# L8-5 Volume of Pyramids

## Prisms

(has 3 times the volume of a pyramid)

$V = Bh$

### cube / rectangular

$V = (bh)h$

### triangular

$V = \left(\frac{bh}{2}\right)h$

### cylindar

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

## Pyramids

$V = \frac{1}{3}Bh$ → height pyramid

$B$: area of base

### Square pyramid

$V = \frac{1}{3}(b \cdot h)h$

$(b \cdot h)$: area of base; $h$: height of pyramid

### triangular pyramid

$V = \frac{1}{3}\left(\frac{bh}{2}\right)h$

$\frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$

$V = \frac{1}{6}(bh)h$

### Cone

$V = \frac{1}{3}(\pi r^2)h$

**What You'll Learn**

Scan the lesson. Write the definitions of lateral face and pyramid.

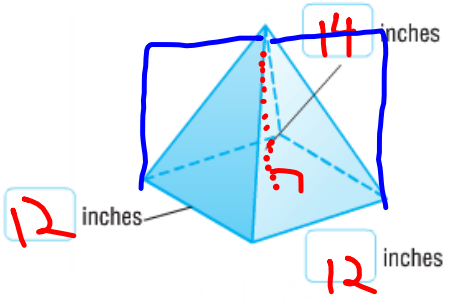
- lateral face faces that meet @ the vertex at the top. (not the base)
- pyramid 3-d object w/ polygon base & triangular faces that meet @ a vertex at top

(Vertex on a cone is actually an apex)

## Real-World Link

**Sand Sculpture** Dion is helping his mother build a sand sculpture at the beach in the shape of a pyramid. The square pyramid has a base with a length and width of 12 inches each and a height of 14 inches.

1. Label the dimensions of the sand sculpture on the square pyramid below.




2. What is the area of the base of the pyramid?

$12 \cdot 12 = 144 \text{ in}^2$

3. What is the volume of a square prism with the same dimensions as the pyramid?

$14 \cdot (12 \cdot 12) = 2016 \text{ in}^3$

The pyramid Dion & his mother built has a volume of $672 \text{ in}^3$.

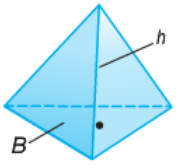
$$\frac{2016}{3} = 672$$

## Volume of a Pyramid

**Words** The volume $V$ of a pyramid is one third the area of the base $B$ times the height of the pyramid $h$.

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

**Model**




**Got It?** Do this problem to find out.

**a.** Find the volume of a pyramid that has a height of 9 centimeters and a rectangular base with a length of 7 centimeters and a width of 3 centimeters.

rectangular pyramid

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

$= \frac{1}{3}(b \cdot h)h$

$= \frac{1}{3}(7 \cdot 3)9$

$= \frac{1}{3}(189) = \frac{189}{3}$

$= 63 \text{ cm}^3$

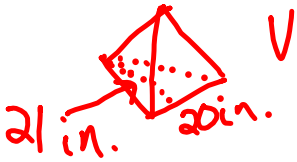
## Find the Height of a Pyramid

You can also use the formula for the volume of a pyramid to find a missing height.

**Got It?** Do these problems to find out.

**b.** A triangular pyramid has a volume of 840 cubic inches. It has a base of 20 inches and a height of 21 inches. Find the height of the pyramid.

**c.** A rectangular pyramid has a volume of 525 cubic feet. It has a base of 25 feet by 18 feet. Find the height of the pyramid.




$V = 840 \cdot in^3$

$V = \frac{1}{6}(b \cdot h)h$ → pyramid (Base)

$840 = \frac{1}{6}(20 \cdot 21)h$ $\quad \frac{420}{1} \cdot \frac{1}{6}$

$840 = \frac{420}{6}h$ $\quad 420 \div 6$

$\frac{840}{70} = \frac{70h}{70}$ → $70 \cdot h$

$12 \cdot in. = h$

The height of the pyramid is 12 in.

**Got It?** Do these problems to find out.

**b.** A triangular pyramid has a volume of 840 cubic inches. It has a base of 20 inches and a height of 21 inches. Find the height of the pyramid.

**c.** A rectangular pyramid has a volume of 525 cubic feet. It has a base of 25 feet by 18 feet. Find the height of the pyramid.

$V = \frac{1}{3}(b \cdot h)h$ → height of pyramid

base

$525 = \frac{1}{3}(25 \cdot 18)h$ $25 \cdot 18$

$525 = \frac{1}{3}(450)h$

$525 = \frac{450}{3}h$ $\frac{450}{1} \cdot \frac{1}{3}$

$\frac{525}{150} = \frac{150h}{150}$

$3.5 \text{ ft} = h$

The pyramid is 3.5 feet tall.

**5.** The Transamerica Pyramid is a skyscraper in San Francisco. The rectangular base has a length of 175 feet and a width of 120 feet. The height is 853 feet.

Find the volume of the building. (Example 5) _____

rectangular pyramid

$V = \frac{1}{3}(b \cdot h)h$

$= \frac{1}{3}(175 \cdot 120)853$

$= \frac{1}{3}(21000)853$

$= \frac{21000}{3} \cdot 853$

$= 7000 \cdot 853$

$= 5971000 \text{ ft}^3$