Teacher Edition

Revised Edition

Performance Coach™ Mathematics 7

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LESSON 19

Understanding Cross Sections of Three-Dimensional Figures

Student Edition pages 182–189

LESSON OVERVIEW

Objectives

Students will:

- Describe the two-dimensional figure that results when a right rectangular prism, a right rectangular pyramid, a cone, or a cylinder is sliced by a plane
- Compare the shapes of different cross sections made by slicing the same three-dimensional figure in different ways

Discussion Questions

MP6 Why is the cross section of a three-dimensional solid a two-dimensional figure?

MP7 How are certain cross sections related to the faces of a three-dimensional solid?

Key Term

cross section

Materials

- Math Tool: Shapes, p. C10
- Math Tool: Net: Square Pyramid, p. C11
- Math Tool: Net: Cone, p. C12
- Math Tool: Net: Cube, p. C13
- three identical paper squares
- clay or blocks of cheese
- tools for slicing the clay or blocks of cheese (e.g., plastic knife or scissors)

Differentiation

Lesson Support If students have difficulty visualizing the slices, provide students with clay or a block of cheese and a simple tool for slicing it. Encourage students to model the solid figures in each of the examples and problems, slicing them as indicated. Providing concrete experiences with cross sections will help students visualize these slices later.

Lesson Extension Provide students with clay or blocks of cheese and a tool for slicing. Assign each student a three-dimensional figure. Have students create models of their assigned figures and determine all of the different cross sections that can result, based on where they cut their figures. Ask students to record their results by describing the angle at which the cut was made and the faces they sliced through. They should also sketch a drawing of each cross section. Have pairs of students compare their results and hypothesize about the number of different cross sections possible for different figures.

1 GETTING THE IDEA

Lesson Opener

Before class, mold clay (or a block of cheese) into a square prism. Show it to students and explain that when a rectangular prism has a base that is a square, the solid figure can also be called a square prism. Point out that a prism always has at least two parallel bases. Go over the Getting the Idea information, and cut your clay model along a plane that is parallel to its base in order to show students that the **cross section** is the same shape as the base.

▸ Example 1

Use your model to demonstrate the difference between a slice parallel to the base and a slice perpendicular to the base, and review the meanings of those terms. Use the diagram in Example 1 to show that the cross section is now a rectangle that is not a square. Ask: *Will the shape of the slice change if I make a perpendicular slice in another spot on the solid?* (no) Slice your model to demonstrate that this is true.

▸ Example 2

Make a cone, using either Math Tool: Net: Cone or clay. Ask: *What shape will you get when you slice a cone?* (It depends on the angle of the slice.) Help students see that slicing the cone parallel to its base results in a circle but that slicing it at a slant results in an oval shape called an ellipse.

▲ ***ELL Support*** *Have students add* cross section *and* ellipse *to their dictionaries and draw an example of each. Provide students with Math Tool: Shapes, and have them write* ellipse *above the oval. Encourage ELL students to refer to this tool to help them accurately describe the two-dimensional shapes of cross sections.*

▲ ***Journal Prompt*** MP3 *When a cone is sliced along a horizontal plane parallel to its base, at different heights above the base, how does the shape of the cross section formed change, if at all?*

▸ Example 3

Make a rectangular pyramid, using either Math Tool: Net: Square Pyramid or clay. Help students see that slicing the pyramid perpendicular to its base but not through its vertex results in a trapezoid. Ask: *Why is it important to state that the slice is not through the vertex?* (because a slice through the vertex would result in a triangular cross section)

DOMAIN 4

2 COACHED EXAMPLE

Make a rectangular cube, using Math Tool: Net: Cube, clay, or a block of cheese. Walk students through the Coached Example, referring to your model, as needed, to help students understand where the cube is sliced and how the shape of the cross section will look.

▲ ***Common Errors*** *Students may say the cross section is an isosceles triangle. Using your model, point out that each of the sides of the cross section is a diagonal of one of the faces. If need be, show students three identical paper squares. Have a volunteer first fold each square along one diagonal and then compare the length of each of the folds to see they are the same length.*

For answers, see Appendix A.

3 LESSON PRACTICE

Problem 3 would be a good problem to use as a quick check for students' understanding of the concepts taught in this lesson. As students are working, pay special attention to problem 8, students may benefit from using kinesthetic models to visualize the results of different plane slices.

For answers, see Appendix A.