Section 3.4 – Volume

Volume

- Volume is the **space that takes up the inside of a 3D shape**
- Intuitively it is the **AREA of the BASE** of the figure times the **HEIGHT**
- The space you can fill with water, sand, yogurt, air, etc.
- Requires 3-axes of direction, 3D

3-D shapes have units cm^3

Some Basic Volume Formulas

- **Cube** a^3 $where\ a\ is\ the\ side\ length\ of\ the\ cube$
- **Rectangular Prism** $l * w * h$
- **Cylinder** $\pi r^2 h$
- **Triangular Prism** $\frac{l*w*h}{2}$

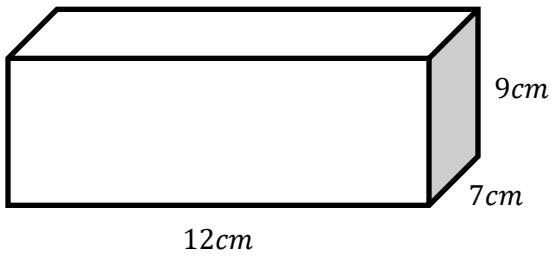
➢ For Volume it is substituting the numbers into the equations and solving for unknowns

➢ **See the list of Surface Area and Volume Equations in the Table provided on page**

Examples:

Find the Volume of the Following Shapes

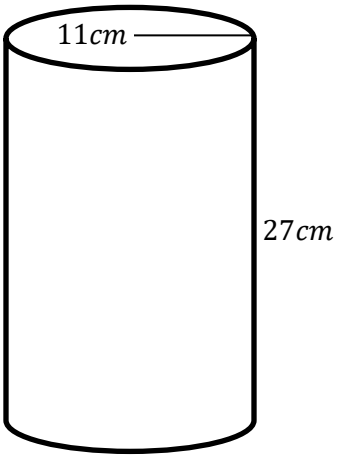
Rectangular Prism



$$V = lwh$$

$$V = (12)(7)(9) = 756\ cm^3$$

Cylinder

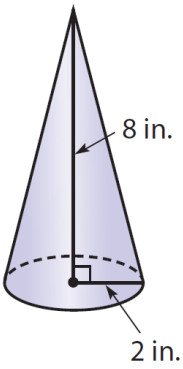


$$V = (Area\ of\ Base)h$$

$$V = \pi r^2(h) = \pi(11)^2(27)$$

$$V = \pi(121)(27) = 3267\pi\ cm^3$$

Cone

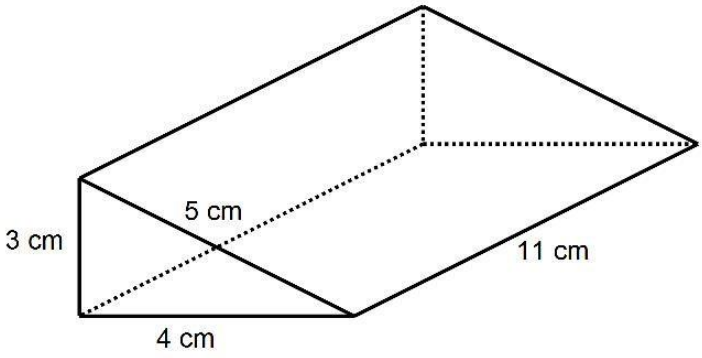


$$V = \frac{1}{3}(Area\ of\ Base)h$$

$$V = \frac{1}{3}\pi r^2(h) = \frac{1}{3}\pi(2)^2(8)$$

$$V = \frac{1}{3}\pi(4)(8) = \frac{32}{3}\pi\ in^3$$

Right Triangular Prism



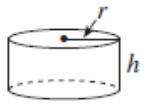
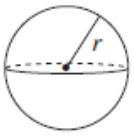
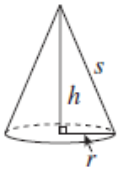
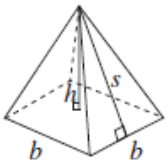
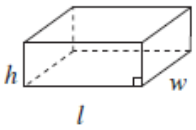
What matters here is how it is oriented, it changes what the base is.

$$V = \frac{1}{2}(Area\ of\ Base)h$$

$$V = \frac{1}{2}l(w)(h) = \frac{1}{2}(11)(4)(3)$$

$$V = \frac{1}{2}(132) = 66\ cm^3$$

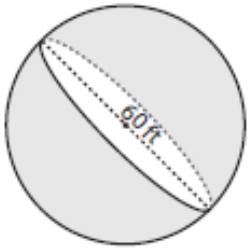
Surface Area and Volume General Formula Sheet

