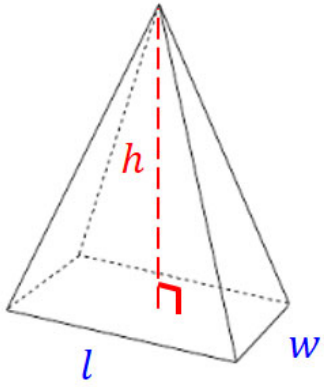
Objective: Use the formula for volume of a pyramid to solve problems in context.

Concept

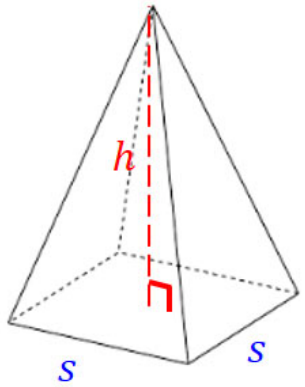
The formula for the **volume V of a pyramid** with base area B is $V = \frac{1}{3}Bh$.

Rectangular Based Pyramid



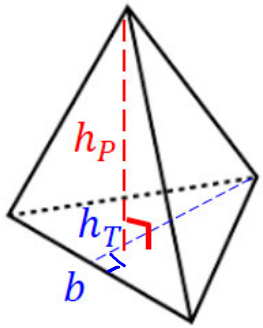
$$V = \frac{1}{3} \cdot B \cdot h$$
$$V = \frac{1}{3} \cdot l \cdot w \cdot h$$

Square Based Pyramid



$$V = \frac{1}{3} \cdot B \cdot h$$
$$V = \frac{1}{3} \cdot s \cdot s \cdot h$$
$$V = \frac{1}{3} \cdot s^2 \cdot h$$

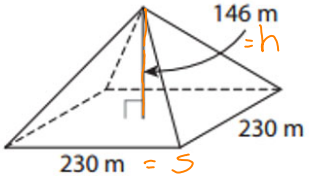
Triangular Based Pyramid



$$V = \frac{1}{3} \cdot B \cdot h$$
$$V = \frac{1}{3} \cdot \frac{1}{2} \cdot b \cdot h_T \cdot h_P$$

Objective: Use the formula for volume of a pyramid to solve problems in context.

Ex) The Great Pyramid in Giza, Egypt, is approximately a square pyramid with the dimensions shown. The pyramid is composed of stone blocks that are rectangular prisms. An average block has dimensions $1.3\ m\ x\ 1.3\ m\ x\ 0.7\ m$. Approximately how many stone blocks were used to build the pyramid? Round to the nearest hundred thousand.



① Volume of the Pyramid

$V = \frac{1}{3} B \cdot h$

$V = \frac{1}{3} \cdot s^2 \cdot h$

$V = \frac{1}{3} (230m)^2 \cdot 146m$

$= \frac{1}{3} \cdot 230^2 \cdot 146\ m^3$

$V \approx 2{,}574{,}466.667\ m^3$

② Volume of a stone block.

$V = B \cdot h$

$V = l \cdot w \cdot h$

$V = 1.3m \cdot 1.3m \cdot 0.7m$

$V = 1.183\ m^3 = 1$ stone block

③ Find the number of blocks.

$\frac{2{,}574{,}466.667\ m^3}{1} \cdot \frac{1\ \text{stone block}}{1.183\ m^3}$

$\approx 2{,}176{,}218.653$ stone blocks

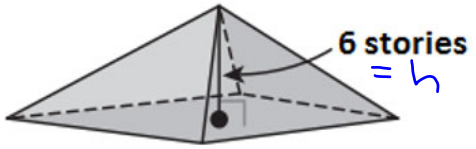
$\approx 2{,}200{,}000$ stone blocks

(hundred thousands place)

④ About 2,200,000 stone blocks were used to build the Great Pyramid.

Objective: Use the formula for volume of a pyramid to solve problems in context.

Ex) An art gallery is a 6 story square pyramid with base area ½ acre (1 acre = 4840 yd², 1 story ≈ 10 ft).



a. Estimate the volume to the nearest cubic yard.

