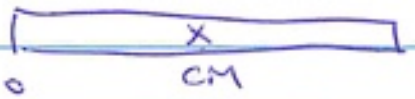
Example 5

(a)

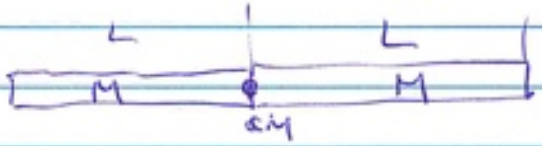


$$I_{com} = \frac{1}{12} ML^2$$

$$I_{end} = \frac{1}{12} ML^2 + M\left(\frac{L}{2}\right)^2$$

$$= ML^2\left(\frac{1}{12} + \frac{1}{4}\right) = \frac{1}{3} ML^2$$

(b)



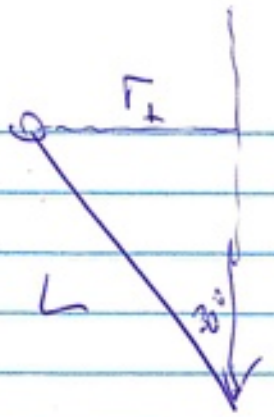
$$I_{CM} = 2 \times \frac{1}{3} ML^2 \qquad m = 2M$$

$$d = 2L$$

$$= \frac{2}{3}\left(\frac{m}{2}\right)\left(\frac{d}{2}\right)^2$$

$$= \frac{2}{3} \times \frac{1}{2} \times \frac{1}{4}\, m d^2$$

$$= \frac{1}{12} m d^2$$



$r_\perp = L \sin 30°$

$= \frac{L}{2}$

$r_\perp F = \frac{L}{2} F$.

Example 6 $\tau = \sum_i F_i r_i$ since all $F_i \perp r_i$

ccw is positive.

$\tau_{net} = +(30N)(0.2m) - (20N)(0.2m)$

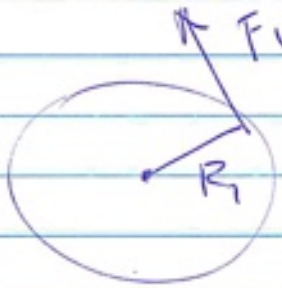
$- (35N)(0.1m)$

$= 6 N\cdot m - 4 N\cdot m - 3.5 N\cdot m$

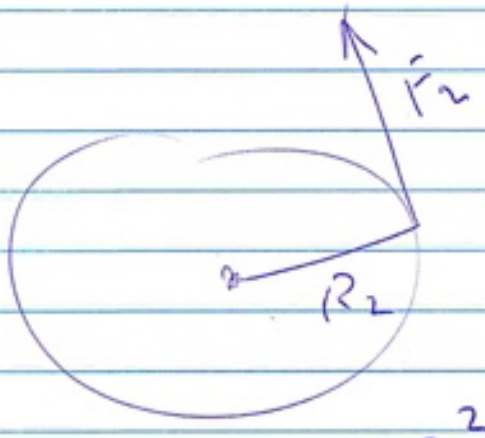
$= -1.5 N\cdot m$

$I = MR^2$ for hoop of radius R.

$\tau = I\alpha$



$I_1 = MR_1^2$



$I_2 = MR_2^2$

$R_2 = 2R_1$

$$\alpha = \frac{\tau}{I} = \frac{F_1 R_1}{I_1} = \frac{F_2 R_2}{I_2}$$

$$= \frac{F_1 R_1}{MR_1^2} = \frac{F_2 R_2}{MR_2^2}$$

$$\therefore \frac{F_1}{R_1} = \frac{F_2}{R_2}$$

$$\therefore \boxed{F_2 = 2R_1}$$