• Fractions, Decimals, and Percents

Power Up

facts   Power Up C

equivalent fractions   The following fractions are equal to one half: $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$. Read the fractions aloud and continue the pattern to $\frac{12}{24}$.

mental math

    a. **Number Sense:** Is 2736 divisible by 4?

    b. **Number Sense:** Is 3726 divisible by 4?

    c. **Number Sense:** $\frac{1}{3}$ of 10

    d. **Number Sense:** $\frac{1}{3}$ of 100

    e. **Geometry:** Each side of the square is $2\frac{1}{2}$ inches long. What is the perimeter of the square?

    f. **Time:** How many seconds is 10 minutes 25 seconds?

    g. **Probability:** A spinner is divided into five equal-sized sectors labeled A, B, C, D, and E. With one spin, what is the probability of the spinner landing on A or B?

    h. **Calculation:** $\sqrt{25}$, $+ 3$, $\times 4$, $+ 1$, $\div 3$

problem solving   Choose an appropriate problem-solving strategy to solve this problem. Isaac erased some digits in a multiplication problem and gave it to Albert as a problem-solving exercise. Copy Isaac's multiplication problem and find the missing digits for Albert.

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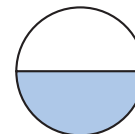
New Concept

Fractions, decimals, and percents are three ways to name part of a whole.

$\frac{1}{2}$ of the circle is shaded.

0.5 of the circle is shaded.

50% of the circle is shaded.

Fractions, decimals, and percents have numerators and denominators. The denominator might not be obvious.

$\frac{1}{2}$ ⟵ The denominator of a fraction can be any number other than zero and is expressed in the fraction.

0.$\underline{5}$ ⟵ The denominator of a decimal number is a number from the sequence 10, 100, 1000, ... The denominator is indicated by the number of digits to the right of the decimal point.

50% ⟵ The denominator of a percent is always 100 and is indicated by the word *percent* or by a percent sign.

To write a decimal or a percent as a fraction, we must express the denominator.

$$0.5 \text{ equals } \frac{5}{10} \qquad 50\% \text{ equals } \frac{50}{100}$$

Notice that both $\frac{50}{100}$ and $\frac{5}{10}$ equal $\frac{1}{2}$.

Example

The fraction manipulative for $\frac{1}{10}$ has 10% and 0.1 printed on it. Change these two numbers into fractions.

We can write a percent as a fraction by replacing the percent sign with a denominator of 100.

$$10\% = \frac{10}{100}$$

A decimal number with one decimal place has a denominator of 10.

$$0.1 = \frac{1}{10}$$

The example above refers to the manipulatives we used in Investigations 2 and 3 that have fractions, percents, and decimals printed on them. Here we show the numbers that are printed on the different pieces:
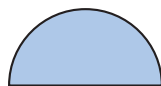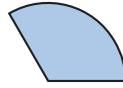
$\frac{1}{2}$, 50%, 0.5 $\frac{1}{4}$, 25%, 0.25 $\frac{1}{10}$, 10%, 0.1

$\frac{1}{3}$, $33\frac{1}{3}$%, $0.\overline{3}$ $\frac{1}{5}$, 20%, 0.2 $\frac{1}{8}$, $12\frac{1}{2}$%, 0.125

Activity 1

Using Fractions and Decimals

Model Use your fraction manipulatives or refer to the figures above to answer these questions:

1. If you fit three $\frac{1}{10}$ pieces together $\left(\frac{1}{10} + \frac{1}{10} + \frac{1}{10}\right)$, you have

   a. what fraction of a circle?

   b. what decimal part of a circle?

   c. greater or less than one half?

2. If you fit three $\frac{1}{5}$ pieces together $\left(\frac{1}{5} + \frac{1}{5} + \frac{1}{5}\right)$, you have

   a. what fraction of a circle?

   b. what decimal part of a circle?

   c. greater or less than one half?

3. If you fit five $\frac{1}{8}$ pieces together $\left(\frac{5}{8}\right)$ and you take away $\frac{1}{4}$, you have

   a. what fraction of a circle?

   b. what decimal part of a circle?

   c. greater or less than one half?

Model Compare. You may use your fraction manipulatives to answer each question.

4. $\frac{8}{10} - \frac{4}{10}$ ◯ 0.5   5. $\frac{1}{4} + \frac{1}{4}$ ◯ $\frac{1}{2}$

6. 0.75 ◯ 0.25 + 0.25

7. 0.70 − 0.10 ◯ 0.5

8. $\frac{3}{10} + \frac{2}{10}$ ◯ 0.5   9. $\frac{10}{10}$ ◯ 1.0

10. three fourths − one fourth ◯ one third

11. one ◯ two thirds + one third

Activity 2

Writing Fractions, Decimals, and Percents

Model Use your fraction manipulatives or refer to the figures in the example to answer these questions:

1. If you fit three $\frac{1}{4}$ pieces together $(\frac{1}{4} + \frac{1}{4} + \frac{1}{4})$, you have

   a. what fraction of a circle?

   b. what percent of a circle?

   c. what decimal part of a circle?

2. If you fit two $\frac{1}{5}$ pieces and one $\frac{1}{10}$ piece together $(\frac{1}{5} + \frac{1}{5} + \frac{1}{10})$, you have

   a. what fraction of a circle?

   b. what percent of a circle?

   c. what decimal part of a circle?

3. a. If you divide 100 by 3, what mixed number is the quotient?

   b. What percent is printed on the $\frac{1}{3}$ fraction manipulative?

4. a. If you divide 1,000,000 by 3, what digit repeats in the quotient?

   b. What decimal number is written on the $\frac{1}{3}$ fraction manipulative?

   c. What is unusual about the way the number is printed?

5. a. If you divide 1000 by 8, what is the quotient?

   b. What decimal number is printed on the $\frac{1}{8}$ fraction manipulative?

   c. What percent is printed on the $\frac{1}{8}$ fraction manipulative?

Model Compare. You may use your fraction manipulatives to answer each problem.

6. 0.125 ◯ 0.2

7. 0.25 ◯ 0.$\overline{3}$

8. 0.5 ◯ 0.25 + 0.25

9. 50% ◯ 33$\frac{1}{3}$%

10. 12$\frac{1}{2}$% ◯ 20%

11. $\frac{1}{4}$ + 0.5 ◯ 0.75

Lesson Practice

Model Use your fraction manipulatives to solve problems **a–d.**

a. Draw a circle and shade 25% of it. What decimal part of the circle did you shade?

b. The fraction manipulative for $\frac{1}{5}$ has the numbers 20% and 0.2 printed on it. Write both 20% and 0.2 as fractions.

c. This square is divided into 100 equal parts, and 33 parts are shaded. Write the shaded portion as a fraction, as a percent, and as a decimal.
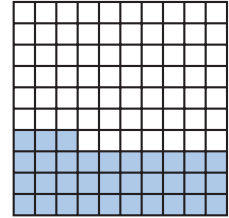
d. **Analyze** Refer to the figure in problem **c** to complete this comparison and to answer the question that follows.

Compare: $\frac{1}{3}$ ◯ 0.33

Explain How did you determine the comparison?

Written Practice *Distributed and Integrated*

*1. What is the total cost of a $7.98 notebook that has 49¢ tax?
(11, 70)

2. In Room 7 there are 6 rows of desks with 5 desks in each row. There are 4 books in each desk. How many books are in all the desks?
(49)

*3. **Analyze** This year, Martin is twice as old as his sister. If Martin is 12 years old now, how old will his sister be next year? Explain how you found your answer.
(49)

4. Silviano saves half-dollars in a coin holder. How many half-dollars does it take to total $5?
(46)

5. **Analyze** Louisa put her nickel collection into rolls that hold 40 nickels each. She filled 15 rolls and had 7 nickels left over. Altogether, how many nickels did Louisa have?
(49)

6. **List** The number 7 has how many different factors? What are they?
(25)

*7. Multiple Choice Which of these fractions is *not* equal to $\frac{1}{2}$?
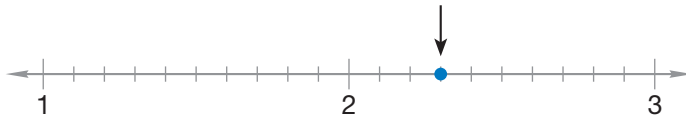(23)

    A $\frac{6}{12}$ **B** $\frac{7}{15}$ **C** $\frac{8}{16}$ **D** $\frac{9}{18}$

8. Allison can swim 50 meters in half a minute. Amy can swim 50 meters
(69) in 28.72 seconds. Which of the two girls can swim faster? Explain how you know.

*9. (Connect) Use a mixed number and a decimal number to name the
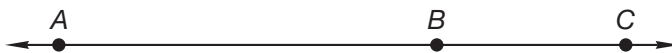(66) point on this number line marked by the arrow.

*10. Which digit in 1.234 is in the thousandths place?
(68)

*11. (Represent) Use digits to write the decimal number ten and one
(68) tenth.

12. How many cents is $\frac{4}{5}$ of a dollar?
(Inv. 3)

13. Segment AB measures 50 millimeters. The length of $\overline{BC}$ is half the length of $\overline{AB}$.
(61) How long is $\overline{AC}$?

*14. Compare: 12.3 $\bigcirc$ 12.30
(69)

15. $5.37   **16.** $60.10   **17.** $9.84
(13) $8.95   (13) $-$ $48.37   (56) $\times$ 150
      $0.71
   $+$ $0.39

18. $1.75 + 36¢ = $ _____   **19.** $1.15 $-$ $0.80 = _____ ¢
(70)   (70)

20. 40 $\times$ 76¢   **21.** $39.00 $\div$ 50
(70)   (54)

22. $\frac{13}{100} + \frac{14}{100}$ **23.** $7 - \left(6\frac{3}{5} - 1\frac{1}{5}\right)$
(41)   (41, 63)

* 24. Addison and her two friends started a babysitting service. The girls
(Inv. 4) agreed that they would all save part of their earnings so that they could
buy toys and supplies for the kids they babysit. The function table
below shows how much they earned and how much they had left after
setting aside their savings.

Total Amount Earned	Earnings Left After Savings
$12	$10
$9	$7
$8	$6

a. (**Generalize**) The babysitters are using what rule to decide how
much of their earnings they should save?

b. (**Predict**) If Addison earned $21 at her last babysitting job, how
much will she have after putting aside her savings?

* 25. The sign showed that lemonade was offered for 0.20¢ per glass. Show
(70) two ways to correct the money amount shown on the sign.

* 26. (**Conclude**) Is the sequence below arithmetic or geometric? What are
(Inv. 4) the next two terms?

$$1, 3, 9, 27, \underline{\quad}, \underline{\quad}, \ldots$$

27. A bag contains 3 red marbles, 4 yellow marbles, 2 purple marbles, and
(57) 1 green marble. Ali selects one marble without looking.

a. Find the probability that the marble is yellow.

b. Find the probability that the marble is not yellow.

* 28. (**Analyze**) The fraction $\frac{2}{5}$ is equivalent to 0.4 and to 40%. Write 0.4 and
(71) 40% as unreduced fractions.

29. What are the names for a parallelogram that also has perpendicular
(45) sides?

30. (**Estimate**) England has had many rulers throughout its long history.
(33) For example, Henry VI reigned from 1422 to 1461. Explain how to use
rounding to estimate the length of Henry VI's reign.

• Area, Part 1

Power Up

facts   Power Up D

mental math

a. **Time:** How many minutes is $2\frac{1}{2}$ hours?

b. **Estimation:** Which is the more reasonable estimate for the height of a flagpole, 6 km or 6 m?

c. **Number Sense:** Is 5172 divisible by 4?

d. **Percent:** 10% of 250

e. **Fractional Parts:** How much is $\frac{1}{2}$ of 12? … $\frac{1}{3}$ of 12? … $\frac{1}{4}$ of 12?

f. **Money:** Peter purchased a sandwich for $3.25, a bag of pretzels for $1.05, and a juice for $1.20. What was the total cost?

g. **Geometry:** If each side of a hexagon is 4 inches long, what is the perimeter of the hexagon? Express your answer in feet.

h. **Calculation:** $\sqrt{36}$, + 1, × 7, + 1, ÷ 5, − 2, ÷ 2

problem solving

Choose an appropriate problem-solving strategy to solve this problem. Triangles *A* and *B* are congruent. Triangle *A* was "flipped" to the right to form triangle *B*. Suppose triangle *B* is flipped down to form triangle *C.* Draw triangles *A, B,* and *C.*

Now suppose that the triangle *C* you drew is flipped to the left to form triangle *D.* Draw triangle *D.*

If you look at the edges of your classroom where the floor and walls meet, you might see a strip of molding or baseboard that runs all the way around the room except at the doorways. That molding illustrates the perimeter of the floor of the room. If you were to buy molding at a store, you would buy a length of it and pay for it by the foot or yard.
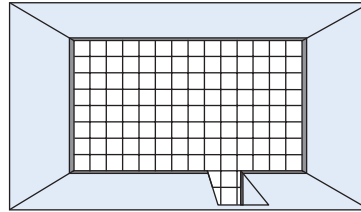
The floor of the room might be covered by tile. That tile illustrates the **area** of the floor. Area is not a length; it is an amount of surface. If you were to buy tile or carpet at a store, you would buy a box or roll of it and pay for it by the square foot or square yard.

A square tile illustrates the units we use to measure area. Many floor tiles are squares with sides one foot long. Each of these tiles is one square foot; that is, each tile would cover one square foot of the area of a room's floor. By counting the number of one-square-foot tiles on the floor, you can determine the area of the room in square feet.

1 ft

1 ft   1 ft

1 ft
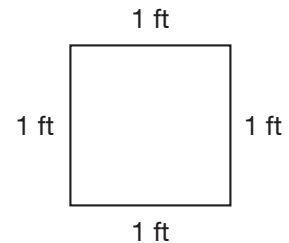
Example 1

In a classroom the floor was the shape of a rectangle and was covered with one-square-foot tiles. The room was 30 tiles long and 25 tiles wide. What was the area of the floor?

