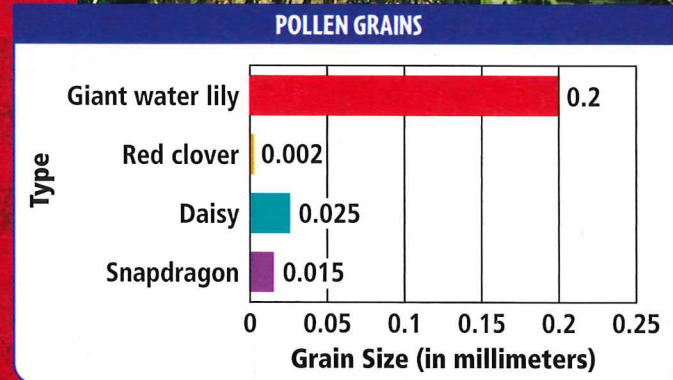


Place Value of Decimals

FAST FACT • SCIENCE

Pollen grains produced by plants are microscopic. Wind, water, and animals can carry pollen grains to new locations. Pollen can drift in from 400 miles out at sea and 2 miles high in the air.

PROBLEM SOLVING The main features that make one type of pollen different from another are size, shape, and the surface of the grain. Look at the graph. Order the sizes of the pollen grains from greatest to least.



Pollen of giant water lilies



Red clover and pollen



Daisies and pollen



Snapdragon and pollen

CHECK WHAT YOU KNOW

Use this page to help you review and remember important skills needed for Chapter 2.

ORDER WHOLE NUMBERS

Write the numbers in order from least to greatest.

- 8,945; 8,962; 8,974
- 890,104; 809,192; 899,110
- 45,325; 44,254; 42,124
- 3,004; 3,040; 3,404

Write the numbers in order from greatest to least.

- 3,257; 3,268; 3,284
- 743,125; 734,216; 763,326
- 23,322; 23,321; 23,335
- 302,233; 326,799; 328,232

READ AND WRITE DECIMALS

Write as a decimal.

-
-
-

Write the number in two other forms.

- fourteen and three tenths
- $7,000 + 4 + 0.1$
- $3,000 + 20 + 7 + 0.2$
- 16.4

VOCABULARY POWER

REVIEW

equivalent [i•kwiv'ə•lənt] *adjective*

Equivalent is the combination of two Latin roots, *aequus* and *valere*. The word *aequus* means "equal" and *valere* means "value." Explain how this information helps you find the number that is equivalent to $72 \div 9$.

PREVIEW

- decimal
- tenth
- hundredth
- thousandth
- ten-thousandth
- equivalent decimals



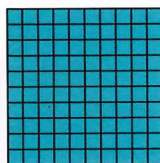
www.harcourtschool.com/mathglossary

Decimal Place Value

Learn

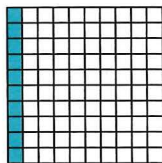
TINY GRAINS! Decimals name wholes and parts of a whole. Scientists use decimals to measure pollen.

One whole is shaded.



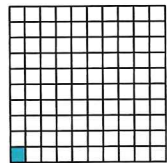
1
1.0
one

One tenth is shaded.



$\frac{1}{10}$
0.1
one tenth

One hundredth is shaded.



$\frac{1}{100}$
0.01
one hundredth

Example 1 Use a place-value chart to find the value of each digit in the number 1.75. Then write the decimal in standard form, in expanded form, and in word form.

Ones	Tenths	Hundredths
1	7	5
$1 \times 1 = 1.0$	$7 \times 0.1 = 0.7$	$5 \times 0.01 = 0.05$

Standard Form: 1.75 Expanded Form: $1 + 0.7 + 0.05$
Word Form: one and seventy-five hundredths

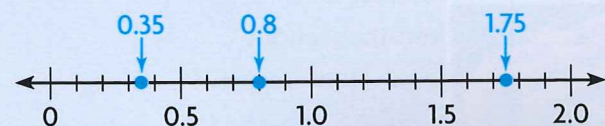
- How are $1\frac{75}{100}$ and 1.75 related?

