

Name: \_\_\_\_\_

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## VOLUMES OF PRISMS AND CYLINDERS COMMON CORE GEOMETRY



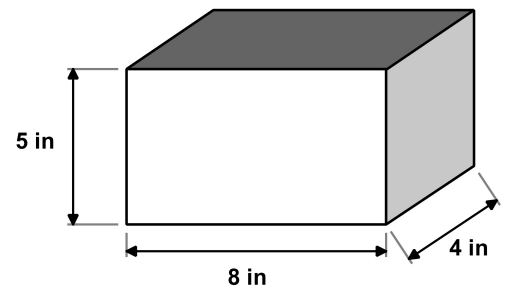
Perhaps the most important quantity measured for solids is their **size** or better put their **volume**. You should be very comfortable with the volume of a box, but let's start with that anyhow.

**Exercise #1:** A rectangular, right prism (or box) has a length of 8 inches, a width of 4 inches, and a height of 5 inches.

$$\text{1 in} \times \text{1 in} \times \text{1 in} = 1 \text{ in}^3$$

(a) What is the area of the base of the box? Use appropriate units.

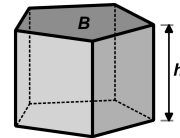
(b) What is the volume of the box? Use appropriate units. How can you use your answer to part (a) to determine the volume?



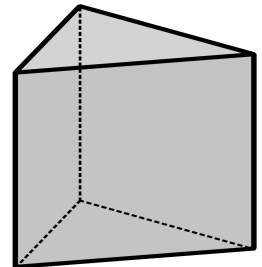
Although the procedure in Exercise #1 might seem like a formula, it is the very definition of volume. In other words, if we have a right prism of any type we can calculate its volume as:

### Volume of a Right Prism

$V = B \cdot h$ , where  $B$  is the area of the base and  $h$  is the height of the prism.

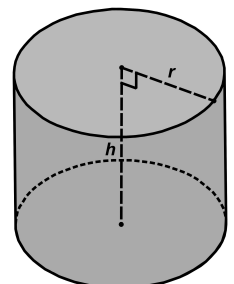


**Exercise #2:** A prism has a base that is an equilateral triangle whose sides measure 6 inches each. The height of the prism is 8 inches. What is the volume of the prism, to the nearest cubic inch?

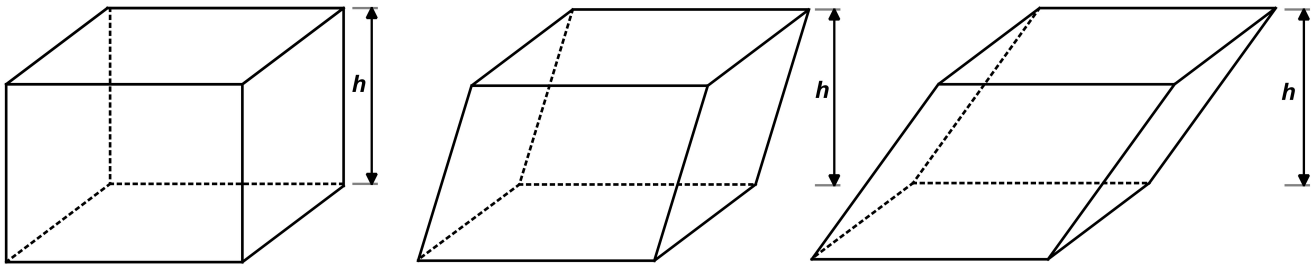


**Exercise #3:** A cylinder is a solid that follows the same rules as a prism because it has a constant cross-sectional shape and area. Explain why the volume of a right circular cylinder is given by:

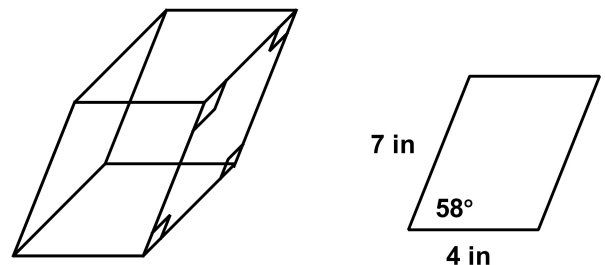
$$V = \pi r^2 h$$



One of the remarkable facts about the volume of solids is given by **Cavalieri's Principle** which states that two solids will have the same volume if their cross-sectional areas are the same at any given height. The three prisms below illustrate this idea. In each one, the height is the same and the cross-sections are all congruent rectangles. Thus, the three prisms have the same volume.



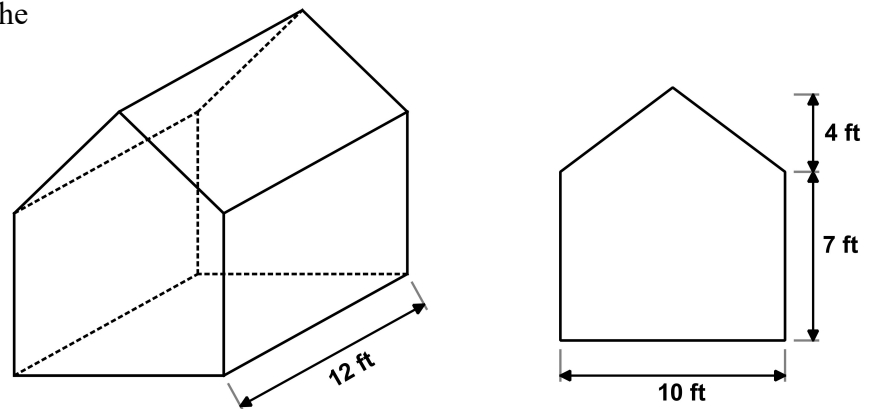
**Exercise #4:** A non-right prism has square bases, two faces that are rectangles, and two vertical faces that are non-rectangular parallelograms. The side-view of the non-rectangular parallelograms is shown. Determine the volume of the prism to the nearest cubic inch.