30 tiles

25 tiles
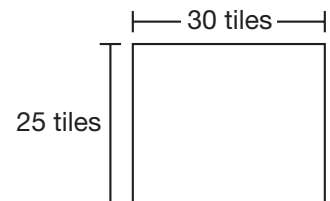
By finding the number of tiles, we will find the area of the room. To find the number of tiles in 25 rows of 30 tiles, we multiply.

$$30 \times 25 = 750$$

There are 750 tiles. Since each tile is one square foot, the area of the floor is **750 square feet.**

Verify Why is the answer labeled "square feet" instead of "feet"?

The areas of rooms, houses, and other buildings are usually measured in square feet. Expanses of land may be measured in acres or square miles (one square mile equals 640 acres). Smaller areas may be measured in **square inches** or **square centimeters.**

A square that has sides 1 centimeter long is called a *square centimeter.* The square at right is the actual size of a square centimeter.

1 cm
1 cm   1 cm
1 cm
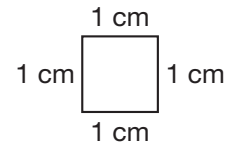
A square that has sides 1 inch long is called a *square inch.* The square below is the actual size of a square inch.

1 in.
1 in.   1 in.
1 in.
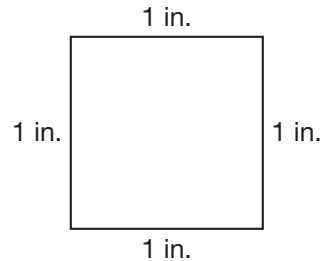
Activity

Using Area Models

Materials needed:
- ruler
- yardstick
- scissors
- newpaper

Model Use newspaper to make a model of a square foot and a square yard.

How many feet are equivalent to one yard?

How many square feet are equivalent to one square yard?

The area of a rectangle may be calculated by multiplying the length of the rectangle by its width. So a **formula** for finding the area of a rectangle is

$$A = l \times w$$

Example 2

Math Language

Dimensions are the perpendicular measures of a figure. Length and width are the dimensions of a rectangle.

Use your ruler to measure the rectangle. How many square centimeters are needed to cover the area of this rectangle?

The length of the rectangle is 3 centimeters, so we can fit 3 square centimeters along the length. The width is 2 centimeters, so we can fit 2 square centimeters along the width. Two rows of three means that the area can be covered with **6 square centimeters.**

2 cm

3 cm
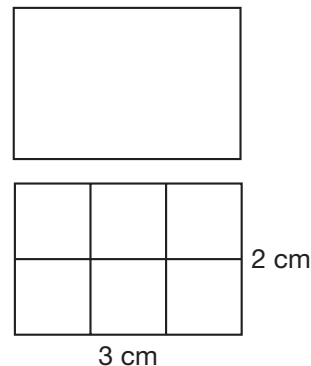
Example 3

Thinking Skill

Discuss

Why do we use 6 inches as the halfway number for rounding up or down?

Use a formula to estimate the area of a room that is 14 ft 3 in. long and 12 ft 8 in. wide. When finding the area of the room, what type of unit will be used to find the answer?

To estimate the area, we round the length and width to the nearest foot and then multiply the rounded measures. If the inch part of the measure is 6 inches or more, we round up to the next foot. If the inch part is less than 6 inches, we round down. So 14 ft 3 in. rounds to 14 ft, and 12 ft 8 in. rounds up to 13 ft.
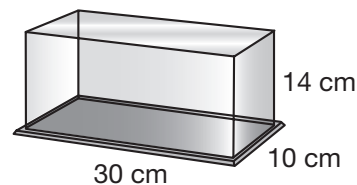
$$A = l \times w$$
$$A = 14 \text{ ft} \times 13 \text{ ft}$$
$$A = 182$$

We know the area is measured in **square feet.** The area of the room is **182 sq. ft.**

Example 4

Maggie has a display case for a model car. The case is 30 cm long, 10 cm wide, and 14 cm high.

14 cm
30 cm
10 cm

a. Maggie wants to paint the ends of the case. Choose a formula and use it to determine the area of the ends she wants to paint.

b. Maggie also wants to glue a ribbon border around the top of the case. The ribbon is purchased in millimeters. Choose a formula and use it to determine the least length of ribbon she will need.

a. The 10 cm by 14 cm ends of the case are rectangles. We find the area of one end and then double the answer for both ends.

$$A = lw$$
$$A = 10 \text{ cm} \times 14 \text{ cm}$$
$$A = 140 \text{ sq. cm}$$
$$2 \times 140 \text{ sq. cm} = \textbf{280 sq. cm}$$

b. The ribbon wraps around the perimeter of the top of the case. We find the perimeter in centimeters and then multiply by 10 to convert to millimeters.
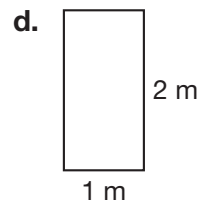
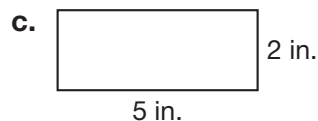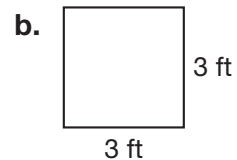$$P = 2l + 2w$$
$$P = 2(30 \text{ cm}) + 2(10 \text{ cm})$$
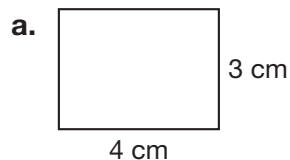$$P = 60 \text{ cm} + 20 \text{ cm}$$
$$P = 80 \text{ cm}$$
$$10 \times 80 \text{ cm} = \textbf{800 mm}$$

Lesson Practice

For problems **a–d,** find the area by drawing each rectangle on your paper and showing the square units inside. Then count the units.

a.
3 cm
4 cm

b.
3 ft
3 ft

c.
2 in.
5 in.

d.
2 m
1 m

Use the information below to answer problems **e–g.**

Lola's bedroom is 10 feet wide and 12 feet long.

e. What is the perimeter of Lola's bedroom?

f. What unit would you use to indicate the area of Lola's room: square feet or cubic feet?

g. What is the area of Lola's bedroom?

h. (**Model**) As a class, calculate the area of the classroom floor. Round the length and width of the room to the nearest foot to perform the calculation.

Written Practice
Distributed and Integrated

1. Demetrius bought a dozen juice boxes for 40¢ each. What was the total
(21, 70) cost of the juice boxes? Write an equation and find the answer.

2. (**Formulate**) The total cost of 4 boxes of crayons was $10.00. If each
(21) box was the same price, what was the price per box? Write an equation and find the answer.

*3. (**Conclude**) Write the next three terms of this sequence:
(Inv. 4)

$$4, 5, 8, 9, 12, 13, \underline{\quad}, \underline{\quad}, \underline{\quad}, \ldots$$

*4. Lauryn has read $\frac{1}{3}$ of a 240-page book. How many pages does she still
(60, 71) have to read to finish the book? What percent of the book does she still have to read?

5. One meter equals 100 centimeters. Five meters equals how many
(21) centimeters?

*6. (**Represent**) Name the decimal number 12.25 with words.
(68)

7. Write a fraction that shows how many twelfths equal one half.
(23)

8. (**List**) Write the factors of 16.
(25)

*9. **(Represent)** Leroy ran 100 meters in ten and twelve hundredths
(58) seconds. Use digits to write Leroy's race time.

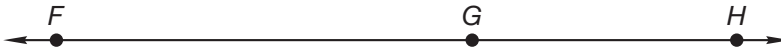***10.** Which digit in 436.2 is in the ones place?
(68)

11. Write the quotient as a mixed number: $\dfrac{100}{3}$
(58)

12. Segment FH measures 90 millimeters. If $\overline{GH}$ is 35 millimeters, then how
(61) long is $\overline{FG}$?

F   G   H

*13. $10.35 + $5.18 + 8¢ + $11 + 97¢
(13, 70)

*14. $80.00   ***15.** $4.97   ***16.**   375
(13) $\underline{-\ \$72.47}$ (17) $\underline{\times\qquad 6}$ (55) $\underline{\times\ 548}$

*17. $7\overline{)\$40.53}$ ***18.** $60\overline{)5340}$ **19.** $30m = 6000$
(26)   (54)   (26, 54)

20. $3\dfrac{3}{8} + 1\dfrac{1}{8} + 4\dfrac{4}{8}$ ***21.** $7\dfrac{3}{4} - \left(5 - 1\dfrac{1}{4}\right)$
(59)   (41, 63)

22. Compare: $55.5 \bigcirc 5.55$
(69)

23. $4\dfrac{1}{10} + 5\dfrac{1}{10} + 10\dfrac{1}{10}$ ***24.** $10 - \left(4 + 1\dfrac{1}{8}\right)$
(41)   (43, 63)

25. **(Analyze)** This rectangle is half as wide as it is long. What is the
(44, 53) perimeter of the rectangle in millimeters?

