Math 9 – Unit 4: Measurement

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Lesson 4.3: Cones, Pyramids and Spheres

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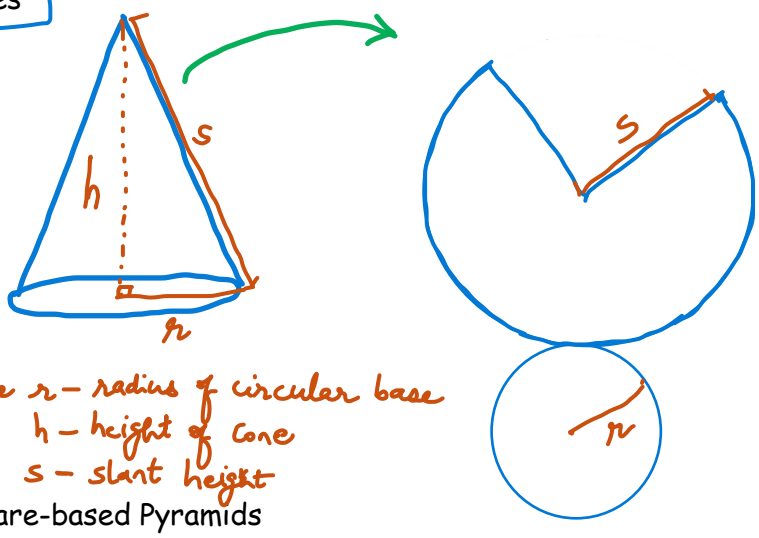
Learning Goal: We are learning to calculate the surface area and volume of cones, square-based pyramids and spheres.

Cones



NOTE:

Right Δ

$\therefore s^2 = h^2 + r^2$ (PYTHAGORAS THEOREM)

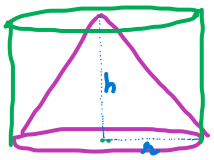
where r – radius of circular base
h – height of cone
s – slant height

FORMULAS TO REMEMBER:

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

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

* ANOTHER IMPORTANT NOTE:



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

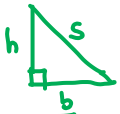
$\text{Water in Cone} = \frac{1}{3}(\text{Water in Cylinder})$

$\therefore$ It is safe to conclude that

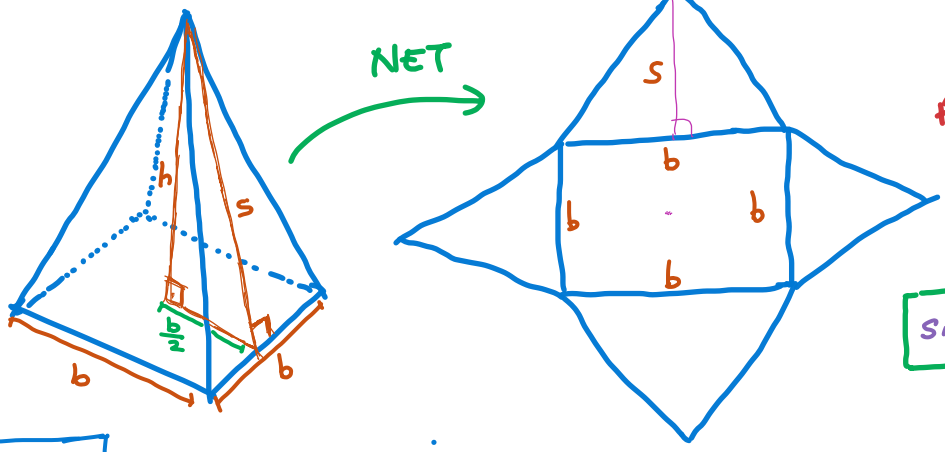
$\text{VOLUME (CONE)} = \frac{1}{3}(\text{VOLUME of CYLINDER})$

Square-based Pyramids

NOTE:



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



FORMULAS TO REMEMBER:

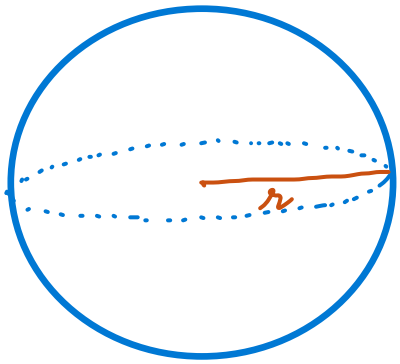
S.A. = Area of 4 identical Δ + Area of □ base

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

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.

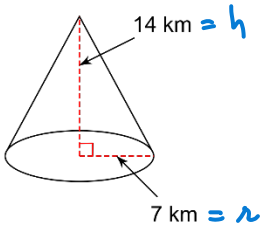
FORMULAS TO REMEMBER:

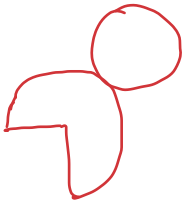
$$S.A.(\text{SPHERE}) = 4\pi r^2$$

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

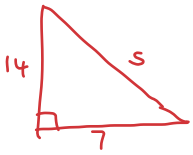
For each new solid, draw a net wherever possible, then calculate the surface area and the volume.

