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**HW 9-6**

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1. For each shape, describe (in a picture or in words) a cross section taken
- a) parallel to the base
  - b) perpendicular to the base



a) circle

b) rectangle



a) rectangle

b) rectangle



a) square

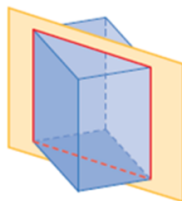
b) triangle



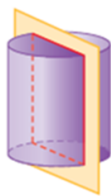
a) circle

b) triangle

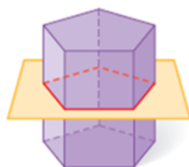
2. Describe each cross-section



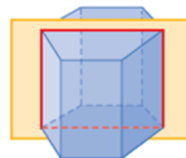
rectangle



rectangle

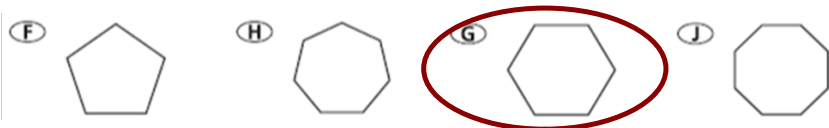


pentagon



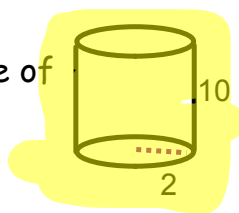
rectangle

3. Which shape best represents a hexagonal prism when viewed from the top?

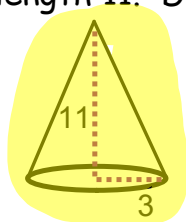


4. Describe the cross section obtained by cutting a plane through the diameter of the base and perpendicular to the base of a right cylinder. rectangle

5. A  $2 \times 10$  rectangle is revolved around the side of length 2. Draw the resulting solid.

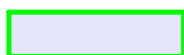


6. A right triangle with leg lengths 3 and 11 is revolved around the side of length 11. Draw the resulting solid.

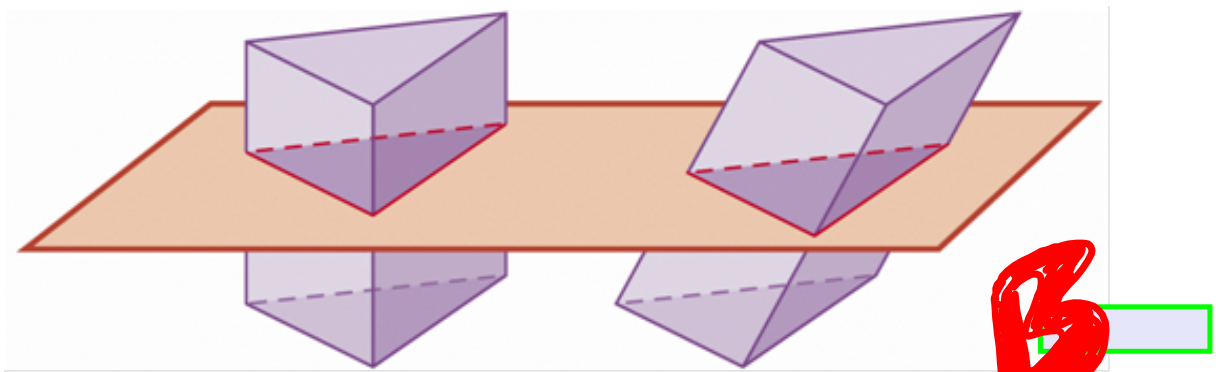


**Notes 4:** Volume of Prisms and Cylinders

The volume of a three-dimensional figure is the number of nonoverlapping unit cubes of a given size that will exactly fill the interior.



*Cavalieri's principle* says that if two three-dimensional figures have the same height and have the same cross-sectional area at every level, they have the same volume.



This means that a right prism and an oblique prism with the same base and height

\_\_\_\_\_ have the same volume.

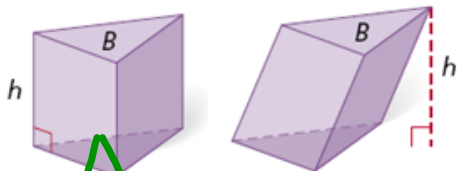
base  
area



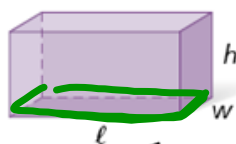
$$V = Bh$$

### Volume of a Prism

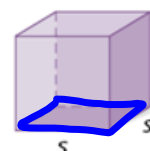
The volume of a prism with base area  $B$  and height  $h$  is  $V = Bh$ .



