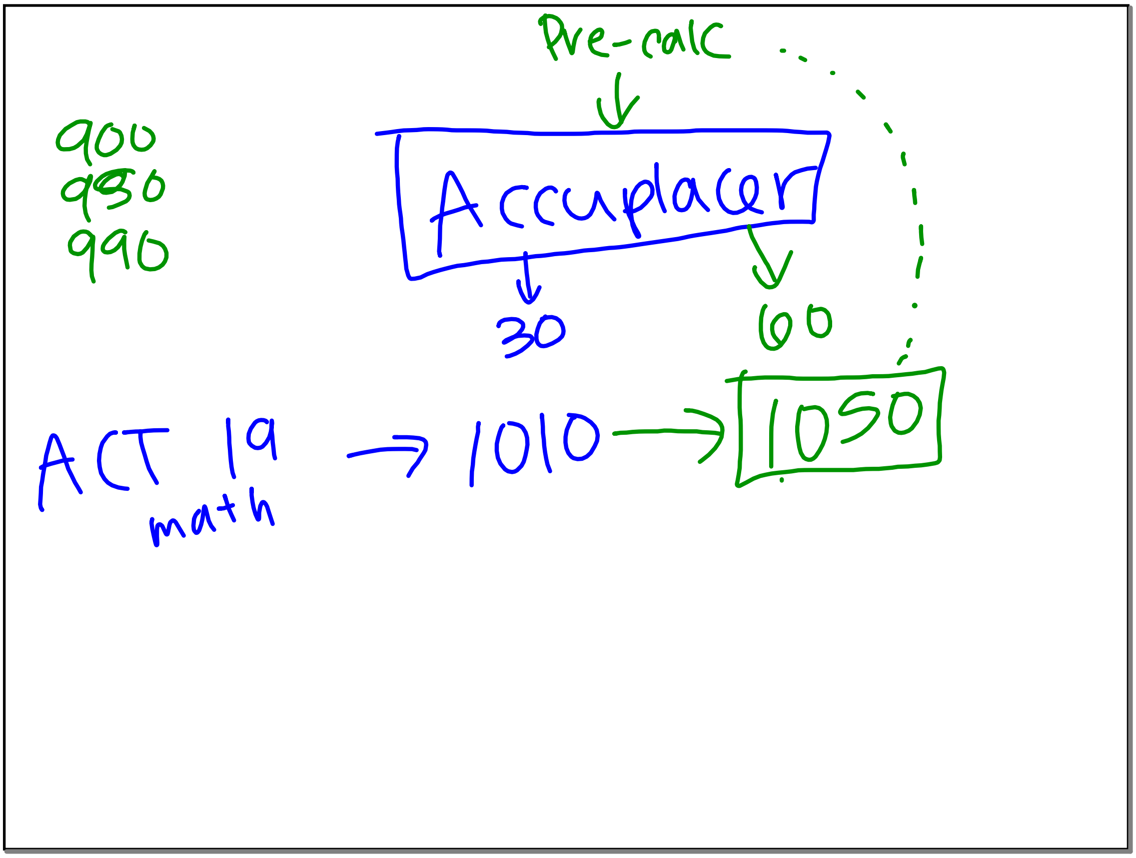


12-1 Cross Sections and Solids of Rotation

Objectives:

I can identify the shapes of two-dimensional cross-sections of three-dimensional objects.

I can identify three-dimensional objects generated by rotations of two-dimensional objects.

I can use geometric shapes, their measures, and their properties to describe objects.

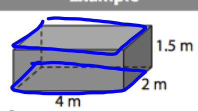
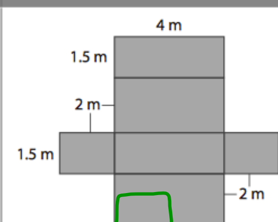
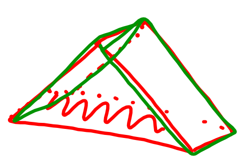
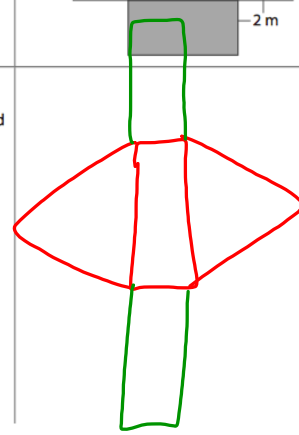
Prism: Same shape on top & bottom

