Name: M Larsen Date: _____ Period: _____

Geometry: Surface Area and Volume Word Problems!

Make a sketch to represent each of the following situations, where appropriate. Show your work, including the formulas used and an appropriate unit of measurement.

1. A right cylinder with a surface area of 48π square units and a volume of 45π cubic units is similar to a larger right cylinder. The scale factor is 2 to 3. Find the exact surface area and volume of the larger figure.

SA: $\frac{4}{9} = \frac{48\pi}{x}$ $\quad 4x = 432\pi$ $\quad x = 108\pi$

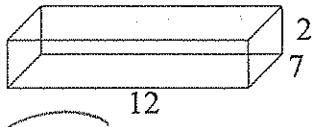
V: $\frac{8}{27} = \frac{45\pi}{x}$ $\quad 8x = 1215\pi$ $\quad x = 151.875\pi$

2. The scale factor of two similar hexagonal prisms is 6 to 5. If the volume of the larger hexagonal prism is $1080\sqrt{3}$ cubic units, find the exact volume of the smaller.

$\frac{6^3}{5^3} = \frac{1080\sqrt{3}}{x}$ $\quad \frac{216}{125} = \frac{1080\sqrt{3}}{x}$ $\quad 216x = 135000\sqrt{3}$ $\quad V = 625\sqrt{3}$

3. The dimensions of the right rectangular prism shown were doubled, how many times larger is the volume of the new prism.

$V_o = 168$ $\quad V_N = 1344$



a) ¼ b) ½ c) 2 d) 4 e) 8

4. What is the ratio of the surface area of two spheres if their volumes are given as 8π and 125π?

$\frac{8\pi}{125\pi} = \frac{r^3}{125} \Rightarrow \frac{2}{5}$

a) $\frac{\sqrt{2}}{\sqrt{5}}$ b) $\frac{2}{5}$ c) $\frac{\sqrt{8}}{\sqrt{125}}$ d) $\frac{4}{25}$ e) $\frac{8}{125}$

5. The volume of a pyramid is 24.5 cubic centimeters and its base is a right triangle with legs 3.5 and 4 cm. What is the height of the pyramid?

$V_p = \frac{1}{3}Bh$ $\quad B = \frac{1}{2}(3.5)(4)$ $\quad = 7$

$24.5 = \frac{1}{3}(7)h$ $\quad 24.5 = \frac{7}{3}h$ $\quad h = 10.5\text{ cm}$

6. A soup can has a diameter of 6 inches and a height of 10 inches. What is its volume? How much paper is needed to make a label?

$r = 3$ $\quad h = 10$

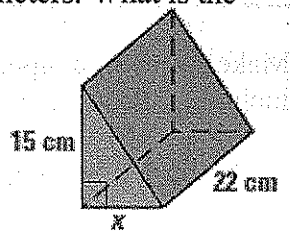
$V = \pi r^2 h$ $\quad = \pi(3)^2(10)$ $\quad = 90\pi\text{ in}^3 \approx 282.7$

↳ Surface area − Bases

$S = 2\pi r^2 + 2\pi rh - 2\pi r^2$

$S_L = 2\pi rh$ $\quad 2\pi(3)(10)$ $\quad = 60\pi \approx 188.5\text{ in}^2$

7. The right triangular prism below has a volume of 1650 cubic meters. What is the value of x?



$V = Bh$ $\quad 1650 = 7.5x(22)$

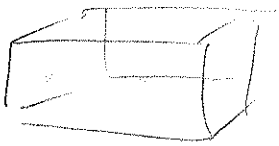
$B = \frac{1}{2}bh$ $\quad 1650 = 165x$

$= \frac{1}{2}(15)(x)$ $\quad x = 10$

$= 7.5x$

a) 8 b) 8.5 c) 10 d) 12 e) 12.5

8. One type of tropical fish requires 250 cubic inches of water for each ONE inch of body length. Sarah's aquarium is 42 inches long, 18 inches wide and 16 inches deep. How many TWO inch fish can the aquarium hold?



$V = (42)(18)(16) = 12096 \text{ in}^3$

$\frac{V}{500} \Rightarrow \frac{12096}{500} = 24.192$ $\quad$ 24 fish

9. Cereal comes in a box that is 10 by 12 by 3 inches. What is the volume of a carton used to ship 24 cereal boxes? Suggest possible, reasonable dimensions for the shipping carton.

$V = (10)(12)(3) = 360 \text{ in}^3$ for 1 box

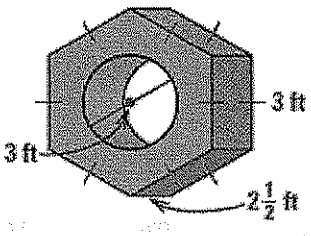
$24 \text{ boxes} \Rightarrow V = 24(360) = 8640 \text{ in}^3$

20 · 20 · 22
less space wasted

Possible dimensions

$\sqrt[3]{8640} \approx 20.5$

10. What is the volume of the solid shown below?



$V_p = Bh$

$B_H = 6\left(\frac{1}{4}s^2\sqrt{3}\right)$

$= 6\left(\frac{1}{4}3^2\sqrt{3}\right)$

$= 13.5\sqrt{3}$

$V = 13.5\sqrt{3}(2.5) = 33.75\sqrt{3} \text{ ft}^3$

$r = 1.5$

$V_c = \pi r^2 h$

$= \pi(1.5)^2(2.5)$

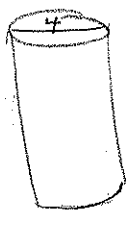
$= 5.625\pi$

$V_p - V_c = 33.75\sqrt{3} - 5.625\pi$

$\approx 46.785 \text{ ft}^3$

a) 34.75 ft^3 b) 36 ft^3 c) 38.58 ft^3 d) 40.79 ft^3 e) 42.22 ft^3

11. If a full glass of water from a 7 inch tall glass with a 4 inch diameter is poured into a rectangular container that is 5 by 19 by 1 inch, will the water overflow? How much is the water over or under the volume of the box? Make a sketch.



