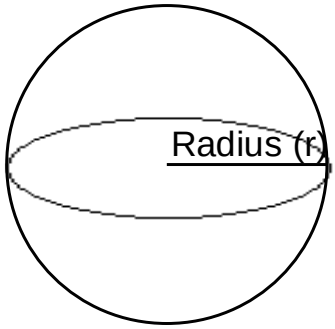
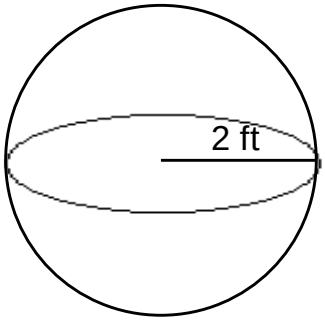
Volume of Spheres

Sphere



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

Example 1: Determine the volume of this sphere in ft^3.



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

$= \frac{4\pi(2)^3}{3}$

$= 33.5\ ft^3$

Example 2: Determine the volume of this basketball if the diameter is 30cm.

$r = \frac{30}{2} = 15cm$

$V = \frac{4\pi(15)^3}{3}$

$= 14137.2\ cm^3$

Example 3: A soup bowl is in the shape of a hemi-sphere (half sphere). If the bowl is filled to the rim, and has a diameter of 6.5in, how much soup is there?

$r = 6.5 \div 2 = 3.25in$

$V = \frac{4\pi r^3}{3} \div 2$

$= \frac{4\pi(3.25)^3}{3} \div 2$

$= 71.9\ in^3$

Surface Area of Spheres

The surface area of a sphere is **four** times the surface area of one cross section through the centre of the sphere.

$A = 4\pi r^2$

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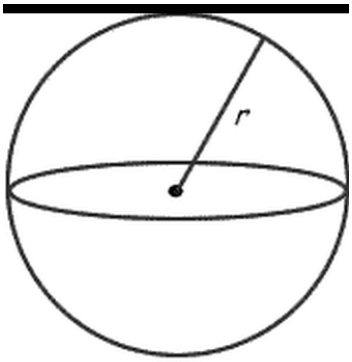
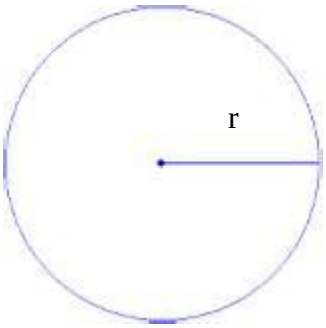




Example 1: Determine the surface area of the basketball if the diameter is 30cm.

$r = \frac{30}{2} = 15$

$A = 4\pi r^2$

$= 4\pi (15)^2$

$= 2827.4\ cm^2$

Example2: This foam piece is in the shape of a hemisphere. You plan to paint the entire outer surface. Calculate the surface area if the radius of the circle base is 2.5cm.

$A = 4\pi r^2 \div 2$

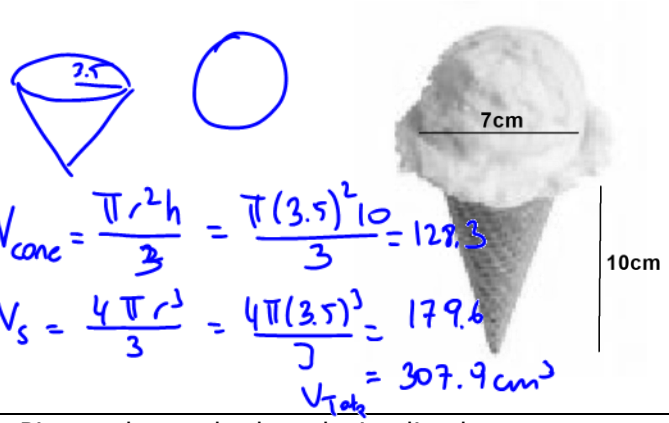
$= 4\pi (2.5)^2 \div 2$

$= 39.3\ cm^2$

Composite Volume of Prisms, Pyramids, Cylinders, Cones, and Spheres

Composite shapes are shapes that don't have a 'unique' name, but they are made up of other shapes we are familiar with. An icecream for example, is a cone with a hemisphere.

a. How much icecream is here, assuming the cone is filled with icecream?

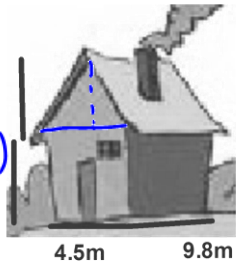


$V_{cone} = \frac{\pi r^2 h}{3} = \frac{\pi (3.5)^2 10}{3} = 128.3$

$V_s = \frac{4\pi r^3}{3} = \frac{4\pi (3.5)^3}{3} = 179.6$

$V_{Tot} = 307.9 cm^3$

b. How much air is inside this empty house, which is made up of a rectangular prism base and a triangular prism roof?



