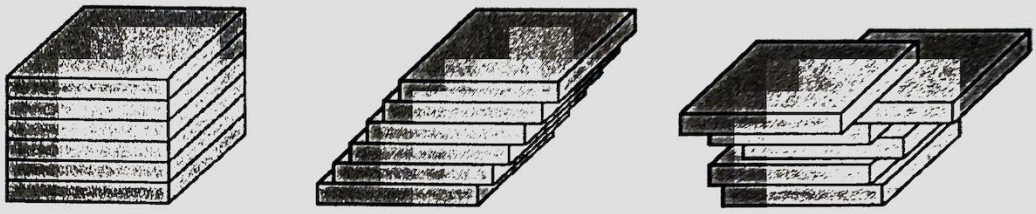
Bonaventura Cavalieri – He was an Italian mathematician born in 1598 – 1657. He is known for his work in optics, motion, calculus, and introduction of logarithms.

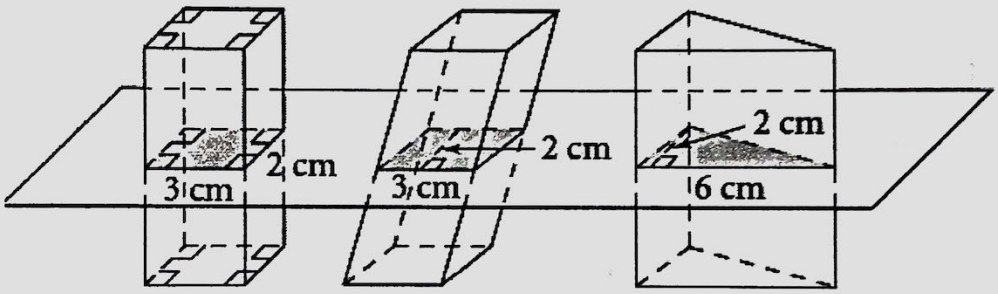
CAVALIERI'S PRINCIPLE

- The volumes of two objects of the same height are equal if the areas of their corresponding cross sections are equal.



These pieces maintain the **SAME** volume regardless of how they are moved!!

Find the area of each cross section below.



$A = 3 \cdot 2$ $= 6\ cm^2$

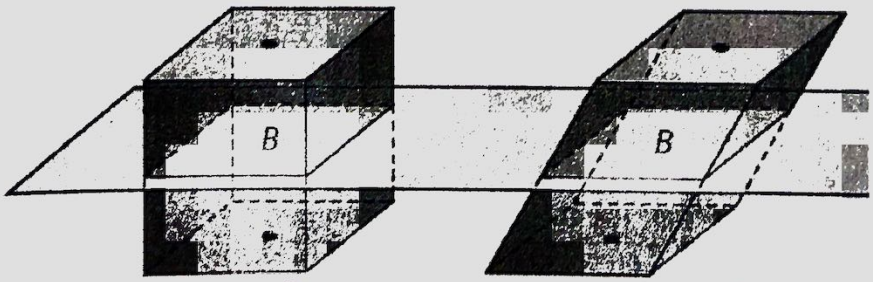
$A = 3 \cdot 2$ $= 6\ cm^2$

$A = \frac{1}{2} \cdot 6 \cdot 2$ $= 6\ cm^2$

Based on what we know about the areas of the cross sections, what can we assume about the volumes (assuming all three heights are the same)?

Since the areas of all their cross sections are congruent, then the volumes of all 3 figures are congruent.

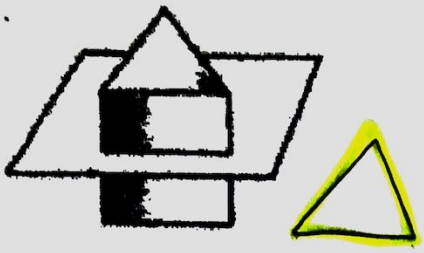
The same volume formula applies whether it's a **right** prism or an **oblique** prism.

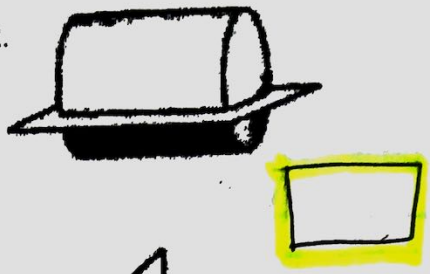


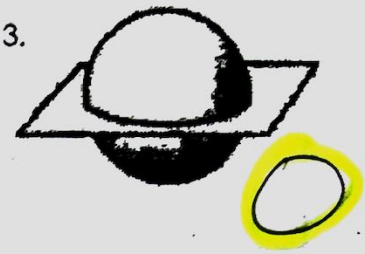
Right Prism Oblique Prism

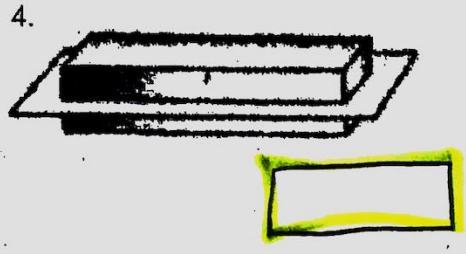
PRACTICE:

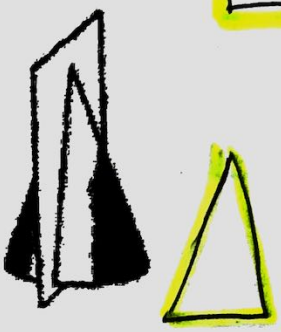
Name the cross section.

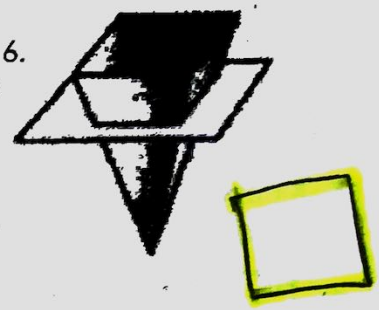
1. 

2. 

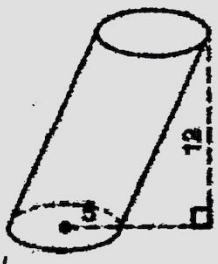
3. 

4. 

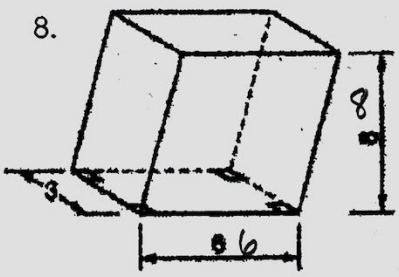
5. 

6. 

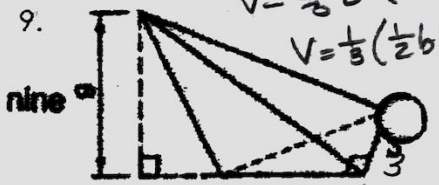
Find the volume of each oblique figure.

7. 

$V = Bh$
$= \pi r^2 h$
$= \pi 5^2 \cdot 12 =$ **942.5 units³**

8. 

$V = l \cdot w \cdot h$
$= 3 \cdot 6 \cdot 8 =$ **144 units³**

9. 

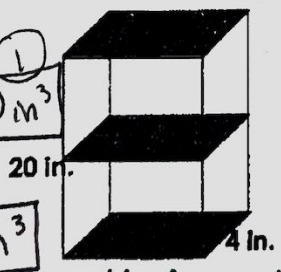
$V = \frac{1}{3} Bh$
$V = \frac{1}{3}(\frac{1}{2}bh)h$
$V = \frac{1}{3}(\frac{1}{2} \cdot 5 \cdot 3) \cdot 9$
$V = 22.5$ unit³

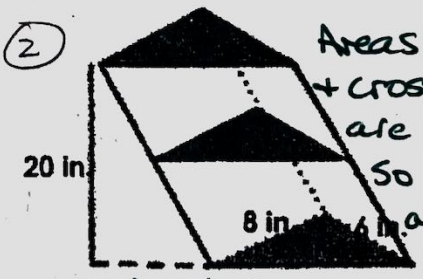
10. Which figure has more volume?

① $V = l \cdot w \cdot h = 6 \cdot 4 \cdot 20 =$ **480 in³**

② $V = (\frac{1}{2} b \cdot h)h = \frac{1}{2} \cdot 8 \cdot 6 \cdot 20 =$ **480 in³**

They have the same volume!





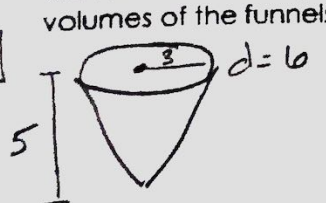
$A_{\square} = 4 \cdot 6 = 24 \text{ in}^2$ ← Cone

$A_{\triangle} = \frac{1}{2} \cdot 8 \cdot 6 = 24 \text{ in}^2$

Areas of bases + cross section are congruent so volumes are congruent by Cavalieri's Principle

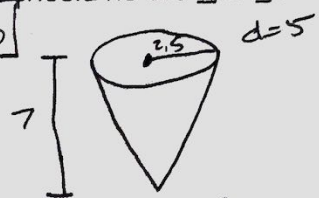
11. Collin is going to change the oil in his Jeep. He has two funnels. A has a diameter of 6 inches and is 5 inches deep. B has a diameter of 5 inches but is 7 inches deep. He wants to use the funnel with the greatest volume to minimize the chance of spilling the oil. What are the volumes of the funnels? Which one should he use A or B?

