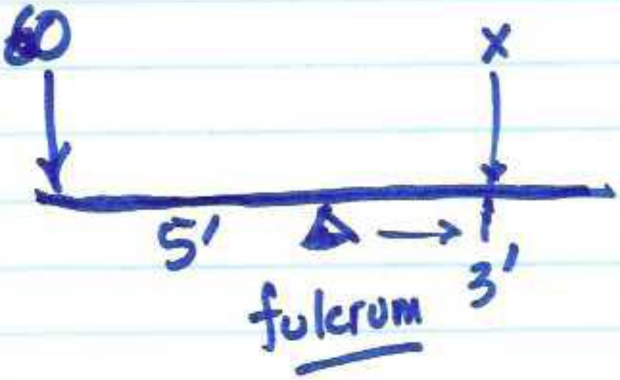
YUBRR

late



CCW ↺

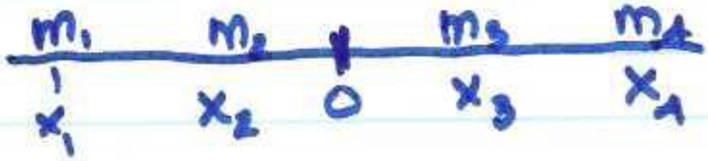
CW ↻

$5 \cdot 60 = 300$ ft·lbs torque ↺

$3 \cdot x = $ ↑ ft·lbs torque ↻

$3x = 300 \Rightarrow x = 100$ lbs

torque about P by F is $F \cdot l$



↓ g

$m_1 g x_1 + m_2 g x_2 + m_3 g x_3 + m_4 g x_4 = 0$

for stability

②

$$\sum_{i=1}^{4} m_i x_i = 0 \text{ for stability}$$

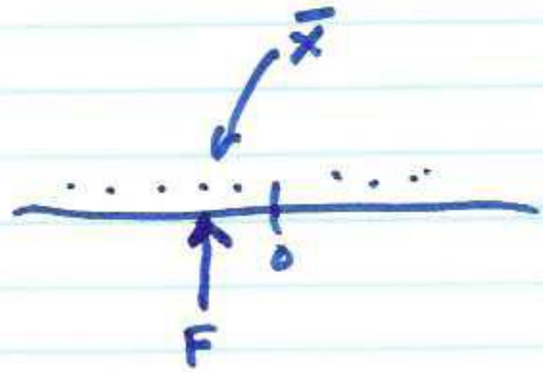
x_i is the moment arm of the i^{th} mass

Given system of masses $m_1, \cdots, m_n$ with locations $x_1, \cdots, x_n$, on the x-axis, where is the "balance point"? That is the unique location of an upward force equal to the weight of the system where no rotation (i.e. net torque) would be present.

$$F = g(m_1 + m_2 + m_3)$$

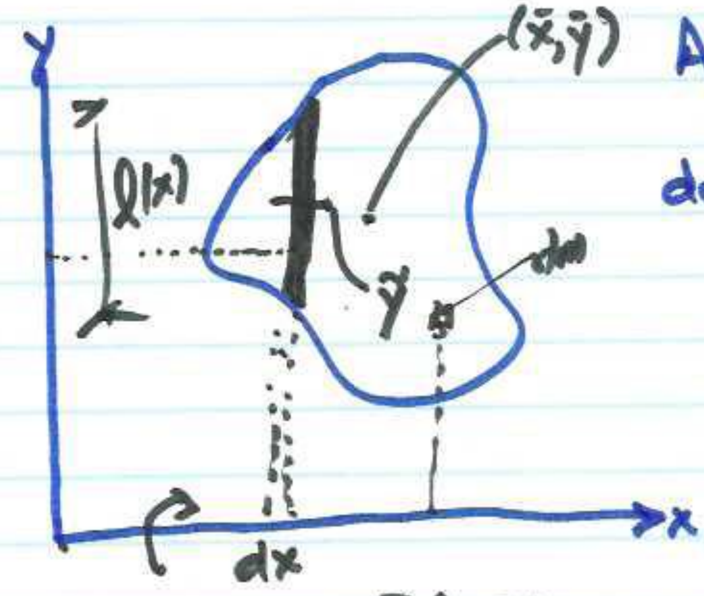
$$\frac{m_1x_1+m_2x_2+m_3x_3}{m_1+m_2+m_3}=\bar{x}$$

$$\frac{\sum_{i=1}^{n} m_i x_i}{\sum_{i=1}^{n} m_i}=\bar{x}$$



$$F\bar{x}=\sum x_i \underline{m_i} g$$

" ~ " is tilde



$x \quad \underline{\delta \ell(x) dx}$

Assume constant density

density = δ

CM (COM)

