Section 12.5

Objective: Volume Notes

Prism*:** A solid with two congruent, parallel polygons called ***bases.

Pyramid: A solid with a polygon for a ***base*** and triangles for all the other faces.

Cylinder: A solid with two congruent, parallel circular bases.

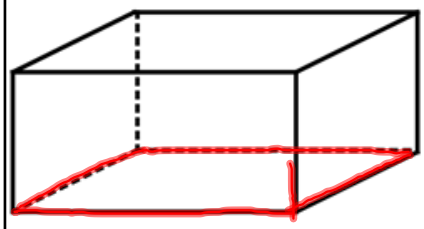
Cone: A solid with a circular base and a vertex that is not in the same plane as the base.

Sphere: All the points in space that are the same distance away from a fixed point, called the ***center.***

Hemisphere: Half of a sphere.

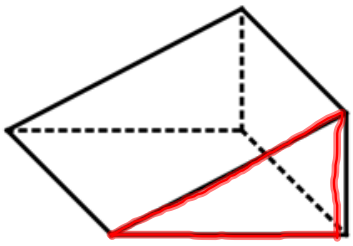
Height of a Prism or Cylinder: The length of a segment that is perpendicular to both bases.

Height of a Pyramid or Cone: The perpendicular distance from the base to the vertex.



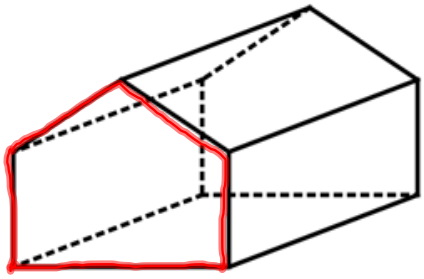
base is a rectangle

rectangular prism



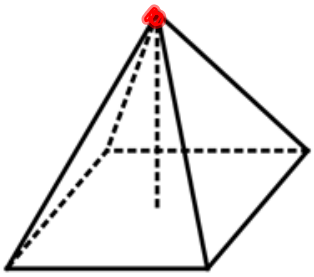
base is a triangle

triangular prism



pentagonal prism

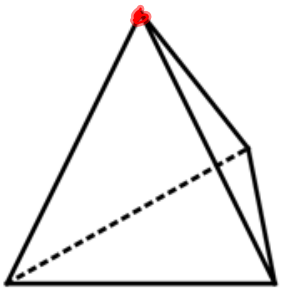
base is a pentagon (5 sides)



base is a rectangle

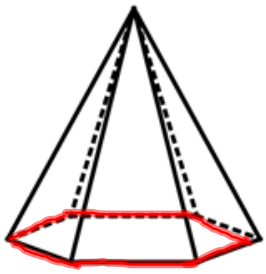
comes to a point

rectangular pyramid



base is a triangle

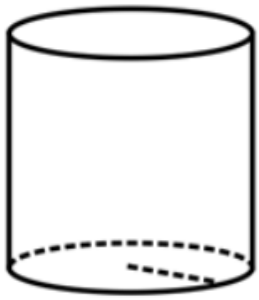
triangular pyramid



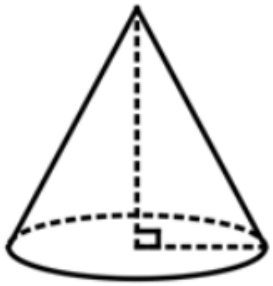
6 sided base

hexagon

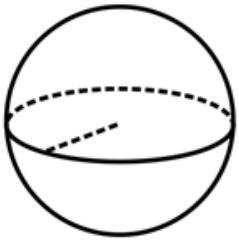
hexagonal pyramid



cylinder



cone

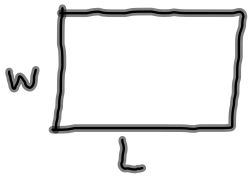


Sphere

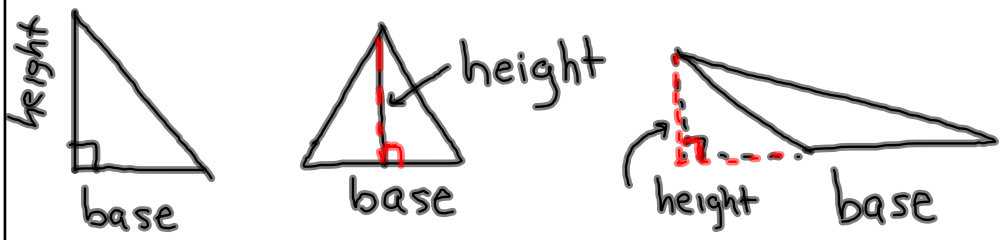
hemisphere

Review of area formulas:

Area of a Rectangle: A = base times height or A = length times width

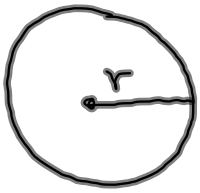


Area of a Triangle: $A = \frac{1}{2}(base\ of\ triangle)(height\ of\ triangle)$



The base and height must form a 90° angle.

