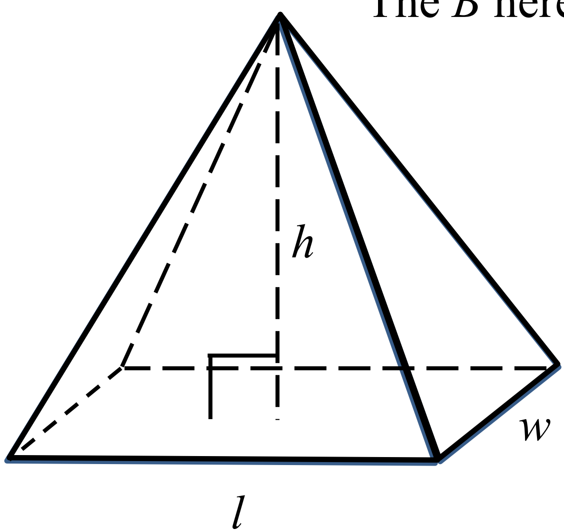
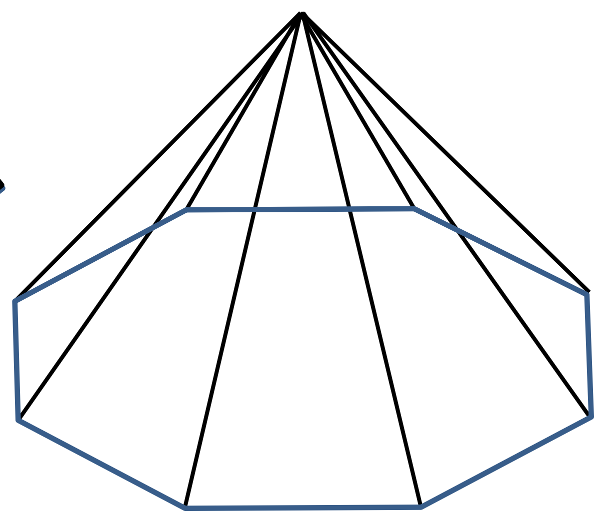
Pyramids

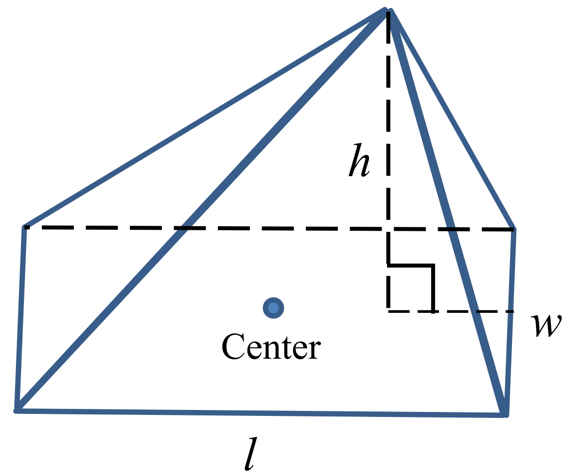
The general formula for the volume of a Pyramid is

$$V_{Pyramid} = \frac{1}{3} Bh$$

The *B* here is the area of the base of the Pyramid







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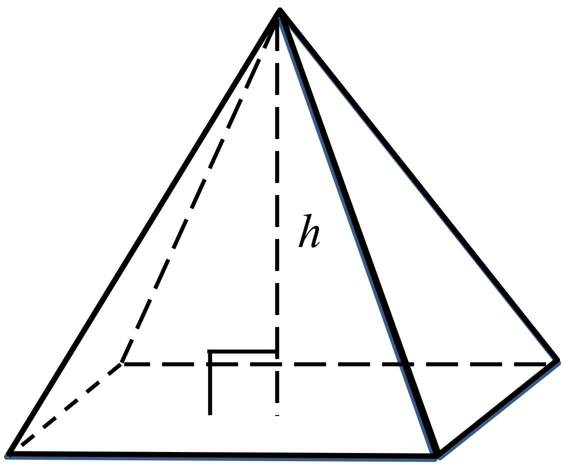
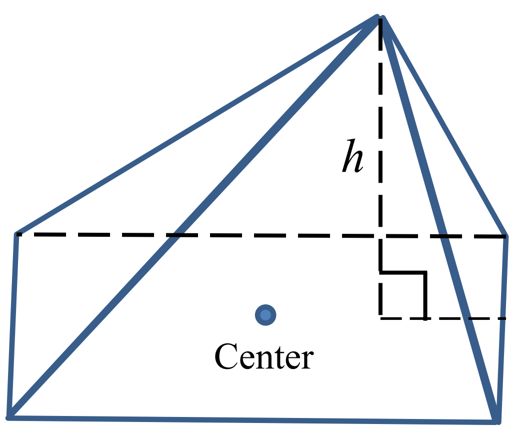
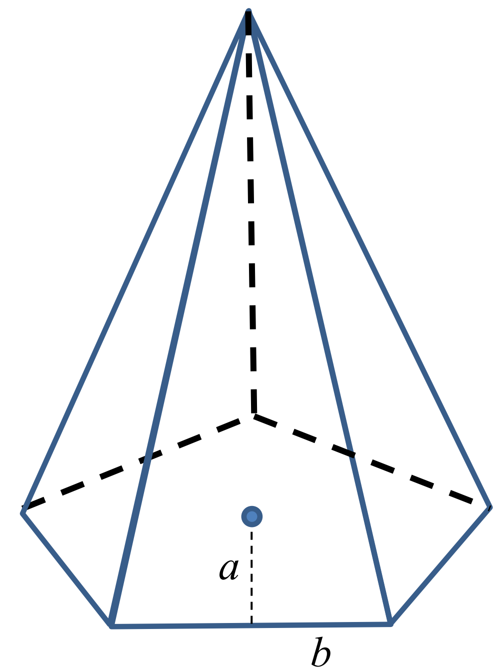