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│                     │
│                     │
│                     │
└─────────────────────┘
 ╓╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╥╖
 cm  1   2   3   4   5
```
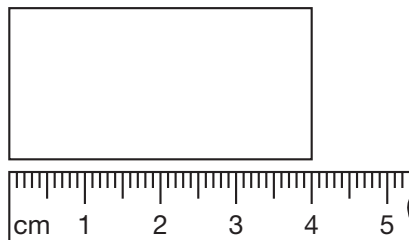
*26. What is the area of the rectangle in problem **25** in square centimeters?
(72)

*27. **Represent** Draw a spinner with four sectors labeled A, B, C, and D.
(57) Your spinner should show that the probability of outcome A is $\frac{1}{2}$, the
probability of outcome B is $\frac{1}{4}$, and the probabilities of outcomes C and
D are equally likely.

28. **Represent** The average amount of precipitation received each year in
(Inv. 7) each of five cities is shown in the table. Choose an appropriate graph
for displaying the data, and then graph the data.

Average Annual Precipitation

City and State	Amount (to the nearest inch)
Albuquerque, NM	9
Barrow, AK	4
Helena, MT	11
Lander, WY	13
Reno, NV	7

*29. Use the chart to solve parts **a–c.**
(48, 62)

a. **Estimate** Bradley mentally kept track of his grocery
purchases. As he placed each item in the cart, he
rounded the item's price to the nearest dollar and then
added the rounded amount to the total. Use Bradley's
method to estimate the total cost of these seven items.

milk	2.59
bread	2.39
cereal	4.89
juice	2.39
vitamins	11.89
eggs	1.99
butter	2.29

b. **Explain** Bradley does not want to spend much more
than $30 on groceries. He mentally keeps a running total
of his purchases. Does Bradley's calculation need to be
exact, or is an estimate acceptable?

c. At the check-out line, the clerk scans Bradley's purchases and
calculates the total cost of the items. Does the clerk's calculation
need to be exact, or is an estimate acceptable?

30. The first commuter train of the morning stops at Jefferson Station at
(28) 5:52 a.m. The second train stops at 6:16 a.m. How many minutes after
the first train arrives does the second train arrive?

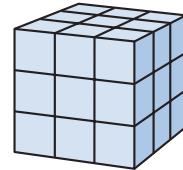# • Adding and Subtracting Decimal Numbers

Power Up

facts   Power Up F

mental math   **a. Measurement:** How many inches is $2\frac{1}{2}$ feet?

b. Geometry: What is the area of a square that is 3 inches on each side?

c. Number Sense: $124 \div 4$

d. Number Sense: $412 \div 4$

e. Number Sense: $1 - \frac{7}{10}$

f. Fractional Parts: One third of 22 is $7\frac{1}{3}$. How much is $\frac{1}{3}$ of 23? … $\frac{1}{3}$ of 25?

g. Probability: Karl has a $1 bill, a $5 bill, and a $10 bill in his wallet. He does not know the order the bills are in. If Karl pulls one bill out of the wallet without looking, what is the probability it will *not* be a $1 bill?

h. Calculation: $\sqrt{64}$, $\div 2$, $\times 3$, $\div 2$, $\times 4$, $\div 3$

problem solving   Choose an appropriate problem-solving strategy to solve this problem. Abdul stacked some small cubes together to form this larger cube. How many small cubes did Abdul stack together? Explain how you arrived at your answer.

Recall that when we add or subtract money, we write the numbers so that the decimal points are vertically aligned. This way we are sure to add digits with the same place value. We insert the decimal point in the answer and align it with the other decimal points, as shown here:

$$
\begin{array}{r}
\$3.45 \\
+\ \$1.25 \\
\hline
\$4.70
\end{array}
\qquad
\begin{array}{r}
\$3.45 \\
-\ \$1.25 \\
\hline
\$2.20
\end{array}
$$

We use the same procedure to add or subtract any decimal numbers. We keep the decimal points in line. This way, we add or subtract digits with the same place value. The decimal points stay in a straight line, as shown here:

$$
\begin{array}{r}
2 \,.\, 4 \\
+\ 1 \,.\, 3 \\
\hline
3 \,.\, 7
\end{array}
\qquad
\begin{array}{r}
2 \,.\, 4 \\
-\ 1 \,.\, 3 \\
\hline
1 \,.\, 1
\end{array}
$$

Example 1

Find the perimeter of the triangle at right. Units are in centimeters.

We keep the decimal points aligned in the problem and answer. We add the digits column by column, just as we would add whole numbers or money.

Justify Why is the answer labeled centimeters and not square centimeters?

$$
\begin{array}{r}
4.3\ \text{cm} \\
12.5\ \text{cm} \\
+\ \ 7.6\ \text{cm} \\
\hline
\mathbf{24.4\ cm}
\end{array}
$$
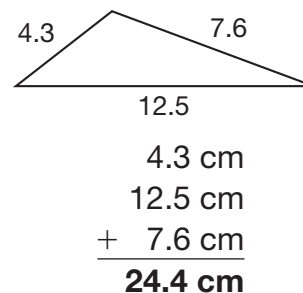
To add or subtract decimal numbers with different numbers of decimal places, we align the decimal points, not the last digits.

Example 2

The roof was 6.37 meters above the ground. The ladder could reach only 4.2 meters. The roof was how much higher than the ladder could reach?

This is a problem about comparing, which we solve by subtracting. As we saw in Lesson 70, we may attach zeros to the end of a decimal number without changing the value of the number. We attach a zero to 4.2 so that there are no empty places in the problem. Then we subtract.

$$
\begin{array}{r}
6.37\ \text{m} \\
-\ 4.20\ \text{m} \\
\hline
\mathbf{2.17\ m}
\end{array}
$$

Example 3

From the beginning of the trail to Hogee Camp is 3.45 miles. From Hogee Camp to the summit is 6.7 miles. How far is it from the beginning of the trail to the summit?

To find the total distance, we add 3.45 mi and 6.7 mi. We line up the decimal points vertically so that we add digits with the same place value. From the beginning of the trail to the summit is **10.15 mi.**

$$\begin{array}{r} 3.45 \\ +6.7 \\ \hline \mathbf{10.15} \end{array}$$

Think about the meaning of each decimal number to be sure your answers are reasonable. In Example 3, 3.45 is more than 3 but less than 4, and 6.7 is more than 6 but less than 7. So the sum should be more than 3 + 6 but less than 4 + 7.

Example 4

A garden snail is moving a distance of 14.63 feet, and moves at a rate of about 2 feet in 1 minute. The snail has already moved 8.71 feet. Estimate the length of time it will take the snail to move the remainder of the distance.

We can use compatible numbers to estimate about how far the snail still has to move. Looking at the two given numbers, we could think of 8.71 feet as close to 8.63 feet (just as $8.71 is close to $8.63). Since 14.63 ft − 8.63 ft = 6 ft, it will take the snail **about 3 minutes** at 2 ft per minute to move the remaining distance.

Lesson Practice Add:

a.
$$\begin{array}{r} 3.4 \\ 6.7 \\ +\ 11.3 \\ \hline \end{array}$$

b.
$$\begin{array}{r} 4.63 \\ 2.5 \\ +\ 0.46 \\ \hline \end{array}$$

c.
$$\begin{array}{r} 9.62 \\ 12.5 \\ +\ 3.7 \\ \hline \end{array}$$

Subtract:

d.
$$\begin{array}{r} 3.64 \\ -\ 1.46 \\ \hline \end{array}$$

e.
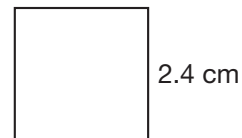$$\begin{array}{r} 5.37 \\ -\ 1.6 \\ \hline \end{array}$$

f.
$$\begin{array}{r} 0.436 \\ -\ 0.2 \\ \hline \end{array}$$

Line up the decimal points and solve. Show your work.

g. 4.2 + 2.65

h. 6.75 − 4.5

i. Estimate the perimeter of this square:

2.4 cm

j. The distance from Rodrigo's house to school is 0.8 mile. How far does Rodrigo travel going from his house to school and back again?

Written Practice   *Distributed and Integrated*

*1. Manish bought a sheet of 39¢ stamps. The sheet had 5 rows of
(49, 70) stamps with 8 stamps in each row. How much did the sheet of stamps cost?

2. **Analyze** Ling is half the age of her brother, but she is 2 years older
(24, 49) than her sister. If Ling's brother is 18 years old, how old is her sister? Write one equation to solve this problem.

*3. Carrie was asked to run to the fence and back. It took her 33.4 seconds
(73) to run to the fence and 40.9 seconds to run back. How many seconds did the whole trip take?

*4. The classroom floor is covered with one-foot-square tiles.
(72) There are 30 rows of tiles with 40 tiles in each row.

40 ft

30 ft

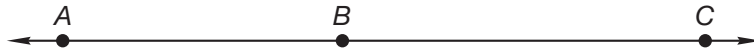   **a.** How many tiles cover the floor?

   **b.** What is the area of the floor?
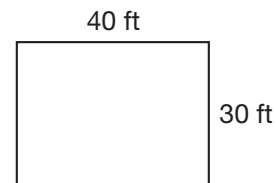
*5. **Represent** Draw two circles. Shade $\frac{2}{8}$ of one circle
(37, 71) and $\frac{1}{4}$ of the other circle. What percent of each circle is shaded?

*6. What fraction is equal to one half of one fourth?
(Inv. 3)

*7. The length of $\overline{AC}$ is 8.5 centimeters. If $\overline{AB}$ is 3.7 centimeters, then how
(61, 73)   long is $\overline{BC}$?

A   B   C

*8. What is the length of this rectangle to the nearest tenth of a centimeter?
(66, 68)   Use words to write the answer.

cm   1   2   3
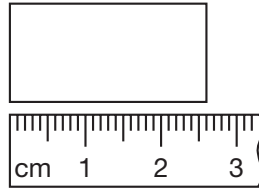
9. **List** Which numbers are factors of both 16 and 20?
(25)

10. Three times a number y can be written $3y$. If $3y = 12$, then what number
(18)   does $2y$ equal?

11. Compare: 12.0 ◯ 1.20
(69)

*12.   53.46
(73) $-\ \ 5.7$

*13. $6.48
(17) $\times\ \ \ \ \ 9$

*14. $4.5 + 6.75$
(73)

*15. $5 - 5¢$
(70)

*16. $5\overline{)\$8.60}$
(26)

*17. $20\overline{)\$8.60}$
(54)

18.   378
(55) $\times\ 296$

19.   800
(29) $\times\ 500$

20. $30w = 9870$
(26, 54)

21. $12 + 1\frac{1}{2}$
(43)

22. $12 - 1\frac{1}{2}$
(63)

23. $\frac{49}{99} + \frac{49}{99}$
(41)

*24. Use this information to answer parts **a** and **b:**
(59)

> *Morgan did yard work on Saturday. He worked for $2\frac{1}{2}$ hours in the morning and $1\frac{1}{2}$ hours in the afternoon. Morgan's parents paid him $5.50 for every hour he worked.*

   a. How many hours did Morgan work in all?

   b. ✏️ **Explain** How much money was Morgan paid in all? Explain how you found your answer.

*25. **Interpret** Thirty-nine girls were asked to choose their favorite form of exercise. Use the frequency table below to answer parts **a** and **b.**
(Inv. 5)

   a. What fraction of the girls chose swimming?

   b. What fraction of the girls chose an exercise other than bicycle riding or roller-skating?

Type of Exercise	Frequency
Bicycle riding	5
Roller-skating	7
Soccer	6
Swimming	10
Walking	5
Basketball	2
Aerobics	4

26. Each side of a square on the playground was 10 ft 3 in. long. Estimate the area of the square.
(72)

10 ft 3 in.
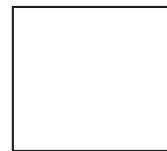
27. The bill for dinner was $14.85. Jenna wanted to leave a tip of about $\frac{1}{5}$ of the bill. So she rounded $14.85 to the nearest dollar and found $\frac{1}{5}$ of the rounded amount. How much did Jenna leave as a tip?
(Inv. 3, 62)

28. **Represent** Draw a rhombus that has a right angle.
(45)

*29. Chandi ran in the Chicago Marathon and finished the race in 3 hours
(28) 32 minutes 44 seconds. If she began the race at 7:59:10 a.m., what
time did she finish the race?

*30. The table shows the temperatures that a number
(Inv. 6) of students recorded at various times on Monday.
Sketch a line graph to display the data.

Hourly Temperatures on Monday

Time	Temperature (°F)
8:00 a.m.	64
9:00 a.m.	65
10:00 a.m.	67
11:00 a.m.	69
12:00 p.m.	72
1:00 p.m.	76
2:00 p.m.	80
3:00 p.m.	85

Early Finishers

Real-World Connection

Mr. Griffin is building a doghouse. He has a board that is 2.75 feet long
and another board that is 2.5 feet long.

a. Draw a number line to show which piece is longer. Explain.

b. Add two lengths to find the combined length of Mr. Griffin's
boards.

• Units of Length

Power Up

facts	Power Up G
mental math	**a.** **Money:** How many cents are in two and a half dollars?
	b. **Measurement:** The low temperature was 55°. The high temperature was 81°. What is the difference between the low and high temperatures?
	c. **Probability:** If one card is drawn from a full deck of 52 cards, what is the probability it will be a "heart"?
	d. **Percent:** 10% of 360 seconds
	e. **Fractional Parts:** $\frac{1}{3}$ of 360 seconds
	f. **Number Sense:** $3\frac{1}{3} + 1\frac{2}{3}$
	g. **Time:** 2 days 2 hours is how many hours?
	h. **Calculation:** $\sqrt{49}$, $+3$, $\times 10$, -1, $\div 9$, -1, $\div 10$
problem solving	Choose an appropriate problem-solving strategy to solve this problem. It takes Orlando about 5 minutes to walk around the block. He takes about 600 steps from start to finish. Orlando travels about 15 feet in 6 steps. About how many feet does Orlando travel when he walks around the block? Explain how you arrived at your answer.

New Concept

The table on the following page lists some common units of length used in the metric system and in the U.S. Customary System. Some units of length used in the metric system are millimeters (mm), centimeters (cm), meters (m), and kilometers (km). Some units of length used in the U.S. Customary System are inches (in.), feet (ft), yards (yd), and miles (mi). The table on the next page also shows equivalencies between units of length.

Units of Length

U.S. Customary System	Metric System
12 in. = 1 ft	10 mm = 1 cm
3 ft = 1 yd	1000 mm = 1 m
5280 ft = 1 mi	100 cm = 1 m
1760 yd = 1 mi	1000 m = 1 km
A meter is about 3 inches longer than a yard.	

Estimate A **kilometer** is about $\frac{3}{5}$ of a mile. Estimate the number of feet in a kilometer. Explain how you found your answer.
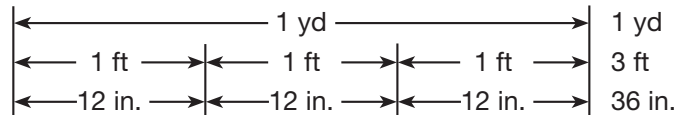
Example 1

One player on the basketball team is 197 centimeters tall. About how many meters tall is the basketball player?

The chart shows that 100 centimeters equals 1 meter. The prefix *cent-* can help us remember this fact because there are 100 cents in 1 dollar. Since 197 centimeters is nearly 200 centimeters, the height of the basketball player is about **2 meters.**

Example 2

Two yards is the same length as how many inches?

The table below shows that 1 yard equals 3 feet and that each foot equals 12 inches.

←————— 1 yd —————→			1 yd
← 1 ft →	← 1 ft →	← 1 ft →	3 ft
←—12 in.—→	←—12 in.—→	←—12 in.—→	36 in.

Thus, 1 yard equals 36 inches. Two yards is twice that amount. So two yards equals **72 inches.**

Example 3

A marathon is 26 miles 385 yards. Leon's goal is to finish under 3 hours. To do so, Leon needs to run about how many miles each hour?
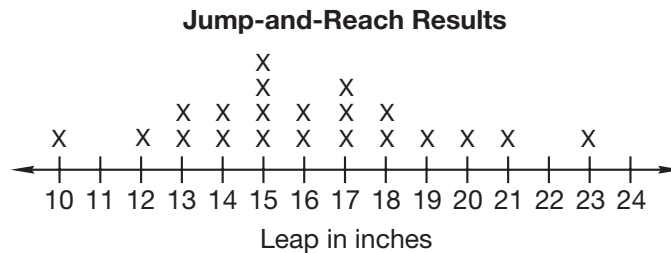
For 26 miles 385 yards, we choose the compatible number 27 miles since it is near 27 miles, and 27 divides by 3 with no remainder.

$$27 \div 3 = 9$$

Leon needs to run about **9 miles each hour** to achieve his goal.

Example 4

During physical education, students performed a jump-and-reach activity to measure their vertical leaping ability. Class results are indicated on the line plot below. Each X indicates the vertical leap in inches of one student.

Jump-and-Reach Results

