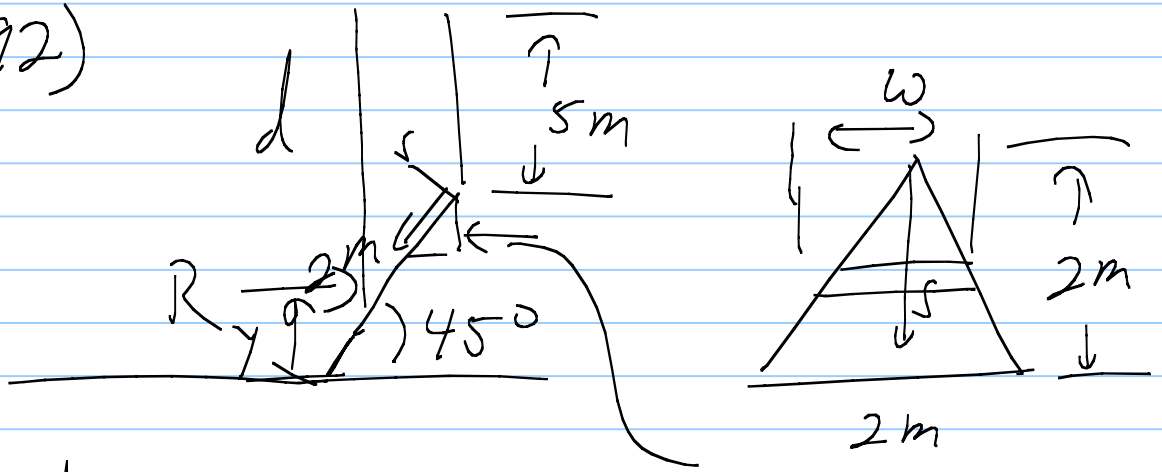
EGR180 6/24

Note Title 6/24/2009

5-92)



$\rho = 1000\ kg/m^3$

$s \in [0, 2]$

$w \in [0, 2]$

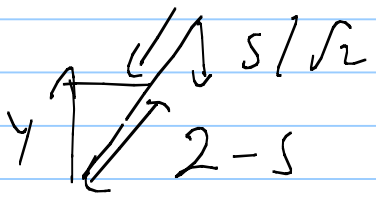
$dA = w\,ds = s\,ds$

$d = 5 + s/\sqrt{2}$

$s\sin(45) = s/\sqrt{2}$

$$R = \int_0^2 \rho\, d\, dA = \int_0^2 1000g\left(5 + s/\sqrt{2}\right) s\, ds = 1000g\left[\frac{5}{2}s^2 + \frac{s^3}{3\sqrt{2}}\right]_0^2$$

$$R = 1000g\left[10 + \frac{4\sqrt{2}}{3}\right] = 116.6\ KN$$



$$y = (2-s)/\sqrt{2}$$

$$M = \int_0^2 \rho g\, y\, dA = 1000g \int_0^2 \frac{2-s}{\sqrt{2}}\left[5 + \frac{s}{\sqrt{2}}\right] s\, ds$$

$$= \frac{1000g}{2} \int_0^2 (2s - s^2)(5\sqrt{2} + s)\, ds$$

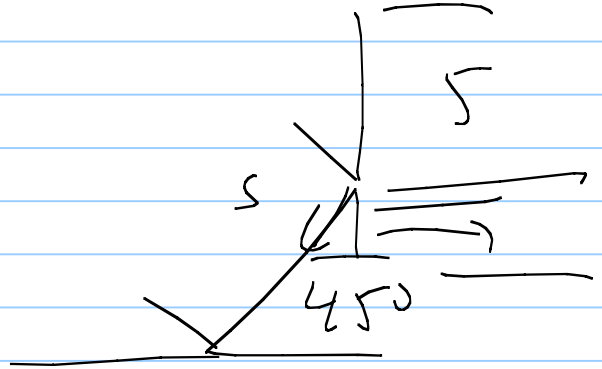
$$= 500g \int_0^2 (10\sqrt{2}\, s + 2s^2 - 5\sqrt{2}\, s^2 - s^3)\, ds$$

$$= 500g\left[5\sqrt{2}s^2 + \frac{2}{3}s^3 - \frac{5\sqrt{2}}{3}s^3 - \frac{s^4}{4}\right]_0^2$$

