

10/19

Aim: General Prisms and Cylinders and Their Cross- Sections

Student outcome: Students understand the definitions of a *general prism* and a *cylinder* and the distinction between a *cross-section* and a *slice*.

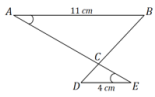
Do Now: Opening exercise A sheet of notebook paper.

Homework: exit ticket

Feb 26-6:28 AM

Exit Ticket

In the following figure, \overline{AE} and \overline{BD} are segments.

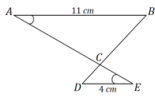


a. $\triangle ABC$ and $\triangle CDE$ are similar. How do we know this?

b. What is the scale factor of the similarity transformation that takes $\triangle ABC$ to $\triangle CDE$?

Oct 9-3:24 PM

c. What is the value of the ratio of the area of $\triangle ABC$ to the area of $\triangle CDE$? Explain how you know.



d. If the area of $\triangle ABC$ is 30 cm^2 , what is the area of $\triangle CDE$?

Oct 9-3:25 PM

Opening exercise:

Sketch a right rectangular prism.

Hint: Box

Feb 26-6:29 AM

Did you use dotted lines to show hidden edges?

How would this change you sketch?

Feb 26-6:29 AM

Is a right rectangular prism hollow? That is, does it include the points inside?

Right rectangular prism: Let E and E' be two parallel planes. Let B be a rectangular region in the plane E . At each point P of B , consider the segment PP' perpendicular to E , joining P to a point P' of the plane E' . The union of all these segments is called a *right rectangular prism*.

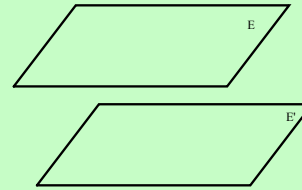
Feb 26-6:29 AM

Use your sheet of notebook paper to sketch a right rectangular prism by taking apart the definition in four steps.

1. Let E and E' be two parallel planes. Draw two parallel planes.

Use your sheet of notebook paper to sketch a right rectangular prism by taking apart the definition in four steps.

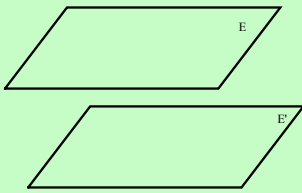
1. Let E and E' be two parallel planes. Draw two parallel planes. Label them.



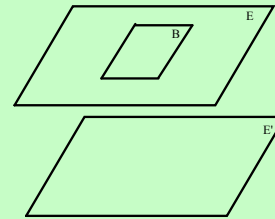
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Feb 26-6:29 AM

2. Let B be a rectangular region in the plane E



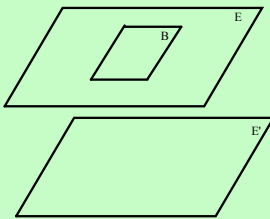
2. Let B be a rectangular region in the plane E



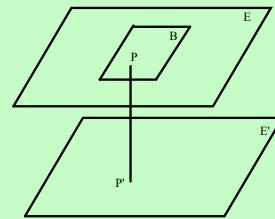
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Feb 26-6:29 AM

At each point P of B , consider the segment PP' perpendicular to E , joining P to a point P' of the plane E' .



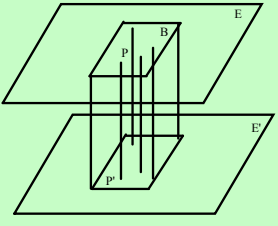
At each point P of B , consider the segment PP' perpendicular to E , joining P to a point P' of the plane E' .



Feb 26-6:29 AM

Feb 26-6:29 AM

The union of all these segments is called a *right rectangular prism*.



A rectangular region is the union of a rectangle and its interior.

Feb 26-6:29 AM

General cylinder: (See Figure 1.) Let E and E' be two parallel planes, let B be a region in the plane E , and let L be a line which intersects E and E' but not b . At each point P of B , consider the segment PP' parallel to L , joining P to a point P' of the plane E' . The union of all these segments is called a *general cylinder with base B* .

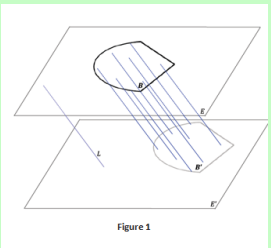


Figure 1

Feb 26-6:29 AM

- Compare the definitions of *right rectangular prism* and *general cylinder*. Are they very different? What is the difference?