```
                    X
                    X       X
              X  X  X  X  X  X
        X     X  X  X  X  X  X  X  X  X        X
    ←───┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼───→
        10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
```

Leap in inches

What is the mode, median, and range of this data?

From the line plot, we find that 15 inches was the vertical leap recorded most frequently, so the mode is **15 inches.**

There are 21 measures shown, so the median is the eleventh measure. Counting up or down we find the eleventh measure is 16, so the median is **16 inches.**

The range is the difference between the least and greatest measures.

$$23 \text{ in.} - 10 \text{ in.} = 13 \text{ in.}$$

We find the range is **13 inches.**

Lesson Practice

a. How many yards are in one fourth of a mile?

b. Fifty millimeters is how many centimeters?

c. Dyami's height is 5 feet 1 inch. How many inches tall is he?

d. A 10K race is a 10-kilometer race. How many meters is 10 kilometers?

e. Multiple Choice The length of a pencil is best measured in ____.

 A centimeters **B** meters **C** kilometers **D** feet

f. Multiple Choice The height of a skyscraper is best measured in ____.

 A inches **B** feet **C** miles **D** centimeters

1. (**Evaluate**) Crayons come in a carton. A carton holds 6 packages. Each
(49)   package holds 10 small boxes. Each small box holds 12 crayons. How
many crayons come in a carton?

*2. When the decimal number two and three tenths is added to three and
(68, 73)   five tenths, what is the sum?

3. Thomas bought 7 pounds of sunflower seeds for $3.43. What was the
(21)   price for 1 pound of sunflower seeds? Write an equation and find the
answer.

4. Compare: $\frac{3}{6}$ ◯ $\frac{6}{12}$
(23)

*5. One of the players on the basketball team is 2 meters tall. Two meters
(74)   is how many centimeters?

6. (**Connect**) Use a fraction and a decimal number to name the point
(66)   marked by the arrow on this number line:

7. (**Represent**) Joanne ran the 100-meter dash in 11.02 seconds. Use
(68)   words to name the decimal number 11.02.

*8. Three yards is the same length as how many inches?
(74)

9. Segment RT measures 4 inches. If $\overline{RS}$ is $2\frac{1}{4}$ inches long, then how long
(61, 63)   is $\overline{ST}$?

10.   7
(43)
   $+ 1\frac{3}{4}$
   ———

11. $3\frac{5}{12}$
(41)
   $- 3\frac{5}{12}$
   ———

12.   4
(63)
   $- 2\frac{1}{4}$
   ———

*13. 16.2 + 1.25
(73)

14.   30.1
(73) − 14.2

15. $12.98
(29) ×   40

16. 6)$45.54
(26)

17. $\frac{4384}{8}$
(26)

18. 12 × 12
(51)

19. $12 + 84¢ + $6.85 + 9¢ + $8 + $98.42 + $55.26
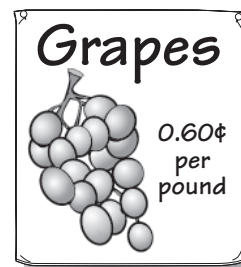(70)

20. Write the quotient as a mixed number: $\frac{18}{5}$
(58)

***21.** Write a decimal number equal to 2.5 that has three decimal places.
(70)

22. The perimeter of a certain square is 24 inches.
(53, 72)

    a. How long is each side of the square?

    b. What is the area of the square described in part **a?**

23. Show two ways to correct the money amount shown on
(70) this sign:

Grapes

0.60¢
per
pound

24. (**Conclude**) Use the map below to answer parts **a–c.**
(31,
Inv. 5)

Ramona

Tyler

Valley

Garvey

N
W — E
S
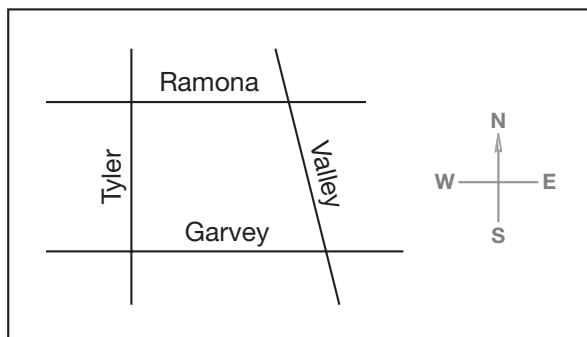
    a. Which street runs straight north and south?

    b. Which street is parallel to Ramona?

    c. Which street is neither perpendicular nor parallel to Garvey?

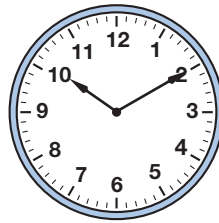***25.** **Conclude** Write the next two terms in this sequence:
(Inv. 7)

$$Z, X, V, T, \underline{\quad}, \underline{\quad}, \ldots$$

*26. **a.** One foot is what fraction of a yard?
(71, 74)

b. One foot is what percent of a yard?

27. **Represent** Draw a circle and shade $\frac{1}{2}$ of it. What percent of the circle
(71) is shaded?

28. The clock on the left shows a morning time. The clock on the right
(35) shows an evening time that same day. What is the elapsed time?

29. The average body temperature of a hummingbird is about 104°F.
(27) The average body temperature of a crocodile is about 26°F cooler.
A crocodile has an average body temperature of about how many
degrees?

30. **Explain** Four students ran a 1-mile relay race. If each student ran
(74) an equal distance, then how many yards did each student run? Explain
how you found the answer.

Early Finishers

Real-World Connection

Doubles tennis tournaments are played on a rectangular tennis court
that measures 12 yards wide and 26 yards long.

a. Change the length and the width to feet.

b. Find the distance around the outside of the tennis court in feet.

• Changing Improper Fractions to Whole or Mixed Numbers

Power Up

**facts** Power Up C

estimation Hold your fingers one inch apart. Hold your hands one yard apart.

mental math

a. **Geometry:** What is the area of a square that is 4 inches on each side?

b. **Number Sense:** $\frac{1}{4}$ of 36

c. **Number Sense:** $\frac{1}{4}$ of 360

d. **Number Sense:** $\frac{1}{3}$ of 36

e. **Money:** The regular price of the backpack is $28. It is on sale for 25% off. What is 25% of $28?

f. **Time:** How many minutes is 4 hours 40 minutes?

g. **Measurement:** A football field is 120 yards long from goalpost to goalpost. How many feet is this?

h. **Calculation:** $\sqrt{81}$, -1, $\times 10$, $+1$, $\div 9$, -9

problem solving

Choose an appropriate problem-solving strategy to solve this problem. If rectangle 1 is rotated a quarter of a turn clockwise around point *A,* it will be in the position of rectangle 2. If it is rotated again, it will be in the position of rectangle 3. If it is rotated again, it will be in the position of a fourth rectangle. Draw the congruent rectangles 1, 2, 3, and 4.
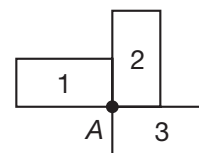
A fraction may be less than 1, equal to 1, or greater than 1. A fraction that is less than 1 is called a **proper fraction.** A fraction that is equal to or greater than 1 is called an **improper fraction.** An improper fraction has a numerator equal to or greater than its denominator.
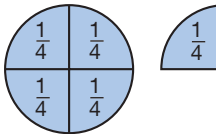
Thinking Skills

Generalize

How can you predict when an improper fraction can be changed to a whole or mixed number?

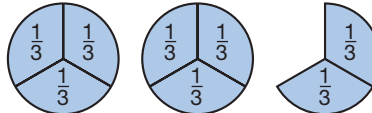| Less than 1	Equal to 1	Greater than 1
$\dfrac{3}{4}$	$\dfrac{4}{4}$	$\dfrac{5}{4}$
Proper fraction	Improper fractions	

Every improper fraction can be changed either to a whole number or to a mixed number. Consider the fractions above. The fraction $\frac{4}{4}$ is equal to 1, and the fraction $\frac{5}{4}$ is equal to $\frac{4}{4} + \frac{1}{4}$, which is $1\frac{1}{4}$.

$$\frac{5}{4} = \frac{4}{4} + \frac{1}{4} = 1\frac{1}{4}$$

Example 1

Separate $\frac{8}{3}$ into fractions equal to 1 plus a proper fraction. Then write the result as a mixed number.

The denominator is 3, so we separate eight thirds into groups of three thirds. We make two whole groups and two thirds remain.

$$\frac{8}{3} = \frac{3}{3} + \frac{3}{3} + \frac{2}{3} = 2\frac{2}{3}$$

When the answer to an arithmetic problem is an improper fraction, we usually convert the answer to a whole number or a mixed number.

Example 2

The chef baked two lemon pies. At the end of the day, $\frac{3}{5}$ of one pie and $\frac{4}{5}$ of the other pie remained. Altogether, how many lemon pies remained?

We add and find that the sum is the improper fraction $\frac{7}{5}$.

$$\frac{3}{5} + \frac{4}{5} = \frac{7}{5}$$

Then we convert the improper fraction to a mixed number.

$$\frac{7}{5} = \frac{5}{5} + \frac{2}{5} = 1\frac{2}{5}$$

We find that $1\frac{2}{5}$ **pies** remained.

When adding mixed numbers, the fraction part of the answer may be an improper fraction.

$$1\frac{2}{3} + 2\frac{2}{3} = 3\frac{4}{3} \longleftarrow \text{Improper fraction}$$

We convert the improper fraction to a whole number or mixed number and add it to the whole-number part of the answer.

$$3\frac{4}{3} = 3 + \frac{3}{3} + \frac{1}{3}$$
$$= 3 + 1\frac{1}{3}$$
$$= 4\frac{1}{3}$$

Thinking Skills

Conclude

Can you add and subtract improper fractions? Use examples to support your answer.

Example 3

A three-person crew worked for $2\frac{1}{2}$ hours to repair a broken water line. The customer will be billed for how many hours of work?

Each person worked $2\frac{1}{2}$ hours, so we add $2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2}$. We get the sum $6\frac{3}{2}$. The fraction part of $6\frac{3}{2}$ is an improper fraction. We find that $\frac{3}{2}$ equals $1\frac{1}{2}$. We add $1\frac{1}{2}$ to 6 and get $7\frac{1}{2}$.

$$6\frac{3}{2} = 6 + \frac{2}{2} + \frac{1}{2}$$
$$= 6 + 1\frac{1}{2}$$
$$= 7\frac{1}{2}$$

The customer will be billed for $7\frac{1}{2}$ **hours** of work.

Lesson Practice   Convert each improper fraction into a whole or mixed number:

a. $\frac{2}{2}$ **b.** $\frac{5}{2}$ **c.** $\frac{5}{3}$ **d.** $\frac{9}{4}$

e. $\frac{3}{2}$ **f.** $\frac{3}{3}$ **g.** $\frac{6}{3}$ **h.** $\frac{10}{3}$

i. $\frac{4}{2}$ **j.** $\frac{4}{3}$ **k.** $\frac{7}{3}$ **l.** $\frac{15}{4}$

Add. Simplify each answer and explain your answer in words. You may use fraction manipulatives.

m. $\frac{4}{5} + \frac{4}{5}$ **n.** $8\frac{1}{3} + 8\frac{1}{3} + 8\frac{1}{3}$

o. $\frac{5}{8} + \frac{3}{8}$ **p.** $7\frac{4}{8} + 8\frac{7}{8}$

q. Analyze What is the perimeter of a square with sides $2\frac{1}{2}$ inches long?

Written Practice

Distributed and Integrated

*1. Robin bought 10 hair ribbons for 49¢ each and a package of barrettes for $2.39. How much did she spend in all?
$(49, 70)$

2. Analyze On the shelf there are three stacks of books. In the three stacks there are 12, 13, and 17 books. If the number of books in each stack were made the same, how many books would be in each stack?
(50)

*3. Arrange these numbers in order from least to greatest. Then find the difference between the least and greatest numbers.
$(69, 73)$

$$32.16 \qquad 32.61 \qquad 31.26 \qquad 31.62$$

4. What is the largest four-digit even number that has the digits 1, 2, 3, and 4 used only once each?
(2)

*5. Connect Name the total number of shaded circles as a mixed number and as a decimal number.
(67)
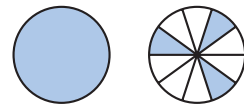
*6. Compare: $\dfrac{4}{3} \bigcirc \dfrac{3}{4}$
(75)

*7. Write 4.5 with the same number of decimal places as 6.25.
(70)

*8. Connect Use a mixed number and a decimal number to name the point marked by the arrow on this number line:
(66)
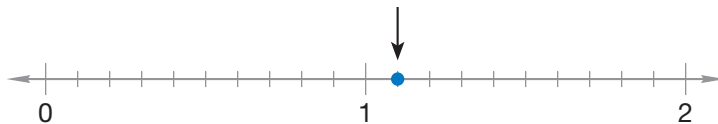
*9. Daniel ran a 5-kilometer race in 15 minutes 45 seconds. How many meters did he run?
(74)

10. The length of $\overline{PQ}$ is $1\frac{1}{4}$ inches. The length of $\overline{QR}$ is $1\frac{3}{4}$ inches. How long
(59, 61) is $\overline{PR}$?

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        P              Q                    R
  ←─────●──────────────●────────────────────●─────→
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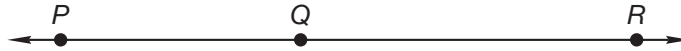***11.** ✎ **Explain** Seven twelfths of the months have 31 days, and the rest
(60) have fewer than 31 days. What fraction of the months have fewer than
31 days? Explain how you know.

*12. $60.45 - 6.7$
(73)

*13. $4.8 + 2.65$
(73)

14. $3d = \$20.01$
(26)

15. $36 \times 9 \times 80$
(18, 29)

16. $\begin{array}{r} 506 \\ \times\ 478 \end{array}$
(56)

17. $\dfrac{4690}{70}$
(54)

18. $\begin{array}{r} \$30.75 \\ \times\qquad 8 \end{array}$
(17)

19. $\$10 + \$8.16 + 49¢ + \$2 + 5¢$
(70)

*20. $\dfrac{4}{5} + \dfrac{4}{5}$
(75)

*21. $\dfrac{5}{9} + \dfrac{5}{9}$
(75)

*22. $16\frac{2}{3} + 16\frac{2}{3}$
(75)

*23. **Analyze** If each side of a square is 1 foot, then the perimeter of the
(53, 71) square is how many inches? Each side of a square is what percent of
the square's perimeter?

*24. a. What is the area of the square in problem **23** in square feet?
(72, 74)

 **b.** What is the area in square inches?

25. Name a parallelogram that is both a rectangle and a rhombus.
(45)

*26. The number of miles a salesperson drove each day for one week is
(74) shown below. Find the median, mode, and range of the data.

Day	Miles
Monday	41
Tuesday	67
Wednesday	13
Thursday	44
Friday	25

27. (**Interpret**) The line graph shows the average monthly temperatures
