GEOMETRY UNIT 11

12-2: Area and Volume of Pyramids

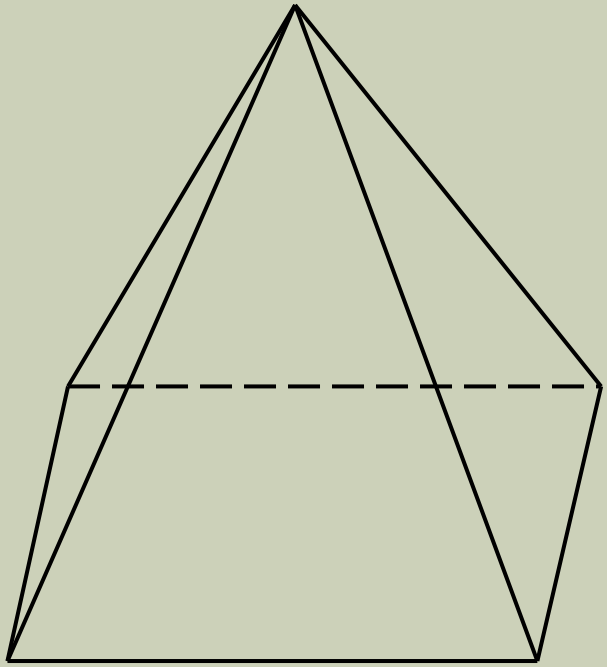
AREA AND VOLUME OF PYRAMIDS

- **Content Objective**: Students will be able to identify the parts required for finding the areas and volume of Regular Pyramids.

- **Language Objective**: Students will be able to use equations to find the areas and volume of Regular Pyramids.

PYRAMIDS

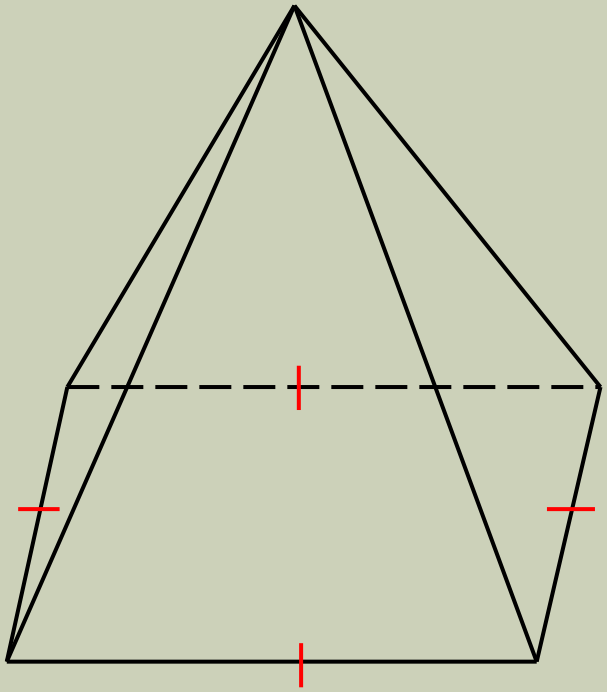
- Our next figure is a Pyramid
- It only has one base, but that base can be any polygon.
- The lateral faces are all triangles.
- It has a vertex (i.e. The point where all the lateral edges meet).



PYRAMIDS

- Refer to this example (a regular square Pyramid):
- The base is a regular polygon.

  *This means that all the sides of the base are congruent.
- All lateral edges are congruent.
- All lateral faces are congruent Isosceles Triangles.