The volume of a right rectangular prism with length  $\ell$ , width  $w$ , and height  $h$  is  $V = \ell wh$ .



The volume of a cube with edge length  $s$  is  $V = s^3$ .



$$V = Bh$$

$$V = Bh$$

$$V = Bh$$

$$V = \frac{1}{2}bh \cdot h$$

$$V = \ell \cdot w \cdot h$$

$$= s^2 s$$

$$V = s^3$$

**FORMULAS**

Triangle	$A = \frac{1}{2}bh$
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Parallelogram	$A = bh$
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Circle	$A = \pi r^2$
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Circle	$C = \pi d$ or $C = 2\pi r$
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General Prisms	$V = Bh$
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Cylinder	$V = \pi r^2 h$
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Sphere	$V = \frac{4}{3}\pi r^3$
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Cone	$V = \frac{1}{3}\pi r^2 h$
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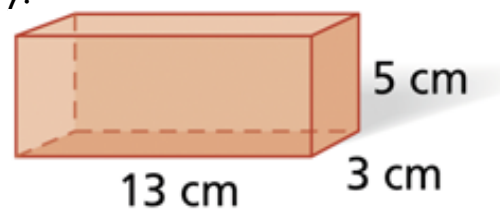
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Pyramid	$V = \frac{1}{3}Bh$
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Examples:

- 1) Find the volume of the prism. Round to the nearest tenth, if necessary.



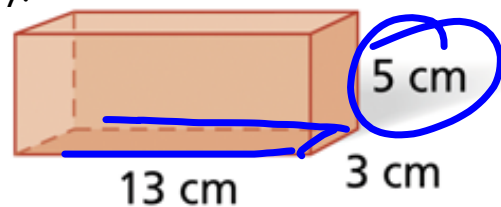
$$V = l \cdot w \cdot h$$
$$= 13 \cdot 3 \cdot 5$$

cm    cm    cm

$$V = 195 \text{ cm}^3$$

Examples:

- 1) Find the volume of the prism. Round to the nearest tenth, if necessary.



$$V = B(h)$$

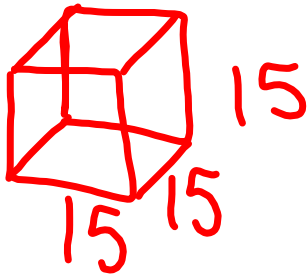
$$V = (13 \cdot 3) 5$$

$$39.5$$

$$V = 195 \text{ cm}^3$$



2) Find the volume of a cube with edge length 15 in.  
Round  
to the nearest tenth, if necessary.

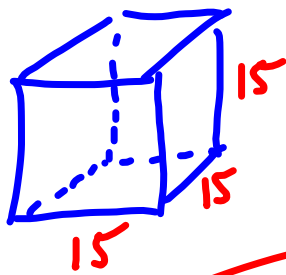


$$V = s^3$$

$$V = 15^3$$

$$V = 3,375 \text{ in}^3$$

2) Find the volume of a cube with edge length 15 in.  
Round  
to the nearest tenth, if necessary

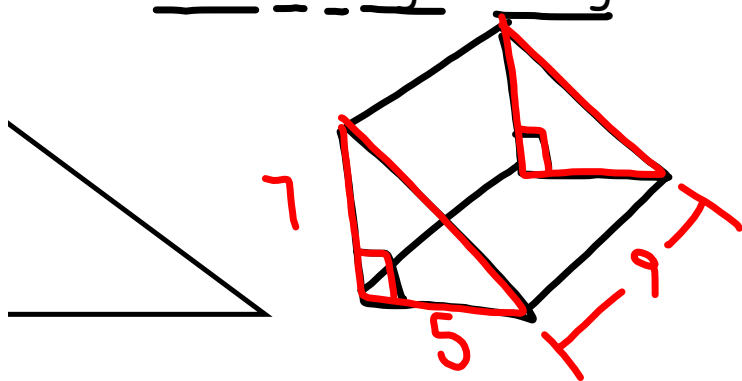


$$V = Bh$$

$$V = (15 \cdot 15) 15$$

$$V = 3375 \text{ in}^3$$

3) Find the volume of a triangular prism with a height of 9 yd whose base is a right triangle with legs 7 yd and 5 yd long.



$$V = \frac{1}{2}bh \cdot h$$

$$V = \frac{1}{2}(7)(5) \cdot 9$$
$$V = 157.5 \text{ yds}^3$$

3) Find the volume of a triangular prism with a height of 9 yd whose base is a right triangle with legs 7 yd and 5 yd long.

