STUDY LINK 8·13 | **Unit 9: Family Letter**

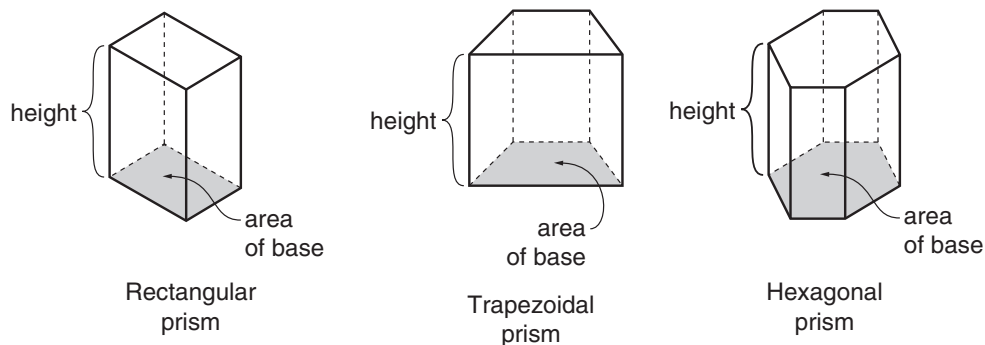# Coordinates, Area, Volume, and Capacity

In the beginning of this unit, your child will practice naming and locating ordered number pairs on a coordinate grid. Whole numbers, fractions, and negative numbers will be used as coordinates. Your child will play the game *Hidden Treasure,* which provides additional practice with coordinates. You might want to challenge your child to a round.

In previous grades, your child studied the perimeters (distances around) and the areas (amounts of surface) of geometric figures. *Fourth Grade Everyday Mathematics* developed and applied formulas for the areas of rectangles, parallelograms, and triangles. In this unit, your child will review these formulas and explore new area topics, including the rectangle method for finding areas of regular and irregular shapes.

Students will also examine how mathematical transformations change the area, perimeter, and angle measurements of a figure. These transformations resemble changes and motions in the physical world. In some transformations, figures are enlarged in one or two dimensions; in other transformations, figures are translated (slid) or reflected (flipped over).

In the Earth's Water Surface exploration, students locate places on Earth with latitude and longitude. Then they use latitude and longitude in a sampling experiment that enables them to estimate, without measuring, the percent of Earth's surface that is covered by water. In the School's Land Area exploration, students use actual measurements and scale drawings to estimate their school's land area.

The unit concludes with a look at volume (the amount of space an object takes up) and capacity (the amount of material a container can hold). Students develop a formula for the volume of a prism (volume = area of the base ∗ the height). They observe the metric equivalents 1 liter = 1,000 milliliters = 1,000 cubic centimeters, and they practice making conversions between U.S. customary measures (1 gallon = 4 quarts, and so on).

height { | Rectangular prism — area of base

height { | Trapezoidal prism — area of base

height { | Hexagonal prism — area of base

Please keep this Family Letter for reference as your child works through Unit 9.

Vocabulary

Important terms in Unit 9:

area The amount of surface inside a 2-dimensional figure. Area is measured in square units, such as square inches (in^2) and square centimeters (cm^2).

axis of a coordinate grid Either of the two number lines that intersect to form a coordinate grid.

capacity The amount of space occupied by a *3-dimensional* shape. Same as *volume.* The amount a container can hold. Capacity is often measured in units such as *quarts, gallons, cups,* or *liters.*

coordinate A number used to locate a point on a number line, or one of two numbers used to locate a point on a coordinate grid.

coordinate grid A reference frame for locating points in a plane using ordered number pairs, or coordinates.
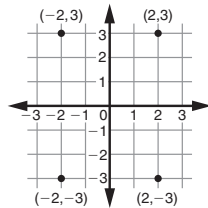
Rectangular coordinate grid

formula A general rule for finding the value of something. A formula is usually an equation with quantities represented by letter *variables.* For example, the formula for the area of a rectangle may be written as $A = \ell * w,$ where A represents the area of the rectangle, ℓ represents the length, and w represents the width.

latitude A measure, in degrees, of the distance of a place north or south of the equator.

longitude A measure, in degrees, of how far east or west of the prime meridian a place is.

ordered number pair Two numbers that are used to locate a point on a *coordinate grid.* The first number gives the position along the horizontal axis; the second number gives the position along the vertical axis. Ordered number pairs are usually written inside parentheses: (2,3).

perpendicular Two lines or two planes that intersect at right angles. Line segments or rays that lie on perpendicular lines are perpendicular to each other. The symbol ⊥ means *is perpendicular to.*

rectangle method A method for finding area in which one or more rectangles are drawn around a figure or parts of a figure.
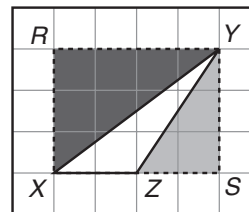
To find the area of triangle *XYZ,* first draw rectangle *XRYS* through its vertices. Then subtract the areas of the two shaded triangles from the area of rectangle *XRYS.*

transformation Something done to a geometric figure that produces a new figure. Common transformations are translations (slides), reflections (flips), and rotations (turns).

volume The amount of space occupied by a 3-dimensional shape. Same as *capacity.* The amount a container can hold. Volume is usually measured in cubic units, such as cubic centimeters (cm^3), cubic inches (in^3), or cubic feet (ft^3).