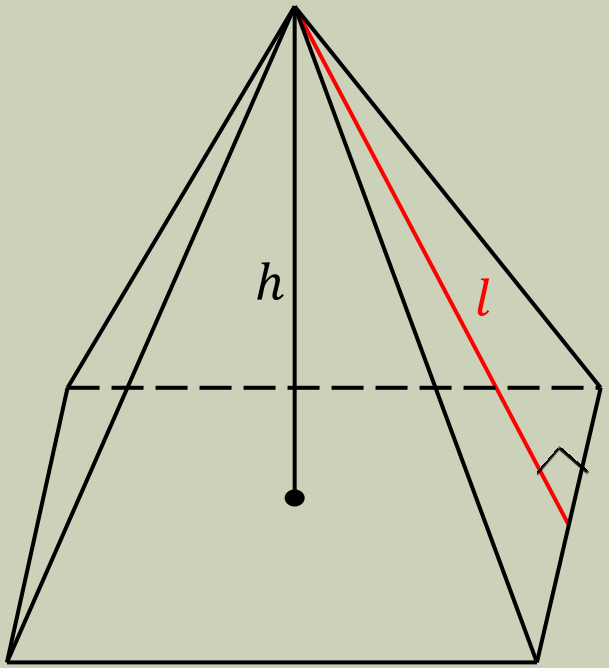


PYRAMIDS

- Refer to this example (a regular square Pyramid):
- The height of a lateral face is called the Slant Height.

*(Slant Height is denoted by the letter l)

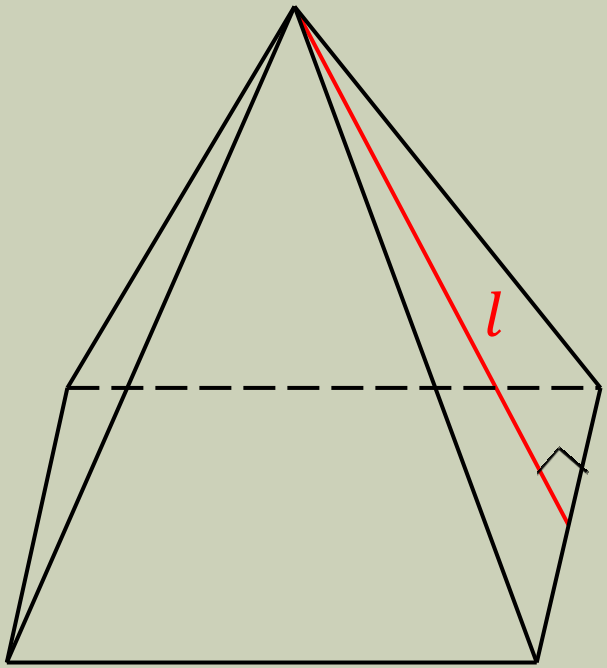
- The altitude (or height) meets the base at its center.



AREA OF A PYRAMID

- **Theorem 12-3**: The lateral area of a pyramid equals half the perimeter of the base times the slant height.

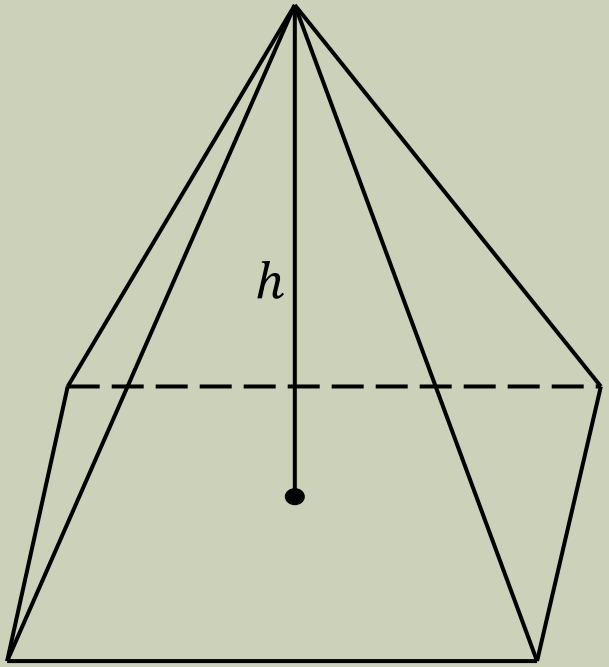
Equation: $L.A. = \frac{1}{2}pl$



VOLUME OF A PYRAMID

- **Theorem 12-4**: The volume of a pyramid equals one third the area of the base times the height of the pyramid.

