8•1 Kitchen Layouts and Perimeter

Objectives To provide experience measuring and adding distances; finding the median and other landmarks of a set of measurements; and finding the perimeters of triangles.

1 Teaching the Lesson

Key Activities

Students sketch arrangements of their kitchen appliances. They calculate the perimeter of the work triangle and compare individual and class results with recommended distances.

Students find landmarks of the perimeter data collected.

Key Concepts and Skills

- Create a tally chart. [Data and Chance Goal 1]
- Find the minimum, maximum, mode, and median of a data set; use landmarks to draw conclusions. [Data and Chance Goal 2]
- Measure distances in feet and inches. [Measurement and Reference Frames Goal 1]
- Calculate the perimeter of a triangle. [Measurement and Reference Frames Goal 2]
- Add mixed units; convert between feet and inches. [Measurement and Reference Frames Goal 3]

Key Vocabulary time-and-motion study • work triangle • perimeter

Ongoing Assessment: Recognizing Student Achievement Use Mental Math and Reflexes. [Number and Numeration Goal 5]

materials

- ☐ *Math Journal 2,* pp. 219–222
- ☐ Study Link 7•11 (*Math Masters,* pp. 235 and 236)
- ☐ slate
- ☐ scissors; tape
- ☐ straightedge
- ☐ yardstick (optional)

2 Ongoing Learning & Practice

Students play *Fraction Match* to practice naming equivalent fractions.

Students practice and maintain skills through Math Boxes and Study Link activities.

materials

- ☐ *Math Journal 2,* p. 223
- ☐ *Student Reference Book,* p. 243
- ☐ Study Link Master (*Math Masters,* p. 247)
- ☐ *Fraction Match* Cards (*Math Masters,* pp. 473–476)
- ☐ ruler

3 Differentiation Options

materials

- ☐ Teaching Masters (*Math Masters,* pp. 248 and 249)
- ☐ Teaching Aid Master (*Math Masters,* p. 437)
- ☐ *5-Minute Math,* p. 50
- ☐ geoboard and rubber bands; Geometry Template; pattern blocks

READINESS

Students construct rectangles and squares of a given perimeter on a geoboard.

ENRICHMENT

Students use pattern blocks to make polygons with different perimeters.

EXTRA PRACTICE

Students solve problems involving perimeter.

Technology

Assessment Management System
Mental Math and Reflexes
See the **iTLG.**

Getting Started

Mental Math and Reflexes ★

Ask students to give the decimal and percent equivalents for fractions with denominators of 100, 10, 5, and 4. *Suggestions:*

●○○	●●○	●●●
$\frac{50}{100}$ 0.50; 50%	$\frac{1}{100}$ 0.01; 1%	$\frac{1}{4}$ 0.25; 25%
$\frac{87}{100}$ 0.87; 87%	$\frac{8}{100}$ 0.08; 8%	$\frac{1}{5}$ 0.20; 20%
$\frac{23}{100}$ 0.23; 23%	$\frac{7}{10}$ 0.7; 70%	$\frac{4}{5}$ 0.80; 80%
$\frac{42}{100}$ 0.42; 42%	$\frac{5}{10}$ 0.5; 50%	$\frac{3}{4}$ 0.75; 75%

Math Message

Complete Problems 1 and 2 on journal page 220.

Ongoing Assessment: Recognizing Student Achievement

Mental Math and Reflexes ★

Use **Mental Math and Reflexes** to assess students' ability to rename fractions as decimals and percents. Students are making adequate progress if they are able to solve the ●○○ and ●●○ problems involving fractions with denominators of 10 and 100. Some students may be able to solve the ●●● problems involving fractions with denominators of 4 and 5.

[Number and Numeration Goal 5]

1 Teaching the Lesson

Math Message Follow-Up

WHOLE-CLASS ACTIVITY

(*Math Journal 2,* pp. 219 and 220; *Math Masters,* pp. 235 and 236)

Ask small groups of students to compare the layout of the stove, sink, and refrigerator in their kitchens.

Read journal page 219 as a class. Discuss the layouts shown. Have students circle the layout they have in their homes.