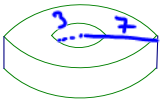
$V_{house} + V_{roof}$

$= (2.4)(4.5)(9.8) + \frac{(2.4)(4.5)(9.8)}{2}$

$= 105.84 + 52.92$

$= 158.76 m^3$

c. Pineapple can be bought in sliced rings that look like the sketch provided. If the outer ring has a radius of 7cm and the inner ring has a radius of 3cm, where the height is 1cm in both cases, find the **volume** of this pineapple slice.



$V_p = V_o - V_i$

$= \pi r_o^2 h - \pi r_i^2 h$

$= \pi (7)^2 (1) - \pi (3)^2 (1)$

$= 49\pi - 9\pi$

$= 40\pi = 125.7 cm^3$

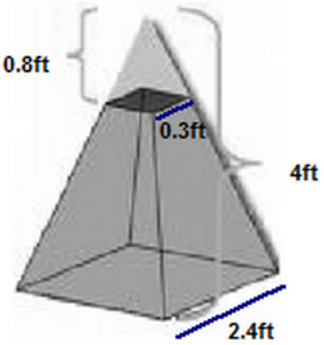
d. The following shape is called a frustrum. It is a square-based pyramid with the tip cut off. Find the volume of the frustrum.

$V_F = V_T - V_{Tip}$

$= \frac{(2.4)^2 4}{3} - \frac{(0.3)^2 0.8}{3}$

$= 7.68 - 0.024$

$= 7.7 ft^3$



e. Three tennis balls are packaged tightly into a cylindrical container. The diameter of one tennis ball is 1.7in. Determine the volume of the space in the can not taken up by the tennis balls.

$V_{Left} = V_{Total} - 3V_{Ball}$

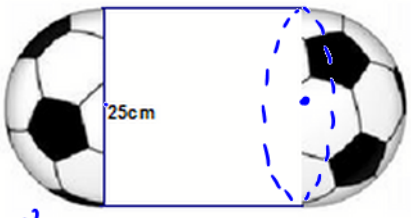
$= \pi r^2 h - 3\frac{4\pi r^3}{3}$

$= \pi (0.85)^2 (5.1) - 4\pi (0.85)^3$

$= 11.6 - 7.7$

$= 3.9 in^3$

f. A shipping tube that ships 3-packs of soccerballs is made from a cylindrical center with a hemisphere at each end. Calculate the space that is inside the container.
*watch for the units



$V_T = V_{ball} + V_{cyl}$

$= \frac{4\pi (12.5)^3}{3} + \pi (12.5)^2 .80$

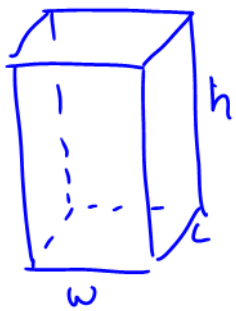
$= 8181.23 + 39269.91$

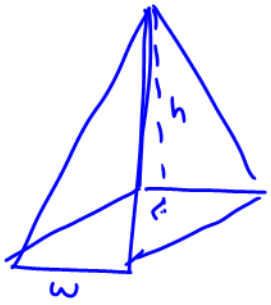
$= 47451.1 cm^3$

0.8m = 80cm

ANSWERS: a. 307.7cm^3, b. 158.76m^3, c. 125.6cm^3, d. 7.7ft^3, e. 3.9in^3, f. 47,427cm^3

h. A rectangular prism has a volume of $603cm^3$. If a rectangular pyramid has the same base and height as this prism, calculate the volume of the pyramid.





$V = 603$

$V = \frac{603}{3}$

$= 201 cm^3$

i.A rectangular prism has a volume of $73.6m^3$. If the length is 8m, the width is 4m, what is the height?

$V = l \cdot w \cdot h$

$73.6 = 8 \cdot 4 \cdot h$

$\frac{73.6}{32} = \frac{32h}{32}$

$h = 2.3cm$

j.A cylinder has a volume of $2009.6cm^3$. If the radius is 8cm, find the height of this cylinder.

$V_c = \pi r^2 h$

$2009.6 = \pi (8)^2 h$

$\frac{2009.6}{201.1} = \frac{201.1h}{201.1}$

$10cm = h$

ANSWERS: g. $12.6cm^3$, h. $201cm^3$, i. 2.3m, j. 10cm