Equation: $V = \frac{1}{3}Bh$



PRACTICE

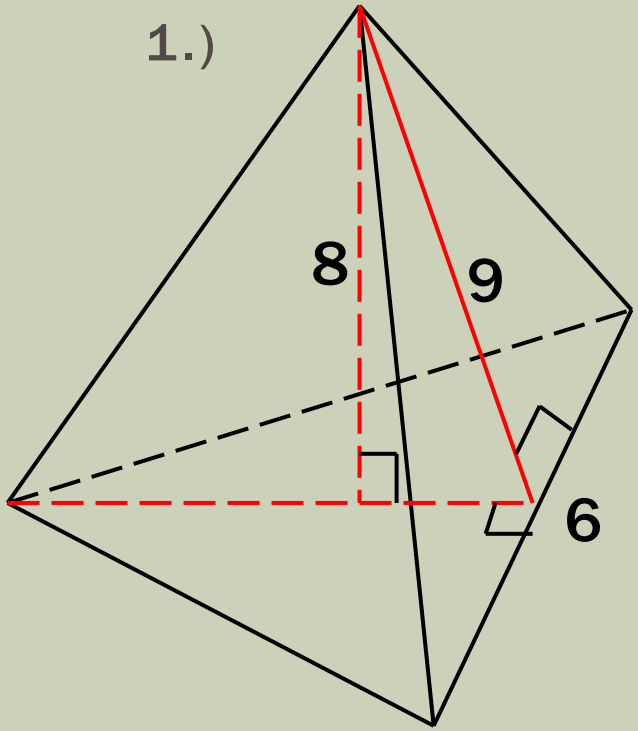
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

1.)



$p = 18$

$l = 9$

$h = 8$

$B = \frac{1}{2} \times 6 \times 3\sqrt{3}$

$= 9\sqrt{3}$

EXAMPLE #1 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 18 \times 9$$

$$= \mathbf{81}$$

Total Area

$$T.A. = L.A. + B$$

$$= \mathbf{81 + 9\sqrt{3}}$$

$$\approx \mathbf{96.59}$$

Volume

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

$$= \frac{1}{3} \times 9\sqrt{3} \times 8$$

$$= 3\sqrt{3} \times 8$$

$$= \mathbf{24\sqrt{3}}$$

PRACTICE

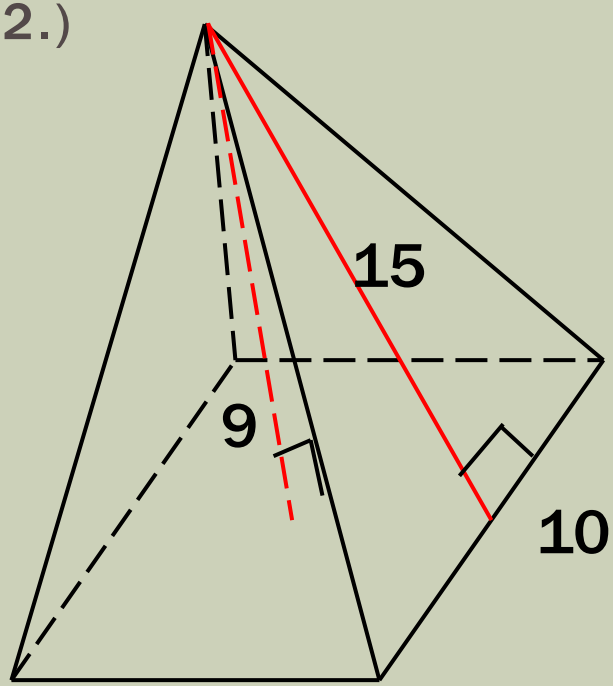
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

2.)



