9622 Ⓑ 50.484
Ⓒ 53.654 Ⓓ 56.484

43. **MULTIPLE CHOICE** Dasan purchased \$13.72 worth of gasoline. He received \$10 back from the attendant. How much did Dasan give the attendant?

- Ⓕ \$15.72 Ⓖ \$20.00 Ⓗ \$25.00 Ⓘ none of these



Web Sites	Hits per 1,000
A	14.699
B	14.295
C	7.790
D	7.563
E	6.137

Source: U.S. News and World Report

Estimate. Use an appropriate method. (Lesson 3-4)

44. $4.231 + 3.98$ 45. $3.945 + 1.92 + 3.55$ 46. $9.345 - 6.625$ 47. $\$11.11 - \6.45
48. Round 28.561 to the nearest tenth. (Lesson 3-3)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Add, subtract, multiply, or divide. (Pages 589–590)

49. $25 + 16$ 50. $96 - 25$ 51. 2×8 52. $24 \div 8$

3-5b

Problem-Solving Strategy

A Follow-Up of Lesson 3-5

Choose the Method of Computation

What You'll LEARN

Solve problems by choosing an appropriate method of computation.

I heard your family drove to North Carolina for a vacation. About how far did you travel?

We drove 356.2 miles the first day, 304.8 miles the second day, and 283.1 miles the third day. Then we drove the same route back home. Let's estimate to figure it out.

Explore

We don't need an exact answer, and it's too hard to compute mentally. Since we need to find *about* how far, we can estimate.

Plan

Let's start by estimating the number of miles traveled each day. Add the total for the three days and double that for the trip back home.

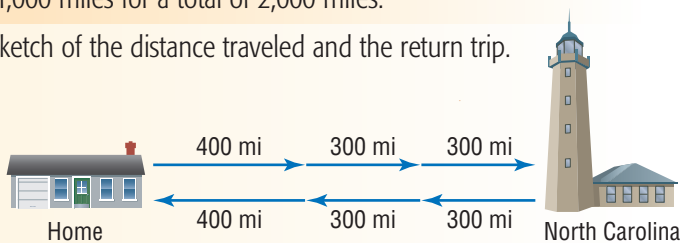
Solve

Day One	----->	356.2		400
Day Two	----->	304.8		300
Day Three	----->	283.1		+300
				<u>1,000</u>

The trip was about 1,000 miles one way. The return trip was approximately another 1,000 miles for a total of 2,000 miles.

Examine

Draw a sketch of the distance traveled and the return trip.



$400 + 300 + 300 + 300 + 300 + 400 = 2,000$
So, our answer of about 2,000 miles is correct.

Analyze the Strategy

1. **Explain** when you would use estimation as the method of computation.
2. **Describe** how to mentally find the product of 40 and 3.
3. **Write** a problem in which you would use a calculator as the method of computation. Explain.

Apply the Strategy

Choose the best method of computation to solve each problem.

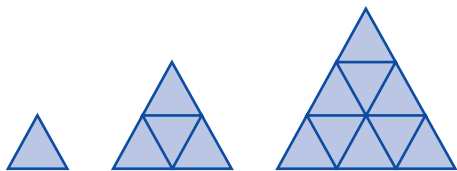
Explain why you chose your method.

4. **TREES** It costs \$283 to plant an acre of trees in a national forest. About how much will it cost to plant 640 acres?
5. **MEASUREMENT** How many seconds are in one week?
6. **SCHOOL** Each of 10 teachers donated \$25 to the school scholarship fund. How much money was donated in all?
7. **MUSIC** Ruben's mother gave him \$20 to buy new strings for his guitar. If the strings cost \$15.38, how much change will he receive?

Mixed Problem Solving

Solve. Use any strategy.

8. **GEOGRAPHY** The area of Rhode Island is 1,212 square miles. The area of Alaska is 591,004 square miles. About how many times larger is Alaska than Rhode Island?
9. **PATTERNS** How many triangles are in the bottom row of the fifth figure of this pattern?