(Inv. 6) during summer in Portland, Maine. Use the graph to answer parts **a–c.**

**Average Summer Temperatures
in Portland, ME**
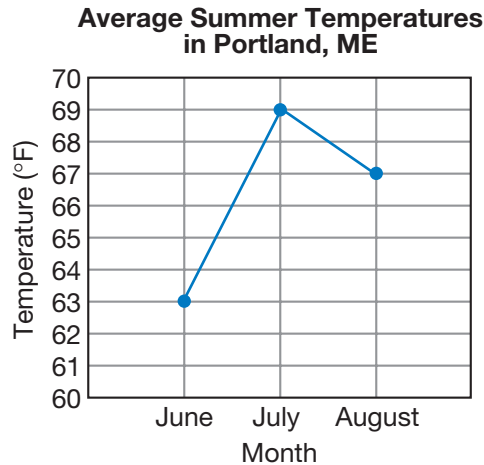
a. What number of degrees represents the range of the
temperatures?

b. How many months have an average temperature that is greater
than 70°F?

c. The coldest average monthly temperature in Portland, Maine
occurs during January. The average temperature that month is
47° lower than the average July temperature. What is the average
monthly temperature during January in Portland, Maine?

28. Name the coin that is equal to half of a half-dollar.
(Inv. 2)

*29. Use a centimeter ruler to measure this rectangle. Then answer
(53, 72) parts **a** and **b.**

a. What is the perimeter of the rectangle?

b. What is the area of the rectangle?

*30. Multiple Choice Three students are volunteer tutors. Last month,
(49) Detrina tutored for 3 more hours than Richard, and Pat tutored
for 2 fewer hours than Detrina. Richard tutored for 7 hours. Which
expression can be used to find the length of time Pat spent tutoring last
month?

A $7 + 3 + 2$ **B** $7 - (3 + 2)$ **C** $(7 + 3) - 2$ **D** $7 - 3 - 2$

• Multiplying Fractions

Power Up

facts   Power Up H

estimation   Hold two fingers one centimeter apart. Hold your hands one meter apart.

mental math

a. **Measurement:** 1 cm = __ mm

b. **Measurement:** 1 m = __ cm

c. **Number Sense:** Is 3828 divisible by 4?

d. **Number Sense:** Is 2838 divisible by 4?

e. **Time:** President Theodore Roosevelt lived for six decades. How many years is six decades?

f. **Estimation:** Choose the more reasonable estimate for the height of a desk: 3 in. or 3 ft.

g. **Probability:** Tulia wrote the letters of the alphabet on separate pieces of paper and put them into a bag. If she chooses one piece of paper from the bag without looking, what is the probability it will be the letter X?

h. **Calculation:** $\sqrt{9}$, × 9, + 1, ÷ 4, + 3, × 8, + 1, ÷ 9

problem solving   Choose an appropriate problem-solving strategy to solve this problem. In Lesson 49, we found that there are 6 ways to roll a total of 7 with two dot cubes. In Lesson 67, we found that there are 3 ways to roll a total of 10 with two dot cubes. Which number, 7 or 10, has a greater probability of being rolled with one toss of two dot cubes?
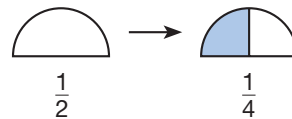
Ted performed an experiment in which he rolled two dot cubes 100 times and recorded the total each time. Out of the 100 rolls, 16 rolls resulted in a 7. What is a reasonable guess for the number of times Ted rolled a 10?

We have added and subtracted fractions. Adding and subtracting fractions involves counting same-size parts. In this lesson we will multiply fractions. When we multiply fractions, the size of the parts change. Consider this multiplication problem:

How much is one half of one half?

Model We can use fraction manipulatives to show one half of a circle. To find one half of one half, we divide the half circle in half. We see that the answer is one fourth.

$$\frac{1}{2} \text{ of } \frac{1}{2} \text{ is } \frac{1}{4}$$

Using pencil and paper, the problem looks like this:

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Notice that the word *of* is another way to say "times." Also notice that we find the answer to a fraction multiplication problem by multiplying the numerators to find the numerator of the product and by multiplying the denominators to find the denominator of the product.

Reading Math

When we multiply fractions, the product is stated in terms of the whole. While only one half of the half-circle is shaded, it is one fourth of the whole circle.

Example 1

Model **Masato found $\frac{1}{4}$ of an English muffin in the refrigerator and ate half of it. What fraction of the whole English muffin did Masato eat?**

We can use the fraction manipulatives to show that one half of one fourth is one eighth.

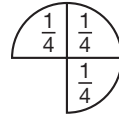$$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

Masato ate $\frac{1}{8}$ of the whole English muffin.

$\frac{1}{2}$ of $\frac{1}{4}$

Example 2

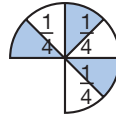**Model** **What fraction is one half of three fourths?**

First we use fraction manipulatives to show three fourths.

To find one half of three fourths, we may either divide each fourth in half or divide three fourths in half.

$\frac{1}{2}$ of $\frac{3}{4}$ $\frac{1}{2}$ of $\frac{3}{4}$

Reading Math

One half of three fourths is three eighths of the whole circle.
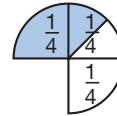
Since one half of one fourth is one eighth, one half of three fourths is three eighths. We may also find one half of three fourths by multiplying.

one half   of   three fourths

$$\frac{1}{2} \quad \times \quad \frac{3}{4} = \frac{3}{8}$$

We multiplied the numerators to find the numerator of the product, and we multiplied the denominators to find the denominator of the product.

Example 3

a. **A nickel is what fraction of a dime?**

b. **A dime is what fraction of a dollar?**

c. **A nickel is what fraction of a dollar?**

d. **The answers to parts a–c show that one half of one tenth is what fraction?**

We know that a nickel is 5¢, a dime is 10¢, and a dollar is 100¢.

a. $\frac{1}{2}$ b. $\frac{1}{10}$

c. $\frac{1}{20}$ d. $\frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$

Example 4
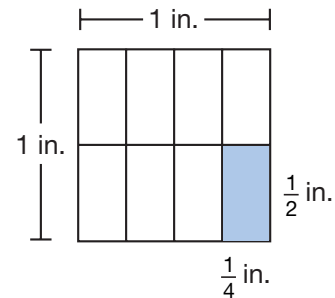
Multiply: $\frac{2}{3} \times \frac{4}{5}$

We find two thirds of four fifths by multiplying.

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

Example 5

a. **What fraction of the whole square is shaded?**

b. **Choose a formula and then use it to find the area of the shaded rectangle?**

├─── 1 in. ───┤

1 in.

$\frac{1}{2}$ in.

$\frac{1}{4}$ in.

a. One of eight equal parts is shaded, so $\frac{1}{8}$ of the whole square is shaded.

b. To find the area of the shaded part, we use the formula $A = l \times w$ and substitute the measurements for length and width.

$$A = l \times w$$
$$A = \frac{1}{2} \text{ in.} \times \frac{1}{4} \text{ in.}$$
$$A = \frac{1}{8} \text{ sq. in.}$$

Lesson Practice

a. **Represent** Draw a semicircle (one half of a circle). Shade one half of the semicircle. The shaded part of the semicircle shows that $\frac{1}{2}$ of $\frac{1}{2}$ is what fraction?

b. **Analyze** A penny is what fraction of a dime? A dime is what fraction of a dollar? A penny is what fraction of a dollar? The answers to these questions show that $\frac{1}{10}$ of $\frac{1}{10}$ is what fraction?

c. What fraction is three fourths of one half?

d. What fraction is one half of one third?

e. What fraction is two fifths of two thirds?

Multiply:

f. $\frac{1}{3} \times \frac{2}{3}$ g. $\frac{3}{5} \times \frac{1}{2}$ h. $\frac{2}{3} \times \frac{2}{3}$ i. $\frac{1}{2} \times \frac{2}{2}$

j. Half of the students were girls, and one third of the girls wore red shirts. What fraction of the students were girls wearing red shirts?

k. What is the area of a square with sides $\frac{1}{2}$ inch long?

1. After two days the troop had hiked 36 miles. If the troop hiked 17 miles
(11) the first day, how many miles did the troop hike the second day? Write an equation and find the answer.

2. The troop hiked 57 miles in 3 days. The troop averaged how many
(21, 50) miles per day? Write an equation and find the answer.

*3. When the decimal number six and thirty-four hundredths is subtracted
(68, 73) from nine and twenty-six hundredths, what is the difference?

4. (**List**) Which factors of 6 are also factors of 12?
(25)

5. (**Analyze**) If $3n = 18$, then what number does $2n$ equal?
(18)

*6. What is the area of a square with sides 10 cm long?
(72)

10 cm

7. Compare: 4.5 ◯ 4.500
(70)

*8. Arrange these fractions in order from least to greatest:
(23, 59)

$$\frac{2}{3}, \frac{1}{2}, \frac{4}{3}, \frac{3}{8}, \frac{5}{5}$$

*9. (**Analyze**) One half of the 64 squares on the board were black. The
(46, 71) other half were red. One half of the black squares had checkers on them. None of the red squares had checkers on them.

   a. How many squares on the board were black?

   b. How many squares had checkers on them?

   c. What fraction of the squares had checkers on them?

   d. What percent of the squares had checkers on them?

10. The length of segment $\overline{AC}$ is 78 millimeters. If $\overline{BC}$ is 29 millimeters,
(61) then what is the length of $\overline{AB}$?

A ——————— B ——— C

* 11. 24.86 − 9.7
(73)

* 12. 9.06 − 3.9
(73)

13. 8m = $36.00
(26, 34)

14. 50w = 7600
(26, 54)

15. $16.08
(17) ×   9

16.   638
(56) × 570

* 17. $3\frac{1}{3}$
(59) $+ 1\frac{2}{3}$

* 18. $1\frac{2}{3}$
(75) $+ 1\frac{2}{3}$

19. 4
(63) $- 1\frac{2}{5}$

* 20. $\frac{1}{2}$ of $\frac{3}{5}$
(76)

* 21. $\frac{1}{3} \times \frac{2}{3}$
(76)

* 22. $\frac{1}{2} \times \frac{6}{6}$
(76)

23. The table shows the cost of general admission tickets to a concert. Use
(1, 76) the table to solve parts **a** and **b.**

Number of Concert Tickets	1	2	3	4
Cost	$35	$70	$105	$140

    a. **Generalize** Write a rule that describes how to find the cost of any number of tickets.

    b. **Predict** A group of 10 friends would like to attend the concert. What will be the total ticket cost for the group of friends?

* 24. Refer to the rectangle to solve parts **a** and **b.**
(32, 44, 76)

    a. What is the area of the rectangle?

    b. Draw a rectangle that is similar to the rectangle but has sides twice as long.

$\frac{3}{4}$ in.

$\frac{3}{8}$ in.
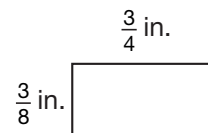
* 25. a. Which number on the spinner is the most unlikely
(57) outcome of a spin?

    b. Which outcomes have probabilities that exceed $\frac{1}{4}$ with one spin of the spinner?
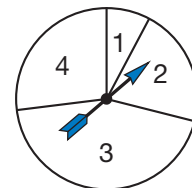
*26. a. A nickel is what fraction of a quarter?

b. A quarter is what fraction of a dollar?

c. A nickel is what fraction of a dollar?

d. The answers to parts **a–c** show that one fifth of one fourth is what fraction?

27. (List) Write the factors of 100.

28. The table below shows the number of goals scored by the top four teams in the soccer league. Display the data in a pictograph and remember to include a key.

Goals Scored by Soccer Teams

Team Name	Goals
Goal Diggers	20
Buckies	16
Legends	15
Hornets	12

*29. The record low temperature in the state of Alaska was $-80°F$, and occurred in Prospect Creek Camp in 1971. The record low temperature in the state of New Hampshire was $-47°F$, and occurred on Mount Washington in 1934. Which temperature is colder? What number of degrees represents the range of those two temperatures?

30. (Explain) Jaxon and Luis ran a race. Jaxon began running 3 seconds before Luis, and Luis completed the race 1 second before Jaxon. Jaxon ran for 32 seconds. For how many seconds did Luis run? Explain how you found your answer.

Early Finishers
Real-World Connection

In the community band, $\frac{3}{4}$ of the band members play brass instruments. In the brass section, $\frac{2}{3}$ of the members play the trumpet. What fraction of the band plays the trumpet?

• Converting Units of Weight and Mass

Power Up

mental math

a. **Time:** What is the time 2 hours 15 minutes after 7:45 a.m.?

b. **Number Sense:** 100 ÷ 4

c. **Number Sense:** 1000 ÷ 4

d. **Geometry:** What is the area of a square that is 5 inches on each side?

e. **Money:** Brian had $10.00. He spent $6.80 on football collector cards. How much money did Brian have left?

f. **Percent:** 50% of $51

g. **Measurement:** The square table was 99 cm on each side. What is the perimeter of the table?

h. **Calculation:** $\sqrt{49}$, × 5, − 10, ÷ 5, − 5

problem solving

Choose an appropriate problem-solving strategy to solve this problem. Kasey built this rectangular prism with 1-inch cubes. How many 1-inch cubes did Kasey use? Explain how you arrived at your answer.

2 in.

4 in.

4 in.
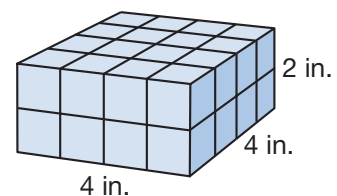
New Concept

When you go to the doctor for a checkup, the doctor takes many measurements. The doctor might measure your height, your temperature, and also your blood pressure and heart rate. To measure your **weight** or **mass,** the doctor uses a scale.