MATH IDEA As you move from left to right on the place-value chart, the value of each place is one-tenth of the value of the place to its left.

You can locate decimals on a number line.

Example 2

Locate 1.75, 0.35, and 0.8 on a number line.



- What if you were to locate 1.23 on the number line above? Would it be closer to 1.2 or closer to 1.3?

Quick Review

What is the value of the digit 8 in each number?

- 1,845
- 408
- 8,209
- 284
- 80,672

VOCABULARY

- decimal
- tenth
- hundredth
- thousandth
- ten-thousandth



▲ The marrow pollen grain is one of the largest pollen grains. Its size is 0.2 mm.

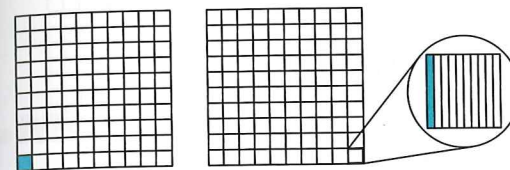
Remember

A mixed number is made up of a whole number and a fraction.

$1\frac{75}{100}$ is a mixed number.

Thousandths and Ten-Thousandths

If you divide one whole by 1,000, you get one thousandth. If one square of a hundredth decimal model were magnified and one column of it were shaded, you could see one thousandth.



one hundredth one thousandth

If you divide one whole by 10,000, you get one ten-thousandth.

$$1 \div 10,000 = \frac{1}{10,000} = 0.0001 = \text{one ten-thousandth}$$

You can also use a place-value chart to find the value of each digit in decimals to ten-thousandths. The chart below shows 2.7835.

Ones	Tenths	Hundredths	Thousandths	Ten-thousandths
2	7	8	3	5
2×1	7×0.1	8×0.01	3×0.001	5×0.0001
2.0	0.7	0.08	0.003	0.0005

Standard Form: 2.7835

Expanded Form: $2 + 0.7 + 0.08 + 0.003 + 0.0005$

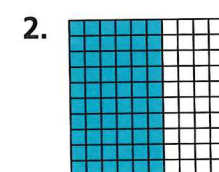
Word Form: two and seven thousand, eight hundred thirty-five ten-thousandths

- How many thousandths are in one hundredth? in one tenth? in one?

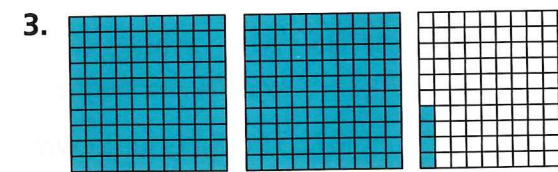
Check

1. Explain a rule for the pattern: 10, 1, $\frac{1}{10}$, $\frac{1}{100}$. Write the next number.

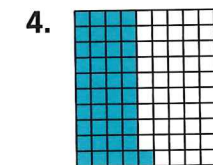
Write as a decimal and as a fraction or mixed number.



5. $3 + 0.57$



6. eight and two tenths



7. thirty-two thousandths

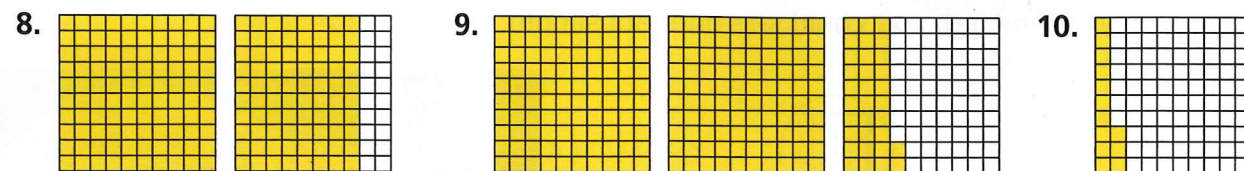


▲ The forget-me-not pollen grain is the smallest pollen grain. Its size is 0.006 mm.

LESSON CONTINUES

Practice and Problem Solving Extra Practice, page 32, Set A

Write as a decimal and as a fraction or mixed number.