Moment about the y-axis

M_x is moment about x-axis

M_y is " " y-axis

So $\frac{M_x}{M} = \bar{y}$ and $\frac{M_y}{M} = \bar{x}$

$M_y = \sum \tilde{x} \Delta m$

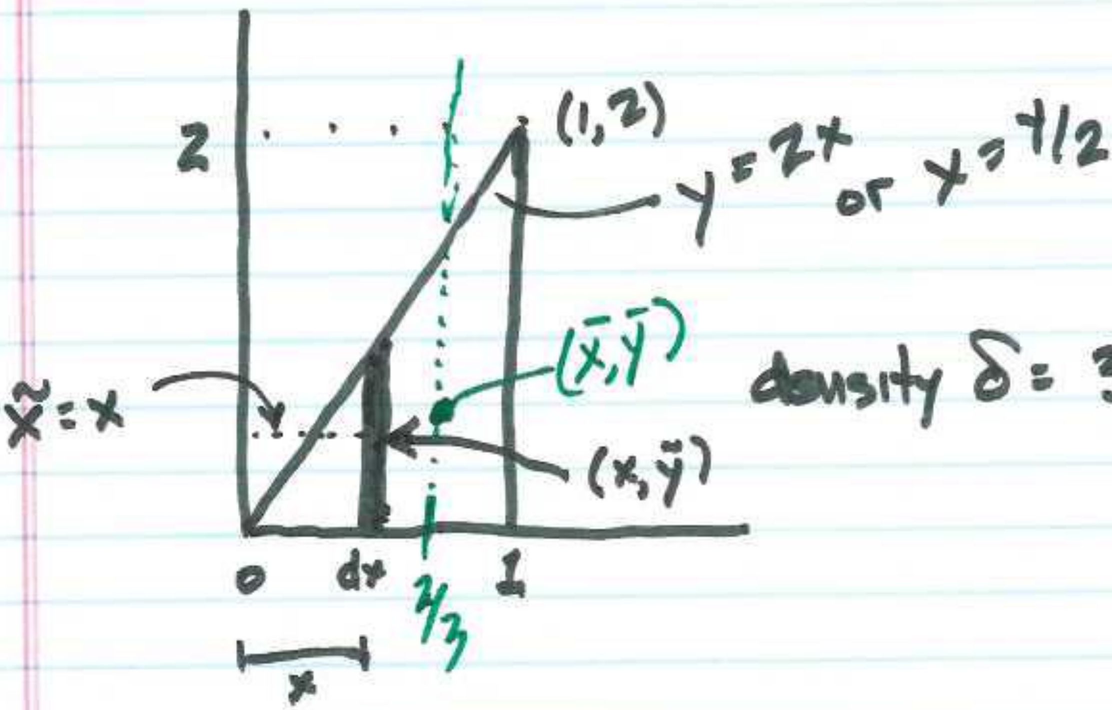
$M_x = \sum \tilde{y} \Delta m$

$\bar{y}$ = avg y position of entire shape

$\tilde{y}$ = avg y position of vertical strip

$\bar{x}$ = avg x position of entire shape

$\tilde{x}$ = avg x position of horiz strip



density $\delta = 3 g/cm^2$

length of strip $= 2x$
width of strip $= dx$
area of strip $= 2x\,dx$
mass of strip $= 6x\,dx = dm$
$\tilde{x} = x$