Geometric Solid	Surface Area	Volume
Cylinder 	$A_{top} = \pi r^2$ $A_{base} = \pi r^2$ $A_{side} = 2\pi rh$ $SA = 2\pi r^2 + 2\pi rh$	$V = (\text{area of base}) \times h$
Sphere 	$SA = 4\pi r^2$ **or** $SA = \pi d^2$	$V = \frac{4}{3}\pi r^3$
Cone 	$A_{side} = \pi rs$ $A_{base} = \pi r^2$ $SA = \pi r^2 + \pi rs$	$V = \frac{1}{3} \times (\text{area of base}) \times h$
Square-Based Pyramid 	$A_{triangle} = \frac{1}{2}bs$ (for each triangle) $A_{base} = b^2$ $SA = 2bs + b^2$	$V = \frac{1}{3} \times (\text{area of base}) \times h$
Rectangular Prism 	$SA = wh + wh + lw + lw + lh + lh$ **or** $SA = 2(wh + lw + lh)$	$V = (\text{area of base}) \times h$
General Right Prism	$SA =$ the sum of the areas of all the faces	$V = (\text{area of base}) \times h$
General Right Pyramid	$SA =$ the sum of the areas of all the faces	$V = \frac{1}{3} \times (\text{area of base}) \times h$

Section 3.4 – Practice Problems

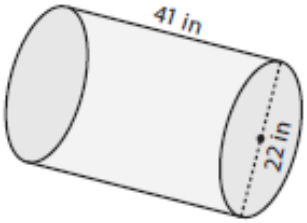
Find the volume of each shape. Round the answer to nearest tenth. (use $\pi = 3.14$)

1)



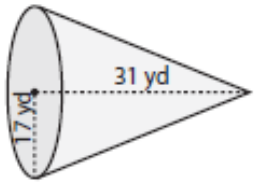
Volume = _____

2)



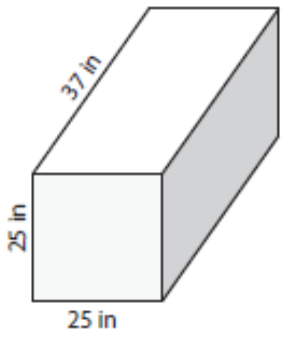
Volume = _____

3)



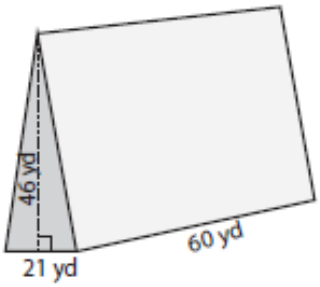
Volume = _____

4)



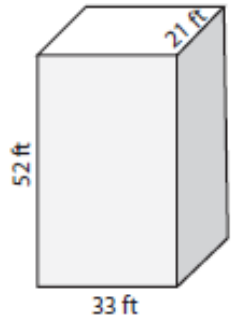
Volume = _____

5)



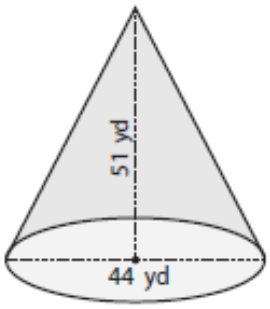
Volume = _____

6)



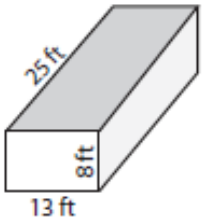
Volume = _____

7)



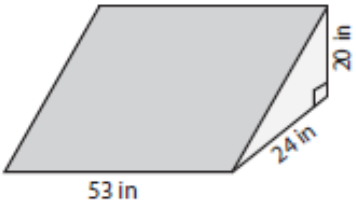
Volume = _____

8)



Volume = _____

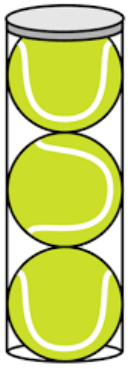
9)



Volume = _____

10. Tennis balls are sold in a cylindrical container. There are 3 balls in each container. If the balls have a radius of $3.4cm$ and fits perfectly in the container side to side and top to bottom, determine:

    a) The volume of one ball. Round to the nearest tenth



    b) The dimensions and the volume of the container, to the nearest tenth.

Section 3.4 – Answer Key

1. $113\ 097.3ft^3$
2. $15\ 585.4in^3$
3. $9381.8yd^3$
4. $23\ 125in^3$
5. $28\ 980yd^3$
6. $36\ 036ft^3$
7. $25\ 849.0yd^3$
8. $2600ft^3$
9. $12\ 720in^3$
10. a) $164.6cm^3$
    b) $740.9cm^3$