Pyramid: Shape on bottom, comes to a point

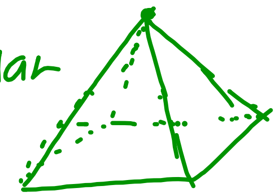
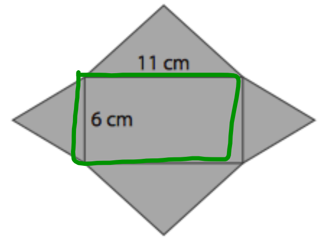
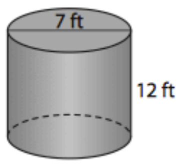
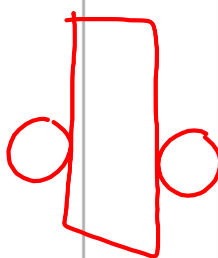
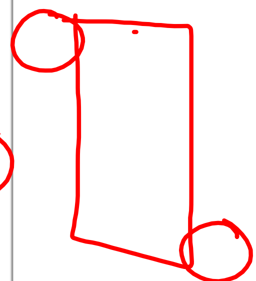
Nets

A **net** is a diagram of the surfaces of a three-dimensional figure that can be folded to form the three-dimensional figure. To identify a three-dimensional figure from a net, look at the number of faces and the shape of each face.

Complete each row of the table:

Type of Solid	Example	Faces	Net
rectangular prism			
triangular prism		a pair of congruent triangles and 3 rectangles	

Complete each row of the table:

Type of Solid	Example	Faces	Net
rectangular Pyramid		a rectangle and 2 pairs of congruent isosceles triangles	
cylinder			

Cross Sections → 2D

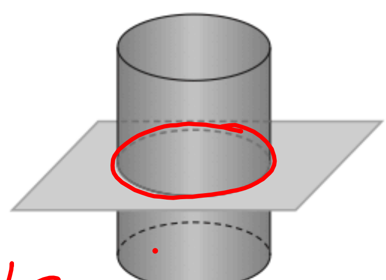
Recall that a *cross section* is a region of a plane that intersects a solid figure. Cross sections of three-dimensional figures sometimes turn out to be simple figures such as triangles, rectangles, or circles.

Example 1 **Describe each cross section of each figure. Compare the dimensions of the cross section to those of the figure.**

(A) The bases of the cylinder are congruent circles.

The cross section is formed by a plane that is parallel to the bases of the cylinder. Any cross section of a cylinder made by a plane parallel to the bases will have the same shape as the bases.

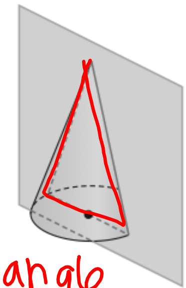
Therefore, the cross section is a circle with the same radius or diameter as the bases.



Circle

(B) The lateral surface of the cone curves in the horizontal direction, but not the vertical direction. Therefore the two sides of the cross section along this surface are straight line segments.

The third side is a diameter of the base of the cone. at ______, so the cross section must contain four ______. Therefore, the cross section is a(*n*) ______ triangle. Its base is the ______ of the cone and its leg length is the ______ height of the cone.

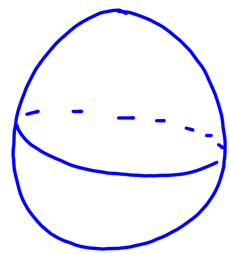


triangle

Reflect

2. A plane intersects a sphere. Make a conjecture about the resulting cross section.

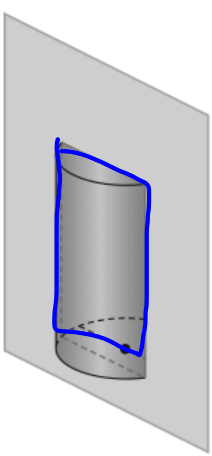
circle



Your Turn

Describe each cross section of each figure. Compare the dimensions of the cross section to those of the figure.

3.



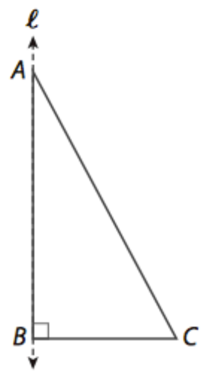
rectangle

3D Rotations

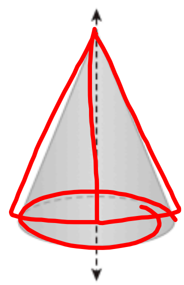
You can generate a three-dimensional figure by rotating a two-dimensional figure around an appropriate axis.