Area of a Circle: $A = \pi r^2$



r is the radius

$A = \pi \cdot r \cdot r$

$A = \pi \cdot radius \cdot radius$

Volume of a Square or Rectangular Prism: $\text{Volume} = (\text{area of base})(\text{height})$

$V = Bh$ **OR** LWH

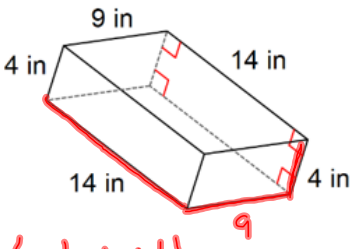
height is distance between parallel bases

Volume of a Triangular Prism: $\text{Volume} = (\text{area of base})(\text{height})$

$V = Bh$ **OR**

$V = \frac{1}{2}(\text{base of triangle})(\text{height of triangle})\cdot(\text{height of prism})$

a)

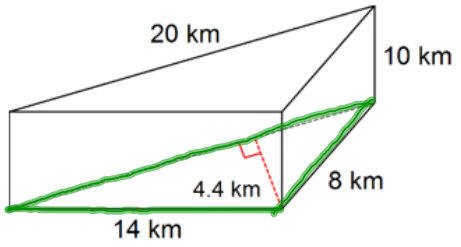


$V = LWH$

$V = 4(9)(14)$

$V = 504 \text{ in}^3$

b)



triangular prism

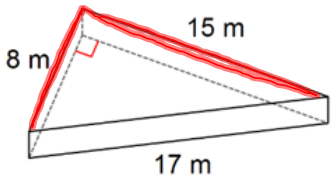
$V =$ area of triangle times height

$\frac{1}{2}$ base · height · height of prism

$V = \frac{1}{2}(20)(4.4)\cdot 10$

440 km^3

c)



← height of prism

triangle area

$\frac{1}{2}(\text{base})(\text{height})$

$\frac{1}{2}(8)(15)$

60

$V =$ area of triangle times height of prism

$\frac{1}{2}(8)(15)\cdot(4)$

$V = 240 \text{ m}^3$

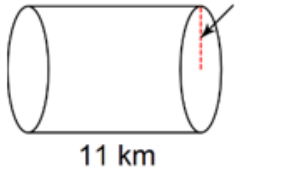
you did not need to use 17m.

Volume of a Cylinder: Volume $=$ (area of base)(height)

$V = Bh$ **OR**

$V = \pi r^2 h$

d)

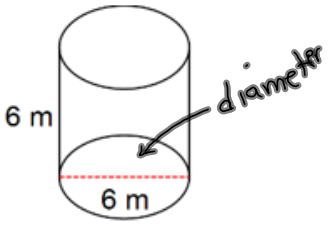


$V = \pi r^2 h$

$V = \pi (4)^2 (11)$

$V = 552.92 \text{ km}^3$

e)



$V = \pi r^2 h$

you need radius

diameter = 2 radius

$6 = 2r$

$3 = r$

$V = \pi (3)^2 (6)$

$V = 169.65 \text{ m}^3$

Volume of a Square or Rectangular Pyramid: $\text{Volume} = \frac{1}{3}(\text{area of base})(\text{height})$

$$V = \frac{1}{3}Bh \qquad \textbf{OR}$$

$$V = \frac{1}{3}LWH$$

Volume of a triangular Pyramid: $\text{Volume} = \frac{1}{3}(\text{area of base})(\text{height})$

$$V = \frac{1}{3}Bh \qquad \textbf{OR}$$

$$V = \frac{1}{3}\bullet\left[\frac{1}{2}(base\ of\ triangle)(height\ of\ triangle)\right]\bullet(height\ of\ pyramid)$$

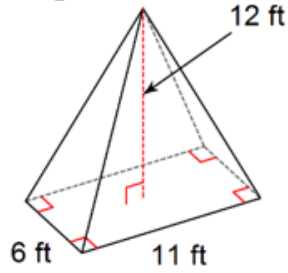
Volume of a Cone: $\text{Volume} = \frac{1}{3}(\text{area of base})(\text{height})$

$$V = \frac{1}{3}Bh \qquad \textbf{OR}$$

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

Examples: Find the volume of each pyramid or cone.

a)