To measure weight in the U.S. Customary System, we use units such as ounces (oz), pounds (lb), and tons (tn). One slice of bread weighs about 1 ounce. A shoe weighs about 1 pound. The weight of a small car is about 1 ton. To measure the mass of an object in the metric system, we use units such as milligrams (mg), grams (g), kilograms (kg), and metric tons (t). The wing of a housefly is about 1 milligram. A paper clip is about 1 gram. A pair of shoes is about 1 kilogram, and a small car is about a metric ton. The table below lists some common units of weight in the U.S. Customary System and units of mass in the metric system. The chart also gives equivalencies between different units.

Units of Weight

U.S. Customary System	Metric System
16 oz = 1 lb 2000 lb = 1 tn	1000 mg = 1 g 1000 g = 1 kg 1000 kg = 1 t

On Earth a kilogram is about 2.2 pounds, and a metric ton is about 2200 pounds.

Example 1

A large elephant weighs about 4 tons. About how many pounds does a large elephant weigh?

One ton is 2000 pounds. Four tons is 4 times 2000 pounds. A large elephant weighs about **8000 pounds.**

Example 2

Boyd's watermelon had a mass of 6 kilograms. The mass of the watermelon was how many grams?

One kilogram is 1000 grams. Six kilograms is 6 times 1000 grams. The watermelon's mass was **6000 grams.**

Example 3

Visit www.SaxonMath.com/Int5Activities for an online activity.

Antoine works at a sandwich shop and uses 2 ounces of cheese for one sandwich. If he makes 16 sandwiches, how many pounds of cheese does he use?

If one sandwich uses 2 ounces of cheese, 16 sandwiches would use 16 times 2 ounces, or 32 ounces of cheese. Sixteen ounces is the same as one pound.

Antoine will use **2 pounds** of cheese for the 16 sandwiches.

Example 4

Mr. Harrison's truck has a cargo capacity of about $\frac{1}{2}$ metric ton. He has 3 containers weighing 156 kg, 127 kg, and 149 kg. Will the weight of the containers overload the truck?

We estimate the total using compatible numbers.

$$150 \text{ kg} + 125 \text{ kg} + 150 \text{ kg} = 425 \text{ kg}$$

Half of a metric ton is 500 kg, so the **containers will not overload** the truck.

Lesson Practice

a. One half of a pound is how many ounces?

b. If a pair of tennis shoes is about 1 kilogram, then one tennis shoe is about how many grams?

c. Ten pounds of potatoes weighs how many ounces?

d. Sixteen tons is how many pounds?

e. A fabric-store manager placed an order to buy 9 rolls of white cotton fabric. If each roll contains 57 yards of fabric, use compatible numbers to approximate how many yards of white cotton fabric the manager bought.

Written Practice   *Distributed and Integrated*

1. In 1926, at the age of 64, Edward Stratemeyer created the ideas that
(35) would appear in the first volumes of the *Hardy Boys* detective series. In what year was Edward Stratemeyer born?

*2. Add the decimal number sixteen and nine tenths to twenty-three and
(68, 73) seven tenths. What is the sum?

*3. Arrange these decimal numbers in order from least to greatest:
(69)

2.13, 1.32, 13.2, 1.23

4. One fourth of the 36 students joined the chess team. One third of the
(46) students who joined attended 100% of the tournaments.

a. How many students joined the chess team?

b. How many students attended 100% of the tournaments?

c. What fraction of the students attended 100% of the tournaments?

*5. A small car weighs about one ton. How many pounds is 1 ton?
(77)

6. (**Connect**) Use a fraction, a decimal number, and a
(71) percent to name the shaded portion of this square:
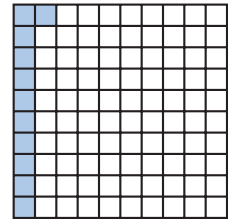
*7. A 2-pound box of cereal weighs how many ounces?
(77)

*8. Three hundred pennies has a mass of about 1 kg. Sonia has
(77) 900 pennies. About how many grams is this?

*9. $\overline{AB}$ is 3.5 centimeters. $\overline{BC}$ is 4.6 centimeters. Find $\overline{AC}$.
(61, 73)

A   B   C
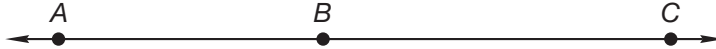
*10. $\dfrac{3}{4} + \dfrac{3}{4} + \dfrac{3}{4}$ ***11.** $\dfrac{3}{3} + \dfrac{2}{2}$ ***12.** $3\dfrac{5}{8} + 4\dfrac{6}{8}$
(75)   (75)   (75)

13. 463 + 2875 + 2489 + 8897 + 7963
(6)

*14. $\dfrac{1}{2} \times \dfrac{5}{6}$ ***15.** $\dfrac{2}{3} \times \dfrac{3}{4}$ ***16.** $\dfrac{1}{2} \times \dfrac{2}{2}$
(76)   (76)   (76)

17.   401.3   **18.** $5.67   **19.**   347
(73) $- 264.7$ (29) $\times$ 80   (55) $\times$ 249

20. 50 × 50   **21.** ($5 + 4¢) ÷ 6
(29)   (24, 70)

22. 64,275 ÷ 8   **23.** $60w = 3780$
(34)   (26, 54)

*24. (✏ **Estimate**) Garon has four identical stacks of coins. Each stack
(31) contains one dime, two nickels, and six pennies. What is a reasonable
estimate of the total amount of money those stacks represent? Explain
your answer.

25. Lindsey lives 1.2 kilometers from her school. Shamika lives
(49) 0.2 fewer kilometers from school than Lindsey, and Doug lives
0.4 fewer kilometers from school than Shamika. Which student or
students live more than one half kilometer from school?

*26. Use the drawing below to answer parts **a–c.**

(44, 53, 72)
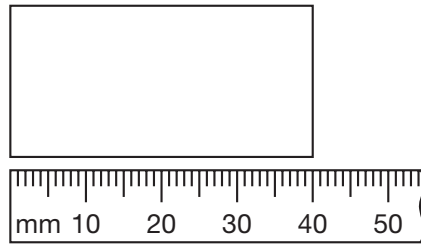
a. How long is the rectangle?

b. If the rectangle is half as wide as it is long, then what is the perimeter of the rectangle?

c. What is the area of the rectangle in square millimeters?

27. **Conclude** Assume that this sequence repeats. What are the next four terms of the sequence?

(Inv. 4)

$$7, 3, 5, 7, \underline{\quad}, \underline{\quad}, \underline{\quad}, \underline{\quad}, \ldots$$

*28. **a.** An inch is what fraction of a foot?

(74, 76)

b. A foot is what fraction of a yard?

c. An inch is what fraction of a yard?

d. The answers to parts **a–c** show that $\frac{1}{12}$ of $\frac{1}{3}$ is what fraction?

*29. **Multiple Choice** The mass of a dollar bill is about ____.

(77)

A 1 milligram **B** 1 gram **C** 1 kilogram **D** 1 metric ton

*30. One square inch is divided into quarter-inch squares, as shown at right:

(76)
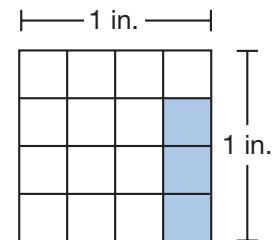
a. What fraction of the square inch is shaded?

b. What is the area of the shaded region?

c. **Explain** Did you use inches or square inches to label the answer in part **b?** Explain why.

• Exponents and Square Roots

Power Up

facts   Power Up H

mental math

a. Measurement: The book weighs 2 lb 8 oz. How many ounces does the book weigh?

b. Measurement: How many pounds are in 1 ton? … 2 tons? … 3 tons?

c. Number Sense: Is 4218 divisible by 4?

d. Number Sense: Is 8124 divisible by 4?

e. Percent: What number is 50% of 5?

f. Estimation: Choose the more reasonable estimate for the mass of a basketball: 1 kilogram or 1 gram.

g. Probability: The sides of a number cube are labeled 1 through 6. If the cube is rolled once, what is the probability it will *not* land on 6?

h. Calculation: $\sqrt{16}$, $\times\,2$, $+\,2$, $\div\,10$, $-\,1$, $\times\,5$

problem solving

Choose an appropriate problem-solving strategy to solve this problem. Quinton is building a fence to enclose his rectangular garden. The length of the garden is 18 feet. Quinton has purchased 54 feet of fencing. If Quinton uses all the fencing materials he purchased, what are the dimensions of the garden?

18 ft
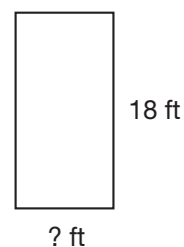
? ft

To show repeated addition, we may use multiplication.

$$5 + 5 + 5 = 3 \times 5$$

To show repeated multiplication, we may use an **exponent.**

$$5 \times 5 \times 5 = 5^3$$

In the expression 5^3, the exponent is 3 and the **base** is 5. The exponent shows how many times the base is used as a factor.

$$5^3 = 5 \times 5 \times 5 = 125$$

Together, the base and exponent are called a **power.** Below are some examples of how **exponential expressions** are read. The examples are "powers of three."

3^2 "three squared"

3^3 "three cubed"

3^4 "three to the fourth power"

3^5 "three to the fifth power"

We could read 3^2 as "three to the second power," but we usually say "squared" when the exponent is 2. The word *squared* is a geometric reference to a square. Here we illustrate three squared:
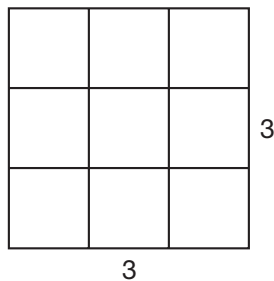
Each side is 3 units long, and the area of the square is 3^2, or 9 units.

(**Discuss**) If the side lengths of the square were 3 inches, we could record the area of the square as 9 in.^{2}, which we read as "9 square inches." Explain why.

When the exponent is 3, we usually say "cubed" instead of "to the third power." The word *cubed* is also a geometric reference.

Here we illustrate three cubed:
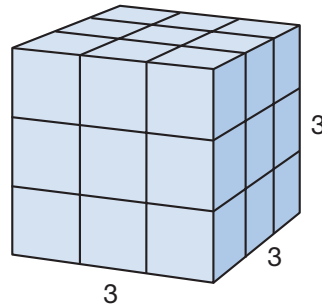
Each edge is three units long, and the number of blocks in the cube is 3^3, or 27 units.

(**Discuss**) In the cube model, are the units squares or cubes?

Example 1

Write 3^3 as a whole number.

We find the value of 3^3 by multiplying three 3s.

$$3^3 = 3 \times 3 \times 3 = \mathbf{27}$$

Example 2

If $2n = 6$, then what does n^2 equal?

The expression $2n$ means "2 times n" (or "$n + n$"). If $2n = 6$, then $n = 3$. The expression n^2 means "n times n." To find n^2 when n is 3, we multiply 3 by 3. So n^2 equals **9.**

When we **evaluate** an expression, we are finding the value of an expression.

Example 3

Here we show four powers of 10:

$$10^1, 10^2, 10^3, 10^4$$

Evaluate each expression, and write each power as a whole number.

$10^1 = \mathbf{10}$

$10^2 = 10 \times 10 = \mathbf{100}$

$10^3 = 10 \times 10 \times 10 = \mathbf{1000}$

$10^4 = 10 \times 10 \times 10 \times 10 = \mathbf{10,000}$

Thinking Skill

Connect

Which place is represented by $10 \times 10 \times 10 \times 10 \times 10$?

Powers of 10 can be used to show place value, as we show in the following diagram:

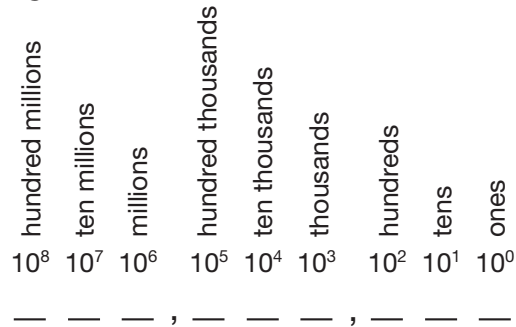| hundred millions	ten millions	millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones
10^8	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0

__ __ __ , __ __ __ , __ __ __

Notice that the power of 10 in the ones place is 10^0, which equals 1.

Example 4

Write 4,500,000 in expanded notation using powers of 10.

In expanded notation, 4,500,000 is expressed like this:

$$(4 \times 1,000,000) + (5 \times 100,000)$$

Using powers of 10, we replace 1,000,000 with 10^6, and we replace 100,000 with 10^5.

$$(4 \times 10^6) + (5 \times 10^5)$$

square root

If we know the area of a square, then we can find the length of each side. The area of this square is 25 square units. Each side must be 5 units long because $5 \times 5 = 25$.
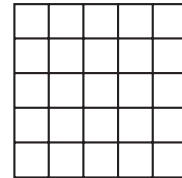
When we find the length of the side of a square from the area of the square, we are finding a **square root.**

Example 5

A square has an area of 36 square centimeters. How long is each side?

The sides of a square have equal lengths. So we need to find a number that we can multiply by itself to equal 36.

$$\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = 36$$

We recall that $6 \times 6 = 36$, so each side of the square has a length of **6 centimeters.**

We use the symbol $\sqrt{}$ to indicate the positive square root of a number.

$$\sqrt{36} = 6$$

We say, "The square root of thirty-six equals six."

Example 6

Find $\sqrt{100}$.

The square root of 100 is **10** because $10 \times 10 = 100$.

A **perfect square** has a whole-number square root. Here we shade the perfect squares on a multiplication table:

	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

The perfect squares appear diagonally on the multiplication table.

Example 7

Compare: $\sqrt{9 + 16}$ $\bigcirc$ $\sqrt{9} + \sqrt{16}$

On the left, 9 and 16 are under the same square root symbol. We add the numbers and get $\sqrt{25}$. On the right, 9 and 16 are under different square root symbols. We do not add until we have found their square roots.

$$\sqrt{9 + 16} \ \bigcirc \ \sqrt{9} + \sqrt{16}$$
$$\sqrt{25} \ \bigcirc \ \sqrt{9} + \sqrt{16}$$
$$5 \ \bigcirc \ 3 + 4$$
$$\mathbf{5 < 7}$$

Lesson Practice

a. **Represent** This figure illustrates "five squared," which we can write as 5^2. There are five rows of five small squares. Draw a similar picture to illustrate 4^2.
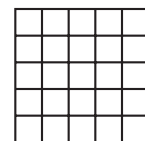
b. This picture illustrates "two cubed," which we can write as 2^3. Two cubed equals what whole number?
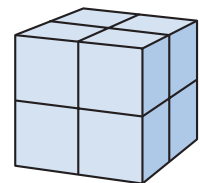