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Do-Anytime Activities

To work with your child on concepts taught in this unit, try these interesting and rewarding activities:

1. Find an atlas or map that uses letter-number pairs to locate places. For example, an atlas might say that Chattanooga, Tennessee, is located at D-9. Use the letter-number pairs to locate places you have visited or would like to visit.

2. Estimate the area of a room in your home. Use a tape measure or ruler to measure the room's length and width, and multiply to find the area. Make a simple sketch of the room, including the length, the width, and the area. If you can, find the area of other rooms or of your entire home.

Building Skills through Games

In Unit 9, your child will develop his or her understanding of coordinates and coordinate grids by playing the following games. For detailed instructions, see the *Student Reference Book.*

Frac-Tac-Toe See *Student Reference Book,* pages 309–311. Two players use a set of number cards 0–10 (4 of each), a gameboard, counters, and a calculator to play one of many versions. Students practice converting between fractions, decimals, and percents.

Hidden Treasure See *Student Reference Book,* page 319. This game for 2 players provides practice using coordinates and coordinate grids. It also offers the opportunity for players to develop good search strategies. Each player will need a pencil and two 1-quadrant playing grids with axes labeled from 0 to 10.

Polygon Capture See *Student Reference Book,* page 328. This game involves two to four players. Materials include polygon pieces and property cards. Players strengthen skills with identifying attributes of polygons. Players may also use 4-quadrant grids with axes labeled from −7 to 7. Practice is extended to coordinates and grids that include negative numbers.

As You Help Your Child with Homework

As your child brings assignments home, you might want to go over the instructions together, clarifying them as necessary. The answers listed below will guide you through some of the Study Links in this unit.
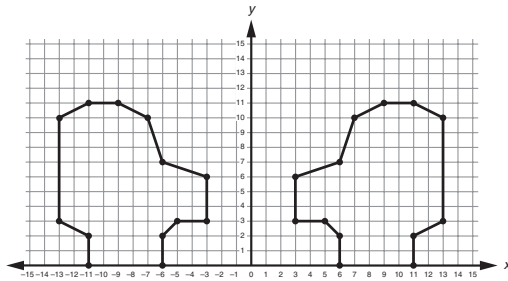
Study Link 9·1

2. Rectangular prism

3. a. (11,7) **4.** 13,297

5. 872.355 **6.** $10\frac{2}{8}$, or $10\frac{1}{4}$

Study Link 9·2

1. Sample answers: (8,16); (0,5); (16,5)

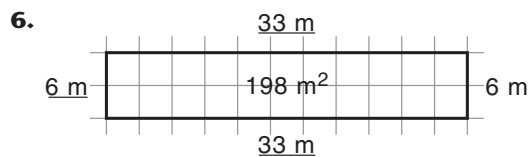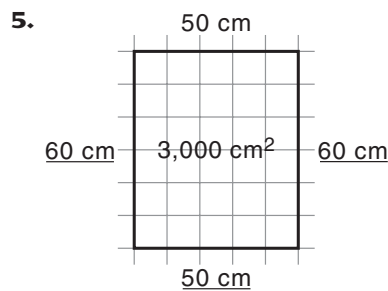**2.** isosceles **4.** quadrangle

Study Link 9·3

2. The first number

3.

4. 26,320 **6.** $\frac{14}{24}$, or $\frac{7}{12}$

Study Link 9·4

1. 150 sq ft; 12 hr 30 min **2.** 114 square feet

3. 80 yd^2 **4.** 33 ft^2

5.

50 cm

60 cm 3,000 cm^2 60 cm

50 cm

6.

33 m

6 m 198 m^2 6 m

33 m

Study Link 9·5

1. 4 cm^2 **2.** 6 cm^2 **3.** 16 cm^2

4. 10 cm^2 **5.** 15 cm^2 **6.** 4 cm^2

Study Link 9·6

1. 4.5 cm^2; $\frac{1}{2} * 3 * 3 = 4.5$

2. 7.5 cm^2; $\frac{1}{2} * 5 * 3 = 7.5$

3. 3 cm^2; $\frac{1}{2} * 2 * 3 = 3$

4. 24 cm^2; $6 * 4 = 24$

5. 12 cm^2; $4 * 3 = 12$

6. 8 cm^2; $4 * 2 = 8$

Study Link 9·7

1. yd^2 **2.** cm^2 **3.** cm^2

4. in^2 **5.** ft^2

6. $A = \frac{1}{2} * 20 * 13$; 130 ft^2 **7.** $A = 8 * 2$; 16 cm^2

8. $A = \frac{1}{2} * 22 * 7$; 77 yd^2 **9.** $A = 8 * 9\frac{1}{2}$; 76 m^2

Study Link 9·8

1. 15 cm^2; 15 cm^3; 45 cm^3 **2.** 8 cm^2; 8 cm^3; 16 cm^3

3. 9 cm^2; 9 cm^3; 27 cm^3 **4.** 14 cm^2; 14 cm^3; 56 cm^3

5. $\frac{3}{40}$ **6.** 960 **7.** 3,840

Study Link 9·9

1. 72 cm^3 **2.** 144 cm^3 **3.** 70 in^3

4. 162 cm^3 **5.** 45 in^3 **6.** 140 m^3

7. 4 **8.** −245 **9.** 160

Study Link 9·10

2. $A = \frac{1}{2} * 7 * 6$; 21 cm^2 **3.** $A = 8 * 6$; 48 in^2