11. $4 + 0.7$ 12. $10 + 7 + 0.7 + 0.01$ 13. $0.3 + 0.04$
 14. nine and six tenths 15. eighteen hundredths 16. one and six hundredths

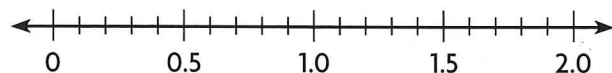
Write each decimal in expanded form and in word form.

17. 1.067 18. 11.03 19. 1.045 20. 0.1234 21. 2.9

Write in standard form.

22. eight thousandths 23. fifty-four ten-thousandths
 24. five hundredths 25. one and sixty-two thousandths

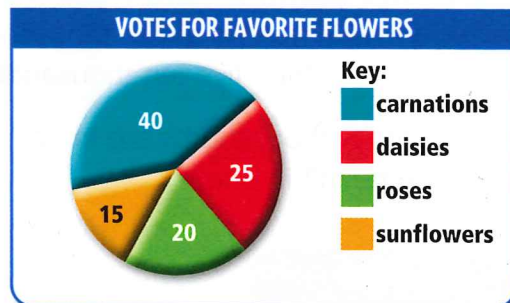
For 26–29, copy the number line below. Then locate each decimal.



26. 0.45 27. 1.8 28. 0.07 29. 1.65

USE DATA For 30–33, use the circle graph.

30. How many people voted?
 31. Mary says more than half of the voters chose daisies or sunflowers. Is Mary correct? Explain.
 32. What fraction of the people voted for daisies?
 33. Write a problem that can be solved by using the circle graph.



REASONING In 34–37, the decimal point in some of the numbers has been placed incorrectly. Write the correct decimal number for each.

34. A car usually travels on the highway at 5.05 miles per hour. 35. When Wanda was sick, her temperature was 10.15 degrees.
 36. In the fishing tournament, only fish 9 inches or longer can be kept. Joe threw back his fish because it measured 85 inches. 37. The long jump was won by Jake, whose jump measured 0.99 feet.

38. **FAST FACT • SCIENCE** One of the greatest producers of pollen is the ragweed. A plant can release 8,000,000 pollen grains in just 5 hours. How many grains can one plant release in 10 hours?

39. **Vocabulary Power** When you write a number in expanded form, you actually “unfold” the place values and show the number in more detail. Write the expanded form of 0.327.

Mixed Review and Test Prep

40. Order 3,019,531; 3,019,643; and 3,019,639 from greatest to least. (p. 10)
 41. The time is 5:25. What time will it be in 1 hour 35 minutes?
 42. $700 + 850$ 43. $1,031 - 103$
 44. **TEST PREP** How many hours are in one week?
 A 168 C 60
 B 148 D 24
 45. Write the factors of 42.
 46. How is $9,000 + 20 + 2$ written in standard form? (p. 2)
 47. 3×40 48. 10×20
 49. **TEST PREP** Which describes the number of sides of a hexagon?
 F 3 sides H 6 sides
 G 4 sides J 8 sides

Problem Solving

LINKUP... to Science

BOTANIST Botanists are scientists who study plants and trees. Sequoias are the tallest trees in the world. The tallest sequoias are as tall as 26-story buildings. The heaviest sequoias can be 10 times the weight of the world’s largest animal, the blue whale.

Giant sequoias begin life as tiny seeds. When botanists measure the very small parts of sequoias, they use decimals.

Use the Sequoia Fact Box to solve.

- Use expanded form to write the width of a sequoia cone.
- Write the length of a sequoia cone in word form.
- Write the length of a sequoia seed as a fraction.
- Use standard form to write the weight of a sequoia seed.



SEQUOIA FACT BOX	
Average length of cone	2.75 in.
Average width of cone	1.875 in.
Average weight of seed	three ten-thousandths oz
Average length of seed	0.1875 in.

