disk is 2-D object.

New!

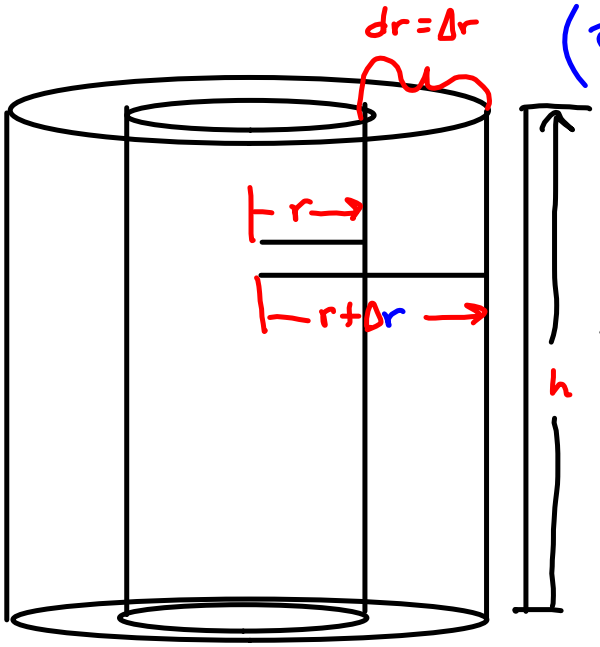
Discussions on Chapter 2. Caitlin's got some 2.7 and 2.8 stuff from whiteboard posted. Nice place to share board shots.

Errata!

Some weirdness in 2.7, an extra question stuck in the solutions. It's #16 thrown in there, for *some* reason. *sigh*

2.9 #13 help?

2.9 #13



(a) Estimate volume of the outer shell with a differential.

Want ΔV

$= \pi(r+\Delta r)^2 h - \pi r^2 h$

$\approx dV$. Well,

$V = \pi r^2 h$

$\frac{dV}{dr} = 2\pi r h + \pi r^2 \frac{dh}{dr}$

h doesn't change.

h is constant.

$\frac{dV}{dr} = 2\pi r h + \pi r^2 \frac{dh}{dr}$, $\frac{dh}{dr} = 0$

$\therefore dV = 2\pi r h\, dr$

(b) What's the error?

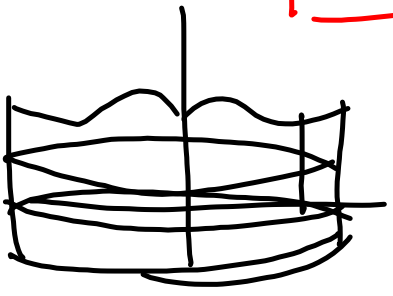
Want $|\Delta V - dV|$

$\Delta V = \pi(r+\Delta r)^2 h - \pi r^2 h$, so

$|\Delta V - dV| = \pi h \left|(r+\Delta r)^2 - r^2 - 2 \cdot r \cdot \Delta r\right|$

$= \pi h \left|r^2 + 2r\Delta r + (\Delta r)^2 - r^2 - 2r\Delta r\right|$

$= \pi h (\Delta r)^2$ is the error in the estimate.



$\Delta r \to 0$

In the limit, the error vanishes!

Relative Error

#12 § 2.9
Google "convert gallons to m^3"

$2r = 50\,m \Rightarrow r = 25\,m$

$\Delta r = (.05\,cm)\left(\frac{1\,m}{100\,cm}\right) = .0005\,m$

Volume of hemisphere

$= V = \frac{1}{2}(\text{sphere's vol}) = \frac{1}{2}\cdot\frac{4}{3}\pi r^3 = \frac{2}{3}\pi r^3 \Rightarrow$

$\Delta V \approx dV = 2\pi r^2 dr$

$\frac{dV}{dr} = 2\pi r^2 \Rightarrow$

$= 2\pi(25)^2(.0005)$

$= .625\pi\ m^3 \approx 1.963495409\,m^3$

$2\cdot Pi\cdot(25)^2\cdot.0005$

$0.6250\,\pi$

$evalf(\%)$

1.963495409

Force Fit a Relative Error Question.

The radius of a hemispherical dome is measured to be 25 m +/- .05 cm.

Estimate the error in measuring the volume of the dome, with a differential:

That's the 1.96 m^3 we got..

Relative Error is:

$\frac{2}{3}\pi(25)^3$

Relative Error $\frac{\Delta V}{V} \approx \frac{dV}{V} = \frac{.625\pi}{\frac{1}{2}\cdot\frac{625\pi}{3}} = \frac{(.625)(3)(2)}{625}$

$\approx .000057296$

Percent Error: $(100\%)\left(\frac{\Delta V}{V}\right) = .0057296\,\%$

USE RADIANS

They relate Angle, Arc Length, and angle in a natural way

Arc Length = $S = r\theta$ (RADIANS)

Area = $\frac{1}{2}r^2\theta$

$2\pi r$ all around