A



$V = \frac{1}{3} \pi 3^2 \cdot 5$
$V = 47.1$ in³

B



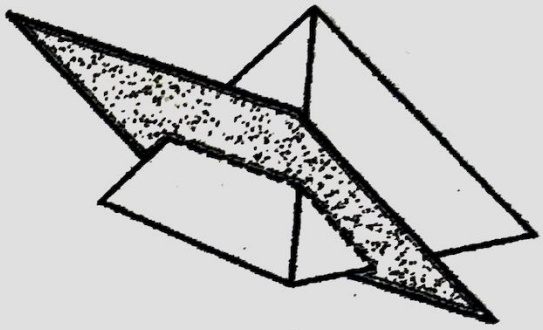
$V = \frac{1}{3} \pi 2.5^2 \cdot 7$
$V = 45.8$ in³

Answer:
A has the most volume!

Geometry
Homework – Cross Sections [redacted]

Name: Key
Date: _____

1. A square pyramid is cut along the shaded plane shown below. Which of the following is the cross-section of this solid?



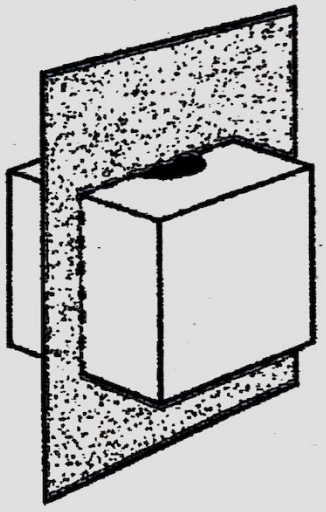
A. 

B. 

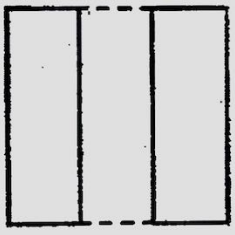
C. 

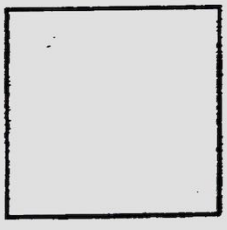
D. 

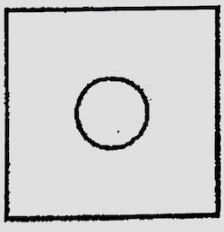
2. A cube with a cylinder cut from its center is cut along the plane shown below. Which of the following is the cross-section of this solid?



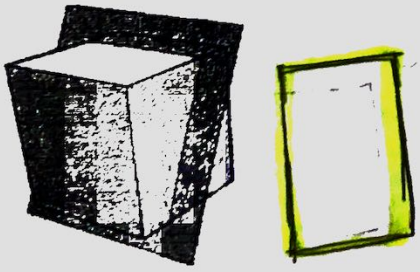
A. 

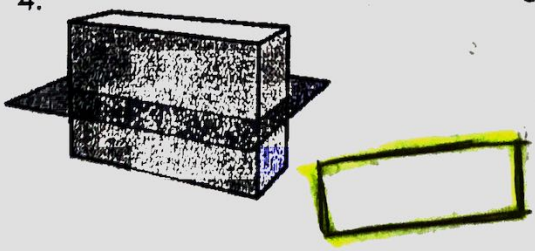
B. 

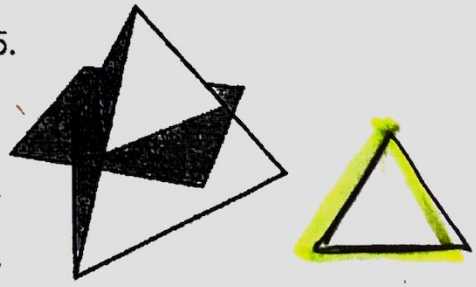
C. 

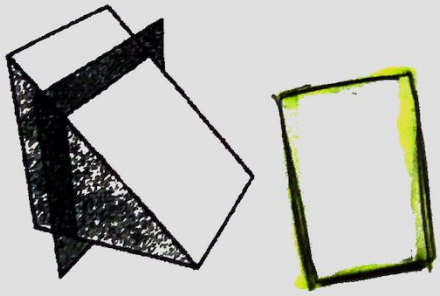
D. 

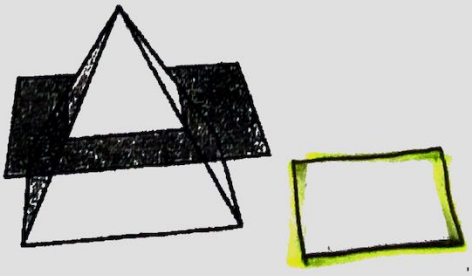
Determine the 2D shape created if the 3D shape were sliced as shown.

3. 

4. 

5. 

6. 

7. 

8.