Unit 9 Overview Notes
Volume

I. Types of Figures

A. Sphere

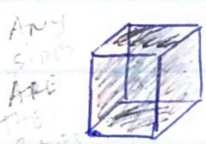
(circle with the same radius & diameter as the sphere)

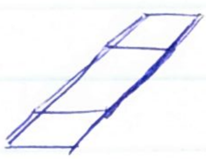
possible cross sections

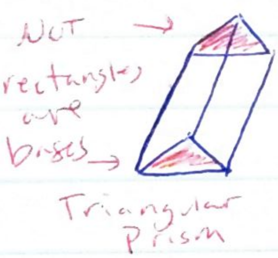
If you cut through a basketball, it will always make

CIRCLES

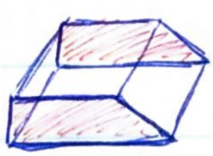
B. Prism







2 of the same shape (bases) connected



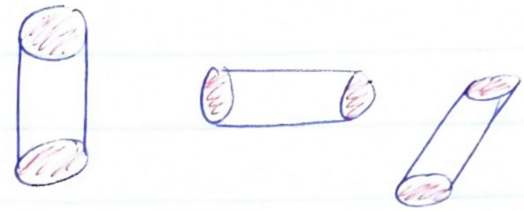
Trapezoidal Prism

possible cross sections

Triangle or a rectangle or any polygon (no more sides than base has)

C. Cylinder

(like a prism, but with circle bases)



possible cross sections

rectangles (parallelogram)
circles & ellipses (ovals)

D. Pyramid

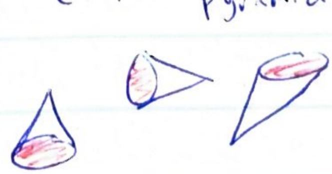
(1 base that connects to a point w/ triangles)

possible cross sections

triangle or other polygon (straight sides) (depending on the base)

E. Cone

(like a pyramid but with circle base)



possible cross sections
Circles, ellipses
triangle

II. Volume Formulas

A. Sphere

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

$$V = \frac{4\pi \, r \cdot r \cdot r}{3}$$

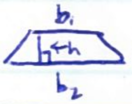
(remember: radius is ½ of diameter)

B. Prism or Cylinder

$$V = (\text{base area})\,\text{Height}$$

If base is a:

○ : πr^2 □ : bh △ : $\frac{bh}{2}$

 : $\frac{(b_1 + b_2)h}{2}$  : $\frac{d_1 d_2}{2}$

C. Pyramid or Cone

$$V = \frac{(\text{base area})\,\text{Height}}{3}$$

ex/ If the radius is 3, then what is the diameter of the great circle?

r, $r = 3$; $d = 6$

6

what is the volume?

$$V = \frac{4\pi r^3}{3} = \frac{4\pi \, r \cdot r \cdot r}{3} = \frac{4\pi(3)(3)(3)}{3}$$

$$V = 4\pi(9) = 36\pi$$ in terms of pi

V = 113.04

3.14×36: $1884 + 9420 = 113.04$

ex/ If the volume of a sphere is 36π, what is the length of the radius?

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

$$3 \cdot 36\pi = \frac{4\pi r^3}{3} \cdot 3$$

$$\frac{108\pi}{4\pi} = \frac{4\pi r^3}{4\pi}$$

$$27 = r^3$$

$$27 = r \cdot r \cdot r$$

$$\boxed{r = 3}$$

ex/ what is the volume of the prism?

2 triangles connected by 3 rectangles!

$$V = (\text{Base area})\,\text{Height}$$

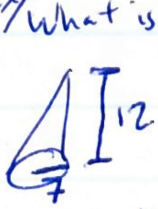
△ : $\frac{bh}{2}$

Base area $= \frac{bh}{2} = \frac{5 \cdot 2}{2} = \frac{10}{2} = 5$

$B = 5$ $H = 8$

$$V = (5)(8) = \boxed{40}$$

ex/ What is the volume of the cone in terms of pi?



$$V = \frac{(\text{Base Area})(\text{Height})}{3}$$

$H = 12$

Base Area: $\pi r^2 = \pi(7)^2 = 49\pi$

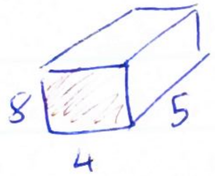
$$V = \frac{(49\pi)(12)}{3} = 49\pi(4) = \boxed{196\pi}$$

III. Changing dimensions

A. If you DILATE all dimensions by multiplying by the **same** number, you create similar figs that follow 3 rules:

1. (length)(change) = new length
2. $(\text{area})(\text{change})^2$ = new area
3. $(\text{volume})(\text{change})^3$ = new volume

ex/ What is the volume?



Base area: $bh = 8 \cdot 4$

$= 32$

$V = (B)(H) = (32)(5)$

$V = 160$

ex/ What would happen to each part if the dimensions are tripled?

a. lengths: 8, 4, 5

(length)(change): $8 \cdot 3 =$ **24**

$4 \cdot 3 =$ **12**

$5 \cdot 3 =$ **15**

b. area: 32

$(\text{area})(\text{change})^2 = (32)(3)^2 = 32 \cdot 9$

new area = **288**

c. volume 160

$(\text{vol})(\text{change})^3 = (160)(3)^3 = (160)(3)(3)(3)$

$= 160(27)$

$=$ **4320**

160
× 27
20