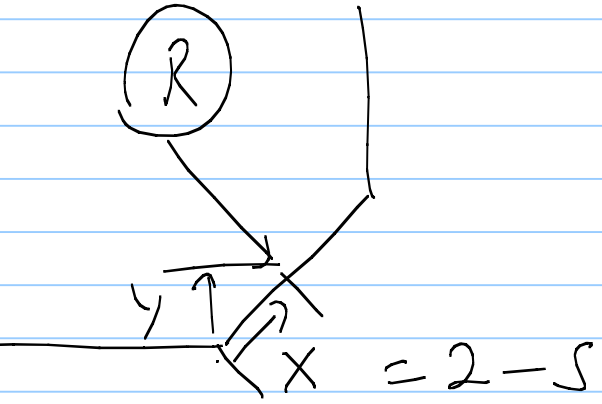
$$= 500g\left[20\sqrt{2} + \frac{16}{3} - \frac{40\sqrt{2}}{3} - 4\right] = 52.8\ kN\cdot m$$

$$y = \frac{m}{R} = 0.45\ m$$

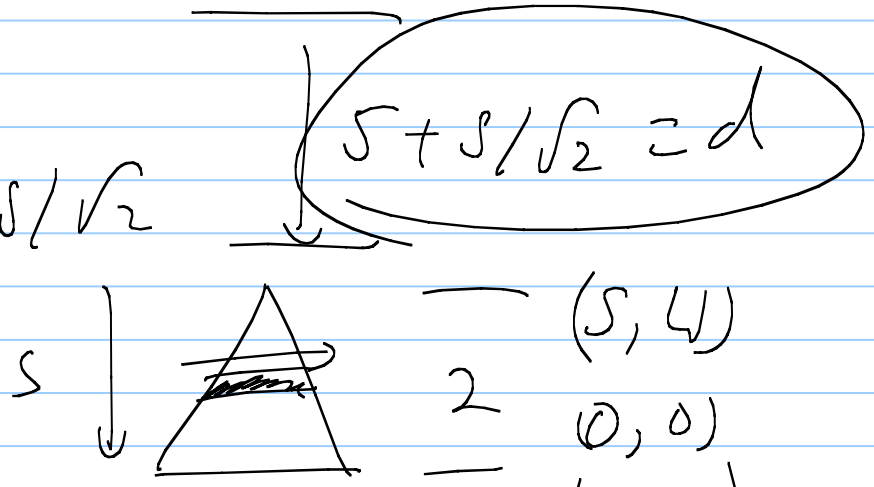
$$R = \iint_A \rho\, dA \qquad M = \iint_A \rho\, y\, dA$$



$s \sin(45) = s/\sqrt{2}$



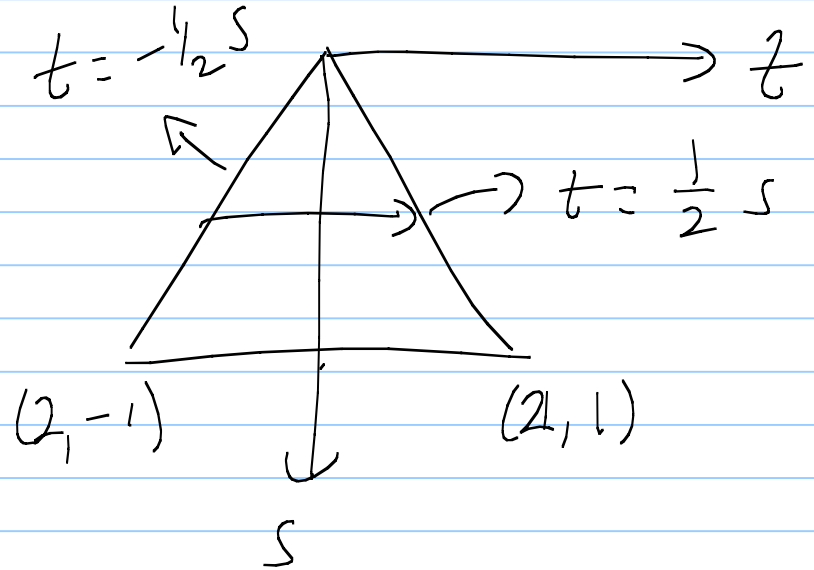
$x = 2 - s$



$\Rightarrow w = s$

$dA = w\,ds = s\,ds$

$$M = \iint_A \rho d x \, dA = \int_0^2 1000g\left[5 - s/2\right][2-s]\, s\, ds$$



