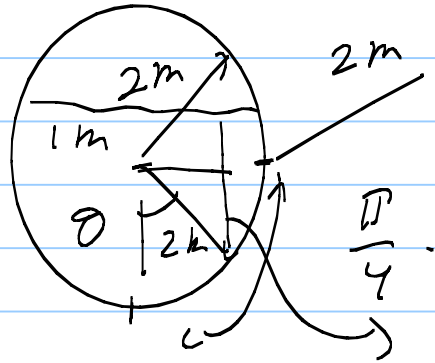
EGR 180 6/23/10

Note Title 6/23/2010

5-96)



$\frac{\pi}{4} \cdot 2 = \frac{\pi}{2}$ m

$A = \frac{\pi}{2} \cdot 2 = \pi \text{ m}^2$

$d = 1 + 2\cos\theta$

$$R = P\,dA = \int_0^{\pi/2} \rho\, d \; 2d\theta \cdot 2$$

$$= 4\rho \int_0^{\pi/2} (1 + 2\cos\theta)\, d\theta = 4\rho \left[\theta + 2\sin\theta \right]_0^{\pi/2}$$

$$R = 4\rho \left[\pi/2 + 2 \right]$$

$$m = \int_A \rho y \, dA = 4\rho \int_0^{\pi/2} (1+2\cos\theta)(2\cos\theta)\, d\theta$$

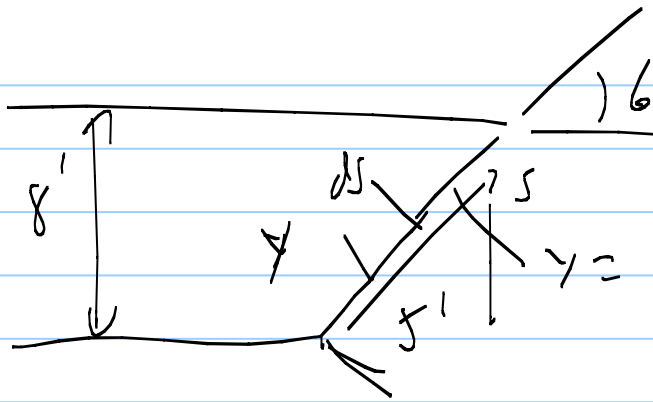
$$= 8\rho \int_0^{\pi/2} (\cos\theta + 2\cos^2\theta)\, d\theta = 8\rho \int_0^{\pi/2} (\cos\theta + 1 + \cos(2\theta))\, d\theta$$

$$= 8\rho \left[\sin\theta + \theta + \frac{1}{2}\sin(2\theta) \right]_0^{\pi/2}$$

$$= 8\rho \left(1 + \pi/2 \right)$$

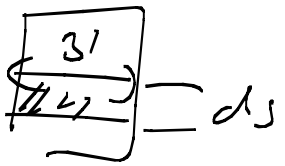
$$\bar{y} = \frac{m}{n} = \frac{8\rho(1+\pi/2)}{4\rho(2+\pi/2)} = \frac{2+\pi}{2+\pi/2}.$$

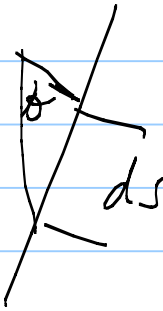
5-84)



$d = 8 - y = 8 - s \sin 60$

$dA = 3\,ds$





$$R = \int_A P\,dA = \int_A \rho\, d\, dA$$

$$= \int_0^5 \rho\,(8 - s \cdot \sin 60)\; 3\,ds$$

$$= 3\rho \int_0^5 \left(8 - \frac{\sqrt{3}}{2} s\right) ds = 3\rho \left[8s - \frac{\sqrt{3}}{4} s^2 \right]_0^5$$

$$= 3\rho \left(40 - \frac{25\sqrt{3}}{4} \right) = 550 \text{ lbs}$$

$$M = \int_A s\,\rho\,dA = \int_0^5 s\,\rho\left(8 - \frac{\sqrt{3}}{2}s\right) 3\,ds$$

