Math 8

Finding Missing Lengths of Solids given Surface Area

To **summarize** the difference between Prisms/Cylinders vs Regular-Based Pyramids (ie: equilateral triangle, square, regular pentagon, etc…)

Shape	**Prisms/Cylinders**	**Regular-Based Pyramids**
Bases	TWO bases, parallel to each other	ONE base
Heights	These stand straight up - they only have the one height	When measuring from the middle of the base STRAIGHT UP to the apex is the HEIGHT, when measuring along the middle of one of the triangular sides is the SLANT HEIGHT (this is the height of one triangular side)
Lateral Area: (area of sides… everything except the bases)	= (Perimeter of the base)(Height)	$= \frac{(Perimeter\ of\ the\ base)(Slant\ Height)}{2}$ We're dividing by 2 since each side is a triangle
Surface Area: (total surface area, including the base(s))	= 2(Area of Base) + Lat Area	= Area of Base + Lat Area

Recall that the area of a circle is πr^2 and its circumference (perimeter) is $2\pi r$, so for the surface area of a cylinder we get:

$$SA = 2(\text{Area of Base}) + \text{Lat Area}$$
$$SA = 2(\text{Area of Base}) + (\text{Perimeter of the base})(\text{Height})$$
$$SA = 2(\pi r^2) + 2\pi r(h)$$

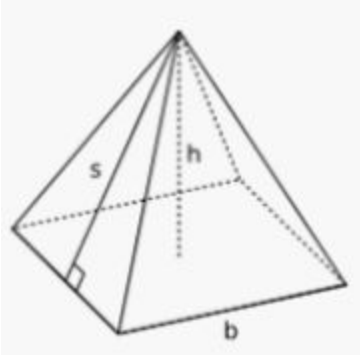
This is written as

$$SA = 2\pi r^2 + 2\pi r h$$

In order to solve for a missing length when given the surface area we need to start with an equation and then work backwards to solve.

Example 1

Find the slant height of a square based pyramid with a surface area of 132 cm^2 and whose base has a side length of 6 cm.



SA = Area of Base + Lat Area

$$SA = \text{Area of Base} + \frac{(Perimeter\ of\ the\ base)(Slant\ Height)}{2}$$

$132 = (6)(6) + \frac{(4)(6)h_s}{2}$ where h_s = slant height

$132 = 36 + 12h_s$ subtract 36 from both sides

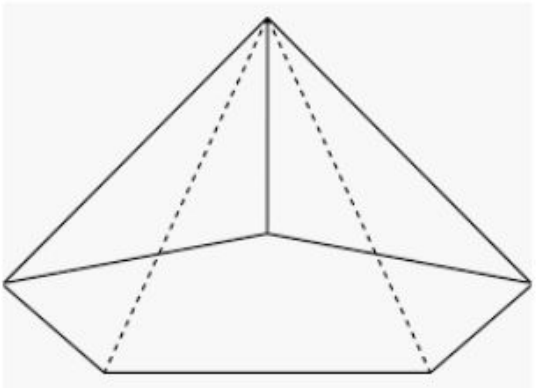
$96 = 12h_s$ divide both sides by 12

$8 = h_s$

The slant height is 8 cm.

Example 2

Find the length of one side of the pentagonal base in the pyramid below if it has a slant height of 20 cm, a surface area of 840 cm^2, and the apothem of the base is 8 cm.



$$SA = \text{Area of Base} + \frac{(Perimeter\ of\ the\ base)(Slant\ Height)}{2}$$

$840 = \frac{(8)(5)(s)}{2} + \frac{(5s)(20)}{2}$ where s is the length of one side

$840 = 20s + 50s$ combine like terms

$840 = 70s$ divide both sides by 70

$12 = s$

The side length of the pentagonal base is 12 cm.