Equivalent Decimals

Learn

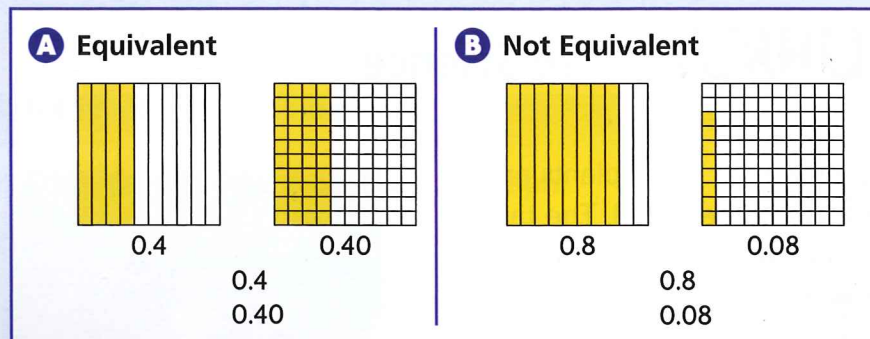
SAME BUT DIFFERENT Newborn red kangaroos, called joeys, are just 2.5 cm long. Adult red kangaroos can grow to a height of 1.6 m. Write an equivalent decimal for 1.6.

Equivalent decimals are different names for the same number or amount. These are some different ways to express the decimal 1.6 or its equivalent.

one and six tenths $1 + 0.6$ 1.60 1.600

To determine if two decimals are equivalent, draw models or line up the decimal points and compare the digits in the same place-value positions.

Examples



MATH IDEA Placing a zero to the right of the last digit of a decimal does not change the value of the decimal.

Check

1. Explain how to determine if 0.046 is equivalent to 0.0406.

Write *equivalent* or *not equivalent* to describe each pair of decimals.

2. 0.09 and 0.009 3. 3.8 and 3.80 4. 4 and 4.0 5. 7.2 and 7.02

Write an equivalent decimal for each number.

6. 5.3 7. 0.034 8. 0.1230 9. 9.030

Quick Review

Write in expanded form.

1. 3.7 2. 0.72
3. 4.908 4. 8.365
5. 13.004

VOCABULARY

equivalent decimals



▲ The red kangaroo is Australia's largest kangaroo.

Technology Link

More Practice: Harcourt Mega Math Fraction Action, *Number Line Mine*, Level M

Practice and Problem Solving

Extra Practice, page 32, Set B

Write *equivalent* or *not equivalent* to describe each pair of decimals.

10. 1.02 and 1.20 11. 6 and 6.0 12. 3.007 and 3.07
13. 7.02 and 7.020 14. 4.09 and 4.099 15. 4.008 and 4.08

Write an equivalent decimal for each number.

16. 0.03 17. 4.630 18. 0.2 19. 5.600 20. 0.83
21. 5.550 22. 7.10 23. 0.900 24. 0.103 25. 2.4

Write the two decimals that are equivalent.

26. 0.0502 27. 0.017 28. 1.00050 29. 8.01
0.00502 0.01700 1.0050 8.0010
0.05020 0.00170 1.005 8.01000

USE DATA For 30–31, use the table.

MAMMALS WITH THE LONGEST TAILS

Mammal	Tail Length (in meters)
African buffalo	1.1
African elephant	1.3
Asian elephant	1.5
Giraffe	1.1
Leopard	1.4



30. Which two animals have tails which are equivalent in length?
31. Write an equivalent decimal for the length of a leopard's tail.
32. A 0.5-pound block of cheddar cheese costs \$1.89. The Swiss cheese costs \$2.98 per pound. Which cheese is less expensive per pound? Explain.
33. The cash register showed change of \$2.50. Miko said this is two and one half dollars. Is Miko correct? Explain.
34. **What's the Error?** Jeb's batting average is .309, and Tom's is .390. Tom says they have the same average. Describe Tom's error.

35. **REASONING** Explain how to use a number line to show that 0.4 is not equivalent to 0.04.

