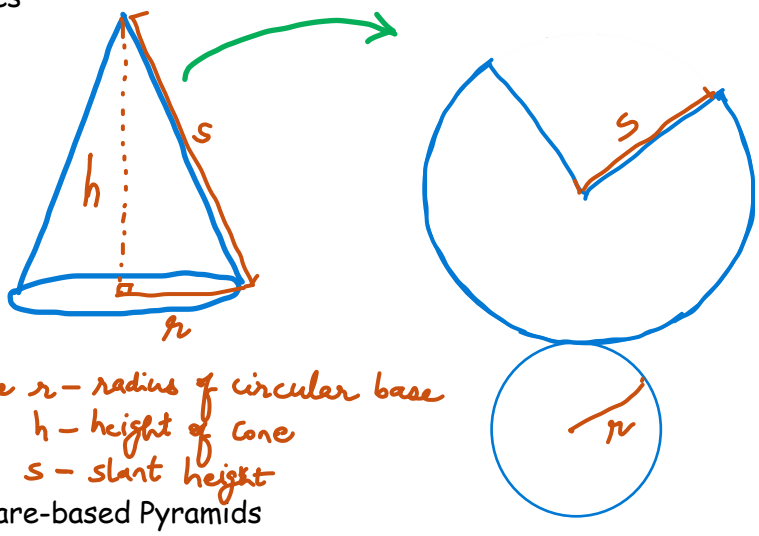
Math 9 – Unit 4: Measurement Name: _____

Lesson 4.3: Cones, Pyramids and Spheres Date: _____

Learning Goal: We are learning to calculate the surface area and volume of cones, square-based pyramids and spheres.

Cones



NOTE:

Right Δ

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

(PYTHAGORAS THEOREM)

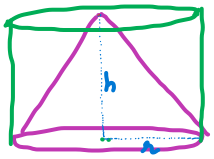
where r – radius of circular base
h – height of cone
s – slant height

FORMULAS TO REMEMBER:

$S.A.(\text{CONE}) = \pi r s + \pi r^2$ (CURVED SURFACE + CIRCULAR BASE)

$\text{VOLUME (CONE)} = \frac{1}{3}\pi r^2 h$

* ANOTHER IMPORTANT NOTE:



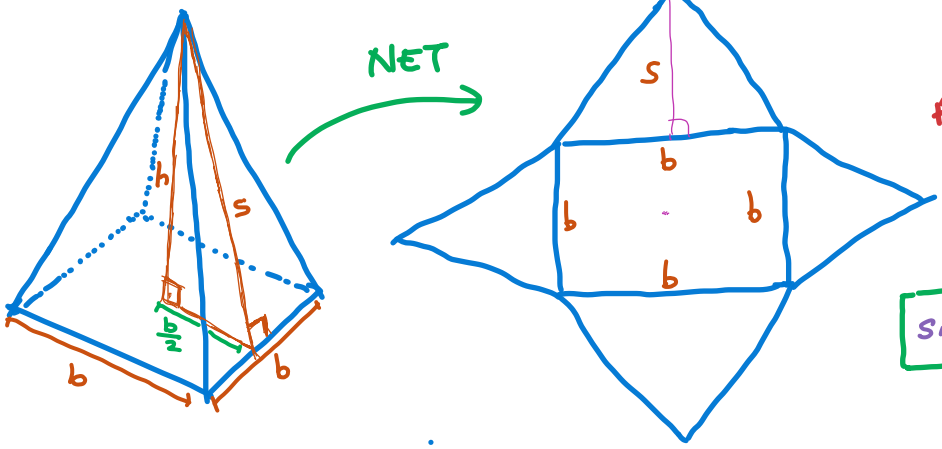
If you fill a cone and a cylinder with same radius r and height h with water, you will observe:

$\text{water in Cone} = \frac{1}{3}(\text{water in Cylinder})$

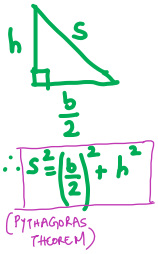
$\therefore$ It is safe to conclude that

$\text{VOLUME (CONE)} = \frac{1}{3}(\text{VOLUME of CYLINDER})$

Square-based Pyramids



NOTE:



$\therefore s^2 = \left(\frac{b}{2}\right)^2 + h^2$

(PYTHAGORAS THEOREM)

FORMULAS TO REMEMBER:

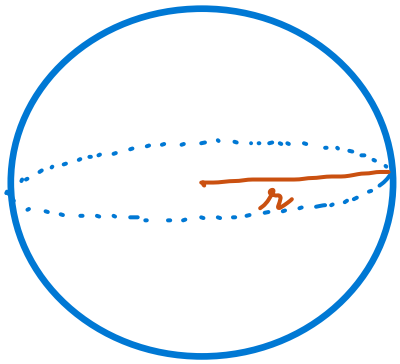
S.A. = Area of 4 identical Δ + Area of □ base

$SA\ (\text{SQUARE PYRAMID}) = 2bs + b^2$

THINK HOW?!!

$\text{VOLUME}\ (\text{SQUARE PYRAMID}) = \frac{1}{3}b^2 h$

Spheres.



THE NET OF A SPHERE WOULD BE LIKE THE PEEL OF AN ORANGE.

