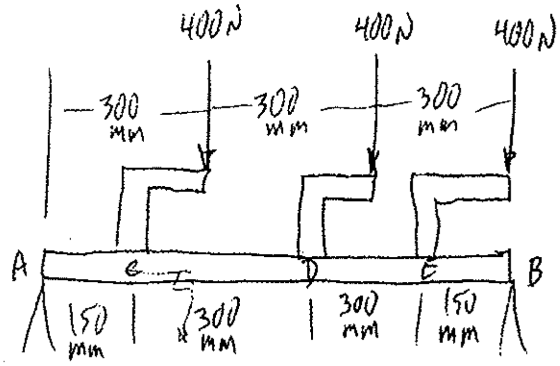
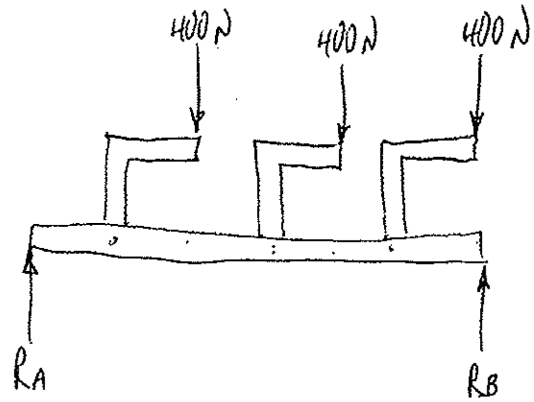
PROB. 7.52

DRAW SHEAR + BENDING MOMENT DIAGRAMS, FIND MAXIMUMS



FBD:

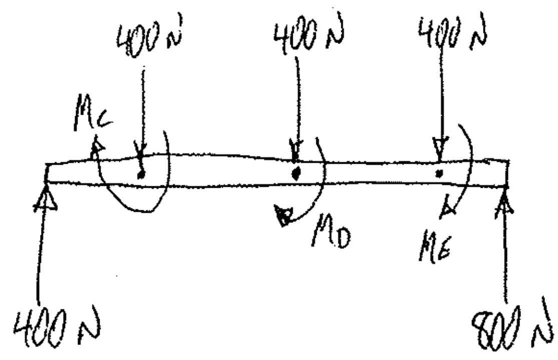


$\Sigma M_A = 0$ +↺: $900 R_B - (300)(400) - (600)(400) - (900)(400) = ($

$R_B = 800$ N

$\Sigma F_y = 0$: $R_A + R_B = 1200$ $R_A = 400$ N

REPLACE 400 N LOADS WITH FORCE-COUPLE SYSTEMS



PROB. 7.52

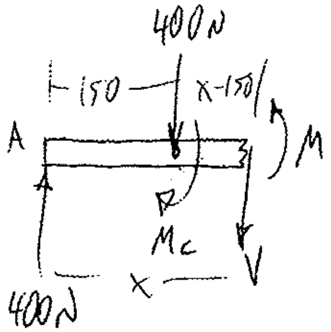
$M_C = M_D = M_E = (400\,N)(150\,mm) = 6\times10^4\ N\text{-}mm$

FBD BETWEEN A + C:

$V = 400$

$M = 400X$

FBD BETWEEN C + D:



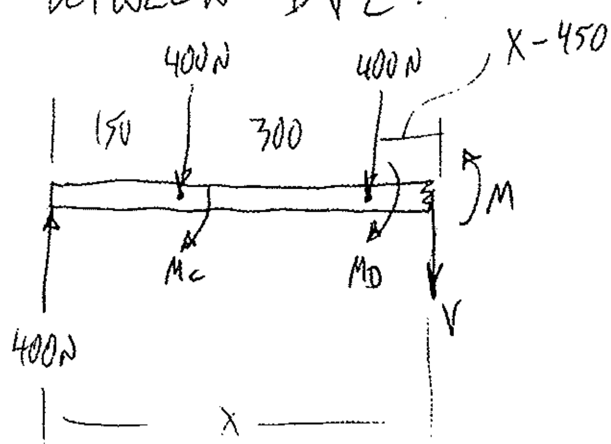
$\Sigma F_y = 0:\ 400 - 400 - V = 0$

$V = 0$

$\Sigma M = 0\ +\circlearrowleft:\quad M + 400(X-150) - 6\times10^4 - 400X = 0$

$M = 1.2\times10^5\ N\text{-}mm$

FBD BETWEEN D + E:



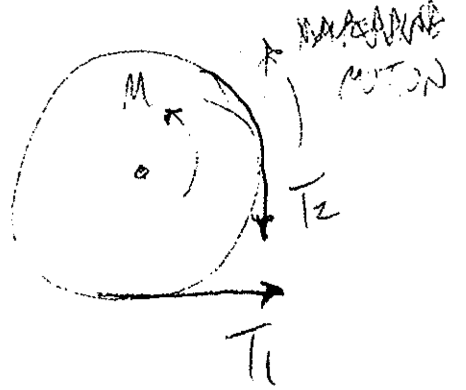
$\Sigma F_y = 0:$

$400 - 400 - 400 - V = 0$

$V = -400\ N$

PROB. 8-87

WHEEL:



$$\frac{T_2}{T_1} = e^{\mu_k \beta}$$

$$\beta = (270^\circ)\left(\frac{\pi}{180^\circ}\right) = \frac{3\pi}{2} \text{ RAD}$$

$$\mu_k = 0.3$$

$$\Sigma M_0 = 0 \; ⟲: \; 50^{N \cdot m} + (150^{mm})T_1 - (150^{mm})T_2 = 0$$

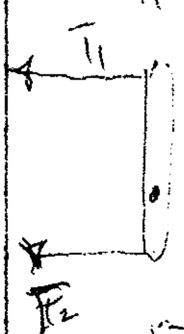
$$T_1 = T_2 - \left(\frac{50^{N\cdot m}}{150^{mm}}\right)\left(\frac{1000^{mm}}{m}\right)$$

$$T_1 = T_2 - 333.3^N$$

$$T_2 = T_1 \cdot e^{(0.3)\left(\frac{3\pi}{2}\right)} = 4.111\,T_1$$

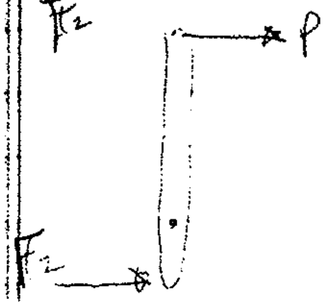
$$T_1 = 4.111\,T_1 - 333.3$$

$$3.111\,T_1 = 333.3, \quad T_1 = 107.1^N$$



$$(50)(107.1) = (25)F_2$$

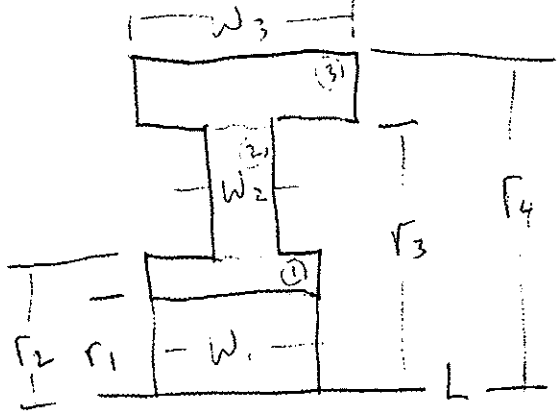
$$F_2 = 214.3^N$$



$$(400)P = (100)(214.3)$$

$$P = 53.6^N$$

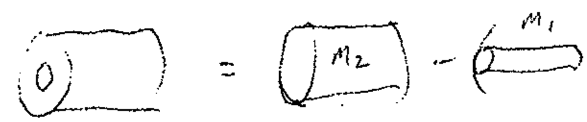
PROB. 8.164 | BEDFORD p. 427



$m = 14^{kg}$

FIND I_L

$I_L = I_1 + I_2 + I_3$



$I_1 = \frac{1}{2} m_2 r_2^2 - \frac{1}{2} m_1 r_1^2$

NEED DENSITY OF MATL:

$V_T = V_1 + V_2 + V_3$

$V_1 = \pi(r_2^2 - r_1^2)w_1 = \pi[(60^{mm})^2 - (35)^2](100^{mm})$

$V_1 = 7.461 \times 10^5 \ mm^3$

$V_2 = \pi(r_3^2 - r_2^2)w_2 = \pi[(220)^2 - (60)^2](50)$

$V_2 = 7.037 \times 10^6 \ mm^3$

$V_3 = \pi(r_4^2 - r_3^2)w_3 = \pi[(250)^2 - (220)^2](150)$

$V_3 = 6.644 \times 10^6 \ mm^3$

$V_T = 1.443 \times 10^7 \ mm^3$

$m = \rho V \qquad \rho = \frac{m}{V_T} = \frac{14^{kg}}{1.443 \times 10^7 mm^3} = 9.704 \times 10^{-7} \ \frac{kg}{mm^3}$

$m_2 = \rho V_2 = \rho \cdot \pi r_2^2 w_1 \ , \ m_1 = \rho V_1 = \rho \cdot \pi r_1^2 w_1$

~~$m_3 = \rho V_3 = \rho \cdot \pi r_3^2 w_2, \quad m_4 = \rho V_4 = \rho \cdot \pi r_4^2$~~

$$I_1 = \frac{1}{2} m_2 r_2^2 - \frac{1}{2} m_1 r_1^2$$

$$= \frac{1}{2} \cdot \pi \rho r_2^2 w_1 \cdot r_2^2 - \frac{1}{2} \pi \rho r_1^2 w_1 \cdot r_1^2$$

$$= \frac{\pi}{2} \rho w_1 (r_2^4 - r_1^4)$$

$$I_2 = \frac{\pi}{2} \rho w_2 (r_3^4 - r_2^4)$$

$$I_3 = \frac{\pi}{2} \rho w_3 (r_4^4 - r_3^4)$$

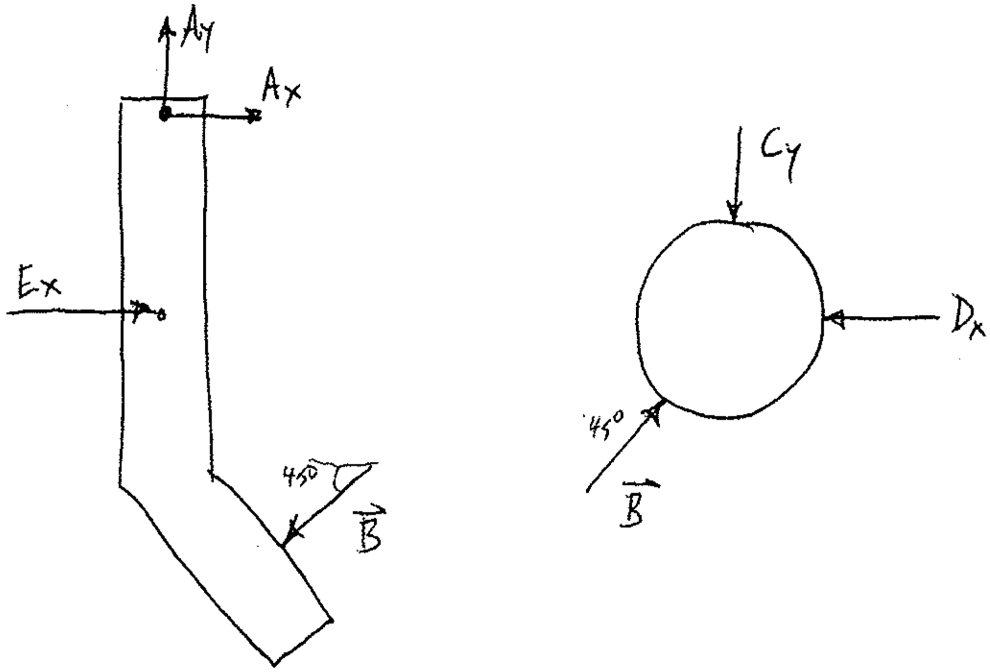
$$I_1 = \frac{\pi}{2}\left(9.704 \times 10^{-7} \frac{kg}{mm^3}\right)(100\ mm)\left[(60)^4 - (35\ mm)^4\right] = 1747.\ kg \cdot mm^2$$

$$I_2 = \frac{\pi}{2}(9.704 \times 10^{-7})(50)\left[(220)^4 - (60)^4\right] = 1.775 \times 10^5\ kg \cdot mm^2$$