moment of strip about y-axis is

$$\tilde{x}\,dm = 6x^2dx$$

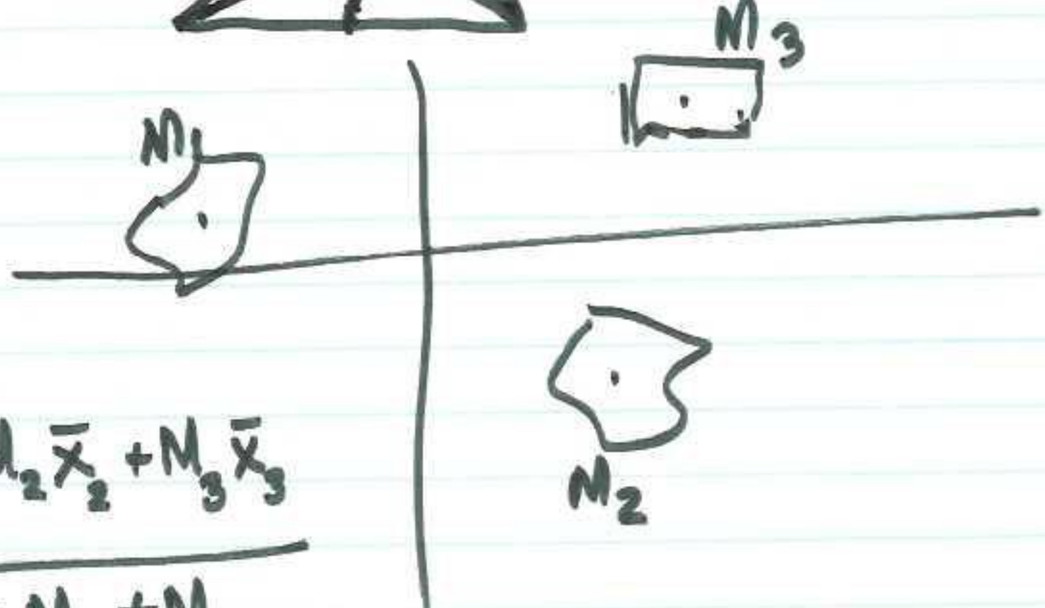
diff moment about y-axis

$$M_y = \int_0^1 6x^2dx = \left[2x^3\right]_0^1 = \boxed{2} \ \text{g-cm}$$

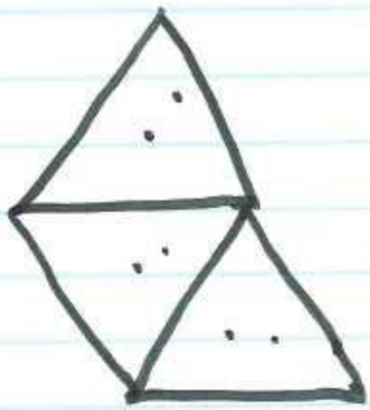
$$M = \int_0^1 6x\,dx = \left[3x^2\right]_0^1 = \boxed{3}$$

