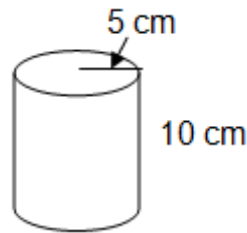
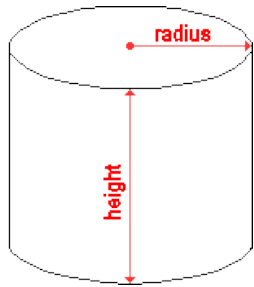


Volume

Cylinders:

$$V = (\text{area of base}) \cdot \text{height}$$

$$V = \pi r^2 h$$



Example:

$$V = \pi r^2 h$$

$$V = \pi \cdot 5^2 \cdot 10$$

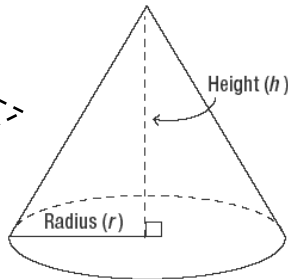
$$V = \pi \cdot 25 \cdot 10$$

$$V = \pi \cdot 250$$

$$V = 250\pi \text{ cm}^3 (\text{exact})$$

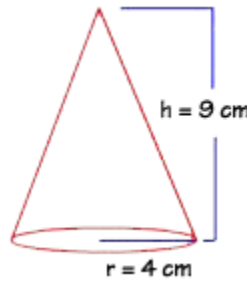
$$V \approx 785 \text{ cm}^3 (\text{estimate using } \pi \approx 3.14)$$

Cones:



$$V = \frac{1}{3} (\text{volume of a cylinder})$$

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



Example:

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

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

$$V = \frac{1}{3} \pi \cdot 16 \cdot 9$$

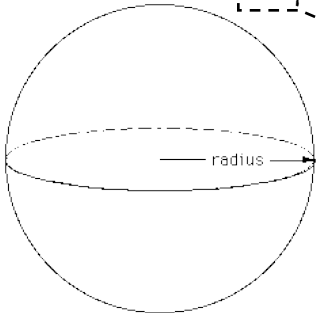
$$V = \pi \cdot \frac{1}{3} \cdot 144$$

$$V = \pi \cdot 48$$

$$V = 48\pi \text{ cm}^3 (\text{exact answer})$$

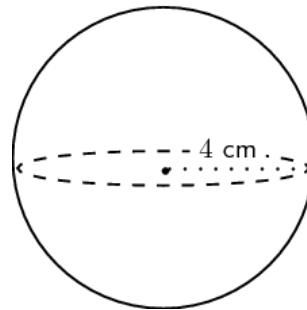
$$V \approx 150.72 \text{ cm}^3 (\text{estimate using } \pi \approx 3.14)$$

Spheres:



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

Remember: The radius is raised to the THIRD power for spheres since there is no height.



Example:

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

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

$$V = \frac{4}{3} \cdot \pi \cdot 216$$

$$V = \pi \cdot 288$$

$$V =$$

$$288\pi \text{ cm}^3 (\text{exact answer})$$

$$V \approx 904.32 \text{ cm}^3 (\text{estimate using } \pi \approx 3.14)$$



Helpful Hints:

If you are given the DIAMETER instead of the radius, remember that $2r = d$ (so divide the diameter by 2 to get the radius).

For the EXACT volume, leave π as part of your answer.

For an ESTIMATE or APPROXIMATION, use 3.14 as an estimate for π and multiply.

For estimated answers, a shortcut is to use $\pi \approx 3$

Just remember that your answer will be a little LOWER than the actual answer!