Mixed Review and Test Prep

36. $70 + 80 + 90$
37. $320 + 110 + 440$
38. Order from greatest to least. 60,692; 605,962; 60,962 (p. 10)
39. Is $909,909 > 909,099$? Write *yes* or *no*. (p. 10)

40. **TEST PREP** Which shows three million, four hundred fifty-six thousand, four hundred thirty-two in standard form? (p. 4)

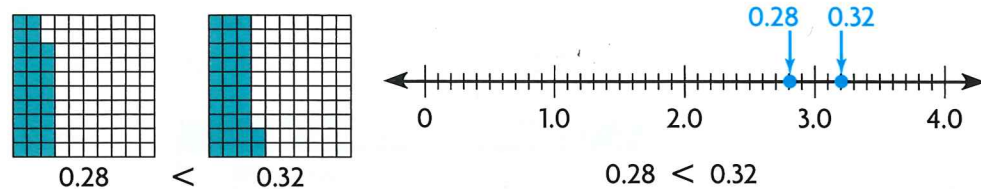
- A 3,456,423
B 3,456,432
C $3,000,000 + 400,000 + 50,000 + 6,000 + 400 + 30 + 2$
D 3,465,432

Compare and Order Decimals

Learn

FIRST PLACE! The cardinal is the most popular state bird. The seven states which have adopted the cardinal are Indiana, North Carolina, Virginia, West Virginia, Illinois, Kentucky, and Ohio. Suppose two cardinal eggs weigh 0.28 oz and 0.32 oz. Which egg is heavier?

You can use decimal models or a number line to compare decimals.



So, the egg weighing 0.32 oz is heavier.

You can also use place value to compare decimals.

Example 1 Compare 1.42 and 1.46. First, line up the decimal points. Then, compare the digits from left to right until they are different.

STEP 1	STEP 2	STEP 3
Begin at the left. Compare the ones. 1.42 ↓ same 1.46	Compare the tenths. 1.42 ↓ same 1.46	Compare the hundredths. 1.42 ↓ 6 > 2, or 2 < 6 1.46

So, $1.46 > 1.42$, or $1.42 < 1.46$.

- Show how you could use decimal models or a number line to compare 1.42 and 1.46.

Example 2 Order 2.853, 2.844, and 2.862 from least to greatest.

STEP 1	STEP 2	STEP 3
Begin at the left. Compare the ones and tenths. 2.853 ↓ ↓ same 2.844 ↓ ↓ 2.862	Compare the hundredths. 2.853 ↓ different 2.844 4 < 5 < 6 ↓ 2.862	Order the numbers. $2.844 < 2.853 < 2.862$

So, $2.844 < 2.853 < 2.862$.

Quick Review

Compare.

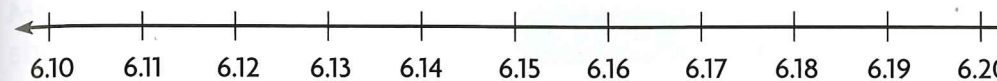
- $34 \bullet 43$
- $250 \bullet 205$
- $600 \bullet 600$
- $450 \bullet 4,500$
- $26,983 \bullet 29,683$



Check

- Explain how you can use a number line to order 1.468, 1.452, and 1.469 from least to greatest.

Write $<$, $>$, or $=$ for each \bullet . Use the number line.



- $6.152 \bullet 6.125$
- $6.14 \bullet 6.140$
- $6.114 \bullet 6.118$
- $6.3 \bullet 6.589$
- $6.170 \bullet 6.175$
- $6.176 \bullet 6.167$

Practice and Problem Solving

Extra Practice, page 32, Set C

Write $<$, $>$, or $=$ for each \bullet . You may wish to use a number line.

- $0.65 \bullet 0.63$
- $0.307 \bullet 0.037$
- $0.759 \bullet 0.769$
- $132.94 \bullet 132.48$
- $156.93 \bullet 156.98$
- $99.989 \bullet 99.998$
- $0.905 \bullet 0.905$
- $63.938 \bullet 63.939$
- $476.069 \bullet 476.096$

Order from least to greatest.

- 6.58, 6.38, 6.29, 7.08
- 13.393, 13.309, 13.339, 13.039
- 4.102, 4.105, 4.118, 4.110
- 15.259, 15.389, 15.291, 15.301

USE DATA For 21–23, use the menu.

- Write the salads in order from the least expensive to the most expensive.
- Name two items that cost more than yogurt but less than onion soup.
- NUMBER SENSE** Lisa has \$5 in her wallet. Which two soups can she buy?
- Write About It** Explain how to compare 1.23 and 1.27.

