

### Solve & Discuss It!

How could Mrs. Mendoza divide the ream of paper equally between two art classes? She has a paper cutter to slice the paper, if needed. What will the dimensions for each sheet of paper be once she has divided the ream? How many sheets will each class receive?



#### Lesson 10-7

### Describe Cross Sections

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**I can...**  
determine what the cross section looks like when a 3D figure is sliced.

**Focus on math practices**

**Use Structure** How would the number of sheets of paper each class receives change if Mrs. Mendoza started with 300 sheets?

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### Essential Question

How do the faces of a three-dimensional figure determine the two-dimensional shapes created by slicing the figure?


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#### EXAMPLE 1 Describe Cross Sections of Right Rectangular Prisms

Rachel and Francesca went to a restaurant that serves rectangular bread rolls. Each sliced her roll in a different way. What do the cross sections look like?

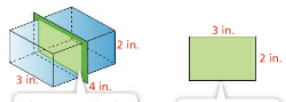
**Use Structure** What faces are parallel to the slice?

**Rachel**



A **cross section** is the two-dimensional shape that is exposed when a slice is made through a three-dimensional object.

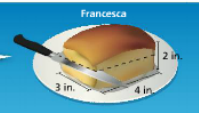
Rachel made a vertical slice that was parallel to the front and back faces of the roll.



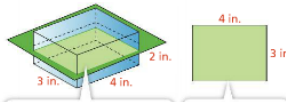
The cross section is parallel to the front and back faces, so it is the same shape as those faces.

The cross section is a rectangle that is 3 inches by 2 inches.

**Francesca**



Francesca made a horizontal slice that was perpendicular to the front and back faces of the roll.



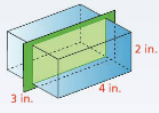

The cross section is parallel to the top and bottom faces, so it is the same shape as those faces.

The cross section is a rectangle that is 4 inches by 3 inches.

**Try It!**

Zachary made a vertical slice that was parallel to the left and right faces of a bread roll. What shape is the cross section, and what are its dimensions?

The shape of the cross section is a  that is  inches by  inches.

**Convince Me!** What are the shapes of horizontal and vertical cross sections of a rectangular prism, and how can you determine the dimensions of the cross sections?

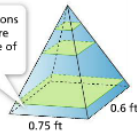
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**EXAMPLE 2** Describe Cross Sections of Right Rectangular Pyramids

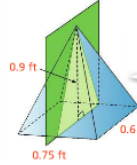
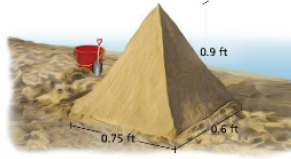
Kenya made a sand castle in the shape of a right rectangular pyramid with a height of 0.9 feet.

- a. If Kenya sliced the castle horizontally, parallel to the base, what would the cross section look like?

Horizontal cross sections are rectangles that are smaller than the base of the pyramid.



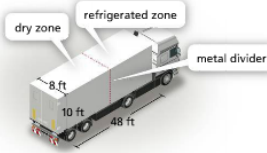
- b. If Kenya sliced the castle vertically, through the top vertex, perpendicular to the base, and intersecting the 0.75-foot edges, what would the cross section look like?



The cross section would be an isosceles triangle with a height of 0.9 feet and a base length of 0.6 foot.

**EXAMPLE 3** Solve Problems Involving Cross Sections

A truck needs a metal divider that separates the refrigerated part of the truck from the dry goods. What should the divider look like, and how many square feet will the metal divider be?



STEP 1 Draw a picture of the cross section.



STEP 2 Find the area of the metal divider.

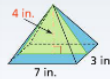
$$A = \ell \times w$$

$$= 10(8) = 80 \text{ ft}^2$$

The metal divider will be 80 square feet.

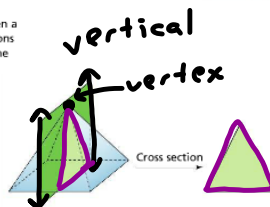
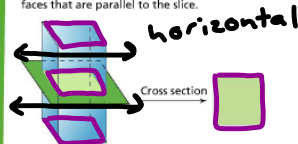
**Try It!**

Draw the cross section that is created when a vertical plane intersects the top vertex and the shorter edge of the base of the pyramid shown. What is the area of the cross section?



**KEY CONCEPT**

A cross section is the two-dimensional shape exposed when a three-dimensional figure is sliced. The shape and dimensions of a cross section in a rectangular prism are the same as the faces that are parallel to the slice.



**Do You Understand?**

1. **Essential Question** How do the faces of a three-dimensional figure determine the two-dimensional shapes created by slicing the figure?

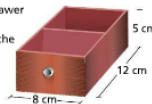
2. **Generalize** What are the shapes of the cross sections that are parallel or perpendicular to the bases of a right rectangular prism?



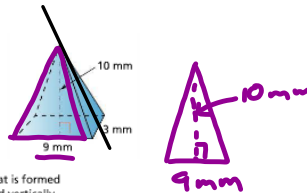
3. **Generalize** What are the shapes of the horizontal cross sections of a right rectangular pyramid? What are the shapes of vertical cross sections through the vertex opposite the base?

**Do You Know How?**

4. The divider in a desk drawer is a cross section that is parallel to the front of the drawer. What is its shape, and what are its dimensions?



5. Use the diagram to answer the questions.

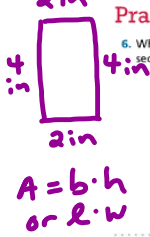


- a. Draw the cross section that is formed when the pyramid is sliced vertically through its vertex and its right face, perpendicular to its base.