① convert to yards

ⓐ $\frac{6 \text{ stories}}{1} \cdot \frac{10 \text{ ft}}{1 \text{ story}} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} = 20 \text{ yd} = h$

ⓑ $\frac{\frac{1}{2} \text{ acre}}{1} \cdot \frac{4840 \text{ yd}^2}{1 \text{ acre}} = 2420 \text{ yd}^2 = B$

② volume

$V = \frac{1}{3} \cdot B \cdot h$

$V = \frac{1}{3} \cdot 2420 \text{ yd}^2 \cdot 20 \text{ yd}$

$V \approx 16,133 \text{ yd}^3$

③ The art gallery has a volume of about $16,133 \text{ yd}^3$.

b. Estimate the volume in cubic feet.

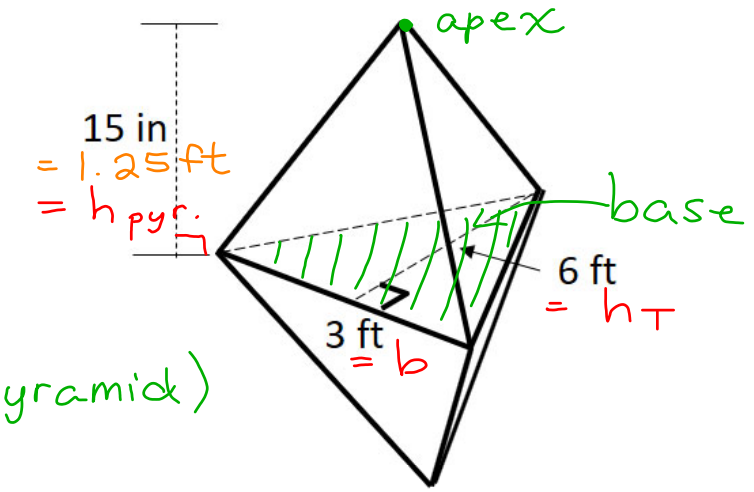
$\frac{16,133 \text{ yd}^3}{1} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \approx 435,591 \text{ ft}^3$

yd^3

The volume of the art gallery is about 435,591 cubic feet.

Objective: Use the formula for volume of a pyramid to solve problems in context.

Ex) A crystal is formed from two congruent (same volume) pyramids. Find the volume of the crystal in cubic feet.



① convert inches to feet

$$\frac{15\text{ in}}{1}\cdot\frac{1\text{ ft}}{12\text{ in}} = 1.25\text{ ft}$$

② volume of one pyramid (triangular pyramid)

$$V = \frac{1}{3}Bh$$

$$V = \frac{1}{3}\left(\frac{1}{2}\cdot b\cdot h_T\right)\cdot h_{pyr.}$$

$$V = \frac{1}{3}\cdot\frac{1}{2}\cdot 3\text{ft}\cdot 6\text{ft}\cdot 1.25\text{ ft}$$

$$= 3.75\text{ ft}^3$$

③ volume of the crystal

$$2(3.75\text{ ft}^3)$$

or $3.75\text{ ft}^3 + 3.75\text{ ft}^3$

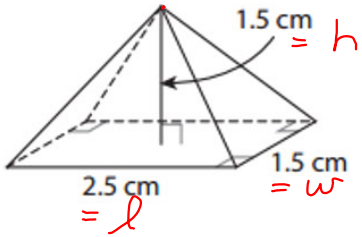
$$= 7.5\text{ ft}^3$$

④ The crystal has a volume of 7.5 cubic feet.

Objective: Use the formula for volume of a pyramid to solve problems in context.

Ex) A piece of pure silver in the shape of a rectangular pyramid with the dimensions shown has a mass of 19.7 grams. What is the density of silver to the nearest tenth?

Note: $Density = \frac{mass}{volume}$



① Volume

$V = \frac{1}{3}Bh$

$V = \frac{1}{3} \cdot l \cdot w \cdot h$

$V = \frac{1}{3} \cdot 2.5cm \cdot 1.5cm \cdot 1.5cm$

$= 1.875cm^3$

② Density of silver

$D = \frac{mass}{V}$

$= \frac{19.7g}{1.875cm^3}$ units

$\approx 10.5\ g/cm^3$

③ The density of silver is about $10.5\ g/cm^3$.