The most common prisms that you will deal with in modeling real world phenomena are right in nature, so we will mostly stick to those. But, keep in mind, that as long as it is a prism, its volume can be calculated as the product of its base area with its height.

**Exercise #5:** A chicken coop is in the shape of the prism shown below.

- (a) Determine the volume, in cubic feet, of the coop. Show the calculations that lead to your answer.



- (b) If the entire volume of air must be moved out of the coop in an hour, how many cubic feet per minute must a fan move to accomplish this task?



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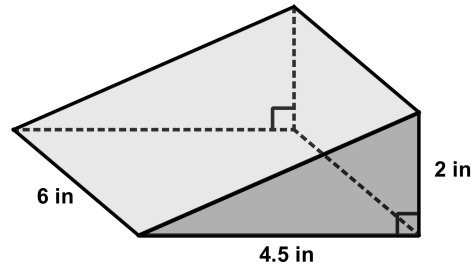
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## THE VOLUME OF PRISMS AND CYLINDERS COMMON CORE GEOMETRY HOMEWORK

### PROBLEM SOLVING

1. The following wedge prism has a volume of

- (1) 12.5 cubic inches
- (2) 19 cubic inches
- (3) 27 cubic inches
- (4) 54 cubic inches

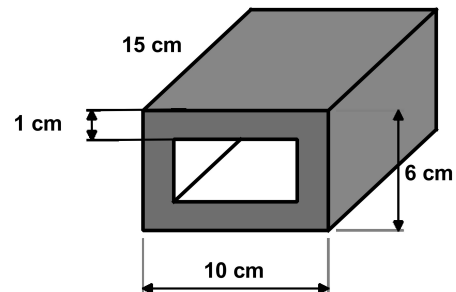


2. A right circular cylinder with a diameter of 14 inches and a height of 10 inches has a volume, in cubic inches, of which of the following?

- (1)  $70\pi$
- (2)  $490\pi$
- (3)  $740\pi$
- (4)  $1,960\pi$

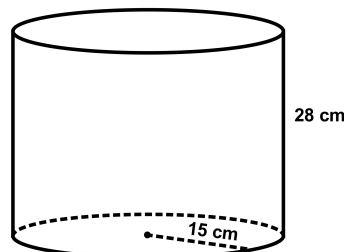
3. A box tube is to be constructed out of 1 cm thick metal that has a width of 10 cm, a height of 6 cm, and a depth of 15 cm. Which of the following represents the volume of the metal used?

- (1)  $420 \text{ cm}^3$
- (2)  $540 \text{ cm}^3$
- (3)  $640 \text{ cm}^3$
- (4)  $760 \text{ cm}^3$

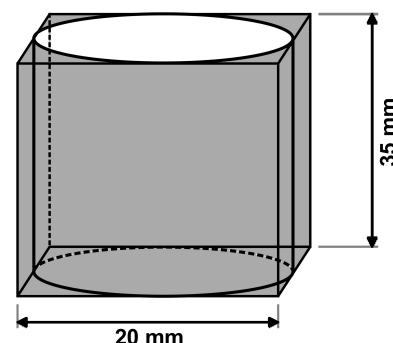


4. A large plastic bucket is in the shape of a right, circular cylinder with dimensions shown below. If there are 1000 cubic centimeters in a liter and 3.785 liters in a gallon, then which of the following is true about the volume of this cylinder?

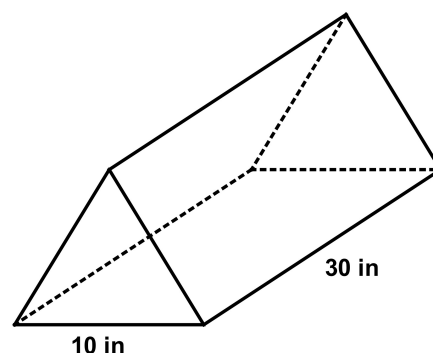
- (1) It is less than one gallon
- (2) It is between 3 and 4 gallons
- (3) It is between 5 and 6 gallons
- (4) It is greater than 10 gallons



5. A piece of hardware is constructed by drilling a cylindrical hole through a right prism with a square base that measures 20 mm on each side. The hole is 35 mm long, as shown in the diagram. Determine the volume of the remaining material once the hole has been drilled. Round your answer to the nearest cubic millimeter.



6. A prism has bases that are equilateral triangles with sides lengths of 10 inches and a length of 30 inches. Determine the volume of the prism to the nearest cubic inch. Show how you arrived at your answer.



## REASONING

7. The shaded prism below is created from the rectangular box as shown. Points  $A$ ,  $B$ , and  $C$  are midpoints of their respective edges. Explain, using Cavalieri's Principle, why the volume of the shaded prism must be one-fourth of the volume of the original rectangular box.