1.





Given: $r = 7\text{km}$, $h = 14\text{km}$



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

$SA = (3.14)(7)(15.65) + (3.14)(7)(7)$

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

$s^2 = 196 + 49$

$s^2 = 245$

$s = \sqrt{245}$

$s \approx 15.65\text{km}$

$SA \approx 343.987 + 153.86$

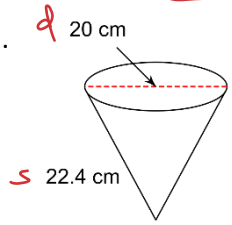
$SA \approx 497.85\ m^2$

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

$V = \frac{(3.14)(7)(7)(14)}{3} \approx 718.01\ km^3$

$V \approx 718.01\ km^3$

2.



Given: $d = 20\text{cm} \therefore r = \frac{20}{2} = 10\text{cm}$

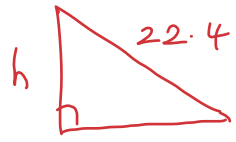
$s = 22.4\text{cm}$

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

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

$= 703.36 + 314$

$SA = 1017.36\ cm^2$



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

$501.76 = h^2 + 100$

$501.76 - 100 = h^2$

$401.76 = h^2$

$\sqrt{401.76} = h$

$20.04 \approx h$

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

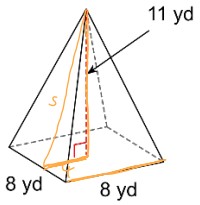
$= \frac{(3.14)(10)(10)(20.04)}{3}$

$V = 2097.52\ cm^3$

$SA = 1017.36\ cm^2$

$V = 2097.52\ cm^3$

3.



Given: $b = 8\text{ yd}$
$s = ?$
$h = 11\text{ yd}$.

$s = \sqrt{11^2+4^2}$

$s = \sqrt{121+16}$

$s \approx 11.7\text{ yd}$

$$S.A = 2bs + b^2$$

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

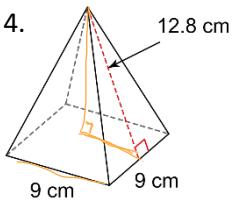
$= 187.2 + 64$

$= 251.2\text{ yd}^2$

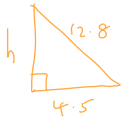
$$V = \frac{1}{3}b^2h$$

$V = \frac{(8)(8)(11)}{3} = 234.67\text{ yd}^3$

4.



Given: $s = 12.8\text{ cm}$.
$b = 9\text{ cm}$



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

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

$163.84 = h^2 + 20.25$

$\sqrt{163.84 - 20.25} = h$

$11.98 \approx h$

$$SA = 2bs + b^2$$

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

$= 230.4 + 81$

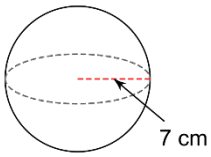
$= 311.4\text{ cm}^2$

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

$V = \frac{(9)(9)(11.98)}{3}$

$= 323.46\text{ cm}^3$

5.



Given: $r = 7\text{cm}$

$SA = 4\pi r^2$

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

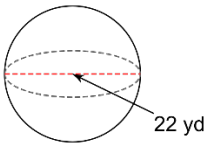
$SA = 615.44\text{ cm}^2$

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

$= \frac{4(3.14)(7)(7)(7)}{3} = \frac{4308.08}{3}$

$V = 1436.03\text{ cm}^3$

6.



Given: $d = 22\text{ yd} \Rightarrow r = 11\text{ yd}$

$SA = 4\pi r^2$

$= 4(3.14)(11)(11)$

$SA = 1519.76\text{ yd}^2$

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

$= \frac{4(3.14)(11)(11)(11)}{3}$

$V = 5572.45\text{ yd}^3$

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.

Given: $h = ?$ $r = 10$ $s = ?$ $V = 2094.4\text{cm}^2$

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

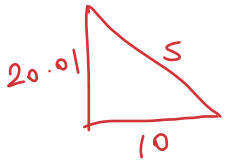
$2094.4 = \frac{(3.14)(10)(10)h}{3}$

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

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

$h \approx 20.01\text{cm}$

$\therefore$ length of slant height is 22.37cm.



$s^2 = (20.01)^2 + (10)^2$

$s^2 = 400.4 + 100$

$s^2 = 500.4$

$s = \sqrt{500.4} \approx 22.37\text{cm}.$

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

$V = 904.78\text{ in}^3$

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

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

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

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

$216.11 = r^3$

$\sqrt[3]{216.11} = r$

$6 \approx r$

$\therefore$ The radius of sphere = 6 in (approx).

Success Criteria

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