For either of these $B = l \times w$

because the base is just a rectangle (or possibly a square)

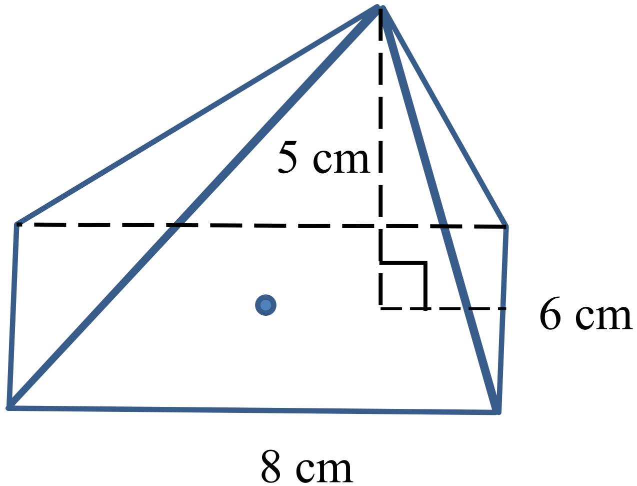




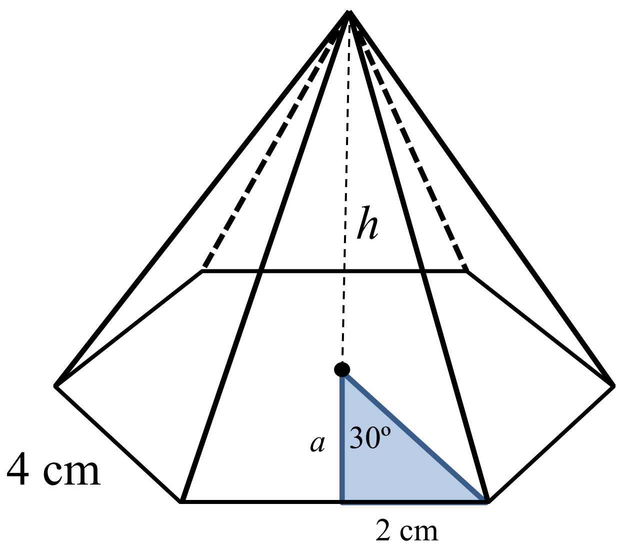
because the base is a Pentagon

$$B = \frac{1}{2}aP = \frac{1}{2}\frac{b}{\tan(36^\circ)}P$$

$$V = \frac{1}{3}\left(\frac{1}{2}\frac{b}{\tan(36^\circ)}P\right)h$$



$$V = \frac{1}{3}lwh = \frac{1}{3}8 \cdot 6 \cdot 5 = 80\ cm^3$$

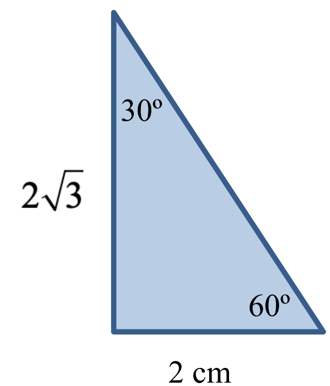


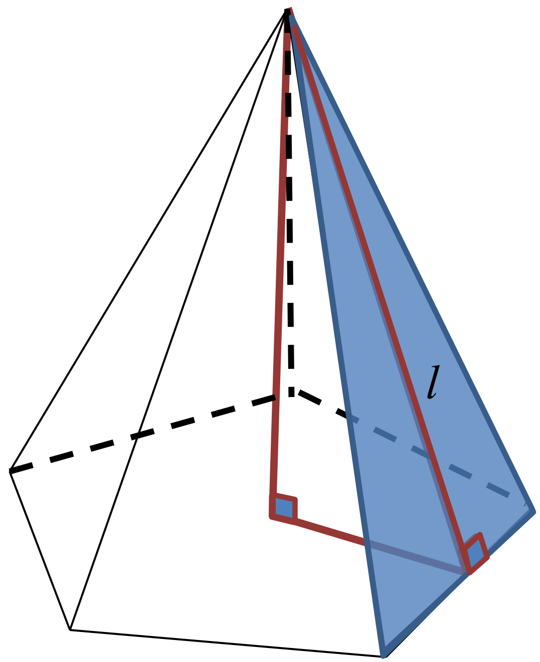
$h = 7$ cm

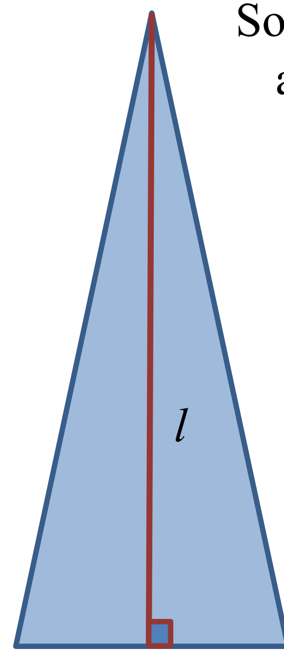
$$V = \frac{1}{3}A_{hexagon}h$$