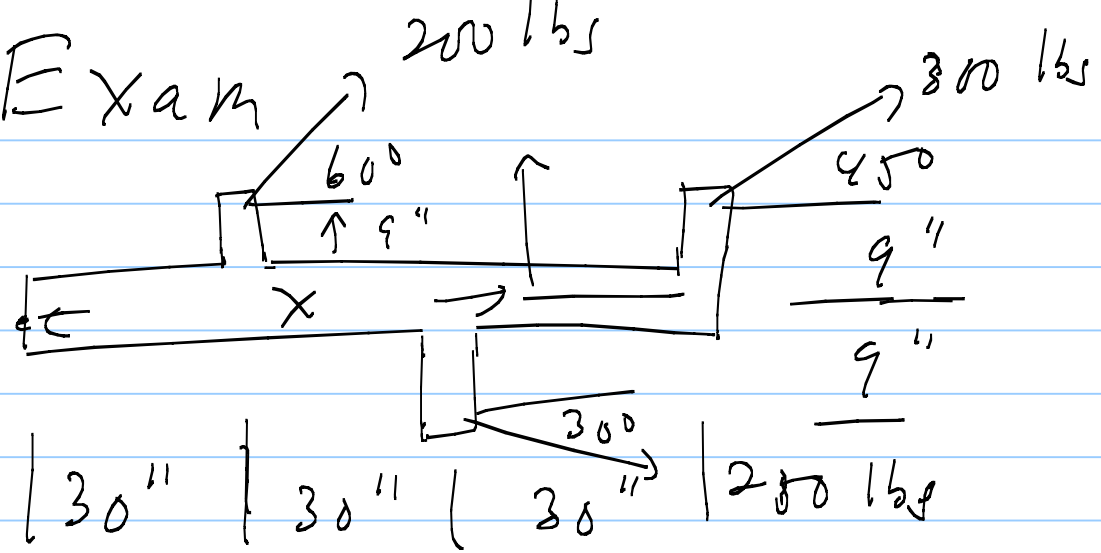
$$= 3\rho \int_0^5 \left(8s - \frac{\sqrt{3}}{2}s^2\right) ds = 3\rho \left| 4s^2 - \frac{\sqrt{3}}{6}s^3 \right|_0^5$$

$$= 3\rho\left[100 - \frac{125\sqrt{3}}{6}\right] = 12.0 \times 10^3 \text{ ft} \cdot \text{lb}_s$$

$$\bar{s} = \frac{M}{R} = 2.19 \text{ ft}$$

Exam

1)



$X = 61.2$ in

$= \frac{15,900}{260.3}$

$\vec{R} = 100\,\hat{i} + 100\sqrt{3}\,\hat{j} + 150\sqrt{2}\,\hat{i} + 150\sqrt{2}\,\hat{j}$

$125\sqrt{3}\,\hat{i} - 125\,\hat{j}$

$= 528.6\,\hat{i} + 260.3\,\hat{j}$ (lbs)

$M = (-9)(100) + 30(100\sqrt{3}) - 9(150\sqrt{2}) + 90\cdot 150\sqrt{2}$

$+9\cdot 125\sqrt{3} - 60\cdot 125 = 15.9$ kip

2) $125\hat{k}$ @ $4\hat{i}+2\hat{j}$

$25\hat{k}$ @ $2\hat{i}+6\hat{j}$

$-100\hat{k}$ @ $2\hat{i}+3\hat{j}$

$\vec{R} = (125+25-100)\hat{k} = 100\hat{k}$ lbs

$\vec{m} = (4\hat{i}+2\hat{j}) \times (125\hat{k})$

$+ (2\hat{i}+6\hat{j}) \times (25\hat{k})$

$+ (2\hat{i}+3\hat{j}) \times (-100\hat{k})$

$\vec{m} = -500\hat{j} + 250\hat{i} - 150\hat{j} + 450\hat{i} + 200\hat{j} - 300\hat{i}$

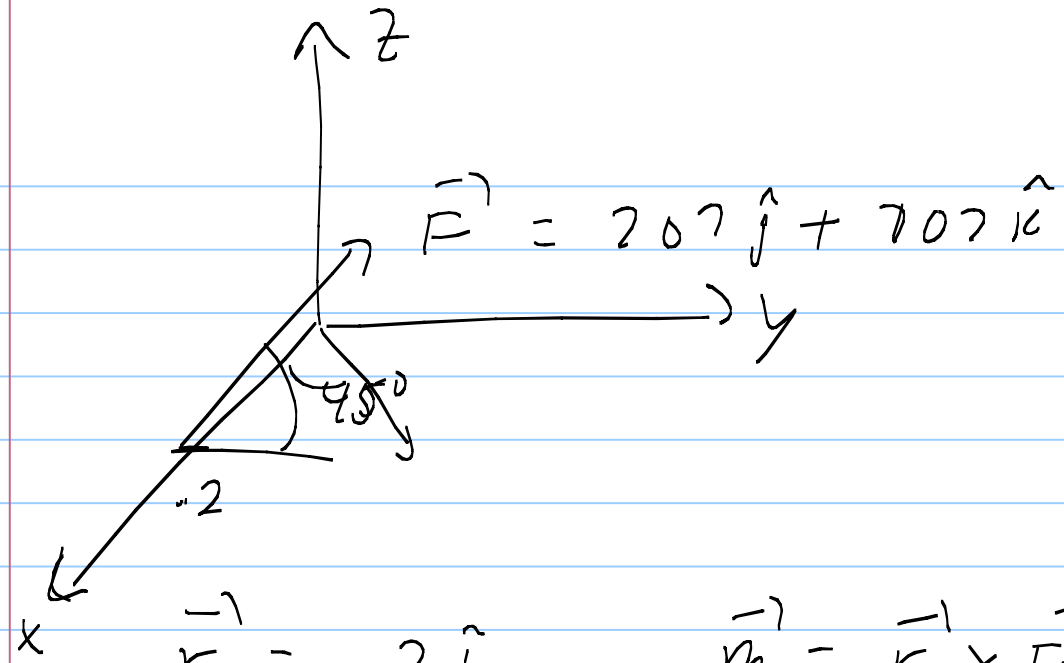
$= 400\hat{i} - 450\hat{j} = (x\hat{i}+y\hat{j}) \times (100\hat{k})$