Feb 26-6:29 AM

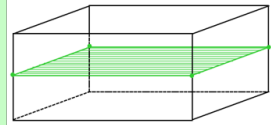


Figure 2

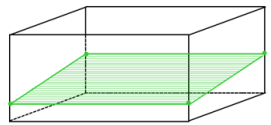


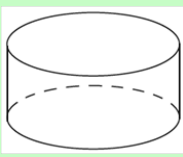
Figure 3

Example of a cross-section of a prism, where the intersection of a plane with the solid is parallel to the base.

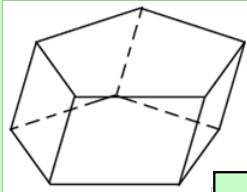
A general intersection of a plane with a prism; sometimes referred to as a slice.

Feb 26-6:29 AM

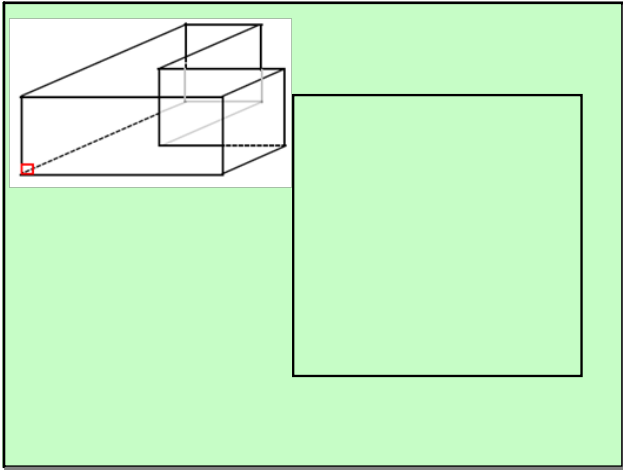
Sketch the cross-section for the following figures:



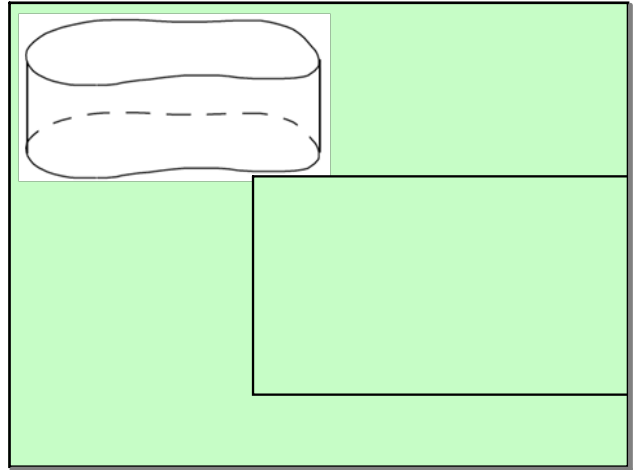
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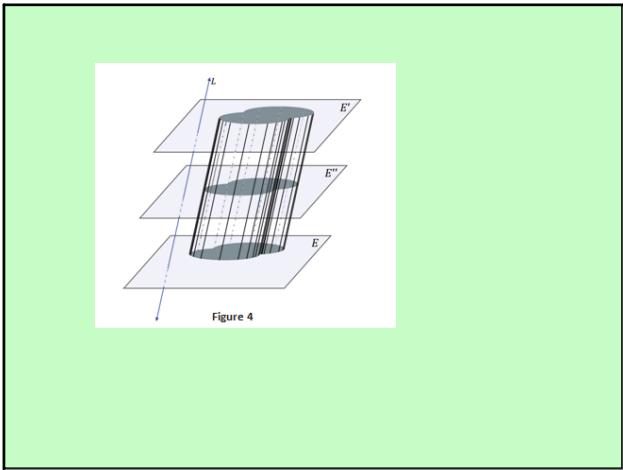
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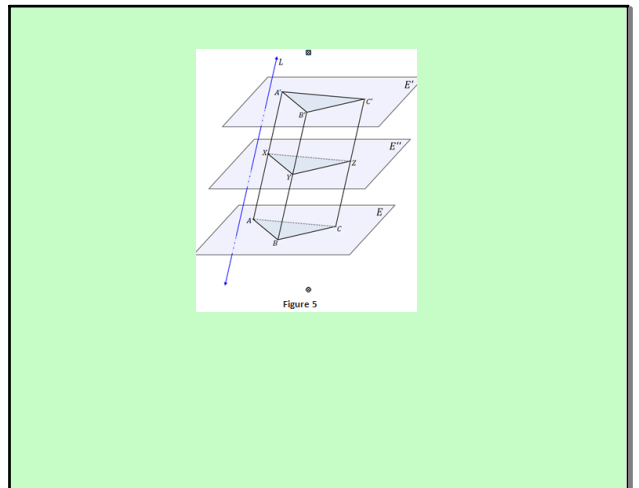
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