Survey the number of students who have a one-wall kitchen, an L-shaped kitchen, a U-shaped kitchen, or a Pullman or galley kitchen. Ask:

- Do any of you have "islands" in your kitchens? Some kitchens have island work areas that include a sink or stove. Share any sketches that show kitchen islands with the class.
- Why might a one-wall kitchen be less efficient than the other types? A person may have to walk longer distances from one appliance to another.

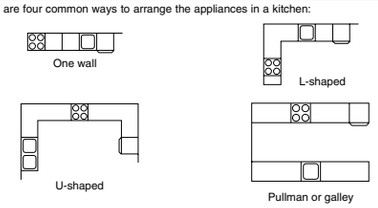
Tell students that in this lesson they will review perimeter by analyzing the placement of the appliances in their kitchens.

Student Page

Date Time

LESSON 8•1 **Kitchen Layouts and Kitchen Efficiency**

Here are four common ways to arrange the appliances in a kitchen:



Pullman kitchens are usually found on passenger trains. **Galleys** are the kitchens on boats and airplanes. The kitchen areas on trains, boats, and airplanes are small. The cooking area is usually lined up against a single wall (a one-wall kitchen) or against two walls with a corridor between them (a Pullman or galley kitchen).

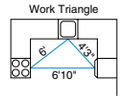
◆ What kind of kitchen layout do you have in your home? Circle one. Answers vary.

One wall L-shaped U-shaped Pullman or galley

Kitchen efficiency experts are people who study the ways we use our kitchens. They carry out **time-and-motion** studies to find how long it takes to do some kitchen tasks and how much a person has to move about in order to do them. They want to find the best ways to arrange the stove, the sink, and the refrigerator. In an efficient kitchen, a person should have to do very little walking to move from one appliance to another. However, the appliances should not be too close to each other, because the person would feel cramped.

A bird's-eye sketch is often drawn to see how well the appliances in a kitchen are arranged. The stove, the sink, and the refrigerator are connected with line segments as shown below. These segments form a triangle called a **work triangle.** The work triangle shows the distance between pairs of appliances.

Work Triangle



Math Journal 2, p. 219

Student Page

Date Time

LESSON 8•1 **Layout of My Kitchen**

1. Copy the distances between your appliances from *Math Masters*, page 235.

Between stove and refrigerator: About _____ feet _____ inches

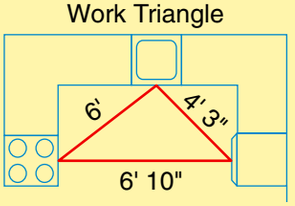
Between refrigerator and sink: About _____ feet _____ inches

Between sink and stove: About _____ feet _____ inches

2. Cut out the sketch of your kitchen from *Math Masters*, page 236 and tape it in the space below.

***Math Journal 2*, p. 220**

Work Triangle



Perimeter	Number of Triangles
Less than 11 ft	/
11 ft	/
12 ft	///
13 ft	/

Tallying perimeters of work triangles

Rating the Efficiency of a Kitchen

WHOLE-CLASS ACTIVITY

Industrial Arts Link As a result of **time-and-motion studies,** kitchen efficiency experts have recommended minimum and maximum distances between each pair of major appliances.

Range of Distances between:
Stove and refrigerator: 4 to 9 feet
Refrigerator and sink: 4 to 7 feet
Sink and stove: 4 to 6 feet

Write these recommendations on the board. Then sketch a stove, sink, and refrigerator and connect them with line segments. The resulting triangle, called a **work triangle,** can be used to show distances between pairs of appliances.

Remind students that the distance around a polygon is called its **perimeter.** Ask questions about the perimeter of a work triangle.

- What is the smallest perimeter of a work triangle that meets the experts' recommendations? 4 + 4 + 4 = 12 feet
- What is the largest perimeter? 9 + 7 + 6 = 22 feet
- What is the middle value for the range of recommended perimeters? The number halfway between 12 and 22 feet is 17 feet.

Analyzing Kitchen Arrangements

WHOLE-CLASS ACTIVITY

(*Math Journal 2,* pp. 220 and 221)

1. Ask students to use straightedges to connect the three appliances in their sketches on journal page 220 and write the distances between appliances on the sides of their triangles. Then have them find the perimeters of their work triangles.

