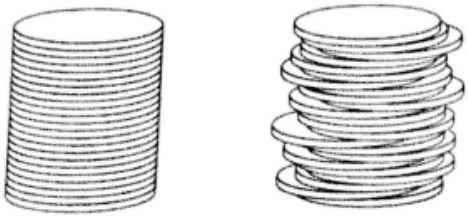
1) New York City has an estimated population of 8.41 million people. The total area of NYC is 469 square miles. What is the population density of NYC (people per square mile)? (17931.8 people per square mile!)

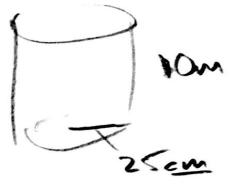
$\frac{8,410,000}{469} = 17931.8 \frac{\text{people}}{\text{mi}^2}$

2) Two stacks of 23 quarters each are shown below. One stack forms a cylinder but the other stack does not form a cylinder.
Use Cavelieri's principle to explain why the volumes of these two stacks of quarters are equal.



Each section of both stacks have the same cross-section. Cavalieries principal says they will have the same volume since they have the same height.

3) Trees that are cut down and stripped of their branches for timber are approximately cylindrical. A timber company specializes in a certain type of tree that has a typical diameter of 50 cm and a typical height of about 10 meters. The density of the wood is 380 kilograms per cubic meter, and the wood can be sold by mass at a rate of $4.75 per kilogram. Determine and state the minimum number of whole trees that must be sold to raise at least $50,000.



25 cm = .25m

Volume of 1 Tree = $\pi r^2 h$

$= \pi (.25)^2 (10)$

$V = .625\pi \ m^3$

Weight of 1 tree: = V · density

Weight of 1 tree = $(.625\pi)(380)$

Weight = 237.5π kg

"Worth" of 1 tree: weight · 4.75

$(237.5\pi)(4.75)$

Worth of 1 tree: $3544.11

$\frac{50{,}000}{3544.11} = 19.653$ trees

20 trees!

$\frac{4}{12} = \frac{1}{3}$ ft

4) A brick patio measures 10' by 12' by 4 inches. Find the volume of the bricks. If the density of the brick is 130 pounds per cubic foot, what is the weight of the patio in pounds?

$V = 10 \cdot 12 \cdot \frac{1}{3} = 40 \text{ ft}^3$

Weight = V · density

$W = 40(130) = 5200$ lbs

5) A contractor needs to purchase 500 bricks. The dimensions of each brick are 5.1 cm by 10.2 cm by 20.3 cm and the density of each brick is 1920 kg/m^3. The maximum capacity of the contractor's trailer is 900 kg. Can the trailer hold the weight of 500 bricks? Justify your answer.

100 cm = 1 m

dimensions in meters: .051, .102, .203

Weight = V · density

$W = (500)(.051 \cdot .102 \cdot .203)(1920) \frac{kg}{m^3}$

(500 = # bricks; volume of 1 brick)

$W = 1013.8$ kg, too heavy for the trailer!

6) VanBuren has a population of 13,185 and an area of 36.1 square miles. What is the population density of VanBuren?

$\frac{13,185}{36.1} = 365.2 \frac{\text{people}}{\text{mile}^2}$

Lysander has a population of 21759 and an area of 64.6 square miles. What is the population density of Lysander?

$\frac{21759}{64.6} = 336.8 \frac{\text{people}}{\text{mile}^2}$

Assume that BCSD draws students from VanBuren and Lysander only. What is the population density of the BCSD?