Option 2

	Figure and Description	Sketch of figure	Sketch of Cross-Section
1.	<p>General Cylinder</p> <p>Let E and E' be two parallel planes, let B be a region in the plane E, and let L be a line which intersects E and E' but not B. At each point P of B, consider the segment PP' parallel to L, joining P to a point P' of the plane E'. The union of all these segments is called a general cylinder with base B.</p>		
2.	<p>Right General Cylinder</p> <p>A general cylinder whose lateral edges are perpendicular to the bases.</p>		

Oct 9-3:33 PM

3.	<p>Right Prism</p> <p>A general cylinder whose lateral edges are perpendicular to a polygonal base.</p>		
4.	<p>Oblique Prism</p> <p>A general cylinder whose lateral edges are not perpendicular to a polygonal base.</p>		

Oct 9-3:33 PM

5.	<p>Right Cylinder A general cylinder whose lateral edges are perpendicular to a circular base.</p> 	
6.	<p>Oblique Cylinder A general cylinder whose lateral edges are not perpendicular to a circular base.</p> 	

Oct 9-3:34 PM

RIGHT RECTANGULAR PRISM: Let E and E' be two parallel planes. Let B be a rectangular region in the plane E . At each point P of B , consider the segment $\overline{PP'}$ perpendicular to E , joining P to a point P' of the plane E' . The union of all these segments is called a *right rectangular prism*.

Feb 26-6:29 AM

LATERAL EDGE AND FACE OF A PRISM: Suppose the base B of a prism is a polygonal region and P_i is a vertex of B . Let P'_i be the corresponding point in B' such that $\overline{P_iP'_i}$ is parallel to the line L defining the prism. The segment $\overline{P_iP'_i}$ is called a *lateral edge of the prism*. If $\overline{P_iP_{i+1}}$ is a base edge of the base B (a side of B), and F is the union of all segments $\overline{PP'}$ parallel to L for which P is in $\overline{P_iP_{i+1}}$ and P' is in B' , then F is a *lateral face of the prism*. It can be shown that a lateral face of a prism is always a region enclosed by a parallelogram.

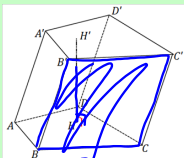
Feb 26-6:29 AM

GENERAL CYLINDER: Let E and E' be two parallel planes, let B be a region in the plane E , and let L be a line which intersects E and E' but not B . At each point P of B , consider the segment $\overline{PP'}$ parallel to L , joining P to a point P' of the plane E' . The union of all these segments is called a *general cylinder with base B* .

Feb 26-6:29 AM


Problem Set

- Complete each statement below by filling in the missing term(s).
 - The following prism is called a(n) oblique prism.
 - If AA' were perpendicular to the plane of the base, then the prism would be called a(n) Right prism.
 - The regions $ABCD$ and $A'B'C'D'$ called the Bases of the prism.
 Bases are Parallel
 - AA' is called a(n) lateral edge.
 - Parallelogram region $BB'C'C$ is one of four lateral faces.



Feb 26-6:29 AM

2. The following right prism has trapezoidal base regions; it is a right trapezoidal prism. The lengths of the parallel edges of the base are 5 and 8, and the nonparallel edges are 4 and 6; the height of the trapezoid is 3.7. The lateral edge length DH is 10. Find the surface area of the prism.



Surface area
Sum of the areas of all the faces.

Trap. $A = \frac{(b_1 + b_2)}{2}h = \frac{(8 + 5)}{2}(3.7) = 24.05u^2$
 $\times 2 = 48.1u^2$

Rect: $A = lw = 10 \cdot 5 = 50u^2$
 $\times 2 = 100u^2$

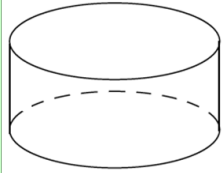
Rect: $4 \cdot 10 = 40u^2$
 $\times 2 = 80u^2$

Rect: $10 \cdot 6 = 60u^2$
 $\times 2 = 120u^2$

278.1

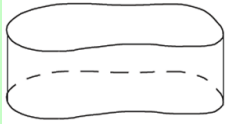
Feb 26-6:29 AM

3. The base of the following right cylinder has a circumference of 5π and a lateral edge of 8 . What is the radius of the base? What is the lateral area of the right cylinder?



