MPM 1DI Unit 9 lesson 4 (8.5) Name:__________________________

Date:_________

Warm Up: QUIZ on Surface Area and Volume of Prisms, Pyramids, Cylinders and Surface Area of Cones.

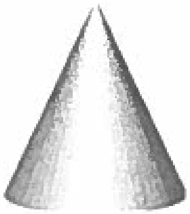
Volume of Cones

A *cylinder* is a three dimensional solid with identical parallel circular bases. The lateral surface is curved and extends from one base to the other base.

The volume of a cylinder is the same as a prism: $V = A_{base} \times$ height

or $V =$

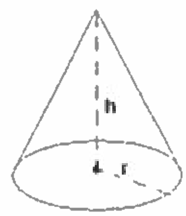
Similar to the relationship between the pyramid and the prism, the volume of a cone is one third the volume of a prism with the same radius and height.



Volume of a cone $= \frac{1}{3} A_{base} \times$ height

or, $V_{cone} = \frac{1}{3}\pi r^2 h$ or $\frac{\pi r^2 h}{3}$

Example 1: Calculate the volume of a cone with radius 3 mm and height 7 mm.



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

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

$= 21\pi$

$= 65.973\ldots$

$\doteq 66 \text{ mm}^3$

Example 2:

a) If the height of a cone is tripled, does this triple the volume? Explain.

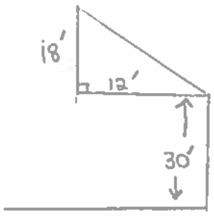
$V_{cone} = \frac{\pi r^2 h}{3}$ ×3

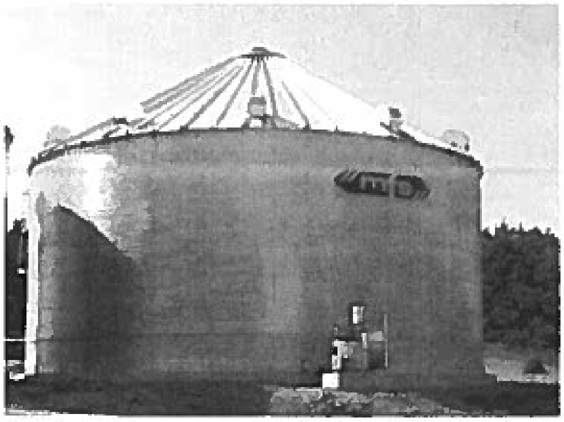
Multiplying the Right side of the equation by 3 will result in triple the value on the left side.

b) If the radius of a cone is tripled, does this triple the volume? Explain.

$V_{cone} = \frac{\pi r^2 h}{3}$ ×3 means V will be $3^2 = 9$ times larger

Example 3: A grain bin has a radius of 12 ft and a height of 48 ft. How much grain will the farmer need to order to fill the bin? (Note: 1 kg of grain fills 1 ft^3 of space. Also, assume grain (oats) is ordered in tonnes (1 metric ton = 1000kg).) (Note: the cone portion has a height of 18 feet)





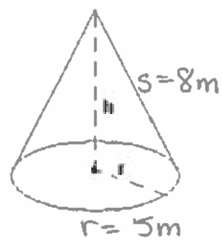
$$V_{total} = V_{cylinder} + V_{cone}$$
$$= \pi r^2 h + \frac{\pi r^2 h}{3}$$
$$= \pi(12)^2(30) + \frac{\pi(12)^2(18)}{3}$$
$$= 13571.68 + 2714.33$$
$$\doteq 16286 \text{ ft}^3$$
$$= 16286 \text{ kg}$$
$$\doteq 16.2 \text{ tonnes}$$

∴ the farmer must order 16.2 tonnes of grain.

Example 4: A conical pile of sand has a base diameter of 10 m and a slant height of 8 m. Determine the volume of the sand in the pile, to the nearest cubic metre.

$$V = \frac{\pi r^2 h}{3}$$
$$= \frac{\pi(5)^2(\sqrt{39})}{3}$$
$$= 163.49366\ldots$$
$$\doteq 163 \text{ m}^3$$

$h^2 = s^2 - r^2$
$h^2 = 8^2 - 5^2$
$h^2 = 39$
$h = \sqrt{39}, h > 0$



∴ the volume of sand is about 163 m^3.

Example 5: A fountain firework is packaged in a conical container. Its volume is 210 m^3. Its diameter is 8 cm. What is the height of the fountain firework, to the nearest tenth of a centimeter?

$$V = \frac{\pi r^2 h}{3}$$
$$210 = \frac{\pi(4)^2 h}{3}$$
$$210 \times \frac{3}{16\pi} = h$$
$$h = 12.533\ldots$$
$$h \doteq 12.5$$

∴ the height is 12.5 cm.

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