$A = 45 \text{ mm}^2$

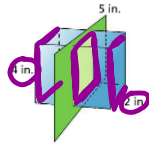
b. What is the area of this cross section?  
 $A = \frac{1}{2} \cdot b \cdot h = \frac{1}{2} \cdot 9 \text{ mm} \cdot 10 \text{ mm}$

A rectangle with a base of 2 inches and a height of 4 inches, and an area is  $8 \text{ in}^2$ .

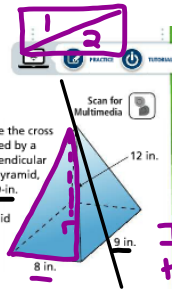


**Practice & Problem Solving**

6. What are the dimensions of the vertical cross section shown on this right rectangular prism?



7. **Be Precise** Describe the cross section that is formed by a vertical plane, perpendicular to the base of the pyramid, that intersects the 9-in. edge and the top vertex of the pyramid shown.



Isosceles triangle with a base of 8 in and height of 12 in.

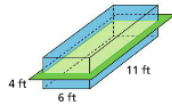
$A_0 = \frac{1}{2} \cdot 8 \cdot 12$   
 $A_0 = 48 \text{ in}^2$

8. Mason is slicing butter for the meal he is preparing. Describe the vertical cross section when the knife slices through the butter, parallel to its sides.



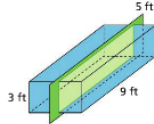
10. Use the figure to the right.

a. Describe the cross section shown.



b. Is it possible to have a horizontal cross section with different dimensions if you had the plane intersect the prism at another height? Explain.

9. a. **Look for Relationships** What are the dimensions of the vertical cross section?

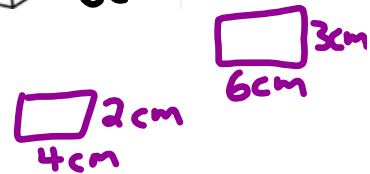
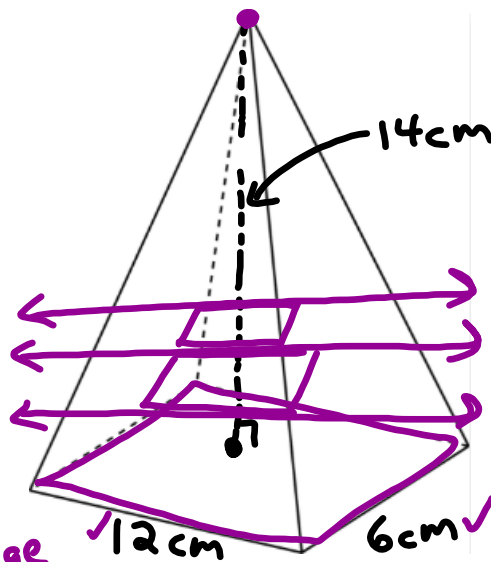


b. What would be the dimensions of a horizontal cross section?

11. **Make Sense and Persevere** The base of a right rectangular pyramid has a length of 12 centimeters, a width of 6 centimeters, and a height of 14 centimeters. Describe the cross section formed by a horizontal plane that intersects the faces of the pyramid above the base.

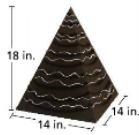
11. **Make Sense and Persevere** The base of a right rectangular pyramid has a length of 12 centimeters, a width of 6 centimeters, and a height of 14 centimeters. Describe the cross section formed by a horizontal plane that intersects the faces of the pyramid above the base.

The rectangle that is created by the cross section will be smaller than the base rectangle, the length will be twice as large as the width. The ratio between  $l$  and  $w$  remains the same.



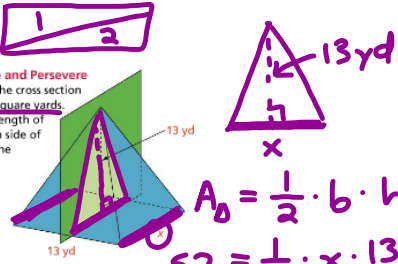
12. **Higher Order Thinking** Luis makes blocks from a painted piece of wood with dimensions of 27 inches  $\times$  24 inches  $\times$  1.5 inches. To make 72 blocks, the wood is cut into 3-inch squares. Draw two pictures showing the horizontal cross section and the vertical cross section of each block.

14. A waiter slices a cake shaped like a square pyramid vertically through the top point.  
 a. **Make Sense and Persevere** Draw the cross section that is made by slicing the cake in this way.



b. What is the area of this cross section?

13. **Make Sense and Persevere** The area of the cross section shown is 52 square yards. What is the length of the unknown side of the base of the pyramid?



$$A_0 = \frac{1}{2} \cdot b \cdot h$$

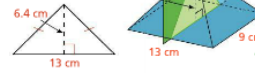
$$52 = \frac{1}{2} \cdot x \cdot 13$$

$$52 = \frac{1}{2} \cdot 13 \cdot x$$

$$52 = \frac{6.5x}{6.5}$$

$$84 = x$$

15. Miranda says that the triangle below represents the cross section of the rectangular pyramid shown.



What mistake might Miranda have made?

$$52 = \frac{1}{2} \cdot 13 \cdot x$$

$$8 = x$$

**Assessment Practice**

16. **PART A** The horizontal cross section has the same shape and dimensions as which sides of the right rectangular prism? Select all that apply.

- Top face
- Bottom face
- Left face
- Front face
- Back face
- Right face

**PART B** What is the area of the cross section? Explain your answer.