So now $\dfrac{M_y}{M} = \bar{x} = \boxed{\dfrac{2}{3}}$

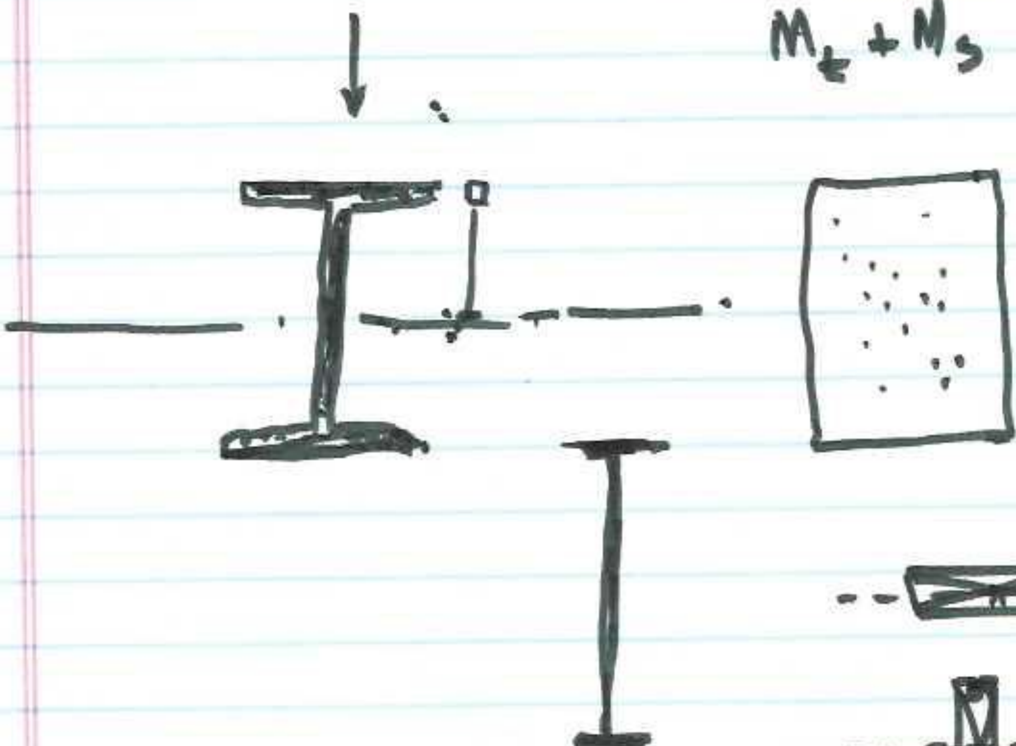
For triangles:

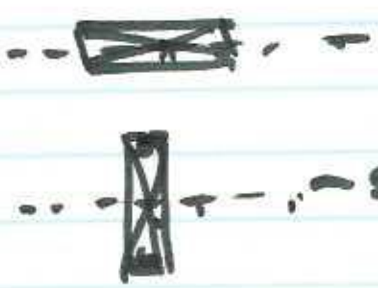


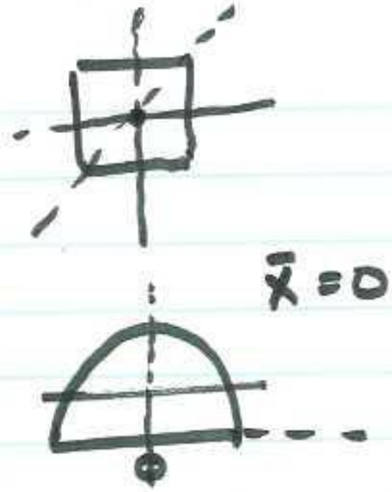
$$\bar{X}_{sys} = \frac{M_1\bar{x}_1 + M_2\bar{x}_2 + M_3\bar{x}_3}{M_1 + M_2 + M_3}$$



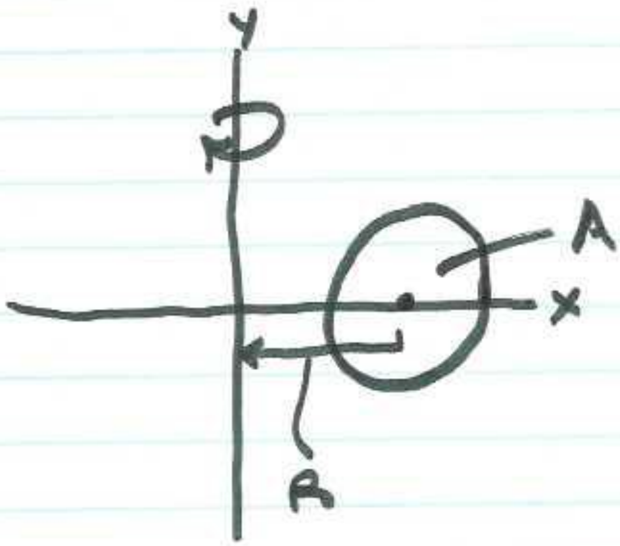
$$\frac{\bar{x}_t M_t + \bar{x}_s M_s}{M_t + M_s} = \bar{x}_{sys}$$







Thm of Pappus



Volume of rotated area is:

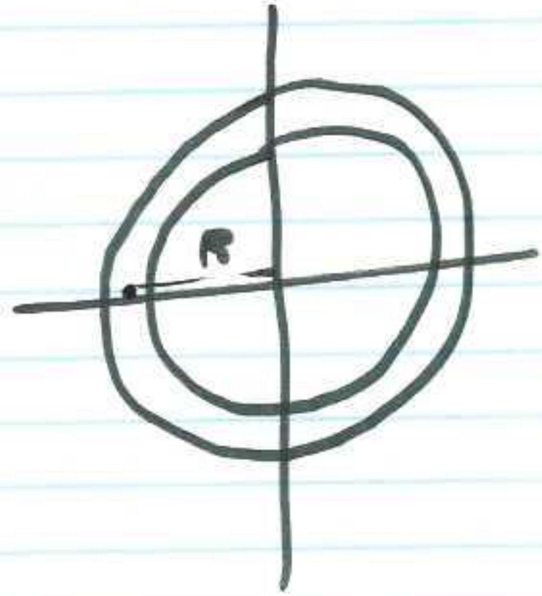
$2\pi R \cdot A = V$

What is volume of a doughnut

$\pi\left(\frac{1}{2}\right)^2 = A$

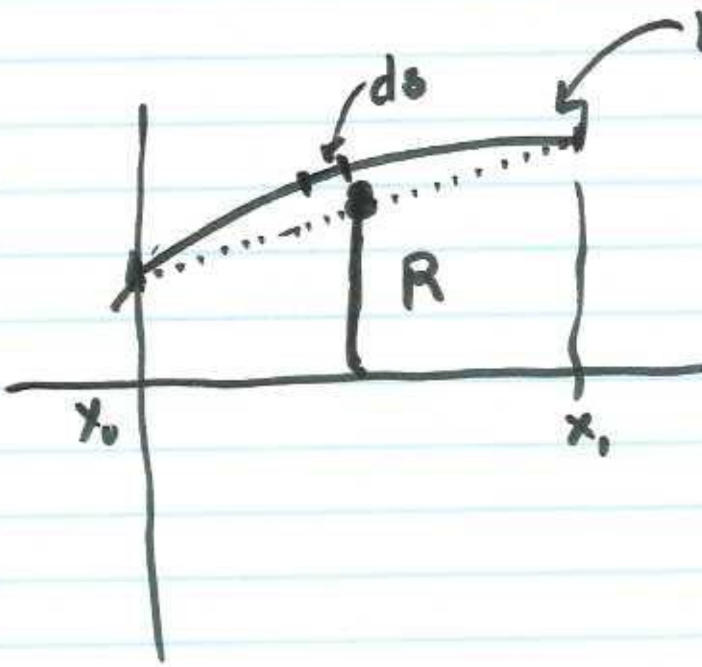
$R = 1\frac{1}{2}"$

$Vol = 2\pi(1.5)(.25)\pi$

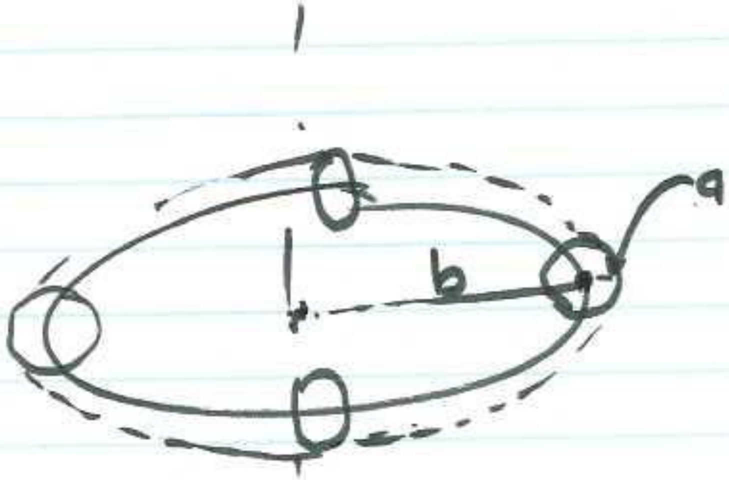


$Vol = 2\pi RWH$

Length of curve = L

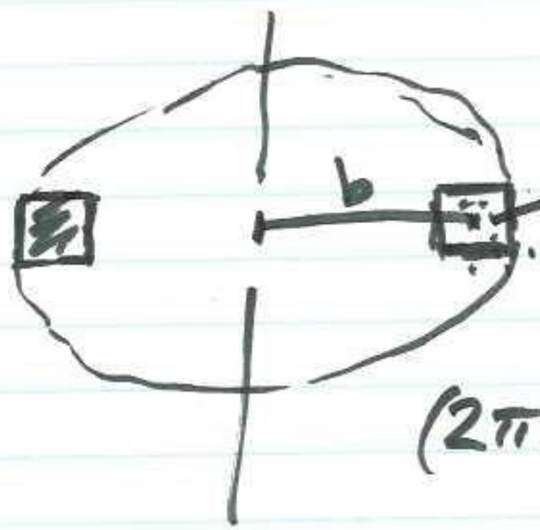


$2\pi R \cdot L$ = Area of figure of revolution