Represent Write each power as a whole number. Show your work.

c. 3^4 **d.** 2^5 **e.** 11^2

f. If $2m = 10$, then what does m^2 equal?

Represent Write each number in expanded notation using powers of 10:

g. 250,000   **h.** 3,600,000   **i.** 60,500

Find each square root in problems **j–o.**

j. $\sqrt{1}$ **k.** $\sqrt{4}$ **l.** $\sqrt{16}$ **m.** $\sqrt{49}$

n. Compare: $\sqrt{36}$ $\bigcirc$ 3^2

o. Find the square roots and then subtract: $\sqrt{25} - \sqrt{16}$

Written Practice

Distributed and Integrated

*1. One half of the students in a fifth grade class belong to an after-school
(76) club, and one third of those students belong to the math club. What fraction of the students belong to the math club? What percent of the students belong to the math club?

2. Chico bought a car for $860 and sold it for $1300. How much profit did
(16) he make?

3. Each hour from 4 p.m. to 8 p.m., an average of 79 guests arrived at a
(50) hotel. How many guests arrived during that time?

*4. **Explain** The truck could carry $\frac{1}{2}$ ton. How many pounds is $\frac{1}{2}$ ton?
(77)

*5. The newborn kitten weighed one half of a pound. How many ounces
(77) did it weigh?

6. **Multiple Choice** Which shaded circle below is equivalent
(Inv. 3, 39) to the larger shaded circle shown on the right?

A **B** **C** **D**
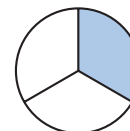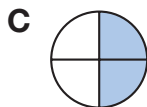
*7. **Multiple Choice** Which of these fractions does *not* equal one half?
(23)

A $\frac{50}{100}$ **B** $\frac{1000}{2000}$ **C** $\frac{16}{30}$ **D** $\frac{6}{12}$

*8. Find the length of this segment twice, first in millimeters and then in centimeters:
(66)

9. (**List**) Write the numbers that are factors of both 6 and 8.
(25)

10. $\overline{LN}$ is 6.4 centimeters. $\overline{LM}$ is 3.9 centimeters. Find $\overline{MN}$.
(61, 73)

*11. $\dfrac{2}{3} + \dfrac{2}{3} + \dfrac{2}{3}$ **12.** $\dfrac{3}{3} - \dfrac{2}{2}$
(75)   (59)

*13. $9\dfrac{4}{10} + 4\dfrac{9}{10}$ **14.** $4.6 + 3.27$
(75)   (73)

15. $\$40.00$ **16.** $\$20.50$
(13) $- \$13.48$ (17) $\times 8$

17. $9\overline{)\$56.70}$ ***18.** $9^2 + \sqrt{9}$ **19.** $80\overline{)4650}$
(34)   (78)   (54)
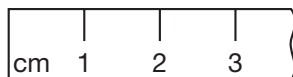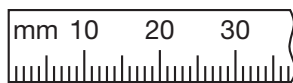
20. Is the quotient of $98 \div 5$ a whole number or a mixed number? Write the
(58) quotient.

*21. $\dfrac{3}{4}$ of $\dfrac{1}{2}$ ***22.** $\dfrac{3}{2} \times \dfrac{3}{4}$ ***23.** $\dfrac{1}{3} \times \dfrac{2}{2}$
(76)   (76)   (76)

*24. Use this information to answer parts **a** and **b**:
(28,
Inv. 5,
73)
> It is 1.5 miles from Kiyoko's house to school. It takes Kiyoko 30 minutes
> to walk to school and 12 minutes to ride her bike to school.

a. How far does Kiyoko travel to school and back in 1 day?

b. If Kiyoko leaves her house at 7:55 a.m. and rides her bike, at what
time will she get to school?

*25. (**Conclude**) Assume that this sequence repeats every four terms. Write
(Inv. 7) the next four terms of the sequence.

$$7, 3, 5, 7, \underline{}, \underline{}, \underline{}, \underline{}, \ldots$$

26.
(61, 72) Each angle of quadrilateral *ABCD* is a right angle. If $\overline{AB}$ is 10 cm and $\overline{BC}$ is 5 cm, what is the area of the quadrilateral?

A   B

D   C
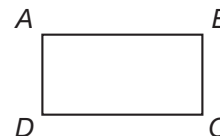
27. **Multiple Choice** Which of these terms does *not* apply to quadrilateral
(45) *ABCD* in problem **27?**

   A rectangle   **B** parallelogram   **C** rhombus   **D** polygon

28. Suppose the 7 letter tiles below are turned over and mixed up. Then
(57) suppose one tile is selected.

| A | C | A | S | L | B | E |

   a. What is the probability that the letter selected is a vowel?

   b. What is the probability that the letter selected is A?

   c. What is the probability that the letter selected comes before G in the alphabet?

***29.** (Represent) Write 25,000,000 in expanded notation using powers of 10.
(78)

***30.** The table below shows the diameters of four planets. The diameters
(Inv. 5) are rounded to the nearest five hundred miles. Display the data in a horizontal bar graph. Then write two questions that can be answered using your graph.

**Planet Diameters
(rounded to the nearest
500 miles)**

Planet	Diameter (miles)
Mercury	3000
Venus	7500
Earth	8000
Mars	4000

Early Finishers

*Real-World
Connection*

In 2000, a baseball stadium with a retractable roof was built in Houston, Texas. The construction cost for the ballpark was about $250,000,000. Write two hundred fifty million in expanded notation using powers of 10.

• Finding Equivalent Fractions by Multiplying by 1

Power Up

facts   Power Up H

estimation   Hold two fingers one centimeter apart. Hold your hands one yard apart.

mental math

   a. Measurement: How many centimeters are in one meter?

   b. Powers/Roots: 3^2

   c. Fractional Parts: $\frac{1}{4}$ of 20

   d. Fractional Parts: $\frac{1}{4}$ of 200

   e. Fractional Parts: $\frac{1}{5}$ of 16

   f. Percent: Tene deposits 25% of his earnings into savings. If Tene earns $20.00, how much will he deposit?

   g. Geometry: What is the area of a rectangular tabletop that is 5 feet long and 2 feet wide?

   h. Calculation: $\sqrt{49}, -2, \div 2, -2$

problem solving

Choose an appropriate problem-solving strategy to solve this problem. Carter, Bao, and Julia drew straws. Carter's $3\frac{3}{4}$-inch straw was a quarter inch longer than Bao's straw and half an inch shorter than Julia's straw. How long were Bao's and Julia's straws?

New Concept

In Lesson 15 we learned that when a number is multiplied by 1, the value of the number does not change. This property is called the Identity Property of Multiplication. We can use this property to find **equivalent fractions.**

Equivalent fractions are different names for the same number. $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$, and $\frac{4}{8}$ are equivalent fractions. To find equivalent fractions, we multiply a number by different fraction names for 1.

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4} \quad \bigg| \quad \frac{1}{2} \times \frac{3}{3} = \frac{3}{6} \quad \bigg| \quad \frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$$

As we see above, we can find fractions equivalent to $\frac{1}{2}$ by multiplying by $\frac{2}{2}, \frac{3}{3}$, and $\frac{4}{4}$. By multiplying $\frac{1}{2}$ by $\frac{5}{5}, \frac{6}{6}, \frac{7}{7}$, and so on, we find more fractions equivalent to $\frac{1}{2}$:

$$\frac{1}{2} \times \frac{n}{n} = \frac{5}{10}, \frac{6}{12}, \frac{7}{14}, \frac{8}{16}, \frac{9}{18}, \frac{10}{20} \cdots$$

Example 1

What name for 1 should $\frac{3}{4}$ be multiplied by to make $\frac{6}{8}$?

$$\frac{3}{4} \times \frac{?}{?} = \frac{6}{8}$$

To change $\frac{3}{4}$ to $\frac{6}{8}$, we multiply by $\frac{2}{2}$. The fraction $\frac{2}{2}$ is equal to 1, and when we multiply by 1 we do not change the value of the number. Therefore, $\frac{3}{4}$ equals $\frac{6}{8}$.

Example 2

Write a fraction equal to $\frac{2}{3}$ that has a denominator of 12.

$$\frac{2}{3} = \frac{?}{12}$$

We can change the name of a fraction by multiplying by a fraction name for 1. To make the 3 become 12, we must multiply by 4. So the fraction name for 1 that we will use is $\frac{4}{4}$. We multiply $\frac{2}{3} \times \frac{4}{4}$ to form the equivalent fraction $\frac{8}{12}$.

$$\frac{2}{3} \times \frac{}{4} = \frac{}{12}$$

$$\frac{2}{3} \times \frac{4}{4} = \frac{8}{12}$$

Example 3

Write a fraction equal to $\frac{1}{3}$ that has a denominator of 12. Then write a fraction equal to $\frac{1}{4}$ that has a denominator of 12. What is the sum of the two fractions you made?

We multiply $\frac{1}{3}$ by $\frac{4}{4}$ and $\frac{1}{4}$ by $\frac{3}{3}$.

$$\frac{1}{3} \times \frac{4}{4} = \frac{4}{12} \qquad \frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$$

Then we add $\frac{4}{12}$ and $\frac{3}{12}$ to find their sum.

$$\frac{4}{12} + \frac{3}{12} = \frac{\mathbf{7}}{\mathbf{12}}$$

Example 4

Write $\frac{3}{4}$ as a fraction with a denominator of 100. Then write that fraction as a percent.

To change fourths to hundredths, we multiply by $\frac{25}{25}$.

$$\frac{3}{4} \times \frac{25}{25} = \frac{\mathbf{75}}{\mathbf{100}}$$

The fraction $\frac{75}{100}$ is equivalent to **75%.**

Lesson Practice Find the fraction name for 1 used to make each equivalent fraction:

a. $\frac{3}{4} \times \frac{?}{?} = \frac{9}{12}$

b. $\frac{2}{3} \times \frac{?}{?} = \frac{4}{6}$

c. $\frac{1}{3} \times \frac{?}{?} = \frac{4}{12}$

d. $\frac{1}{4} \times \frac{?}{?} = \frac{25}{100}$

Analyze Find the numerator that completes each equivalent fraction:

e. $\frac{1}{3} = \frac{?}{9}$

f. $\frac{2}{3} = \frac{?}{15}$

g. $\frac{3}{5} = \frac{?}{10}$

h. **Analyze** Write a fraction equal to one half that has a denominator of 6. Then write a fraction equal to one third that has a denominator of 6. What is the sum of the two fractions you made?

i. Write $\frac{3}{5}$ as a fraction with a denominator of 100. Then write that fraction as a percent.

Written Practice *Distributed and Integrated*

*1. Mr. Geralds bought 1 ton of hay. If his two cows eat a total of
(21, 77) 50 pounds of hay a day, how many days will the hay last?

*2. A platypus is a mammal with a duck-like bill and webbed feet. A platypus
(23, 74) is about $1\frac{1}{2}$ feet long. One and one half feet is how many inches?

3. Toshi bought 3 shovels for his hardware store for $6.30 each. He
(49) sold them for $10.95 each. How much profit did Toshi make on all
3 shovels? (Toshi's profit for each shovel can be found by subtracting
how much Toshi paid from the selling price.)

*4. (**Represent**) Add the decimal number ten and fifteen hundredths to
(68, 73) twenty-nine and eighty-nine hundredths. Use words to name the sum.

*5. What fraction name for 1 should $\frac{2}{3}$ be multiplied by to
(79) make $\frac{6}{9}$?

$$\frac{2}{3} \times \frac{?}{?} = \frac{6}{9}$$

*6. (**Represent**) Draw a rectangle whose sides are all 1 inch long. What is
(44, 72) the area of the rectangle?

7. (**List**) Write the numbers that are factors of both 9 and 12.
(25)

*8. (**Analyze**) Write a fraction equal to $\frac{3}{4}$ that has a denominator of 12.
(79) Then write a fraction equal to $\frac{2}{3}$ that has a denominator of 12. What is
the sum of the fractions you wrote?

9. $\overline{AC}$ is 9.1 centimeters and $\overline{BC}$ is 4.2 centimeters. Find $\overline{AB}$.
(61, 73)

$$A \qquad\qquad\qquad B \qquad\qquad\qquad C$$

10. $1\frac{1}{5} + 2\frac{2}{5} + 3\frac{3}{5}$
(75)

11. $5 - \left(3\frac{5}{8} - 3\right)$
(43, 63)

12. $10 - 10¢$
(70)

13. $10 \div 4$
(34)

14. $9 \times 64¢$
(70)

15. $24.6 + m = 30.4$
(10, 73)

16. $w - 6.35 = 2.4$
(14, 73)

17. $9n = 6552$
(26)

18. $7\overline{)43,859}$
(26)

*19. $15^2 - \sqrt{25}$
(78)

20. $80\overline{)4137}$
(54)

*21. $\frac{1}{2}$ of $\frac{1}{5}$
(76)

*22. $\frac{3}{4} \times \frac{2}{2}$
(76)

*23. $\frac{3}{5} \times \frac{5}{4}$
(76)

*24. The graph below shows the number of fruit cups sold at the snack bar
(Inv. 5) from June through August. Use the information in the graph to answer
parts **a** and **b.**

Fruit Cup Sales

June	🍊 🍊
July	🍊 🍊 🍊 🍊
August	🍊 🍊 🍊 🍊
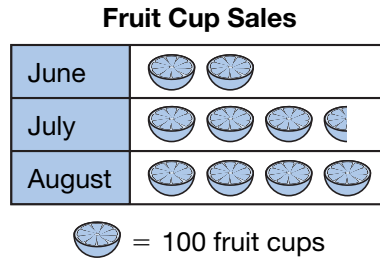
🍊 = 100 fruit cups

   a. Multiple Choice How many fruit cups were sold in July?

    A $3\frac{1}{2}$ **B** 300   **C** 305   **D** 350

   b. Altogether, how many fruit cups were sold during June, July, and
August?

25. **Analyze** A standard number cube is rolled once. What is the
(57) probability that the upturned face is *not* 4?

26. To multiply 12 by 21, Walker thought of 21 as 20 + 1. Then he mentally
(51) calculated this problem:

$$(20 \times 12) + (1 \times 12)$$

What is the product of 12 and 21? Try mentally calculating the answer.

*27. Multiple Choice Fourteen books were packed in a box. The
(77) mass of the packed box could reasonably be which of the following
masses?

   A 15 milligrams   **B** 15 grams   **C** 15 kilograms   **D** 15 metric tons

*28. What is the perimeter of this equilateral triangle?
(53, 73)

1.5 cm

*29. Compare: 500 mg ◯ 1.0 g
(77)

30. **Estimate** Mr. Johnson is deciding which of two used cars to buy.