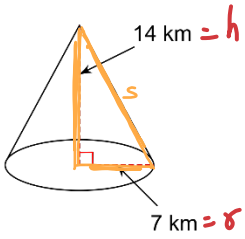
FORMULAS TO REMEMBER:

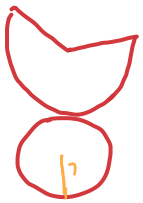
$S.A.(\text{SPHERE}) = 4\pi r^2$

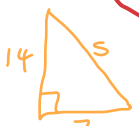
$\text{VOLUME (SPHERE)} = \frac{4}{3}\pi r^3$

For each new solid, draw a net wherever possible, then calculate the surface area and the volume.

1.







$s^2 = 14^2 + 7^2$

$s = \sqrt{196+49}$

$s = 15.7\text{ km}$

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

$= (3.14)(7)(15.7) + 3.14(7)(7)$

$= 345.08 + 153.86$

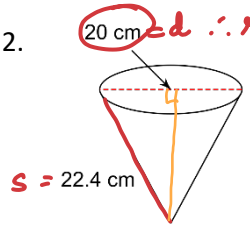
$S.A. = 498.94\text{ km}^2$

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

$V = \frac{3.14(7)(7)(14)}{3}$

$V = 718.013\text{ km}^3$

2.



$\therefore r = 10\text{ cm}$

$c^2 = a^2 + b^2$

$22.4^2 = h^2 + 10^2$

$501.76 = h^2 + 100$

$501.76 - 100 = h^2$

$\sqrt{401.76} = h$

$h = 20.04\text{ cm} \approx 20$

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

$= (3.14)(10)(22.4) + (3.14)(10)(10)$

$= 703.36 + 314$

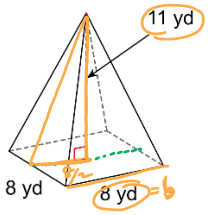
$= 1017.36\text{ cm}^2$

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

$V = \frac{(3.14)(10)(10)(20)}{3}$

$= 2097.52\text{ cm}^3$

3.



$c^2 = a^2 + b^2$

$s^2 = 4^2 + 11^2$

$s^2 = 16 + 121$

$s = \sqrt{137}$

$s \approx 11.7$

$SA = b^2 + 2bs$

$= (8)(8) + 2(8)(11.7)$

$= 64 + 187.2$

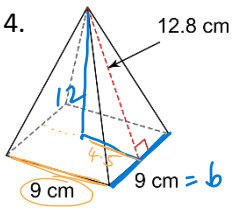
$S.A. = 251.2\ yd^2$

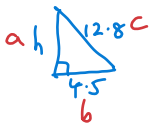
$V = \frac{b^2 h}{3}$

$= \frac{(8)(8)(11)}{3}$

$V = 234.6\ yd^3$

4.





$c^2 = a^2 + b^2$

$12.8^2 = h^2 + 4.5^2$

$163.84 = h^2 + 20.25$

$163.84 - 20.25 = h^2$

$\sqrt{143.59} = h$

$12 \approx h$

$SA = b^2 + 2bs$

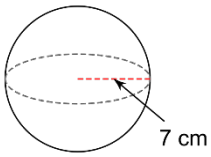
$= (9)(9) + 2(9)(12.8)$

$= 81 + 230.4$

$= 311.4\ cm^2$

$V = \frac{b^2 h}{3} = \frac{(9)(9)(12)}{3} = 324\ cm^3$

5.



$r = 7$

$SA = 4\pi r^2$

$= 4(3.14)(7)(7)$

$= 615.44\ cm^2$

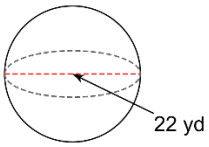
$V = \frac{4\pi r^3}{3}$

$= \frac{4(3.14)(7)(7)(7)}{3}$

$= \frac{4308.08\ cm^3}{3}$

$= 1436.02\ cm^3$

6.



$d = 22$

$r = 11$

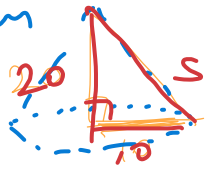
$SA = 4\pi r^2$

$V = \frac{4\pi r^3}{3}$

Use the appropriate formula to solve for the missing measurement.

7. A cone has a volume of 2094.4cm^3 with a radius of 10cm. Determine the length of the slant height.

$V = 2094.4\ cm^2$ $r = 10cm$ $s = ?$



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

$2094.4 = \frac{(3.14)(10)(10)h}{3}$

$2094.4 = \frac{314h}{3}$

$\frac{3(2094.4)}{314} = h \Rightarrow h \approx 20$

$s^2 = 20^2 + 10^2$

$s^2 = 400 + 100$

$s = \sqrt{500}$

$s \approx 22.36cm$

∴ slant height $= 22.36cm$

8. A sphere has a volume of 904.78in^3. Determine the length of the radius.

$V = 904.78$ $r = ?$

$V = \frac{4\pi r^3}{3}$

$904.78 = \frac{4(3.14)(r^3)}{3}$

$904.78 = \frac{12.56r^3}{3}$

$\frac{(904.78)(3)}{12.56} = r^3$

$216.1 \approx r^3$

$\sqrt[3]{216.1} \approx r^3$

$6 \approx r$

∴ radius of sphere $= 6$ inches approx.

Success Criteria

- I can use the appropriate formula to find the surface area or volume of a cone, pyramid, or sphere