Power Lunch Menu	
	Bean Soup \$2.25
	Onion Soup \$2.95
	Tomato Soup \$2.75
	Taco Salad \$1.89
	Garden Salad \$1.80
	Fruit Salad \$1.85
	Yogurt \$1.95

Mixed Review and Test Prep

- Is 2.05 equal to 2.50? Write yes or no. (p. 26)
- Write 3.025 in word form. (p. 22)
- $1,401 - 989$
- 260×10
- TEST PREP** Which decimal is NOT equivalent to five hundred ten thousandths? (p. 26)
A 0.501 C 0.510
B 0.5100 D 0.51

Problem Solving Skill

Draw Conclusions



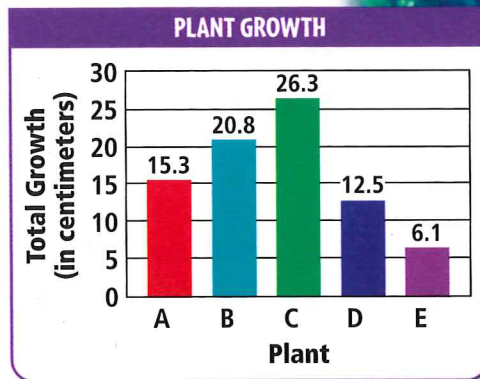
Quick Review

- 7×4
- $18 \div 6$
- $25 \div 5$
- $120 \div 12$
- $24.08 \div 10$

THINK FOR YOURSELF Sometimes you will need to analyze data to draw conclusions.

The table and the bar graph below display data about an experiment involving five plants all of the same type. You can use the data to draw conclusions.

PLANT FOOD DROPS USED	
Plant	Number of Plant Food Drops
A	1
B	5
C	9
D	13
E	17



▲ This Pacific giant kelp can grow 18 inches in one day.

ANALYZE	CONCLUSION
• Look at the graph. Which plant grew the tallest?	Plant C grew the tallest.
• Look at the table. How many drops of plant food did the tallest plant receive?	Plant C received 9 drops.
• What relationship do you notice between the number of drops of plant food and the plant's growth?	Up to 9 drops, more plant food helped the plants grow taller. With 13 and 17 drops, growth decreased.

- What conclusion can you draw about Plants A, B, and C? about Plants D and E?
- **What if** the total growth for Plant D had been 35.89 cm and for Plant E, 38 cm? What conclusion could you draw about all five plants?

Problem Solving Practice

For 1–4, can the conclusion be drawn from the information given? Write *yes* or *no*. Explain your choice.

Mrs. Carson measured the heights of her fifth graders. The shortest student is 50 inches tall, and the tallest student is 64 inches tall. There are 25 students in Mrs. Carson's class.

- All of the students are taller than 5 feet.
- The tallest student in the class is taller than 5 feet.
- All of the students are shorter than Mrs. Carson.
- The difference between the tallest student and the shortest student in the class is 14 inches.

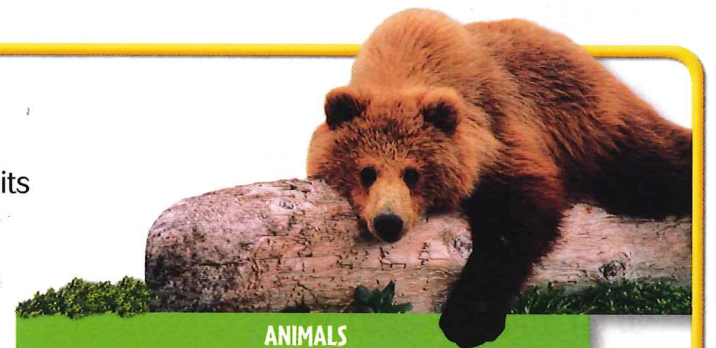
Lena thinks that the smaller box of cereal is a better buy than the larger box. The larger box has 10 servings, and the smaller box has 8 servings. The smaller box costs \$3.20, and the larger box costs \$3.90.