Adjusting the Activity

Suggest that students think in terms of the partial-sums algorithm when adding mixed units—add feet, add inches, and then convert inches to feet, if necessary. For example, 6' + 4' 3" + 6' 10" = 16' 13" = 17' 1".

Encourage students to use a yardstick to help them visualize and rename mixed feet-and-inches measurements in simpler form.

AUDITORY • KINESTHETIC • TACTILE • VISUAL

2. Have students report the perimeters of their own work triangles. You or a student tallies these perimeters on the board. To simplify the record-keeping, ignore the inches in the perimeter or round each perimeter to the nearest foot.

3. Have students find the minimum, maximum, mode, and median of the class perimeters and record them in Problem 4 on journal page 221. Ask:

   - Is the class median close to 17 feet—the median of the recommended perimeters?
   - Does anyone have a work triangle with a perimeter outside the recommended range (less than 12 feet or greater than 22 feet)? If so, share your sketches with the class.
   - Does anyone have a work triangle in which the distance between two appliances is *outside* the recommended range but whose *perimeter* is within the recommended range? (For example, the distance between stove and sink is 3 feet, but the perimeter is 14 feet.)

Sketching Work Triangles of Given Perimeters

PARTNER ACTIVITY

(*Math Journal 2,* p. 222)

Have students sketch work triangles that meet the conditions specified on journal page 222 and share solution strategies.

One possible approach might be to establish the distance from sink to stove as 4, 5, or 6 feet.

- If the distance between sink and stove is 4 feet, then the sum of the other two distances must be 17 feet (4 + 17 = 21). But this sum may not exceed 16 feet (9 + 7). Therefore, the distance between sink and stove cannot be 4 feet.
- If the distance between sink and stove is 5 feet, then the sum of the other two distances must be 16 feet (5 + 16 = 21). So the distance between stove and refrigerator would be 9 feet, and the distance between refrigerator and sink would be 7 feet.
- If the distance between sink and stove is 6 feet, then the sum of the other two distances must be 15 feet (6 + 15 = 21). Therefore, the other two distances would be either 8 feet and 7 feet, or 9 feet and 6 feet.

2 Ongoing Learning & Practice

Playing *Fraction Match*

SMALL-GROUP ACTIVITY

(*Student Reference Book,* p. 243; *Math Masters,* pp. 473–476)

Students play *Fraction Match* to practice naming equivalent fractions. See Lesson 7-6 for additional information.

Student Page

Date Time

LESSON 8•1 **How Efficient Is My Kitchen?**

Answer the questions below to see how well the appliances in your kitchen are arranged.

1. With a straightedge, draw a triangle connecting the appliances in your sketch on page 220. Write the distances between the appliances on the sides of your triangle. This triangle is called a **work triangle.**

2. Find the **perimeter** of your work triangle. Show your work.

   _____ feet _____ inches
   _____ feet _____ inches
   \+ _____ feet _____ inches

   The perimeter is about _____ feet _____ inches.

   That's close to _____ feet.

3. Kitchen efficiency experts recommend the following distances between appliances:

   Between stove and refrigerator: 4 feet to 9 feet
   Between refrigerator and sink: 4 feet to 7 feet
   Between sink and stove: 4 feet to 6 feet

   Does your kitchen meet these recommendations? _____

4. How many students reported their work triangle perimeters? _____ students

   The minimum perimeter is about _____ feet.

   The maximum perimeter is about _____ feet.

   The mode of the perimeters is about _____ feet.

   The median perimeter is about _____ feet.

***Math Journal 2,* p. 221**

Student Page

Date Time

LESSON 8•1 **Work Triangles**

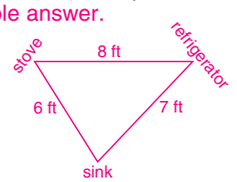
1. a. Below, draw a work triangle that meets all of the following conditions:
   - The perimeter is 21 feet.
   - The length of each side is a whole number of feet.
   - The length of each side is in the recommended range:

     Between stove and refrigerator: 4 feet to 9 feet
     Between refrigerator and sink: 4 feet to 7 feet
     Between sink and stove: 4 feet to 6 feet

   b. Write the distances on the sides of your triangle.