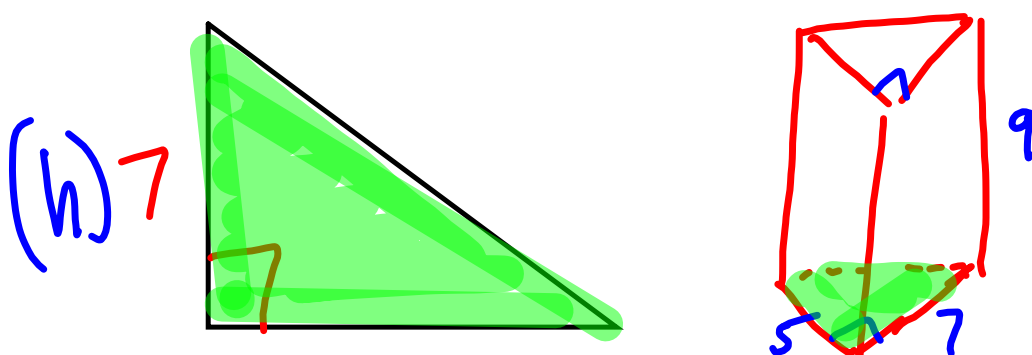


Diagram illustrating the components of the triangular prism:

- Base triangle (right triangle) with legs labeled  $(h) 7$  and  $(b) 5$ .
- Height of the prism labeled  $9$ .

Formulas and calculations:

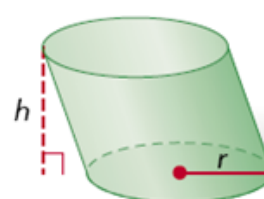
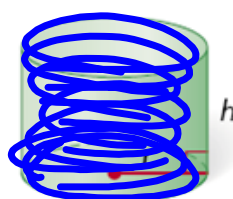
$$B = \frac{bh}{2}$$
$$V = Bh$$
$$V = \left( \frac{7(5)}{2} \right) 9$$
$$V = (35) 9$$
$$V = 157.5 \text{ yd}^3$$

Cavalieri's principle  
also relates to cylinders.  
The two stacks have  
the same number of  
CDs, so they have  
the same volume.



**Volume of a Cylinder**

The volume of a cylinder with base area  $B$ , radius  $r$ , and height  $h$  is  $V = Bh$ , or  $V = \pi r^2 h$ .

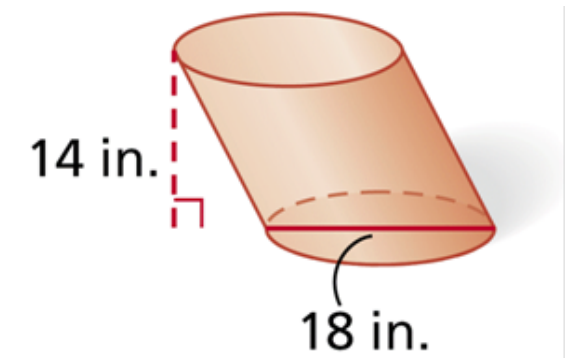


Examples:

1) Find the volume of the cylinder. Give your answers

- a) in terms of  $\pi$  and
- b) rounded to the nearest tenth.

$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (9)^2 (14) \\ a) \quad V &= 1134\pi \text{ in}^3 \\ b) \quad V &\approx 3,562.6 \text{ in}^3 \end{aligned}$$



Examples:

1) Find the volume of the cylinder. Give your answers

a) in terms of  $\pi$  and

b) rounded to the nearest tenth.

