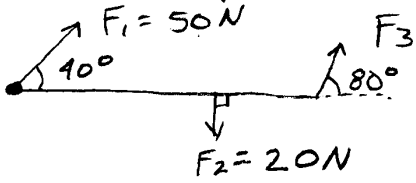
1) Find the torque about the left end of this 8m bar.



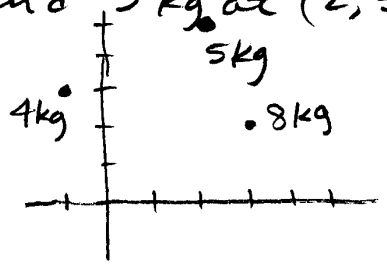
F_2 is at 5m.

$\Sigma \tau = -r_2 F_2 + r_3 F_3 \sin 80°$

$= -5m(20N) + 8m(30N)\sin 80°$

$\boxed{\Sigma \vec{\tau} = 136N, \text{ ccw}}$

2) Find the c.m. of 8kg at (3, 2), 4kg at (−1, 3), and 5kg at (2, 5).



$$x_{cm} = \frac{M_1 x_1 + M_2 x_2 + M_3 x_3}{M_1 + M_2 + M_3}$$

$$= \frac{8kg(3m) + 4kg(-1m) + 5kg(2m)}{8kg + 4kg + 5kg}$$

$x_{cm} = 1.76\,m$

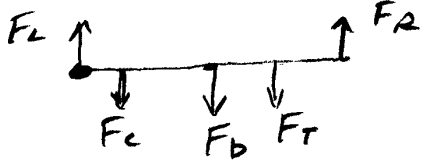
$$y_{cm} = \frac{M_1 y_1 + M_2 y_2 + M_3 y_3}{M_1 + M_2 + M_3}$$

$$= \frac{8kg(2m) + 4kg(3m) + 5kg(5m)}{8kg + 4kg + 5kg}$$

$y_{cm} = 3.12\,m$

$\boxed{(x,y)_{cm} = (1.76m, 3.12m)}$

3) Find the upward force exerted by each pillar on a 15000N bridge 10m long that has a 2000N car at 2m and at 7000N truck at 7m.



$\Sigma \tau = 0$

$-r_c F_c - r_b F_b - r_T F_T + r_R F_R = 0$

$$F_R = \frac{r_c F_c + r_b F_b + r_T F_T}{r_R}$$

$$= \frac{2m(2000N) + 5m(15000N) + 7m(7000N)}{10m}$$

a) $\boxed{F_R = 12800N}$

$\Sigma F = 0$

$F_L - F_c - F_b - F_T + F_R = 0$

$F_L = F_c + F_b + F_T - F_R$

$= +2000N + 15000N + 7000N - 12800N$

b) $\boxed{F_L = 11200N}$