$$\int_0^2 \int_{-\frac{1}{2}s}^{\frac{1}{2}s} \rho d \, dt \, ds$$

$$= \int_0^2 \rho d \, s \, ds$$

$g = 9.81 m/s^2$

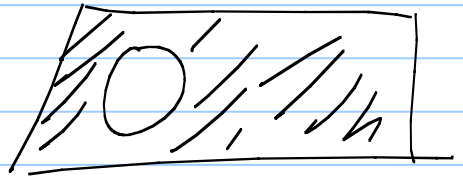
$Kg \rightarrow N$

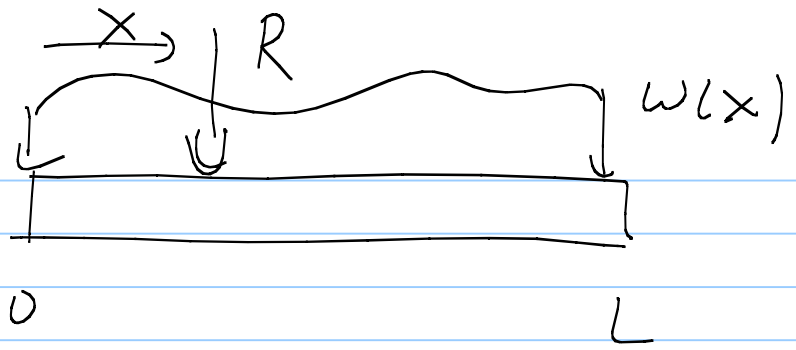
Center of mass with point masses

Centroid Curve, Surface, Volume



Centroid of Composite Body





R , x

Submerged R, M, x

Surface

5 Kg @ (1m, 2m, 3m) 10Kg (-2m, 1m, -1m)

15 Kg @ (1m, -1m, -2m)

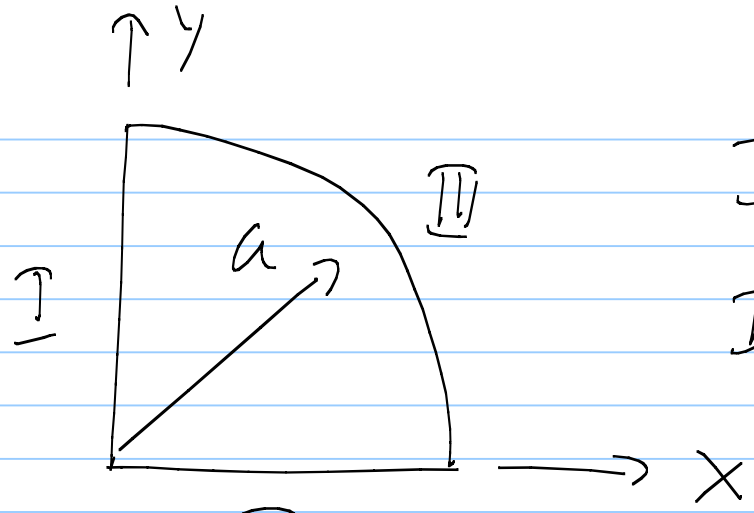
$m = 5 + 10 + 15 = 30\,Kg$

$\bar{x} = \frac{5 \cdot 1 + 10(-2) + 15 \cdot 1}{30} = 0$

$\bar{y} = \frac{5 \cdot 2 + 10 \cdot 1 - 15 \cdot 1}{30} = \frac{5}{30} = \frac{1}{6}\,m$