10. **MONEY** You have \$100.75 in your checking account. You write checks for \$21.78, \$43, and \$7.08. What is your new balance?
11. **BASEBALL CARDS** Jamal has 45 baseball cards. He is collecting 5 more cards each month. Alicia has 30 baseball cards, and she is collecting 10 more each month. How many months will it be before Alicia has more cards than Jamal?
12. **MEASUREMENT** If there are 8 fluid ounces in 1 cup, 2 cups in 1 pint, 2 pints in 1 quart, and 4 quarts in 1 gallon, how many fluid ounces are in 1 gallon?
13. **MONEY** Jane's lunch cost \$3.64. She gives the cashier a \$10 bill. How much change should Jane receive?

14. **HURRICANES** Refer to the table below.

Hurricanes	
Category	Wind Speed (miles per hour)
one	74–95
two	96–110
three	111–130
four	131–155
five	above 155

Source: www.carteretnewtimes.com

Hurricanes can be classified according to their wind speeds. What is the average of the minimum and maximum speeds for a category four hurricane?

15. **FOOD** Is \$7 enough money to buy a loaf of bread for \$0.98, one pound of cheese for \$2.29, and one pound of luncheon meat for \$3.29? Explain.
16. **STANDARDIZED TEST PRACTICE**
Alita, Alisa, and Alano are sharing the cost of their mother's birthday gift, which costs \$147. About how much will each child need to contribute?
 - (A) between \$30 and \$35
 - (B) between \$35 and \$40
 - (C) between \$40 and \$45
 - (D) between \$45 and \$50

Vocabulary and Concept Check

clustering (p. 117)

equivalent decimals (p. 109)

expanded form (p. 103)

front-end estimation (p. 117)

standard form (p. 103)

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

- The number 0.07 is greater than 0.071.
- When rounding decimals, the digit in the place being rounded should be rounded up if the digit to its right is 6.
- In 643.082, the digit 2 names the number two hundredths.
- Six hundred and twelve thousandths* written as a decimal is 0.612.
- Decimals that name the same number are called equivalent decimals.

Lesson-by-Lesson Exercises and Examples

3-1 Representing Decimals (pp. 102–105)

Write each decimal in standard form and in expanded form.

- thirteen hundredths
- six and five tenths
- eighty-three and five thousandths

- GARDENING** A giant pumpkin weighed fifty-three and one hundred seventy-five thousandths pounds. Write this weight 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. 108–110)

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

- 0.35 \bullet 0.3
- 0.10 \bullet 0.1
- 6.024 \bullet 6.204
- 8.34 \bullet 9.3

Example 3 Use $<$, $>$, or $=$ to compare 4.153 and 4.159.

4.153 Line up the decimal points.

4.159 Starting at the left, find the first place the digits differ.

Since $3 < 9$, $4.153 < 4.159$.



Mixed Problem SolvingFor mixed problem-solving practice,
see page 626.**3-3 Rounding Decimals** (pp. 111–113)

Round each decimal to the indicated place-value position.

14. 5.031; hundredths

15. 0.00042; ten-thousandths

16. **FOOD COSTS** A box of cereal costs \$0.216 per ounce. Round this price to the nearest cent.

Example 4 Round 8.0314 to the hundredths place.

8.0314 Underline the digit to be rounded.

$$\begin{array}{r} 8.03\overset{\uparrow}{1}4 \\ \text{Then look at the digit to the right.} \\ \text{Since 1 is less than 5, the digit 3} \\ \text{stays the same.} \end{array}$$

So, 8.0314 rounds to 8.03.

3-4 Estimating Sums and Differences (pp. 116–119)

Estimate using rounding.

17. $37.82 + 14.24$ 18. $\$72.18 - \29.93

19. $6.8 + 4.2 + 3.5$ 20. $129.6 - 9.7$

Estimate using front-end estimation.

$$\begin{array}{r} 21. \quad 31.29 \\ \quad + 58.07 \\ \hline \end{array} \qquad \begin{array}{r} 22. \quad 93.65 \\ \quad - 62.13 \\ \hline \end{array}$$

$$\begin{array}{r} 23. \quad 145.91 \\ \quad + 31.65 \\ \hline \end{array} \qquad \begin{array}{r} 24. \quad 87.25 \\ \quad - 63.97 \\ \hline \end{array}$$

Estimate using clustering.