Feb 26-6:29 AM

4. The following right general cylinder has a lateral edge of length 8 , and the perimeter of its base is 27 . What is the lateral area of the right general cylinder?



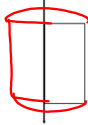
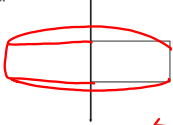
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3. A right prism has base area 5 and volume 30 . Find the prism's height, h .

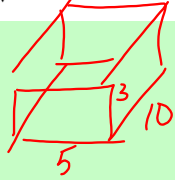
$V = Bh$
 Volume = (Area of Base) height
 $30 = \frac{5h}{5}$
 $6 = h$

Feb 26-6:29 AM

6. Sketch the figures formed if the rectangular regions are rotated around the provided axis.

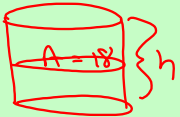
a.  b. 

$A = \frac{1}{2}(6 \cdot 10)$
 $V = \text{Area of Base} \cdot h$
 $(5 \cdot 10) \cdot 3$



Feb 26-6:29 AM

5. A cross-section is taken parallel to the bases of a general cylinder and has an area of 18 . If the height of the cylinder is h , what is the volume of the cylinder? Explain your reasoning.



$V = Bh$
 $V = 18h$

Feb 26-6:29 AM

8. A general cylinder has a volume of 144 . What is one possible set of dimensions of the base and height of the cylinder if all cross-sections parallel to its bases are ...

- Rectangles?
- Right triangles?
- Circles?

Feb 26-6:29 AM

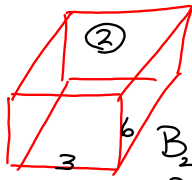
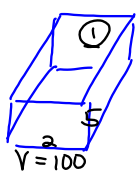
9. A general hexagonal prism is given. If P is a plane that is parallel to the planes containing the base faces of the prism, how does P meet the prism?

Feb 26-6:29 AM

8. Two right prisms have similar bases. The first prism has height 5 and volume 100. A side on the base of the first prism has length 2, and the corresponding side on the base of the second prism has length 3. If the height of the second prism is 6, what is its volume?

Ratio of area = (Ratio of sides)²
 Volume = (Area of Base) (height)

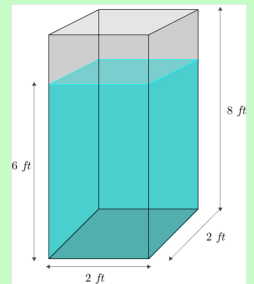
Feb 26-6:29 AM



ratio of : $\frac{3}{2}$
 $V = B \cdot h$
 $100 = B_1(5)$
 $20 = B_1$
 ratio of : $(\frac{3}{2})^2 = \frac{9}{4}$
 $B_2 = 20(\frac{9}{4})$
 $B = 45$
 Volume = $B \cdot h$
 $V = 45 \cdot 6$
 $V = 270 \text{ u}^3$

Oct 31-11:09 AM

11. A tank is the shape of a right rectangular prism with base 2 ft. \times 2 ft. and height 8 ft. The tank is filled with water to a depth of 6 ft. A person of height 6 ft. jumps in and stands on the bottom. About how many inches will the water be over the person's head? Make reasonable assumptions.



Feb 26-6:29 AM

Feb 26-6:29 AM

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Feb 26-6:29 AM



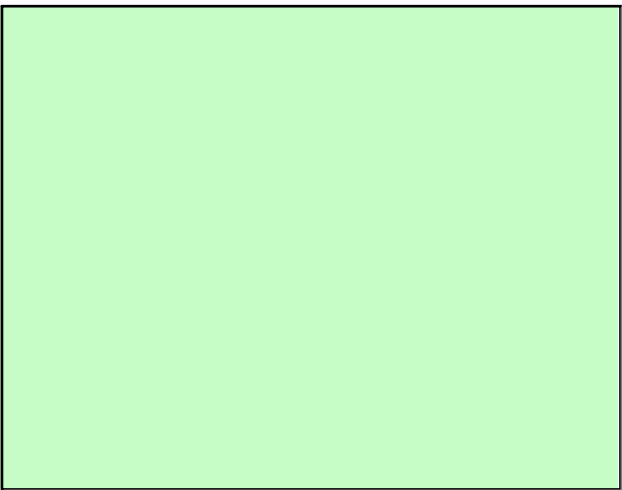
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