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

$$V = \frac{1}{3}\left[\frac{1}{2}\left(2\sqrt{3}\right)24\right]7 = 56\sqrt{3}\ \text{cm}^3$$







So the slant height is linked to the apothem and the height of the pyramid by the Pythagorean Theorem

$$a^2 + h^2 = l^2$$

l = slant height

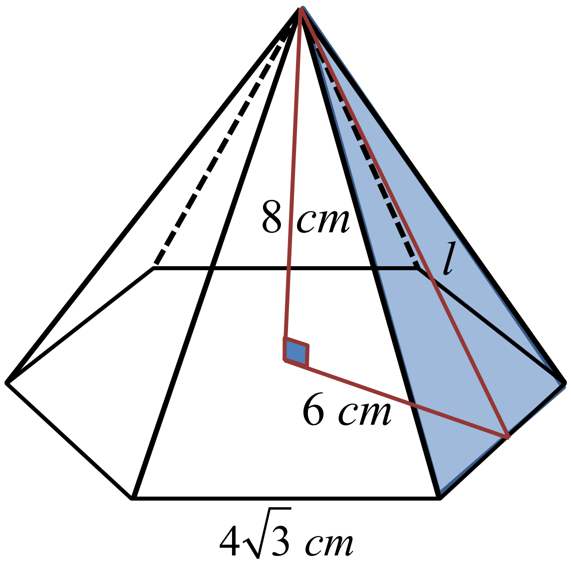
The surface area involves knowing the slant height of the pyramid

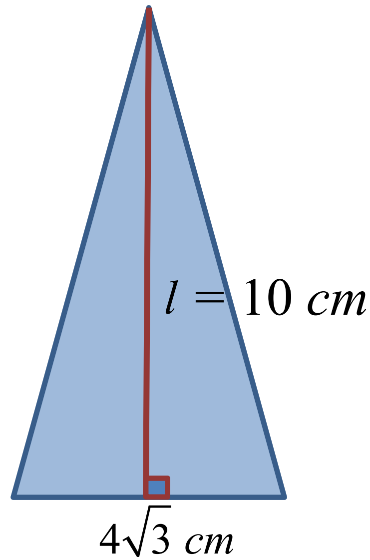
What is the slant height and how do we find it?

h l

l = slant height

a





Find the surface area of the pyramid (Minus the base)

