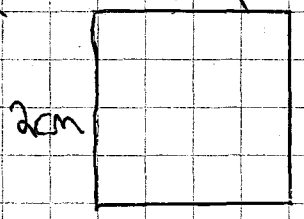
10/17/08
Snack Soda

*Note: for scale purposes, the length of one side of one box on this paper will be used as 1/2 cm. Exact measurements have been done with a ruler on the other sheet.

Solution

To calculate the volume of the liquid in this bottle, I divided the bottle into 3 seperate basic shapes. Then I simply added the volumes of each shape together.

First Shape: "Neck"

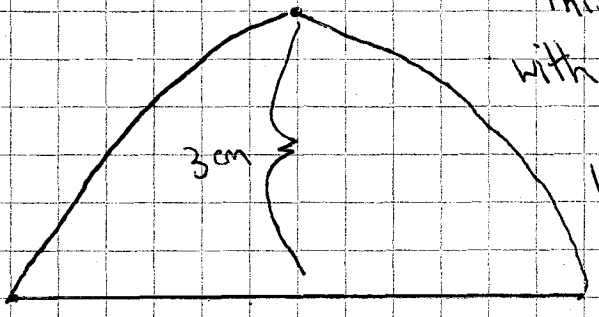


This is a cylinder with height 2 cm and radius 1 cm.

$V(\text{cylinder}) = \pi r^2 h$

$V(\text{Neck}) = \pi(1^2)(2) = \boxed{2\pi \text{ cm}^3}$

Second Shape: "Upper Body"



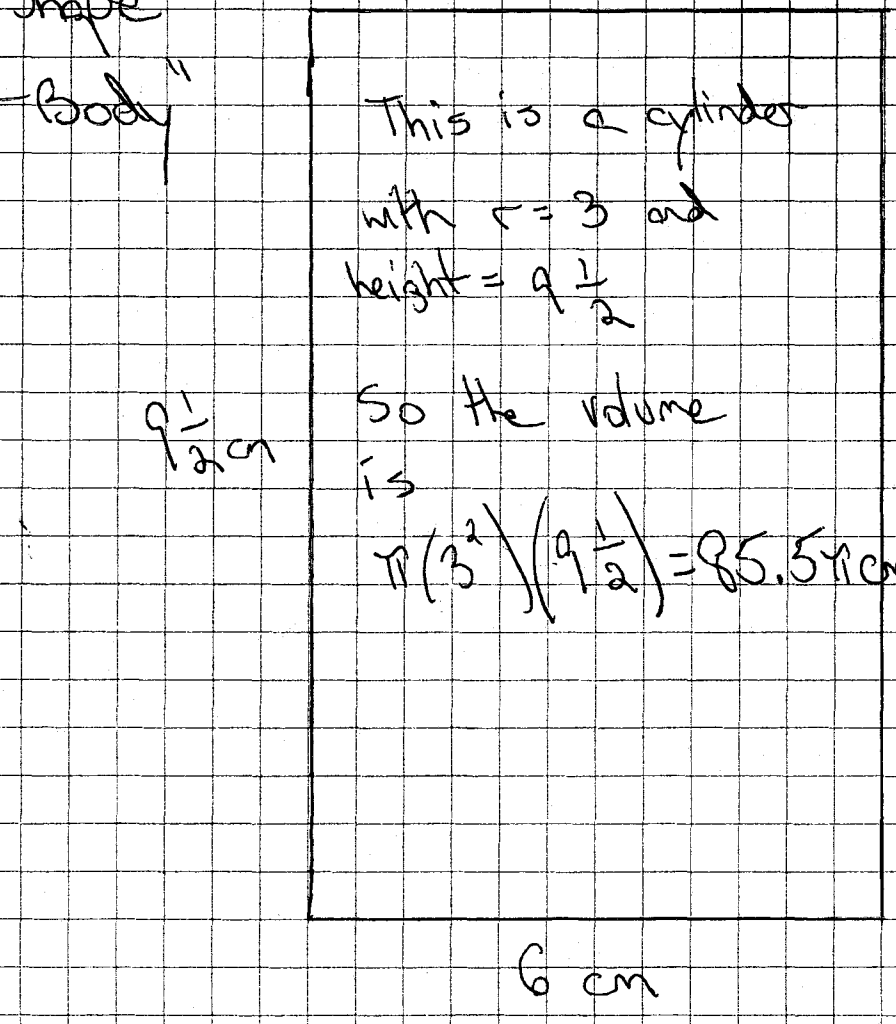
This is a half-sphere with radius 3 cm

$V(\text{sphere}) = \frac{4}{3}\pi r^3$

$V(\text{Upper Body}) = \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)\pi(3^3)$

$= \boxed{18\pi \text{ cm}^3}$

Third Shape
"Lower Body"



To get the total volume of the liquid in the bottle, I add the 3 shapes together.

$$21\pi\ cm^3 + 18\pi\ cm^3 + 85.5\ cm^3 = \boxed{105.5\ cm^3}$$

This answer makes sense to me given the overall dimensions of the bottle.

This problem was easy, especially because I was given formulas for volume.

Regarding the accuracy of my answer, I believe it is an overestimate for 2 reasons.

(1.) The radius I used in each calculation was too high by about $\frac{1}{10}$ of a cm. I used round numbers to make as easy as possible for someone to be able to focus on following my processes, without getting wrapped up in calculations.

* a deliberate choice - violates #1

(2.) My approximation does not take into account that the very bottom of the bottle curves in, not making it a perfect cylinder.

So, the actual volume of the liquid is probably closer to about 103π cm^3.