$p = 40$

$l = 15$

$h = 9$

$B = 10^2$

$= 100$

EXAMPLE #2 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 40 \times 15$$

$$= \mathbf{300}$$

Total Area

$$T.A. = L.A. + B$$

$$= 300 + 100$$

$$= \mathbf{400}$$

Volume

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

$$= \frac{1}{3} \times 100 \times 9$$

$$= \mathbf{300}$$

GROUP PRACTICE

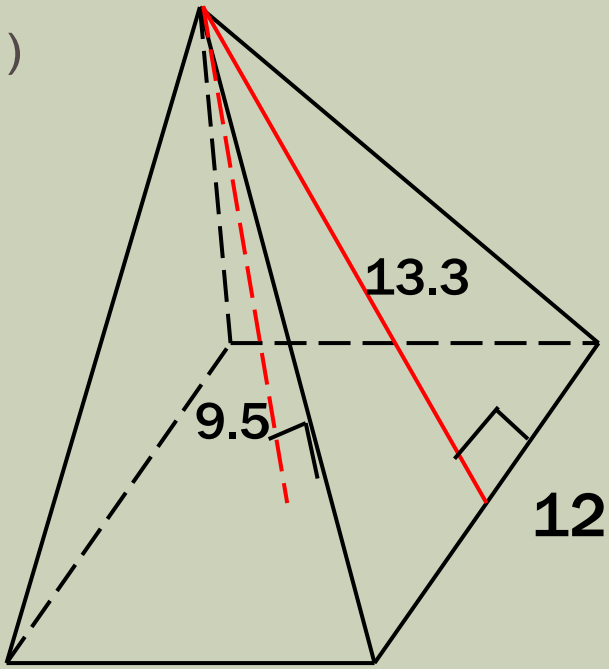
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

1.)



$p = 48$

$l = 13.3$

$h = 9.5$

$B = 12^2$

$= 144$

GROUP #1 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 48 \times 13.3$$

$$= \mathbf{319.2}$$

Total Area

$$T.A. = L.A. + B$$

$$= 319.2 + 144$$

$$= \mathbf{463.2}$$

Volume

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

$$= \frac{1}{3} \times 144 \times 9.5$$

$$= \mathbf{456}$$

GROUP PRACTICE

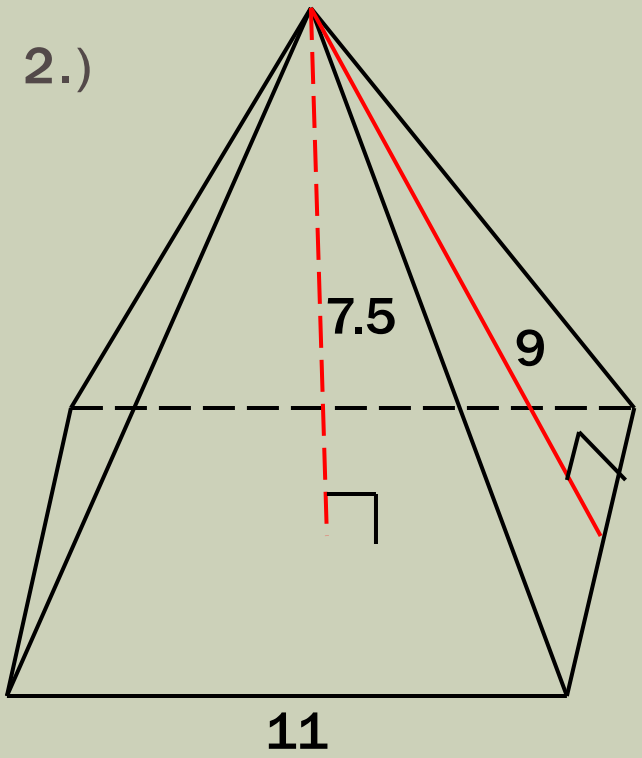
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

2.)