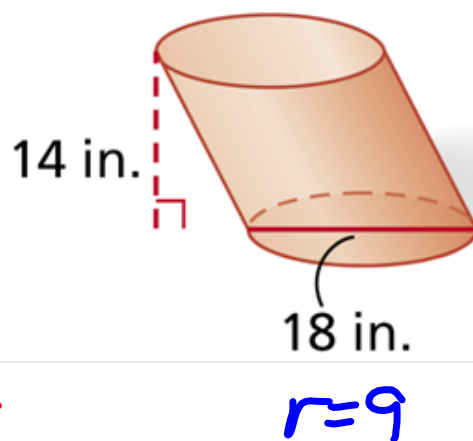
$$V = \pi r^2 h$$

$$V = \pi (9)^2 14$$

$$V = \pi (81) 14$$

$$a) V = 1134\pi \text{ in}^3$$

$$b) 3562.6 \text{ in}^3$$





- 2) Find the volume of a cylinder with a diameter of 16 in. and a height of 17 in. Give your answer
- a) in terms of  $\pi$  and
  - b) rounded to the nearest tenth.

- 2) Find the volume of a cylinder with a diameter of 16 in. and a height of 17 in. Give your answer
- $r=8$
- a) in terms of  $\pi$  and  
b) rounded to the nearest tenth.

$$V = \pi r^2 h$$

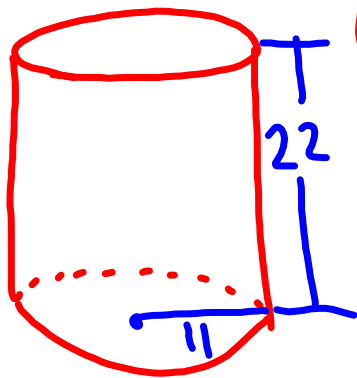
$$V = \pi (8)^2 17$$

$$V = \pi (64) 17$$

$$a) V = 1088\pi \text{ in}^3$$

$$b) \approx V = 3418.1 \text{ in}^3$$

- 3) Find the volume of a cylinder with base area  $121\pi \text{ cm}^2$  and a height equal to twice the radius. Give your answer
- in terms of  $\pi$  and
  - rounded to the nearest tenth.



①  $A = \pi r^2$       ②

$\sqrt{121\pi} = \sqrt{\pi r^2}$        $V =$

$11 = r$

- 3) Find the volume of a cylinder with base area  $121\pi$   $\text{cm}^2$  and a height equal to twice the radius. Give your answer a) in terms of  $\pi$  and b) rounded to the nearest tenth.

$$V = \pi r^2 h$$

$$V = \pi (11)^2 22$$

$$V = 2662\pi \text{ cm}^3$$

$$V = 8362.9 \text{ cm}^3$$

$$A = 121\pi$$

$$\cancel{\pi} r^2 = 121 \cancel{\pi}$$

$$\sqrt{r^2} = \sqrt{121}$$

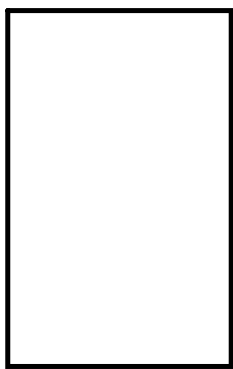
$$r = 11$$

$$h = 2(11) = 22$$



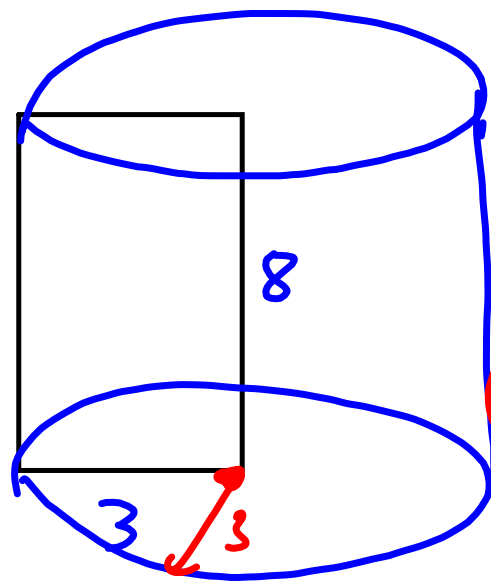
## Volumes formed by revolution:

4) A 3in x 8 in rectangle is rotated around the 8in side. Draw and find the volume of the resulting solid.