- Which expression describes the price per serving for the smaller box?
A $\$3.20 \times 8$
B $\$3.20 \div 20$
C $\$3.20 \div 8$
D $\$3.20 \times 20$
- What conclusion can you draw from the data?
F The smaller box costs less per serving.
G The larger box costs less per serving.
H Both boxes cost the same per serving.
J The smaller box costs twice as much per serving.

Mixed Applications

USE DATA For 7–11, use the table.

- Does the weight of the animal determine its speed? Explain.
- What's the Error?** Don says that the more an animal eats, the more it sleeps. Explain the error in Don's conclusion.
- Which animal eats the greatest amount of fruits and vegetables?
- How many hours longer does the bear sleep than the elephant? than the giraffe?
- What's the Question?** Use the data from the table. The answer is 2 times as many kilograms.



	ANIMALS		
	Elephant	Bear	Giraffe
Weight	5,450 kg	725 kg	1,180 kg
Speed	51 kph	48 kph	51 kph
Sleep per day	180 min	8 hours	240 min
Fruits and vegetables eaten per day	1.8 kg	0.9 kg	0.1 kg

1 hour = 60 minutes (min)
kph = kilometers per hour

Extra Practice

Set A (pp. 22–25)

Write in expanded form and in standard form.

- two hundred sixteen ten-thousandths
- five and five hundredths
- two and seven hundred two thousandths

Write in word form.

- 44.009
- 2.0189
- 0.8
- 0.505

Write as a decimal and as a fraction or mixed number.

- $4 + 0.07$
- $10 + 0.3 + 0.09$
- $8 + 0.8 + 0.01$

- thirteen and four hundredths
- fifty-seven hundredths

- Mike rode his bike three and four hundredths of a mile. Write this number in standard form.

Set B (pp. 26–27)

Write *equivalent* or *not equivalent* to describe each pair of decimals.

- 3.45 and 3.450
- 0.097 and 0.970
- 23.504 and 23.50

Write an equivalent decimal for each number.

- 5.2
- 9.320
- 87.0800
- 2.02

Set C (pp. 28–29)

Order from greatest to least.

- 54.453, 54.59, 54.811
- 7.564, 17.4, 11.94

Order from least to greatest.

- 31.104, 31.05, 31.94
- 6.309, 6.42, 6.341

- Leslie has \$4.68 in her pocket. Which of the following items can she buy?

Notebook	\$2.30	Box of Pencils	\$4.67
Binder	\$8.53	Markers	\$4.69

Review/Test

CHECK VOCABULARY AND CONCEPTS

Choose the best term from the box.

- A decimal or fraction that names one part of ten equal parts is one ?. (p. 22)
- If you divide one whole by 1,000, you get one ?. (p. 22)
- A decimal or fraction that names one part of 100 equal parts is one ?. (p. 22)
- The decimal 0.0016 is sixteen ?. (p. 22)

tenth
hundredth
decimal
thousandth
ten-thousandths

CHECK SKILLS

Write as a decimal and as a fraction or mixed number. (pp. 22–25)

- twenty-one and one hundredth
- seven and six tenths
- three hundred forty-nine thousandths

Write each decimal in expanded form and in word form. (pp. 22–25)

- 17.0002
- 1.002
- 13.201
- 4.076

Write *equivalent* or *not equivalent* to describe each pair of decimals. (pp. 26–27)

- 0.650 and 0.65
- 9.502 and 9.52
- 3.0040 and 3.040
- 10.01 and 10.010

Order from least to greatest. (pp. 28–29)

- 0.057; 0.56; 0.05
- 5.98; 5.908; 5.809
- 6.969; 9.696; 6.696

CHECK PROBLEM SOLVING

Solve. (pp. 30–31)

- Jim worked 5 hours last week and earned \$31.25. Sara earned \$43.75 and worked 7 hours. Latasha earned \$56.25 and worked 9 hours. Draw a conclusion about this information.
- Kerry, Stu, Beth, and Julio are in line. Kerry is first in line. Julio is between Kerry and Stu. Beth is after Stu. Beth is last in line. Draw a conclusion about where Julio stands in line.