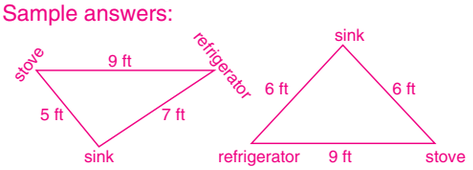
   c. Label each vertex (corner) of the triangle as *stove, sink,* or *refrigerator.*

Sample answer.



2. Below, draw a different work triangle that meets the same conditions listed in Problem 1.

Sample answers:



***Math Journal 2,* p. 222**

Student Page

Date Time

LESSON 8•1 **Math Boxes**

1. Some fourth graders were asked how many minutes they spend studying at home per week. Here are the responses from ten students:

   130, 45, 240, 35, 160, 185, 120, 20, 55, 160

   a. What is the mode? 160 minutes

   b. What is the median? 125 minutes

2. Insert >, <, or = to make each number sentence true.

   a. $\frac{11}{12} < \frac{19}{20}$

   b. $\frac{1}{4} > \frac{1}{9}$

   c. $\frac{4}{9} = \frac{12}{27}$

   d. $\frac{10}{12} = \frac{30}{36}$

   e. $\frac{7}{2} = \frac{21}{6}$

3. a. Use your Geometry Template to draw an equilateral triangle.

   b. Measure one of the angles with your protractor. Record the measure.

   60 °

4. If you spin the spinner below 100 times, how many times would you expect it to land

   on red? 20 times

   on black? 40 times

   on white? 40 times

5. Solve the open sentence $\frac{1}{4} + y = \frac{3}{8}$. Circle the best answer.

   A $y = \frac{2}{4}$

   B $y = \frac{4}{12}$

   (C) $y = \frac{1}{8}$

   D $y = \frac{1}{4}$

6. A store is giving a 50% discount on all merchandise. Find the discounted prices.

Regular price	Discounted price
$26.00	$13.00
$0.48	$0.24
$140.60	$70.30
$65.24	$32.62

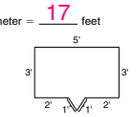
Math Journal 2, p. 223

Study Link Master

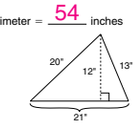
Name Date Time

STUDY LINK 8•1 **Perimeter**

1. Perimeter = 17 feet

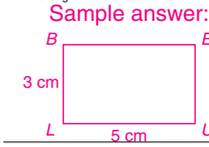
   

2. Perimeter = 54 inches

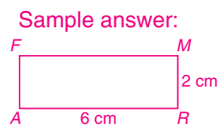
3. Draw a rectangle *BLUE* whose perimeter is 16 centimeters. Label the length of the sides.

   Sample answer:

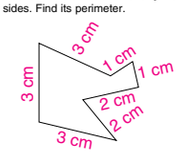
   

4. Draw a different rectangle *FARM* whose perimeter is also 16 centimeters. Label the length of its sides.

   Sample answer:

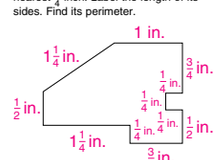
   

5. Measure the sides of the figure to the nearest centimeter. Label the length of its sides. Find its perimeter.

   Perimeter = 15 centimeters

6. Measure the sides of the figure to the nearest $\frac{1}{4}$ inch. Label the length of its sides. Find its perimeter.

   Perimeter = 7 inches

Practice

7. $\frac{1}{4}$ of 24 = 6

8. 16 = $\frac{2}{3}$ of 24

9. 25 = $\frac{5}{8}$ of 40

Math Masters, p. 247

Math Boxes 8•1

INDEPENDENT ACTIVITY

(*Math Journal 2,* p. 223)

Mixed Practice Math Boxes in this lesson are paired with Math Boxes in Lesson 8-3. The skill in Problem 6 previews Unit 9 content.

Writing/Reasoning Have students write a response to the following: *Explain how you solved Problem 4.* Sample answer: $\frac{1}{5}$ of the spinner is red, $\frac{2}{5}$ of the spinner is black, and $\frac{2}{5}$ of the spinner is white. Since $\frac{1}{5}$ of 100 is 20, I expect the spinner to land on red 20 times. $\frac{2}{5}$ of 100 is 40, so I expect the spinner to land on black 40 times and on white 40 times.

