Cross Sections

Overview

In this activity, students will slice three-dimensional figures in the augmented reality environment. They will slice the figures from multiple angles and identify the two-dimensional shapes, or cross sections, that are formed by these slices.

Objectives

Upon completion of the activity, students will be able to identify cross sections formed by slices of three-dimensional figures, including cylinders, spheres, cones, and triangular and rectangular prisms and pyramids.

Launch

Scanning The device needs a variety of perspective information to understand the space.

- Slowly move the camera throughout the space.
- View surfaces at an angle.
- Aim the camera at multiple points throughout the space.

Exploration

- Move the phone closer in to increase the size of the objects in AR.
- Move the phone around the objects to view them from different angles.
- Touch the screen to select and drag objects.

Environment Ideal spaces for AR should feature the following:

- a flat open space
- a surface with non-patterned visual texture and contrast
- a matte or minimally reflective surface
- a static environment, where nothing in the space is in motion
- a well-lit space, where detail is visible in the darkest and brightest parts of the space

Duration of Activity

15-20 minutes

Materials

- Smartphone or tablet with the McGraw Hill AR Application installed,
- flat, non-patterned surface

Standards

7.G.A.3 Describe the twodimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

G.GMD.B.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects.



During the Activity

Teacher Tips

- Make sure students understand that they can rotate the figures during the Explore, so they can view them at different angles.
- Point out the impacts of the slanted slices on the cross sections.
- Discuss the relationship between the base and the horizontal cross section.

Evaluate

• Students will be presented with five randomly selected exercises from the following exercise set.

Identify and select the shape formed by the slice.





After the Activity

Additional Exercises

These are additional exercises that can be assigned after the activity.

- 1. Identify the possible cross sections of the figure.
 - A. Square
 - B. Rectangle
 - C. Trapezoid
 - D. Triangle
 - (B, C, D)
- 2. Identify the possible cross sections of the figure.
 - A. Square
 - B. Rectangle
 - C. Trapezoid
 - **D.** Triangle
 - (B, D)
- **3.** Identify the possible cross sections of the figure.
 - A. Square
 - B. Rectangle
 - C. Trapezoid
 - **D.** Triangle
 - (A, B, D)



4. Identify the figures which have a triangular cross section.



5. Identify the figures which have a rectangular cross section.



- **6.** Identify the figures which have a circular cross section.
 - A. Rectangular Prism
 - B. Triangular Prism
 - C. Cone
 - D. Sphere
 - (C, D)





Extension			
These are more challenging exercises to extend the activity.			
1. In a prism, which cross section is the same size as the base?			
A. horizontal	B. vertical	C. slanted	
(A)			
2. In a pyramid, the horiz	zontal cross section is	the base.	
A. greater than	B. smaller than	C. equal to	
(B)			
 If a plane perpendicular to the base of a prism intersects the prism, the cross section is a 			
A. triangle	B. trapezoid	C. rectangle	
(C)			
 If a plane intersects a pyramid through its vertex and perpendicular to its base, the cross section is a 			
A. triangle	B. trapezoid	C. rectangle	D. square
(A)			
 If a plane that is not parallel or perpendicular to the base of a rectangular prism intersects the prism, the cross section is a 			
A. triangle	B. trapezoid	C. square	D. parallelogram
(D)			
6. If a plane that is not parallel or perpendicular to the base of a rectangular pyramid intersects the pyramid, the cross section is a			
A. triangle	B. trapezoid	C. square	D. parallelogram
(B)			

The following images are associated with the extension questions.





Enrichment

Enrichment content beyond what is learned in the activity.

- Conic sections, or conics, are the figures formed when a plane intersects a double-napped right cone. A double-napped cone is two cones opposite each other and extending infinitely upward and downward. The four common conic sections are the parabola, the ellipse, the circle, and the hyperbola.
- When the plane intersects the vertex of the cone, the figures formed are degenerate conics. A degenerate conic may be a point, a line, or two intersecting lines.
- 1. A cross section parallel to the base of a double-napped cone is a(n) ____ **B.** ellipse **A.** circle **C.** parabola **D.** hyperbola
 - **(A)**
- 2. A cross section perpendicular to the base and not through the center of a double-napped cone is a(n) _____.
 - **B.** ellipse A. circle C. parabola **D.** hyperbola
 - **(D)**
- 3. An angle cross section through the base of a double-napped cone is a(n) _____.
 - **A.** circle **B.** ellipse
 - **C.** parabola
 - **(C)**
- 4. An angle cross section not through the base of a double-napped cone is a(n) _____.

D. hyperbola

- A. circle **B.** ellipse
- **C.** parabola **D.** hyperbola
- **(B)**





parabola

hyperbola



point

(degenerate

ellipse)



line

(degenerate parabola)

ellipse



intersecting lines (degenerate parabola)