$\frac{13185 + 21759}{36.1 + 64.6} = 347.0 \frac{\text{people}}{\text{mi}^2}$

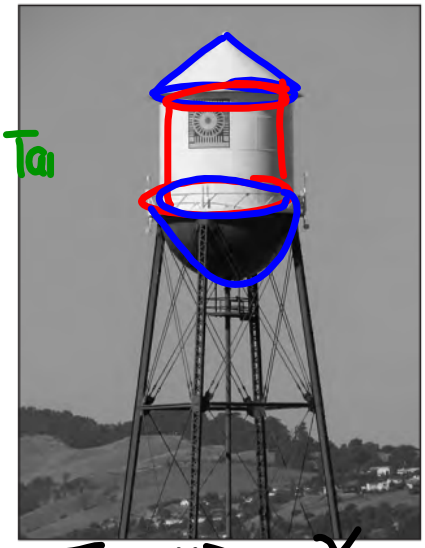
7) The Great Pyramid of Giza was constructed as a regular pyramid with a square base. It was built with an approximate volume of 2,592,276 cubic meters and a height of 146.5 meters. What was the length of one side of its base, to the *nearest meter*?

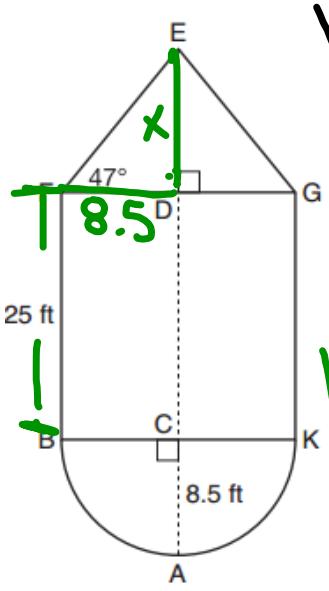
$2592276 = \frac{1}{3} s^2 \cdot 146.5$

$230 \approx s$

(1) 73
(2) 77
(3) 133
(4) 230

The water tower in the picture below is modeled by the two-dimensional figure beside it. The water tower is composed of a hemisphere, a cylinder, and a cone. Let C be the center of the hemisphere and let D be the center of the base of the cone.





$\tan 47 = \frac{x}{8.5}$ $x = 9.1151$

$V_{cone} = \frac{1}{3}\pi r^2 h$
$= \frac{1}{3}\pi (8.5)^2 (9.1151)$
$= 689.6487 \text{ ft}^3$

$V_{cylinder} = \pi r^2 h$
$= \pi (8.5)^2 (25)$
$= 5674.5017$

If $AC = 8.5$ feet, $BF = 25$ feet, and $m\angle EFD = 47°$, determine and state, to the *nearest cubic foot*, the volume of the water tower.

$V = 7{,}650 \text{ ft}^3$

$V_{Hemi} = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$
$= 1286.2204 \text{ ft}^3$

The water tower was constructed to hold a maximum of ~~400,000~~ pounds of water. If water weighs 62.4 pounds per cubic foot, can the water tower be filled to 85% of its volume and *not* exceed the weight limit? Justify your answer.

No, it will exceed the weight limit

$\frac{62.4 \text{ lbs}}{1 \text{ ft}^3} = \frac{x}{7{,}650 \text{ ft}^3}$

$477{,}360 \text{ lbs}$ $\times .85 = 405{,}756$ lbs

2) A hemispherical tank is filled with water and has a diameter of 10 feet. If water weighs 62.4 pounds per cubic foot, what is the total weight of the water in a full tank, to the nearest pound?

(1) 16,336 (2) 32,673 (3) 130,690 (4) 261,381

3) A shipping container is in the shape of a right rectangular prism with a length of 12 feet, a width of 8.5 feet, and a height of 4 feet. The container is completely filled with contents that weigh, on average, 0.25 pound per cubic foot. What is the weight, in pounds, of the contents in the container?

1) 1,632 2) 408 3) 102 4) 92

4) Walter wants to make 100 candles in the shape of a cone for his new candle business. The mold shown below will be used to make the candles. Each mold will have a height of 8 inches and a diameter of 3 inches. To the *nearest cubic inch*, what will be the total volume of 100 candles?

Walter goes to a hobby store to buy the wax for his candles. The wax costs $0.10 per ounce. If the weight of the wax is 0.52 ounce per cubic inch, how much will it cost Walter to buy the wax for 100 candles?

If Walter spent a total of $37.83 for the molds and charges $1.95 for each candle, what is Walter's profit after selling 100 candles?

HW 9-11

Finish the problems in the notes!