## Volumes formed by revolution:

4) A 3in x 8 in rectangle is rotated around the 8in side. Draw and find the volume of the resulting solid.



$$V = \pi r^2 h$$

$$V = \pi (3)^2 8$$

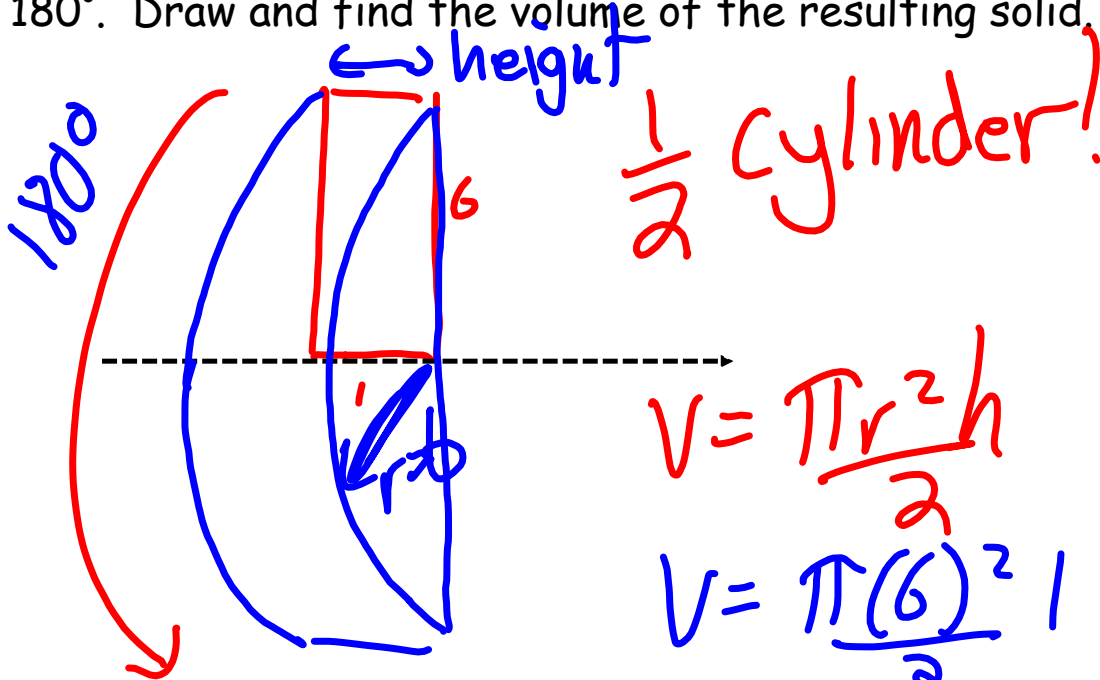
$$V = 72\pi \text{ in}^3$$

5) A  $1\text{ m} \times 6\text{ m}$  rectangle is rotated around the 1 in side by  $180^\circ$ . Draw and find the volume of the resulting solid.





5) A 1 m x 6 m rectangle is rotated around the 1 in side by  $180^\circ$ . Draw and find the volume of the resulting solid.



$$V = \frac{\pi r^2 h}{2}$$

$$V = \frac{\pi (6)^2 1}{2}$$

$$V = \frac{36\pi}{2} = 18\pi \text{ m}^3$$

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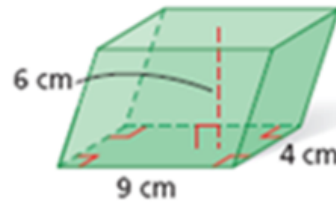
Find the volume of each prism.

1. A cube with edge length 8 ft.

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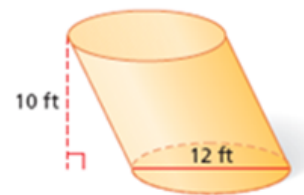
9-7

2.

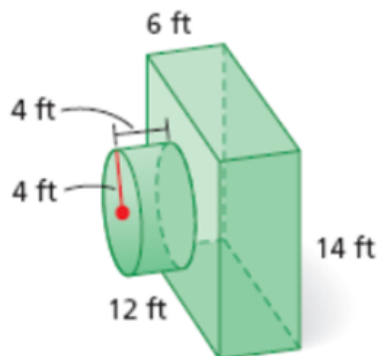


3. Find the volume of a cylinder with base area  $25\pi \text{ cm}^2$  and height 3cm more than the radius.

4. Find the volume of the cylinder.



5. Find the volume.



6. Find the volume of the solid formed by revolving the triangle below around the short side.