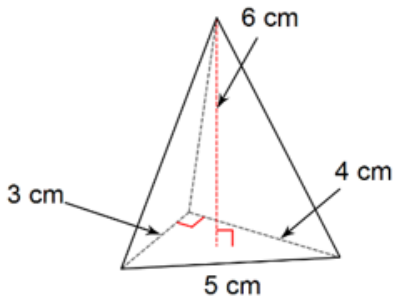


$V = \frac{1}{3} L w H$

$V = \frac{1}{3}(6)(11)(12)$

$V = 264\ ft^3$

b)



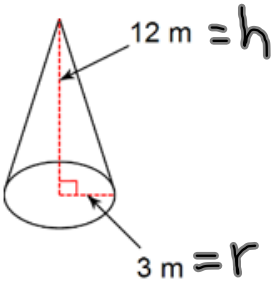
$V = \frac{1}{3}\left(\frac{1}{2}bh\right)$ (height of pyramid)

triangle area

$V = \frac{1}{3}\left(\frac{1}{2}\cdot 3\cdot 4\right)\cdot 6$

$V = 12\ cm^3$

c)

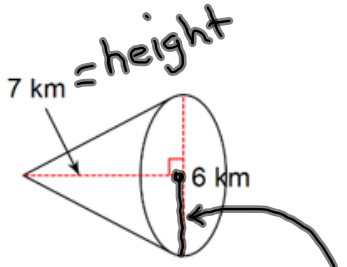


$V = \frac{1}{3}\pi r^2 h$

$\frac{1}{3}\pi(3)^2(12)$

$113.097\ m^3$ or $113.1\ m^3$

d)



diameter = 6

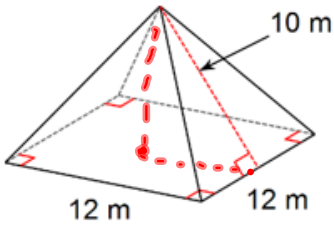
radius = 3

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

$V = \frac{1}{3}\pi(3)^2\cdot 7$

$V = 65.97\ km^3$

e)



= Slant height not height

height of pyramid ⇒ 10, 6 ⇐ ½ of side

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

$6^2+h^2=10^2$

$h^2=10^2-6^2$

$h=\sqrt{10^2-6^2}$

$h=\sqrt{64}$

$h=8$

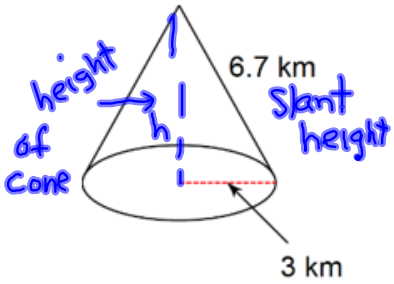
Now you can find volume

$V=\frac{1}{3}(L\cdot w)\cdot$ Height of pyramid

$V=\frac{1}{3}(12\cdot 12)(8)$

$384\ m^3$

f)



Find height of cone

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

$3^2+h^2=6.7^2$

$h^2=6.7^2-3^2$

$h^2=35.89$

$h=\sqrt{35.89}$

$h=5.99$

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

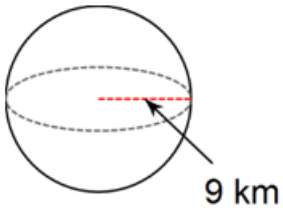
$V=\frac{1}{3}\pi(3)^2(5.99)$

$V=56.45\ km^3$

Volume of a Sphere: $V = \frac{4}{3}\pi r^3$ ***Volume of a Hemisphere:*** $V = \frac{1}{2} \cdot \frac{4}{3}\pi r^3$

Examples: Find the volume of each sphere or hemisphere.

a)

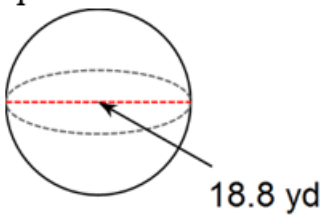


$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi (9)^3$

$V = 3053.628 \text{ km}^3$

b)



diameter = 18.8 yd

radius = 9.4 yd.

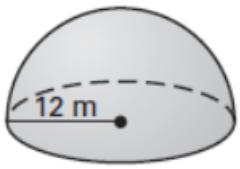
$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi (9.4)^3$

$(4 \div 3)(\pi)(9.4)^3$

3479.14 yd^3

c)



This is $\frac{1}{2}$ a sphere

a hemisphere

$V = \frac{1}{2} \cdot \frac{4}{3}\pi r^3$

$V = \frac{1}{2} \cdot \frac{4}{3} \cdot \pi (12)^3$

$V = 3619.11 \text{ m}^3$