

MATH 10 – UNIT 1 – LESSON 7 – SURFACE AREA OF RIGHT PYRAMIDS & RIGHT CONES

MEASUREMENT UNIT

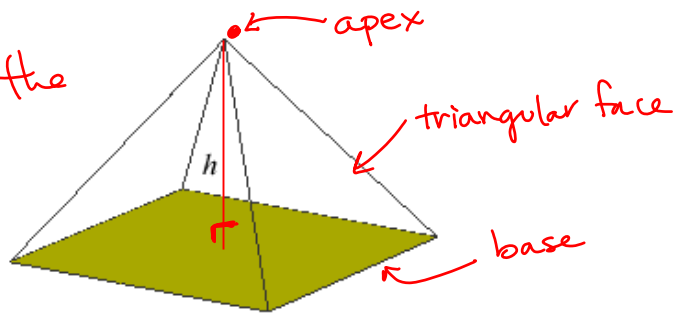
Name: Key

Right Pyramid: a 3-D object with triangular faces and a polygon base.
 The name of the pyramid depends on the shape of the base. → square pyramid
→ rectangular pyramid

Apex: the tip of the pyramid where the triangular faces meet.

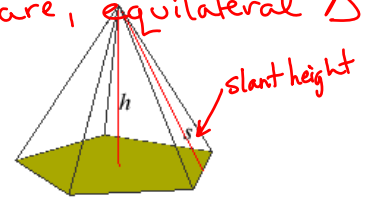
Height: the \perp distance from the apex to the centre of the base.

* The name of the pyramid depends on the shape of the base.



Regular Polygon: closed shape made up of straight lines where all sides are = and all \angle 's are = Ex: square, equilateral Δ

Regular Pyramid: When the base of a right pyramid is a regular polygon, the triangular faces are congruent and the **slant height (s)** of the right pyramid is equal to the height of a triangular face.



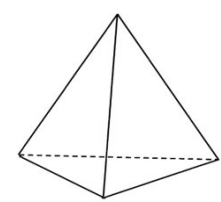
Right Pentagonal Pyramid

Tetrahedron:

A pyramid with a triangular base.

Regular Tetrahedron:

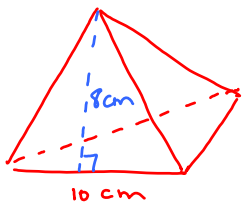
A pyramid with 4 congruent equilateral triangular faces.
 i.e. All sides + \angle 's are = !



Tetrahedron

$4 = \Delta$'s

Example #1: Sketch and find the surface area of a regular tetrahedron with a base of side length 10 cm and a slant height of 8 cm.



Area of 1 $\Delta = \frac{1}{2}bh = \frac{1}{2}(10)(8) = 40\text{cm}^2$
 Area of 4 Δ 's = $4 \times 40 = 160\text{cm}^2$

(side)

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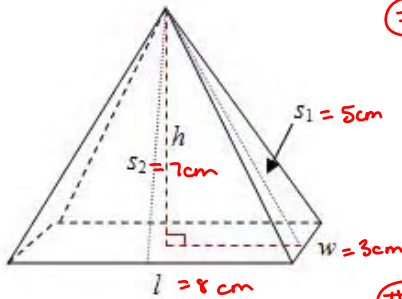
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Lateral Area of a Pyramid (A_L): Area of all faces except the base

Also called side area.

Example #2: Determine the lateral area of the following right rectangular pyramid to the nearest tenth of a square centimetre, if: $l = 8$ cm, $w = 3$ cm, $s_1 = 5$ cm, $s_2 = 7$ cm.



#1 Find A of 1 big Δ



$$A_1 = \frac{bh}{2} \\ = \frac{8 \times 7}{2} \\ = 28 \text{ cm}^2$$

↳ Not all Δ faces are =!
We will have 2 big Δ ; 2 small Δ
* opposite Δ 's are congruent!

#3 Find A_L - sum of all Δ faces

$$A_L = 2 \times 28 + 2 \times 7.5 \\ = 71 \text{ cm}^2$$

∴ The lateral Area is 71 cm^2

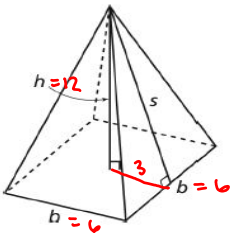
#2 Find A of 1 small Δ



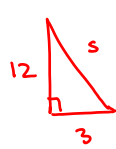
$$A_2 = \frac{bh}{2} \\ = \frac{3 \times 5}{2} \\ = 7.5 \text{ cm}^2$$

4 = Δ faces + square base

Example #3: A right square pyramid has a base of 6 ft. by 6 ft., and a height of 12 ft. Sketch a diagram and calculate the surface area to the nearest square foot. (HINT: This question gives you height, NOT slant height!)



#1 use pythagoras to find s



$$s^2 = 12^2 + 3^2 \\ s = \sqrt{144 + 9} \\ s = \sqrt{153}$$

#2 Plug into SA formula

SA for a square pyramid → $SA = 2bs + b^2$
 $= 2(6)(\sqrt{153}) + 6^2$
 $= 184.43$

* check your formula sheet! *

∴ Surface area is approximately 184 ft^2

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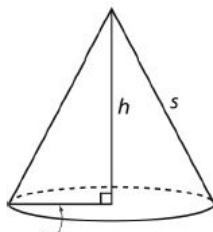
MEASUREMENT UNIT

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Right Cone: a 3-D object that has a circular base and a curved surface.

Height: ⊥ distance from the apex to the centre of the base.

Slant Height: shortest distance from the apex to the circumference of base



(Side) Lateral Area of a Cone (A_L): Area of the curved surface of the cone (not including) base

Lateral Area of a Right Cone

$$A_L = \pi r s$$

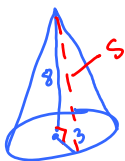
where s is slant height & r is radius

Surface Area of a Right Cone

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

where s is slant height & r is radius

→ Example #1: A right cone has a base radius of 3 ft. and a height of 8 ft. Sketch a diagram and calculate the surface area to the nearest square foot. Whole #



#1 Find slant height

$$s^2 = 8^2 + 3^2$$

$$s = \sqrt{73}$$

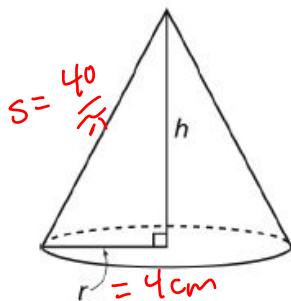
#2 Plug it into formula

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

$$= \pi (3)(\sqrt{73}) + \pi (3^2) = 109 \text{ square feet}$$

Example #2: The lateral area of a cone is 160 cm^2 . The diameter of the cone is 8 cm. Determine the height of the cone to the nearest hundredth of a centimetre.

$$r = 4 \text{ cm}$$



$$A_L = 160 \text{ cm}^2$$

$$\pi r s = 160$$

$$\frac{\pi (4) s}{4\pi} = \frac{160}{4\pi}$$

$$s = \frac{40}{\pi}$$

Find height using pythagoras

$$s^2 = r^2 + h^2$$

$$\left(\frac{40}{\pi}\right)^2 = 4^2 + h^2 \rightarrow \left(\frac{40}{\pi}\right)^2 - 4^2 = h^2$$

$$h^2 = \left(\frac{40}{\pi}\right)^2 - 4^2$$

$$h = \sqrt{\left(\frac{40}{\pi}\right)^2 - 4^2}$$

$$h = 12.09 \text{ cm}$$

Lesson 7 Homework: WS 10-1-7 "Surface Area of Right Pyramids & Right Cones"