25. $12.045 + 11.81 + 12.3 + 11.56$

26. $\$6.45 + \$5.88 + \$5.61 + \6.03

27. $1.15 + 0.74 + 0.99 + 1.06$

Example 5 Estimate $38.61 - 14.25$ using rounding.

$$\begin{array}{r} 38.61 \rightarrow 39 \\ - 14.25 \rightarrow - 14 \\ \hline 25 \end{array} \quad \text{Round to the nearest whole number.}$$

Example 6 Estimate $24.6 + 35.1$ using front-end estimation.

$$24.6 + 35.1 \quad \text{Add the front digits to get 5. Then add the next digits. An estimate is 59.}$$

Example 7 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.**3-5 Adding and Subtracting Decimals** (pp. 121–124)

Add or subtract.

$$\begin{array}{r} 28. \quad 18.35 \\ \quad + 23.61 \\ \hline \end{array} \qquad \begin{array}{r} 29. \quad 148.93 \\ \quad - 121.36 \\ \hline \end{array}$$

$$\begin{array}{r} 30. \quad 1.325 \\ \quad + 0.081 \\ \hline \end{array} \qquad 31. \quad 248 - 131.28$$

32. **TRAVEL** Mr. Becker drove 11.3 miles to the dentist, 7.5 miles to the library, and 5.8 miles back home. How far did he travel?

Example 8 Find the sum of 48.23 and 11.65.

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

$$\begin{array}{r} 48.23 \\ + 11.65 \\ \hline 59.88 \end{array} \quad \begin{array}{l} \text{Line up the decimals.} \\ \text{Add as with whole numbers.} \end{array}$$

The sum is 59.88.

Practice Test

Vocabulary and Concepts

1. Define *expanded form* and give an example.
2. Describe how place value is used to compare decimals.

Skills and Applications

Write each decimal in word form.

3. 0.07
4. 8.051
5. 43.43
6. **SCIENCE** The weight of a particular molecule is given as 0.0003 ounce. Write the weight in word form.

Write each decimal in standard form and in expanded form.

7. six tenths
8. two and twenty-one thousandths
9. one and nine hundredths

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

10. 0.06 \bullet 0.60
11. 4.888 \bullet 4.880
12. 2.03 \bullet 2.030

Order each set of decimals from greatest to least.

13. 5.222, 5.202, 5.022, 5.2222
14. 0.04, 0.0404, 0.404, 0.0444

Round each decimal to the indicated place-value position.

15. 2.059; hundredths
16. 27.35; tens
17. 4.86273; ten-thousandths
18. 3.4553; thousandths

19. **ARCHITECTURE** Round each ceiling height in the table to the nearest tenth of a foot.

Room	Porch	Living Room	Bedroom
Ceiling Height (ft)	8.12	12.35	8.59

20. Estimate $38.23 + 11.84$ using rounding.
21. Estimate $75.38 + 22.04$ using front-end estimation.

Add or subtract.

22.
$$\begin{array}{r} 43.28 \\ + 31.45 \\ \hline \end{array}$$
23.
$$\begin{array}{r} 392.802 \\ - 173.521 \\ \hline \end{array}$$
24.
$$\begin{array}{r} 0.724 \\ + 6.458 \\ \hline \end{array}$$

Standardized Test Practice

25. **MULTIPLE CHOICE** Matthew ordered juice for \$0.89, scrambled eggs for \$3.69, and milk for \$0.59. About how much did he spend?

(A) \$10 (B) \$8 (C) \$6 (D) \$4

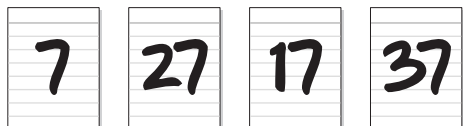


PART 1 Multiple Choice

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

- There are ten million people living in a city. How is ten million written in standard form? (Prerequisite Skill, p. 586)

(A) 10,000 (B) 1,000,000
(C) 10,000,000 (D) 10,000,000,000
- Xavier, Justin, Leslie, and Cree are playing a game of prime and composites. Points are given when a card with a prime number is selected. Who did *not* score any points on this turn? (Lesson 1-3)



Xavier

Justin

Leslie

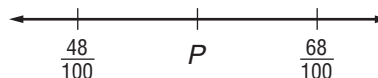
Cree

- (F) Cree (G) Justin
(H) Leslie (I) Xavier
- Mrs. Sabina graded the spelling test for her sixth-grade class. The range in scores is 56. If the lowest grade is 42, what is the highest grade? (Lesson 2-7)

(A) 14 (B) 56 (C) 96 (D) 98
 - How is 2.6251 read? (Lesson 3-1)