$\bar{z} = \frac{5 \cdot 3 + 10(-1) + 15(-2)}{30}$

$= \frac{-25}{30} = -\frac{5}{6}\,m$

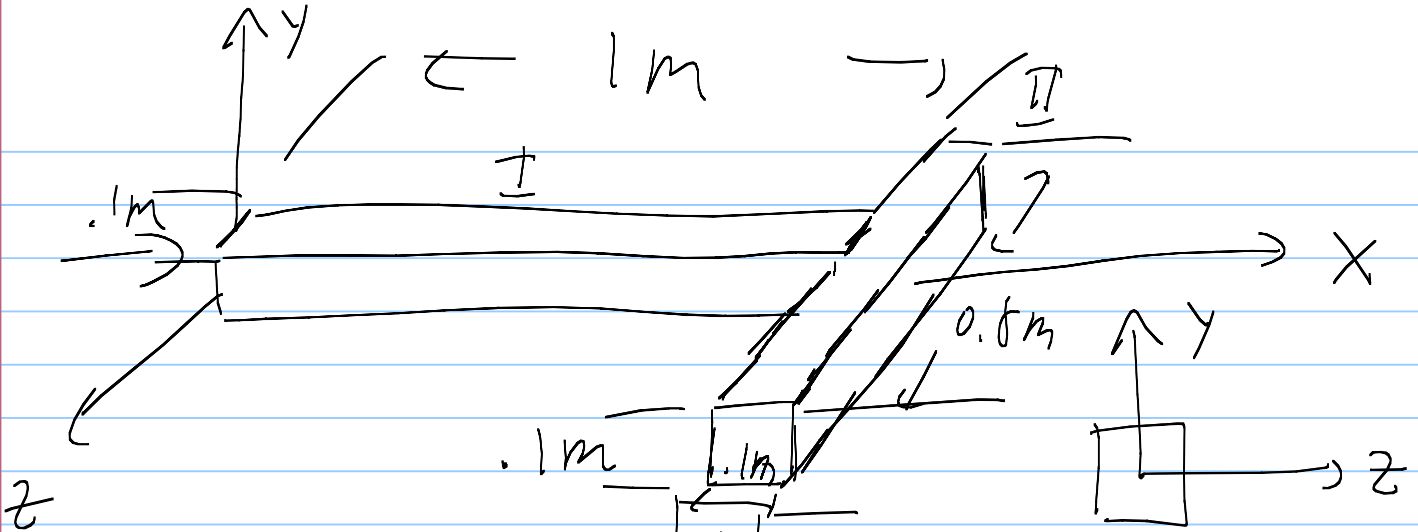


I: $(0, a/2)$ III: $\left(\frac{2a}{\pi}, \frac{2a}{\pi}\right)$

II: $\left(\frac{a}{2}, 0\right)$

$$\bar{x} = \frac{\sum \bar{x}_i \cdot l_i}{\sum l_i} = \frac{0 \cdot a + \frac{a}{2} \cdot a + \frac{2a}{\pi} \cdot \frac{\pi}{2} a}{2a + \frac{\pi}{2} a} = \frac{\frac{a^2}{2} + a^2}{2a + \frac{\pi}{2} a}$$