Study Link 8•1

INDEPENDENT ACTIVITY

(*Math Masters,* p. 247)

Home Connection Students measure figures to the nearest centimeter and nearest $\frac{1}{4}$ inch and calculate the perimeter of each. They draw rectangles of a given perimeter.

3 Differentiation Options

READINESS

PARTNER ACTIVITY

15–30 Min

Investigating Perimeters on a Geoboard

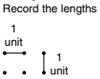
(*Math Masters,* pp. 248 and 437)

To explore the concept of perimeter using a concrete model, have students construct rectangles and squares of a given perimeter on a geoboard and record the lengths of the sides on *Math Masters,* page 248. Consider having students use a straightedge to sketch their rectangles and squares on *Math Masters,* page 437.

Name Date Time

LESSON 8•1 **Geoboard Perimeters**

On a geoboard, make rectangles or squares with the perimeters given below. Record the lengths of the long side and short side of each shape.



Perimeter (units)	Long side (units)	Short side (units)
12	5	1
12	4	2
12	3	3
14	6	1
14	5	2
14	4	3
16	7	1
16	6	2
16	5	3
16	4	4

Math Masters, page 248

ENRICHMENT

PARTNER ACTIVITY

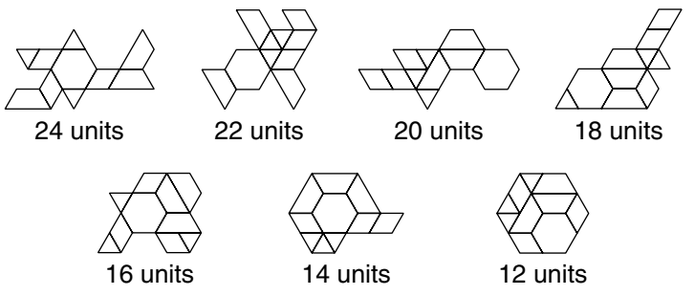
15–30 Min

Investigating Pattern-Block Perimeters

(*Math Masters,* p. 249)

Portfolio Ideas

To apply students' understanding of perimeter, have them use a given set of pattern blocks (1 hexagon, 3 trapezoids, 3 blue rhombi, and 3 triangles) to create polygons with as many different perimeters as possible. Acknowledge that many different polygons can be made with the *same* perimeter, but encourage students to look for polygons with different perimeters. Have students discuss and compare their strategies. *Sample answers:*



EXTRA PRACTICE

SMALL-GROUP ACTIVITY

5–15 Min

5-Minute Math

To offer students more experience with perimeter, see *5-Minute Math,* page 50.

Planning Ahead

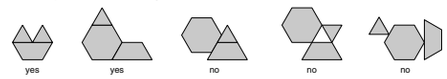
Starting in Lesson 8-3, students will study area. Make and display unit squares with sides measuring 1 inch, 1 foot, 1 yard, 1 centimeter, 1 decimeter, and 1 meter. Use any kind of paper. Label each square in two ways, such as *1 square inch* and *1 in^2*.

Teaching Master

Name Date Time

LESSON 8•1 **Pattern-Block Perimeters**

1. Use the following pattern blocks to create shapes with as many *different* perimeters as you can: 1 hexagon, 3 trapezoids, 3 blue rhombi, and 3 triangles.
   - Every shape must include all 10 pattern blocks.
   - Each side of a pattern block measures 1 unit. The long side of a trapezoid pattern block measures 2 units.
   - At least one side of every pattern block must *line up exactly* with a side of another pattern block. See figures.



2. Use your Geometry Template to record your shapes on a separate sheet of paper. The polygons should all have different perimeters. Write the perimeter next to each shape.

Sample answers:

3. What was the smallest perimeter you were able to make? 14 units
   Describe the strategy you used to find this perimeter.
   The tighter the blocks are packed together, the smaller the distance around the outside will be.

4. What was the largest perimeter you were able to make? 24 units
   Describe the strategy you used to find this perimeter.
   If the blocks are spread out, then the distance around the outside will be greater.

Math Masters, p. 249