Pappus' Surface Area Thm

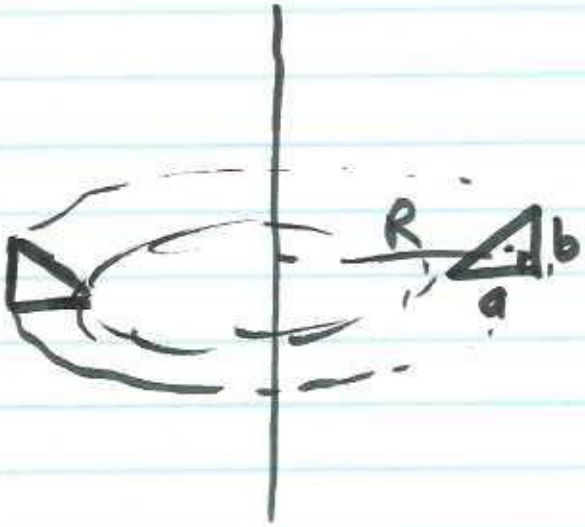
$$S = (2\pi b)(2\pi a) = 4\pi^2 ab$$



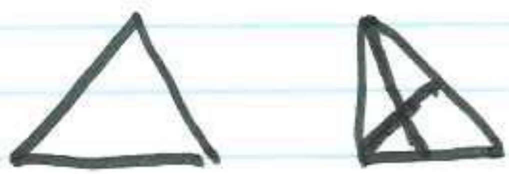
a on a side

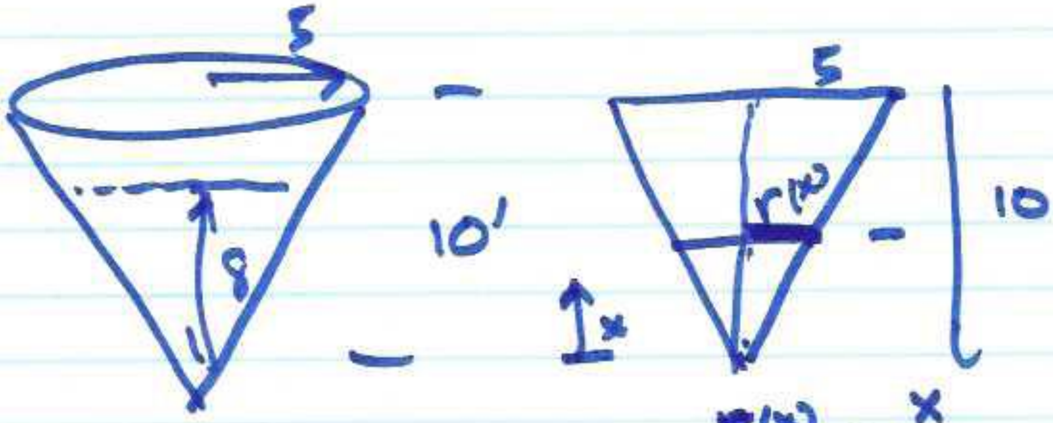
$$(2\pi b)(a^2) = \underline{2\pi a^2 b}$$

$$(2\pi b)(4a) = 8\pi ab$$



$$\cancel{2}\pi R\left(\frac{1}{\cancel{2}}ab\right) = \boxed{\pi abR}$$





$$\frac{R(x)}{5} = \frac{x}{10}$$