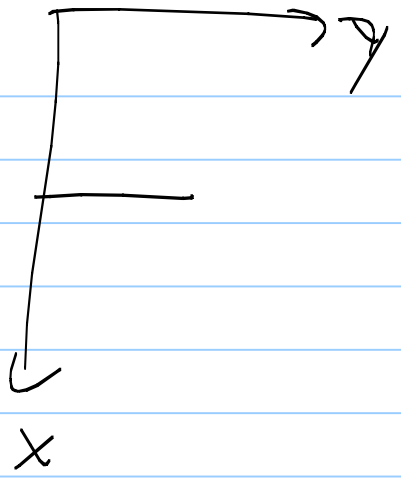
$= 100y\hat{i} - 100x\hat{j}$

$100y = 400$ $\quad -100x = -450$

$y = 4$ ft $\quad x = 4.5$ ft

3)





$\vec{F} = 707\hat{j} + 707\hat{k}$

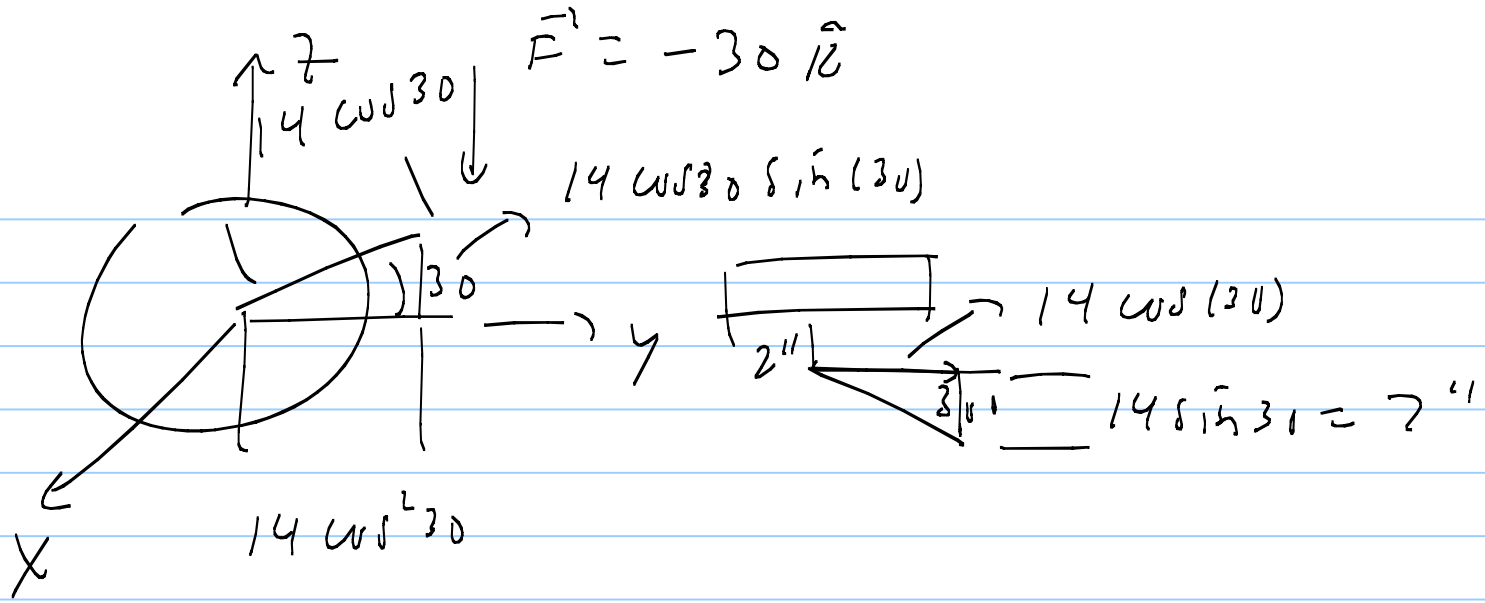
$\vec{r} = .2\hat{i}$

$\vec{m} = \vec{r} \times \vec{F} = .2\hat{i} \times (707\hat{j} + 707\hat{k})$

$= -141\hat{j} + 141\hat{k}$ N·m

$\hat{e} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$

$m_e = \hat{e} \cdot \vec{m} = -100$ N·m



$$\vec{r} = 9\hat{i} + 10.5\hat{j} + 3.5\sqrt{3}\,\hat{k}$$

$$\vec{m} = (9\hat{i} + 10.5\hat{j} + 3.5\sqrt{3}\,\hat{k}) \times (-30\,\hat{k})$$

$$= -315\,\hat{i} + 270\,\hat{j} \quad \text{in-lbs}$$

$$m = -315 \quad \text{in-lbs}$$