Example 2 **Describe and then sketch the figure that is generated by each rotation in three-dimensional space.**

(A) A right triangle rotated around a line containing one of its legs

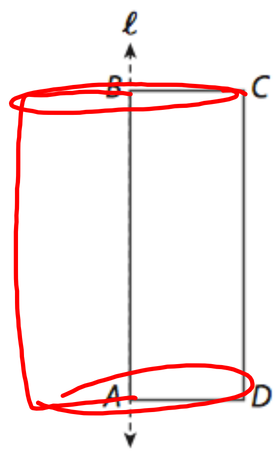


Leg $\overline{BC}$ is perpendicular to ℓ, so vertex C traces out a circle as it rotates about ℓ, and therefore $\overline{BC}$ traces out a circular base. The hypotenuse, $\overline{AC}$, traces out the curving surface of the cone whose base is formed by $\overline{BC}$. The figure formed by the rotation is a cone.



cone

(B) A rectangle rotated around a line containing one of its sides

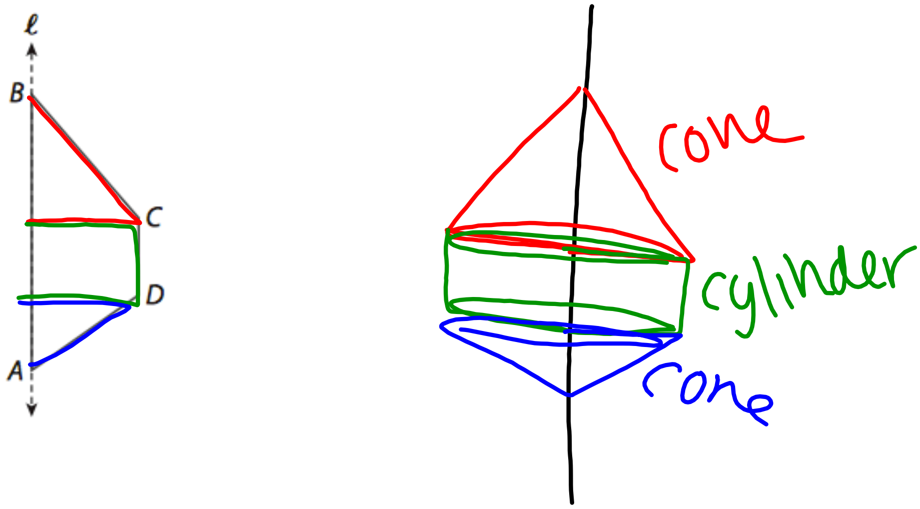


cylinder

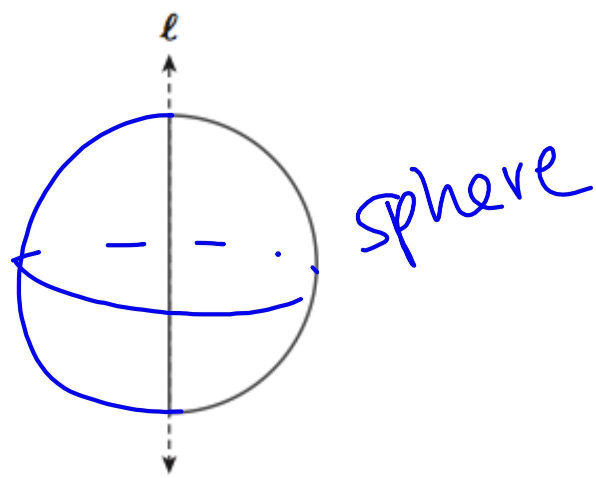
Your Turn

Describe and then sketch the figure that is generated by each rotation in three-dimensional space.

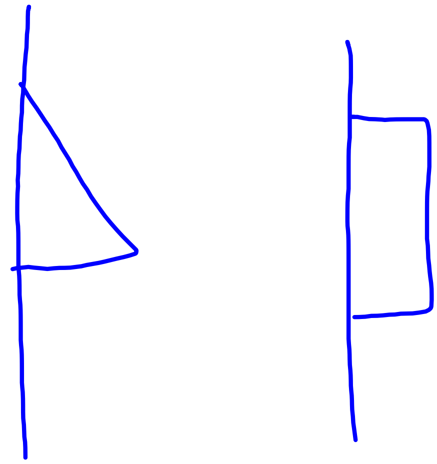
5. A trapezoid with two adjacent acute angles rotated around a line containing the side adjacent to these angles



6. A semicircle rotated around a line containing its diameter



7. Discussion If a solid has been generated by rotating a plane figure around an axis, will the solid always have cross-sections that are circles? Will it always have cross sections that are not circles? Explain.



yes