Standardized Test Prep

★ NUMBER SENSE, CONCEPTS, AND OPERATIONS

1. Use the table to order the meats from **greatest** number of calories to **least**.

CALORIES IN MEATS	
Type (3 oz)	Calories
Ham	205
Liver	185
Ground Beef	245
Steak	240

- A liver, ham, steak, ground beef
 B ham, steak, ground beef, liver
 C steak, ham, liver, ground beef
 D ground beef, steak, ham, liver
2. The average annual precipitation in Miami is fifty-five and ninety-one hundredths inches. How is this number written in standard form?

- F 5.91
 G 50.91
 H 55.90
 J 55.91

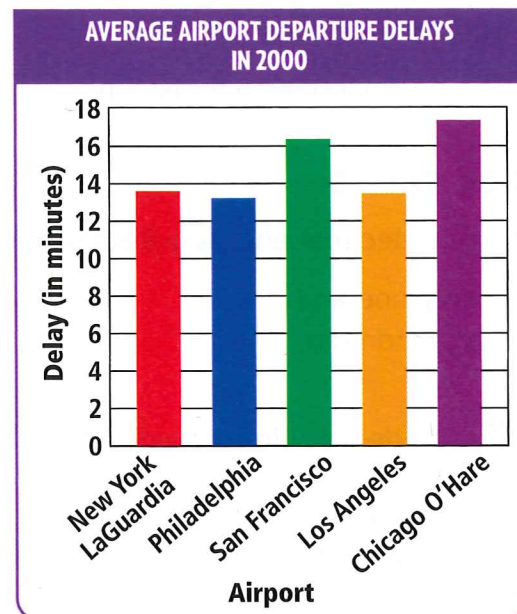
TIP Look for important words. See item 3. *Estimate* is an important word. It tells you to round the addends to estimate rather than find the exact answer.

3. **Explain It** The table shows the results of a survey. ESTIMATE to find the total number of people who have pets. Explain your estimate.

SURVEY RESULTS	
Pet	Number of People
Cat	30,482
Dog	27,407

★ DATA ANALYSIS AND PROBABILITY

4. The bar graph shows the average airport departure delays. Which airport had the shortest average departure delays in 2000?



- A New York LaGuardia
 B Philadelphia
 C Los Angeles
 D Chicago O'Hare
5. Jodi has 3 dimes, 1 quarter, and 2 pennies in her wallet. She takes one coin out. What is the probability that it is a quarter?
- F one out of six H three out of five
 G two out of six J three out of three
6. **Explain It** A spinner has 6 sections, 2 red, 2 blue, and 2 yellow. Explain how you can determine the probability of spinning red, blue, or yellow.

★ ALGEBRAIC THINKING

7. Rafael drew this geometric pattern.



Which figure did he draw next in the pattern?

- A
- B
- C
- D

8. Which is the missing number in the pattern below?

3, 7, 11, 15, ■, 23, 27

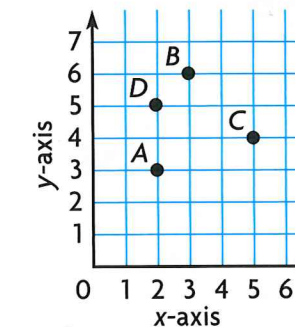
- F 15
 G 17
 H 19
 J 21

9. **Explain It** Describe the relationship between x and y in this table.

INPUT	OUTPUT
x	y
1	4
2	5
3	6
4	7
5	8

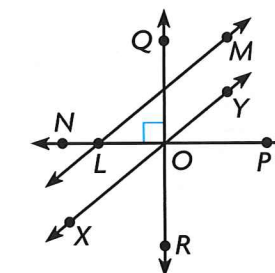
★ GEOMETRY AND SPATIAL SENSE

10. Suppose four bright stars are located at A , B , C , and D . Which is the correct location of star C ?



- A (2,5)
 B (5,4)
 C (3,6)
 D (2,3)

11. Which two lines are perpendicular?



- F \overline{NP} and \overline{QR}
 G \overline{LM} and \overline{NP}
 H \overline{QR} and \overline{XY}
 J \overline{QR} and \overline{LM}

12. **Explain It** A polygon has sides of 4 feet, 5 feet, 4 feet, 5 feet, and 6 feet. Draw and name the polygon.