$p = 44$

$l = 9$

$h = 7.5$

$B = 11^2$

$= 121$

GROUP #2 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 44 \times 9$$

$$= \mathbf{198}$$

Total Area

$$T.A. = L.A. + B$$

$$= 198 + 121$$

$$= \mathbf{319}$$

Volume

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

$$= \frac{1}{3} \times 121 \times 7.5$$

$$= \mathbf{302.5}$$

GROUP PRACTICE

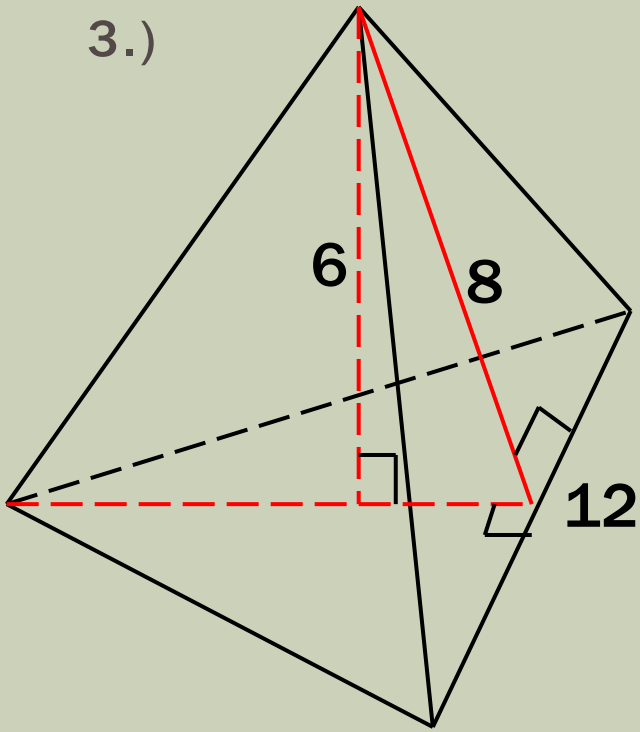
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

3.)



$p = 36$

$l = 8$

$h = 6$

$B = \frac{1}{2} \times 12 \times 6\sqrt{3}$

$= 36\sqrt{3}$

GROUP #3 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 36 \times 8$$

$$= 18 \times 8$$

$$= \mathbf{144}$$

Total Area

$$T.A. = L.A. + B$$

$$= 144 + 36\sqrt{3}$$

$$\approx \mathbf{206.35}$$

Volume

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

$$= \frac{1}{3} \times 36\sqrt{3} \times 6$$

$$= \mathbf{72\sqrt{3}}$$

GROUP PRACTICE

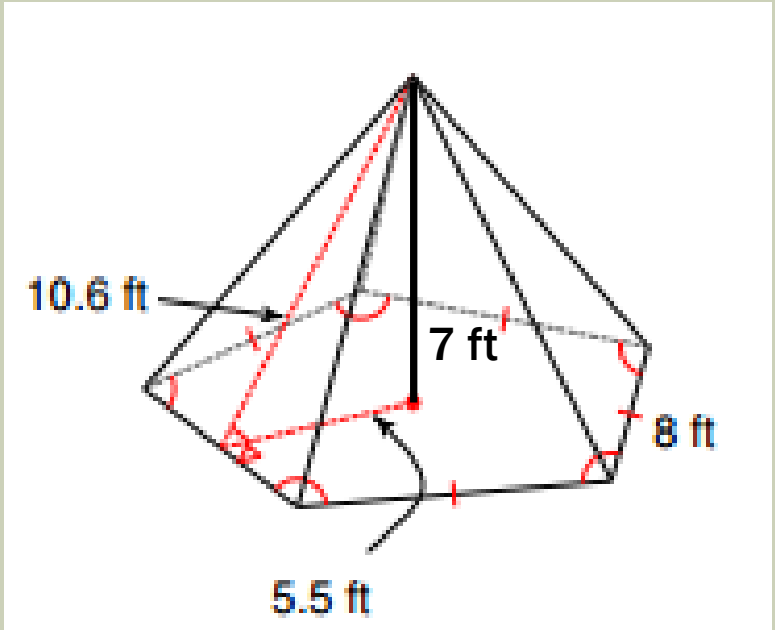
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

4.)