$r = 2$

$V = \pi r^2 h$

$= \pi(2^2)(7)$

$= 28\pi$

$= 87.96$

$V = 5(19)(1) = 95 \text{ in}^3$

under by $\approx 7 \text{ in}^3$

12. How many cubic inches of air are needed to inflate a ball with a radius of 15 inches? If the average person can fill 9600 cubic inches of air per minute, how long will it take to blow up the ball?

$r = 15$

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

$V = \frac{4}{3}\pi (15)^3$

$= 4500\pi$

$\approx 14137.167 \text{ in}^3$

$\frac{14137.167}{9600}$

1.47 minutes

13. Mrs. Cooper has a window box that is 4 feet long, 16 inches wide and 10 inches deep. How many cubic FEET of soil does she need to fill the box?

$16 \text{in} = 1\frac{1}{3} \text{ft}$

$10 \text{in} = 5/6 \text{ft}$

$V = 4(1\frac{1}{3})(5/6)$

$= 4.44 \text{ ft}^3$

$V = 48(16)(10)$

$= 7680 \text{ in}^3$

$\frac{7680}{12^3} \approx 4.44 \text{ft}^3$

14. The Great Pyramid of Giza, Egypt was built around 2600 BC. It is considered to be one of the great wonders of the world. The base is a square with each side 230 meters. The original height was approximately 147 meters. What was the original volume?

$h = 147 \text{m}$

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

$B = (230)(230)$

$= 52900$

$V = \frac{1}{3}(52900)(147)$

$= 2,592,100 \text{m}^3$

15. The base of a rectangular prism is 4 by 10 cm. If the volume is 640 cm, what is the height of the prism?

$V = Bh$

$640 = 4(10)h$

$h = 16 \text{ cm}$

16. A hole with diameter of 4 mm is drilled vertically through the metal block shown. The material is removed. Find the volume of the remaining solid.

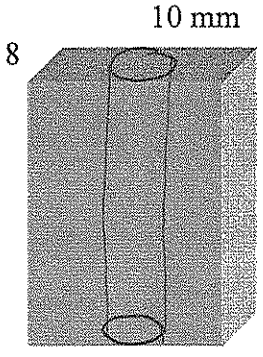
$V = V_{prism} - V_{cyl}$

$= lwh - \pi r^2 h$

$= (15)(8)(10) - (\pi (2)^2 (15))$

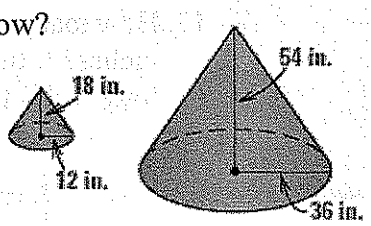
$= 1200 - 60\pi$

$= 1011.5 \text{ mm}^3$



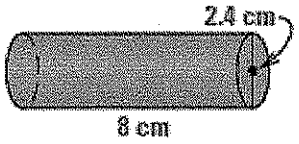
17. What is the ratio of the volumes of the right cones shown below?

$\frac{12}{36} = \frac{1}{3}$



a) 2:5 b) 1:3 c) 3:20 d) 1:9 e) 1:27

18. What is the lateral area (area of the "sides" only) of the right cylinder below?



$S = 2\pi r^2 + 2\pi rh$

$S_{LA} = 2\pi rh$

$= 2\pi(1.2)(8)$

$= 19.2\pi$

a) 2.4π cm^2 b) $9.6\ \pi$ cm^2 c) 11.5π cm^2 d) 19.2π cm^2 e) 38.4π cm^2

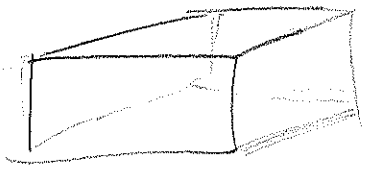
19. Mark says that to reduce the volume of a dessert by half, a baking dish with dimensions that are half the dimensions of the original dish must be used. Is Mark correct? Explain.

No, Volume is a cubic relationship

ie: $V = (4)(2)(8) = 64$

$\frac{1}{2}V = (2)(1)(4) = 8$ $\quad \frac{\frac{1}{2}V}{V} = \frac{8}{64} = \frac{1}{8}$

20. A right rectangular prism has a width of 6.8 meters and a length of 28 meters. If the surface area of the prism is 2608 square meters, what is its height?



$S = 2B + Ph$ $\quad P = 6.8 + 6.8 + 28 + 28$

$B = 6.8(28)$ $\quad = 69.6$

$= 190.4$

a) 20 m b) 22.5 m c) 24.8 m d) 30 m e) 32 m

$S = 2B + Ph$

$2608 = 2(190.4) + 69.6(h)$

$2608 = 380.8 + 69.6h$

$2227.2 = 69.6h$

$h = 32$