(33) The price of one is $7995 and the price of the other is $8499. Find the
approximate difference in price. Explain how you used rounding.

• Prime and Composite Numbers

Power Up

facts Power Up H

mental math

  a. Measurement: How many grams equal one kilogram?

  b. Measurement: A pair of shoes weighs about one kilogram. One shoe weighs about how many grams?

  c. Percent: 25% of 16

  d. Percent: 25% of 160

  e. Fractional Parts: $\frac{1}{3}$ of 16 hours

  f. Powers/Roots: 4^2

  g. Estimation: Kelvin walked 490 m to the bank, then 214 m to the grocery store, and then 306 m back home. Round each distance to the nearest hundred meters; then add to find the approximate distance Kelvin walked.

  h. Calculation: $\sqrt{81}, -2, \div 2, -1, \times 2, -5$

problem solving

Choose an appropriate problem-solving strategy to solve this problem. LaKeisha erased some of the digits in a multiplication problem. She then gave it to Judy as a problem-solving exercise. Copy LaKeisha's multiplication problem and find the missing digits for Judy.

$$\begin{array}{r} 4\_ \\ \times \;\underline{\_\_} \\ 4\_4 \end{array}$$

New Concept

We have practiced listing the factors of whole numbers. Some whole numbers have many factors. Other whole numbers have only a few factors. In one special group of whole numbers, each number has exactly two factors.

Below, we list the first ten counting numbers and their factors. Numbers with exactly two factors are **prime numbers.** Numbers with more than two factors are **composite numbers.** The number 1 has only one factor and is neither prime nor composite.

Number	Factors	Type
1	1	
2	**1, 2**	**prime**
3	**1, 3**	**prime**
4	1, 2, 4	composite
5	**1, 5**	**prime**
6	1, 2, 3, 6	composite
7	**1, 7**	**prime**
8	1, 2, 4, 8	composite
9	1, 3, 9	composite
10	1, 2, 5, 10	composite

We often think of a prime number as a number that is not divisible by any other number except 1 and itself. Listing the factors of each number will help us see which numbers are prime.

Example 1

The first three prime numbers are 2, 3, and 5. What are the next three prime numbers?

We list the next several whole numbers after 5. A prime number is not divisible by any number except 1 and itself, so we mark through numbers that are divisible by some other number.

$$\cancel{6}, 7, \cancel{8}, \cancel{9}, \cancel{10}, 11, \cancel{12}, 13, \cancel{14}, \cancel{15}, \cancel{16}, 17, \cancel{18}$$

The numbers that are not marked through are prime numbers. The next three prime numbers after 5 are **7, 11,** and **13.**

Every number in the shaded part of this multiplication table has more than two factors. So every number in the shaded part is a composite number.

	1	2	3	4	5	6	7	8	9	10	11
1	1	②	③	4	⑤	6	⑦	8	9	10	⑪
2	②	4	6	8	10	12	14	16	18	20	22
3	③	6	9	12	15	18	21	24	27	30	33
4	4	8	12	16	20	24	28	32	36	40	44
5	⑤	10	15	20	25	30	35	40	45	50	55
6	6	12	18	24	30	36	42	48	54	60	66
7	⑦	14	21	28	35	42	49	56	63	70	77
8	8	16	24	32	40	48	56	64	72	80	88

In this multiplication table, prime numbers appear *only* in the row and column beginning with 1. We have circled the prime numbers that appear in the table. Even if the table were extended, prime numbers would appear only in the row and column beginning with 1.

Model We can use tiles to illustrate arrays that show the difference between prime and composite numbers. An **array** is a rectangular arrangement of numbers or objects in columns and rows. Here we show three different arrays for the number 12:

□ □ □ □   □ □ □ □ □ □   □ □ □ □ □ □ □ □ □ □ □ □
□ □ □ □   □ □ □ □ □ □   12 by 1
□ □ □ □   6 by 2
  4 by 3

Twelve is a composite number, which is demonstrated by the fact that we can use **different pairs** of factors to form arrays for 12. By turning the book sideways, we can actually form three more arrays for 12 (4 by 3, 6 by 2, and 12 by 1), but these arrays use the same factor pairs as the arrays already shown. For the prime number 11, however, there is only **one pair** of factors that forms arrays: 1 and 11.

□ □ □ □ □ □ □ □ □ □ □

Generalize Explain how you can use factor pairs to identify prime numbers.

Example 2

Draw three arrays for the number 16. Use different factor pairs for each array.

The multiplication table can guide us. We see 16 as 4 × 4 and as 8 × 2. So we can draw a 4-by-4-unit array and a 8-by-2-unit array. Of course, we can also draw a 16-by-1-unit array.

□ □ □ □   □ □ □ □ □ □ □ □   □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

□ □ □ □   □ □ □ □ □ □ □ □   16 by 1

□ □ □ □   8 by 2

□ □ □ □

  4 by 4
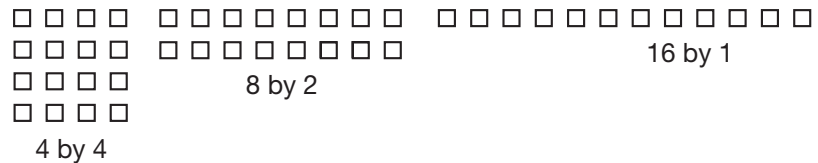
Activity

Identifying Composite and Prime Numbers

Materials needed:
- bag of 13 color tiles
- bag of 18 color tiles

Using your bag of 13 tiles, make as many different arrays as possible. Draw the arrays that you make using Xs.

a. List the factor pairs for 13.

b. Is 13 an example of a prime or composite number? Explain why.

Repeat the activity using the bag of 18 tiles.

c. List the factor pairs for 18.

d. Is 18 an example of a prime or composite number? Explain why.

Lesson Practice

a. Use color tiles to make as many different arrays as possible for the numbers 14 and 19. Draw the arrays using Xs. List the factor pairs for each number and tell if each number is prime or composite.

b. Draw two arrays of Xs for the composite number 9. Use different factor pairs for each array.

c. List all the factors for 15 and 17. Which number can be drawn using more than two arrays? Show the arrays of both numbers and use the arrays to determine which number is prime and which number is composite.

d. Use color tiles to make arrays of the following numbers: 10, 11, and 12. Which number(s) of tiles can be arranged in more than one array? Which number(s) of tiles can be arranged in only one array? Identify each number as prime or composite and explain your answer.

Written Practice

Distributed and Integrated

1. The store buys one dozen pencils for 96¢ and sells them for 20¢ each. How much profit does the store make on a dozen pencils?
(49, 70)

*2. A small car weighs about 1 ton. If its 4 wheels carry the weight evenly, then each wheel carries about how many pounds?
(21, 77)

3. (List) Write the numbers that are factors of both 8 and 12.
(25)

*4. The first five prime numbers are 2, 3, 5, 7, and 11. What are the next three prime numbers?
(80)

*5. (Explain) What fraction name for 1 should $\frac{3}{4}$ be multiplied by to make $\frac{9}{12}$? Explain how you found your answer.
(79)

$$\frac{3}{4} \times \frac{?}{?} = \frac{9}{12}$$

*6. Write a fraction equal to $\frac{1}{2}$ that has a denominator of 6. Then write a fraction equal to $\frac{2}{3}$ that has a denominator of 6. What is the sum of the fractions you wrote?
(79)

*7. (Justify) Think of a prime number. How many different factors does it have? How do you know?
(80)

**8.** Arrange these numbers in order from least to greatest:
(23, 59)

$$\frac{3}{8}, \frac{4}{6}, \frac{5}{6}, \frac{6}{12}, \frac{7}{7}$$

9. (Analyze) One mile is 1760 yards. How many yards is $\frac{1}{8}$ mile?
(46, 74)

10. $\overline{XZ}$ is 84 millimeters. $\overline{XY}$ equals $\overline{YZ}$. Find $\overline{XY}$.
(61)

11. $8.43 + 68¢ + \$15 + 5¢$
(70)

12. $6.505 - 1.4$
(73)

13. $12 - 12¢$
(70)

14. 18.07×6
(17)

15. $6w = \$76.32$
(26)

*16. 2^6
(78)

*17. $\sqrt{9} + \sqrt{16}$
(78)

18. Divide 365 by 7 and write the quotient as a mixed number.
(58)

*19. $\dfrac{3}{4}$ of $\dfrac{3}{4}$
(76)

*20. $\dfrac{3}{2} \times \dfrac{3}{2}$
(76)

*21. $\dfrac{3}{10} = \dfrac{?}{100}$
(79)

*22. $3\dfrac{2}{3} + 1\dfrac{2}{3}$
(75)

23. $5 - \dfrac{1}{5}$
(63)

24. $\dfrac{7}{10} - \dfrac{7}{10}$
(41)

25. A babysitter began work in the evening at the time shown
(28) on the clock and worked for $6\dfrac{1}{2}$ hours. What time did the babysitter finish work?
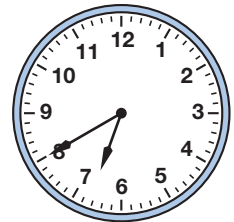

26. The sun is about 92,956,000 miles from Earth. Which digit in
(52) 92,956,000 is in the millions place?

*27. The sun is about 150,000,000 kilometers from Earth. Write that distance
(78) in expanded notation using powers of 10.

28. (Conclude) Is the sequence below arithmetic or geometric? Find the
(Inv. 4) next two terms in the sequence.

$$2, 4, 8, 16, \underline{\quad}, \underline{\quad}, \ldots$$

29. As the coin was tossed, the team captain called, "Heads!" What is the
(57) probability that the captain's guess was correct?

*30. The fraction $\dfrac{4}{5}$ is equivalent to 0.8 and 80%. Write 0.8 and 80% as
(71) unreduced fractions.

Focus on

• Graphing Points on a Coordinate Plane

• Transformations

If we draw two perpendicular number lines so that they intersect at their zero points, we create an area called a **coordinate plane.** Any point within this area can be named with two numbers, one from each number line. Here we show some examples:
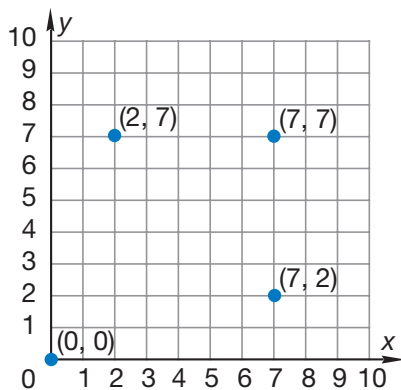
The horizontal number line is called the **x-axis,** and the vertical number line is called the **y-axis.** The numbers in parentheses are called **coordinates,** which give a point's "address." Coordinates are taken from the scales on the x-axis and y-axis. The first number in parentheses gives a point's horizontal position. The second number gives the point's vertical position. The point where the x-axis and y-axis intersect is called the **origin.** Its coordinates are (0, 0).

Refer to this coordinate plane to answer problems **1–5:**
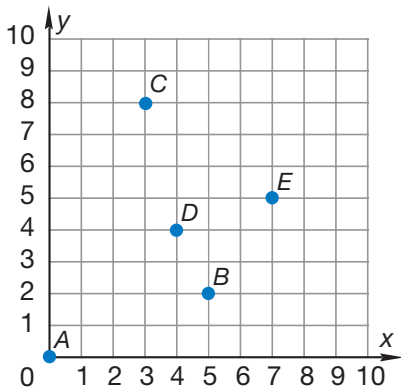
1. The coordinates of point *A* are (0, 0). What is the name for this point?

Use the coordinate plane on the previous page to write the coordinates of each of these points:

2. point *B*　　　　**3.** point *C*　　　　**4.** point *D*　　　　**5.** point *E*

Below is a design drawn on a coordinate plane. To draw the design, we could start at (5, 9), draw a segment to (2, 1), and then continue through the pattern back to (5, 9). We would connect the points in this order:

(5, 9) ⟶ (2, 1) ⟶ point *F* ⟶
point *G* ⟶ point *H* ⟶ (5, 9)
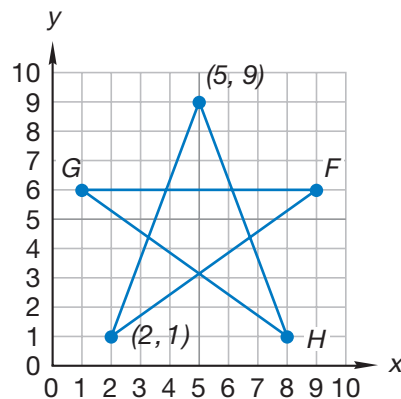
Write the coordinates of each of these points from the star design above:

6. point *F*　　　　　　**7.** point *G*　　　　　　**8.** point *H*

Activity 1

Graphing Designs

Material needed:
- **Lesson Activity 41**

a. Graph each of the following points. Then make a design by connecting the points in alphabetical order. Complete the design by drawing a segment from the last point back to the first point. What is the name for the figure?

I (7, 10)　　　　　　*M* (4, 1)
J (4, 10)　　　　　　*N* (7, 1)
K (1, 7)　　　　　　*O* (10, 4)
L (1, 4)　　　　　　*P* (10, 7)

b. On **Lesson Activity 41,** draw a polygon on the coordinate plane. Be sure each corner (vertex) of the polygon is at a point where grid lines meet. Then create directions for another student to recreate your polygon. Your directions should consist of the coordinates of each corner, listed in an order that will complete the design.
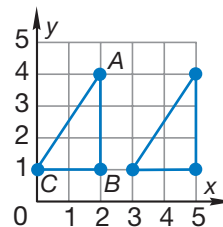
Transformations

We can move figures on a plane by sliding them, turning them, or flipping them. These movements are called **transformations** and they have special names.
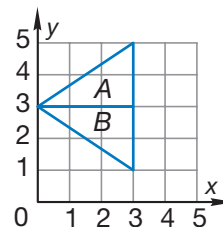
Names of Transformations

| Movement	Name
slide	**translation**
turn	**rotation**
flip	**reflection**

9. This figure shows triangle *ABC* and the image of where triangle *ABC* would appear translated three units to the right. Write the coordinates of points *A, B,* and *C* before the translation and after the translation.

10. Which transformation moves triangle *A* into the position of triangle *B*? Explain.

11. The figure shows triangle *ABC* and its image after what transformation? Explain.
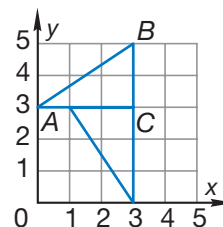
Activity 2

Transformations

Material needed:
- **Lesson Activity 41**

Draw a right triangle. Then draw the image as it would appear after each of these transformations. If you use graph paper, you will need to draw your own *x*-axis and *y*-axis. Be sure to draw each axis on a grid line and not between grid lines. Label each transformation.

a. a translation 4 units down

b. a half-turn rotation (180°) around one vertex of the triangle

c. a reflection across one side of the triangle