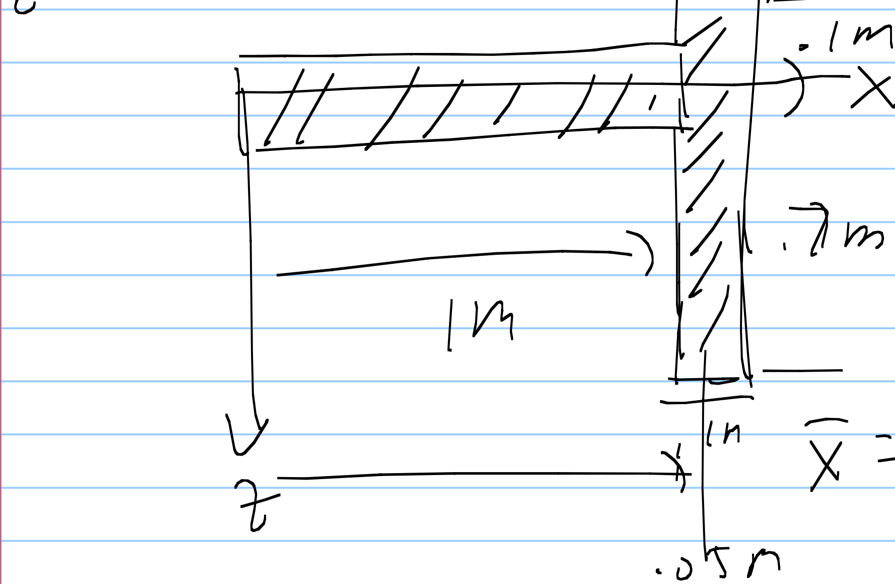
$$= \frac{3a}{4+\pi} = \bar{y}$$



$\bar{Y} = 0$

$\bar{Z} = \dfrac{(.3)(.008)}{.018}$

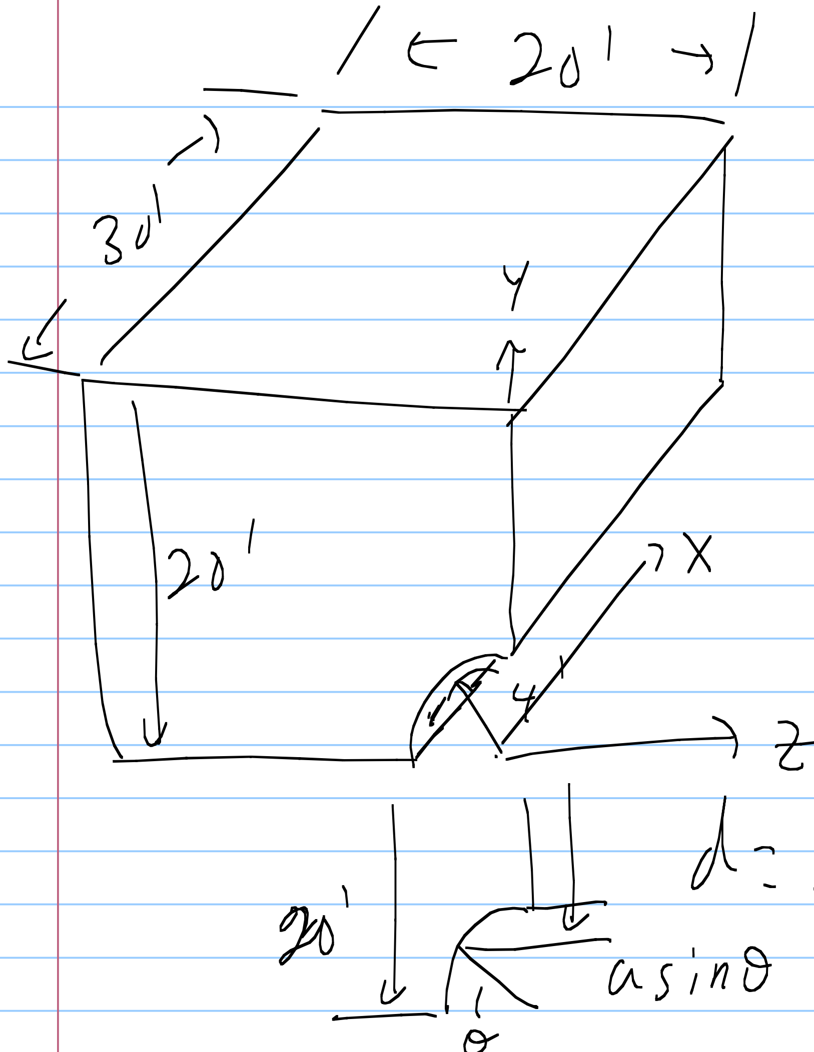
$= .13\,m$



I: $(.5, 0, 0)$

II: $(1.05, 0, .3)$

$\bar{X} = \dfrac{(.5)(.01) + 1.05(.008)}{.01 + .008} = .74\,m$



$$R = \iint_A \rho\, d\, dA$$

$dA = dx \cdot a\,d\theta$

$$= \int_0^{\pi/2} \int_0^{30} \rho(20 - 4 \cdot \sin\theta)\underline{4}\, dx\, d\theta$$

$$d = 20 - a\sin\theta$$

$$= \underline{16}\rho \int_0^{\pi/2} \int_0^{30} (5 - \sin\theta)\, dx\, d\theta$$

$$= 480\rho \int_0^{\pi/2} (5 - \sin\theta)\, d\theta$$

$$= 480\rho\left[5\cdot\frac{\pi}{2} - 1\right] = 205 \times 10^3 \text{ lbs}$$