$p = 40$

$l = 10.6$

$h = 7$

$B = \frac{1}{2} \times 40 \times 5.5$

$= 110$

GROUP #4 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 40 \times 10.6$$

$$= \mathbf{212}$$

Total Area

$$T.A. = L.A. + B$$

$$= 212 + 110$$

$$= \mathbf{322}$$

Volume

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

$$= \frac{1}{3} \times 110 \times 7$$

$$= \frac{770}{3}$$

$$\approx \mathbf{256.67}$$

GROUP PRACTICE

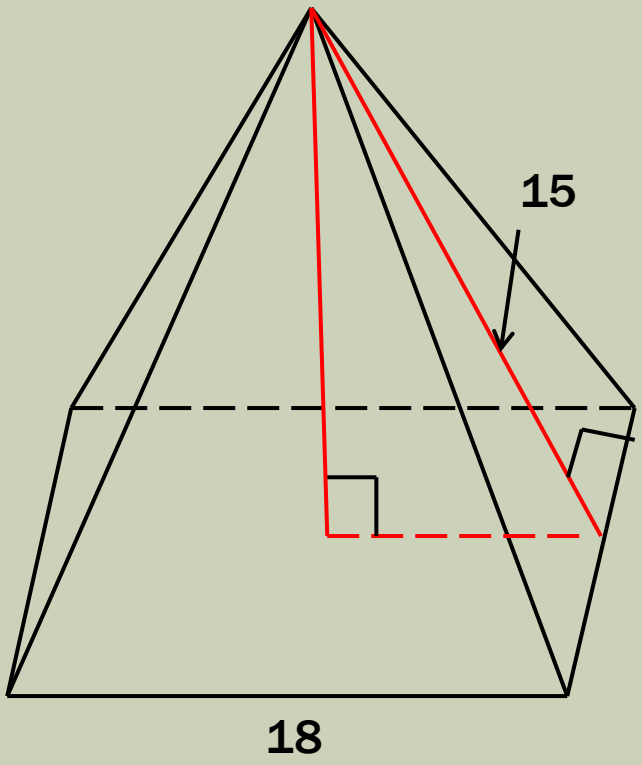
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

5.)



$p = 72$

$l = 15$

$h = 12$

$B = 324$

GROUP #5 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 72 \times 15$$

$$= \mathbf{540}$$

Total Area

$$T.A. = L.A. + B$$

$$= 540 + 324$$

$$= \mathbf{864}$$

Volume

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

$$= \frac{1}{3}(324) \times 12$$

$$= 324 \times 4$$

$$= \mathbf{1296}$$

GROUP PRACTICE

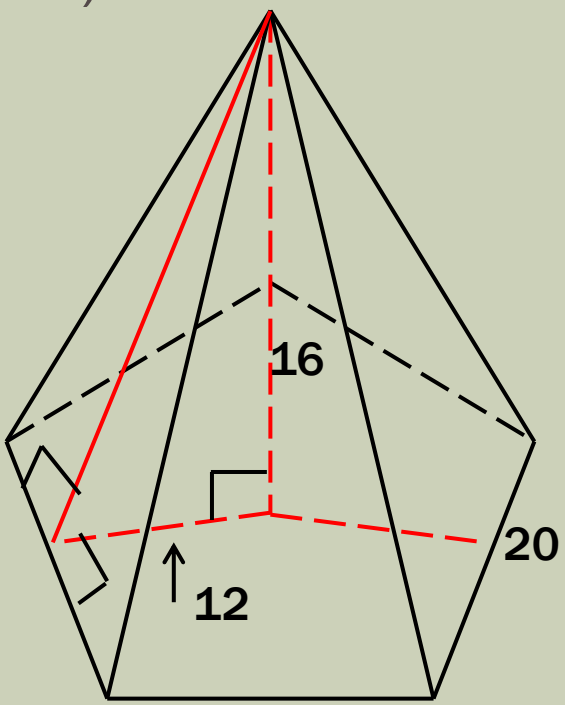
- For the following regular pyramids, First find the values listed, then find the

a.) Lateral Area

b.) Total Area

c.) Volume

6.)



$p = 100$

$l = 20$

$h = 16$

$B = 600$

GROUP #6 SOLUTION

Lateral Area

$$L.A. = \frac{1}{2}pl$$

$$= \frac{1}{2} \times 100 \times 20$$

$$\boldsymbol{l = 1000}$$

Total Area

$$T.A. = L.A. + B$$

$$= 1000 + 600$$

$$\boldsymbol{= 1600}$$

Volume

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

$$= \frac{1}{3} \times 600 \times 16$$

$$\boldsymbol{= 3200}$$