(F) two and six thousand two hundred fifty-one thousandths
(G) two and six thousand two hundred fifty-one hundred thousandths
(H) two and six thousand two hundred fifty-one ten thousandths
(I) two and six thousand two hundred fifty-one hundredths

- Which decimal number can replace P on the number line? (Lesson 3-1)



- (A) 0.32 (B) 0.48 (C) 0.56 (D) 0.69
- Michael practiced his long jump after school. He recorded each jump. Which jump is the longest? (Lesson 3-2)

(F) 7.008 m (G) 7.049 m
(H) 7.073 m (I) 7.080 m
 - The store calculates sales tax and rounds it to the nearest cent. The tax on a coat totaled \$3.02. Which of the following could be the actual amount of the tax before it was rounded? (Lesson 3-3)

(A) \$3.000 (B) \$3.024
(C) \$3.036 (D) \$3.030
 - The table shows the distance Jillian walked each day. What is the *best* estimate of the distance she walked over the five days? (Lesson 3-4)

Jillian's Walks	
Day	Distance (km)
Monday	2.4
Tuesday	5.2
Wednesday	3.6
Thursday	7.9
Friday	4.1

- (F) 21 km (G) 23 km
(H) 25 km (I) 26 km
- How much greater is 11.2 than 10.8? (Lesson 3-5)

(A) 0.4 (B) 1.4 (C) 1.6 (D) 22.0

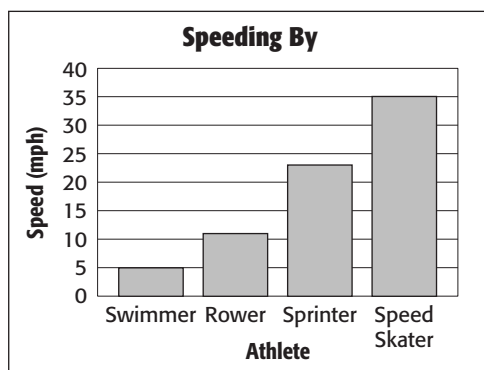
PART 2 Short Response/Grid In

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

10. Write $5 \times 5 \times 5 \times 5$ using an exponent. Then find the value of the power.

(Lesson 1-3)

11. The graph shows the approximate top speeds of the world's fastest athletes. How much faster is a speed skater than a swimmer? (Lesson 2-2)



Source: Chicago Tribune

12. The table shows the prices of various recycled products. What is the median price per ton? (Lesson 2-7)

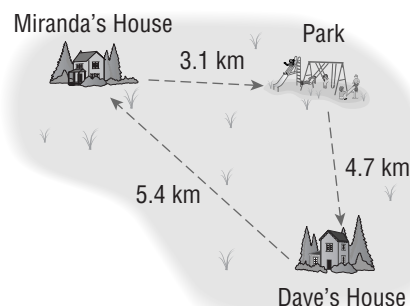
Price Per Ton (\$)			
62	60	53	97
88	42	69	119
84	132	153	165
153	121	30	17

13. Sasha checked her reaction time using a stopwatch. During which trial was Sasha's reaction time the slowest? (Hint: The slowest time is the longest). (Lesson 3-2)

Reaction Time (s)	
Trial 1	1.031
Trial 2	1.016
Trial 3	1.050
Trial 4	1.007

14. Kelly scored an average of 12.16 points per game. What is her average score rounded to the nearest tenth? (Lesson 3-3)

15. Miranda rode her bike to the park and then to Dave's house. By the end of the day, she had biked a total of about 13 kilometers. From Dave's house, did Miranda bike back to the park, and then home? Explain. (Lesson 3-4)



16. Is 6.14, 6.2, or 1.74 the solution of $x - 3.94 = 2.2$? (Lesson 3-5)

PART 3 Extended Response

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

17. Mr. Evans had a yard sale. He wrote both the original cost and the yard sale price on each item. (Lesson 3-5)

Item	Original Price (\$)	Selling Price (\$)
Table	95.15	12
Mirror	42.14	8
Picture Frame	17.53	2
Television	324.99	52

- If Mr. Evans sold all four items, how much did he make at the yard sale?
- What was his loss?
- Explain how you calculated his loss.

TEST-TAKING TIP

Question 16 To check the solution of an equation, replace the variable in the equation with your solution.