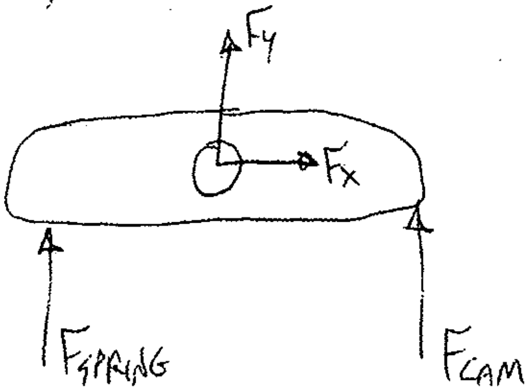
$$I_3 = \frac{\pi}{2}(9.704 \times 10^{-7})(150)\left[(250)^4 - (220)^4\right] = 3.575 \times 10^5\ kg \cdot mm^2$$

$$I_L = 5.368 \times 10^5\ kg \cdot mm^2 \left(\frac{m}{1000\ mm}\right)^2 = \boxed{0.5368\ kg \cdot m^2}$$

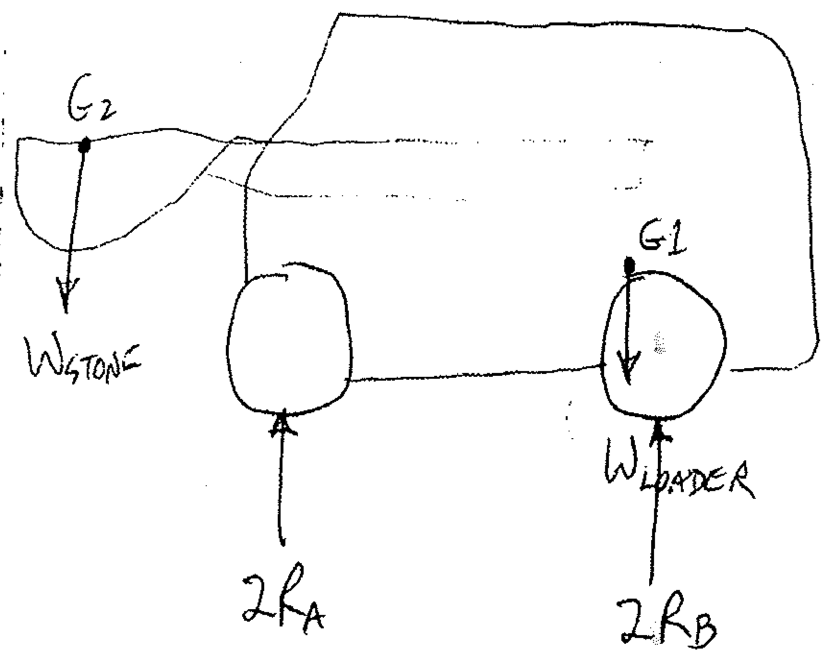
PROB. 4 a)

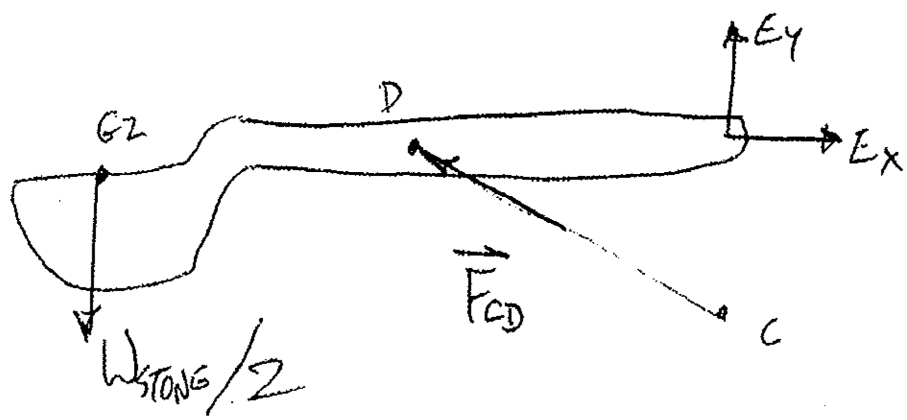


4 b)



4 c)





4 d)