Since there are six triangles, let's find one triangle's area and then multiply this result by six

$$6^2 + 8^2 = l^2$$

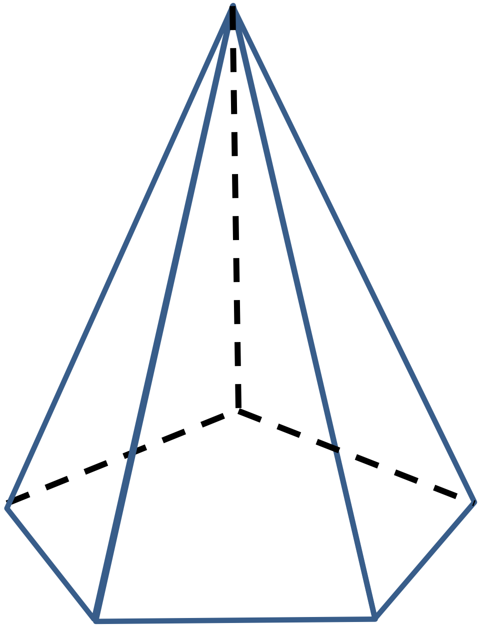
This is just a 3-4-5 Triangle

$$l = 10\ cm$$

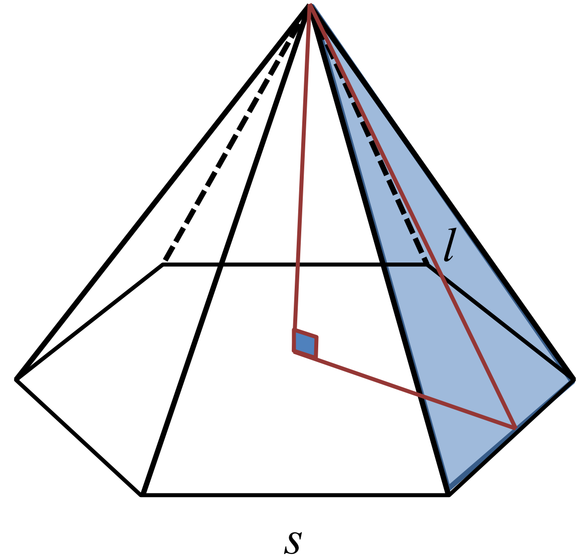
$$A_{triangle} = \frac{1}{2} 4\sqrt{3} \cdot 10 = 20\sqrt{3}$$

Six of these gives us

$$120\sqrt{3}\, cm^2$$

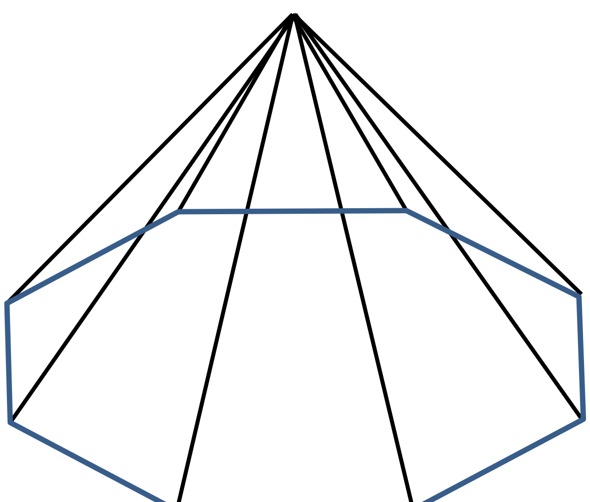


So the surface area of a pyramid excluding the base is the area of one triangle times the number of triangles

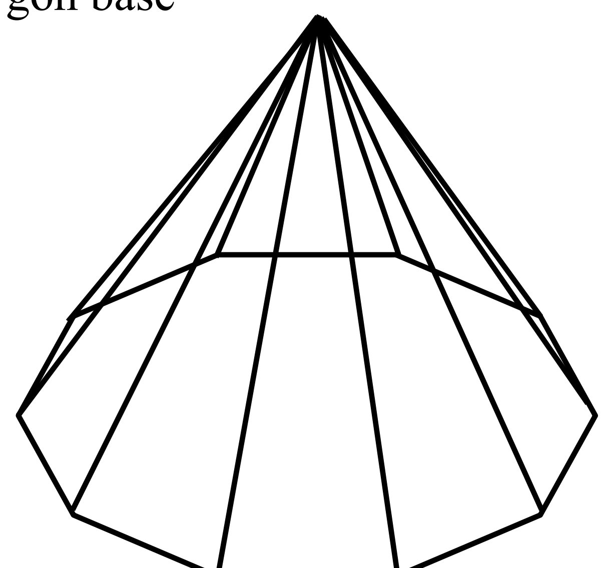


$$A_{surface} = \frac{1}{2}nsl$$

n is the number of sides
s is the length of each side of the polygon base
l = the slant height



This can be simplified to



$$A_{surface} = \frac{1}{2}Pl$$

P is the perimeter of the base
l = the slant height