4.68

$\Sigma F_x = F_B \sin 30° - F_A \cos\alpha = 0$

$\Sigma F_y = F_A \sin\alpha + F_B \cos 30° - 6000\,lb = 0$

$\Sigma M_B = -F_A \sin\alpha \cdot 60ft + 40ft \cdot 6000lb = 0$

$F_A = \frac{F_B \sin 30°}{\cos\alpha}$ $\qquad F_B \sin 30° \tan\alpha + F_B \cos 30° = 6000\,lb$

$\Sigma M_A = 60ft\, F_B \cos 30° - 20ft \cdot 6000\,lb = 0$

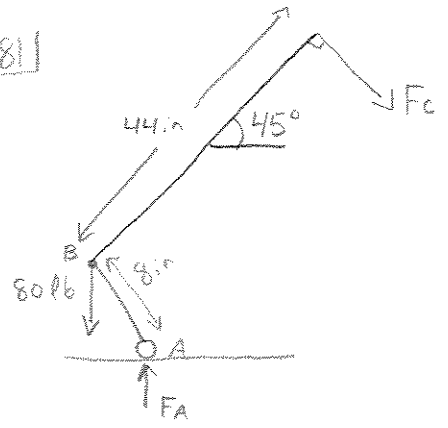
$F_B = 2310\,lb$

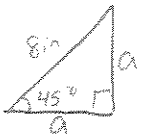
$\alpha = 73.9°$

$F_A = 4160\,lb$

MAE 206 HW 4 # 4.81

4.81





$a = 8\text{ in} \cos 45°$

$a = 5.65\text{ in}$

$\sum F_Y = -80\text{ lb} + F_{AY} - F_C \sin 45° = 0$ $\quad F_{AY} = 80\text{ lb} + F_C \sin 45°$

$\sum F_X = F_C \cos 45° - F_{AX} = 0$ $\quad F_{AX} = F_C \cos 45°$

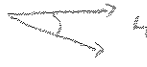
$\sum M_B = -F_C \cdot 44\text{in} + F_{AY} \cdot a - F_{AX} \cdot a$

$\sum M_B = -F_C \cdot 44\text{in} + (80\text{ lb} + F_C \sin 45°)a - (F_C \cos 45°)a = 0$

$F_C = 10.3\text{ lb}$ $\quad |F_A| = \sqrt{(87.3\text{ lb})^2 + (7.28\text{ lb})^2}$

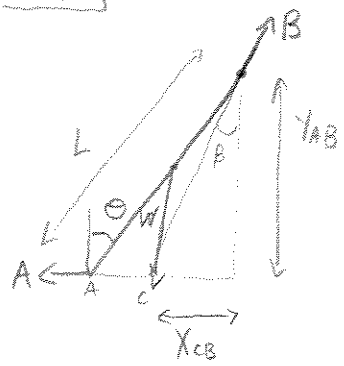
$F_{AX} = 7.28\text{ lb}$ $\quad \theta_A = \tan^{-1}\left(\frac{87.3}{7.28}\right)$

$F_{AZ} = 87.3\text{ lb}$

$F_C = 10.3\text{ lb}$ $\quad$  $\quad 45°$

$F_A = 87.6\text{ lb}$ $\quad$  $\quad 85.2°$

4.90]



$$\tan\beta = \frac{X_{CB}}{Y_{AB}}$$

$$Y_{AB} = L\cos\theta$$

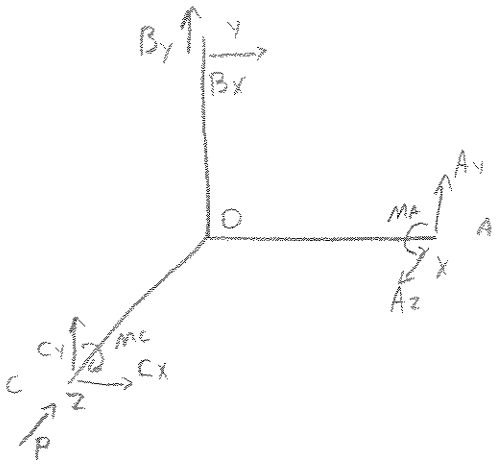
$$X_{CB} = \frac{1}{2}L\sin\theta$$

$$\tan\beta = \frac{\frac{1}{2}L\sin\theta}{L\cos\theta}$$

$$\boxed{2\tan\beta = \tan\theta}$$

MAE 206 HW 4 # 4.137

4.137



a = 240 mm
b = 200 mm
c = 180 mm

P = 60 N
M_A = 6.3 Nm
M_C = 13 Nm

$\Sigma F_x = 0 \quad = B_x + C_x \qquad B_x = -C_x$

$\Sigma F_y = 0 \quad : \quad A_y + B_y + C_y$

$\Sigma F_z = 0 \quad : \quad A_z - P \qquad A_z = P = 60N$

$\Sigma M_O = \vec{r}_{OA} \times \vec{A} + \vec{r}_{OB} \times \vec{B} + \vec{r}_{OC} \times C + M_A \hat{\imath} - M_C \hat{k} = 0$

$a\hat{\imath} \times (A_y \hat{\jmath} + A_z \hat{k}) + b\hat{\jmath} \times (B_x \hat{\imath} + B_y \hat{\jmath}) + c\hat{k}(C_x \hat{\imath} + C_y \hat{\jmath})$

$+ M_A \hat{\imath} - M_C \hat{k} = 0$

$a A_y \hat{k} - a A_z \hat{\jmath} - b B_x \hat{k} + c C_x \hat{\jmath} - c C_y \hat{\imath} + M_A \hat{\imath} - M_C \hat{k} = 0$

equating coefficients of the unit vectors:

$\hat{\imath}: \quad -c C_y + M_A = 0 \qquad C_y = \frac{M_A}{c} = 35.0N$

$\hat{\jmath}: \quad -a A_z + c C_x = 0 \qquad C_y = \frac{a A_z}{c} = 80.0N$

$\hat{k}: \quad a A_y - b B_x - M_C = 0 \qquad A_y = +\frac{b}{a} B_x + \frac{M_C}{A} = -12.5N$

$B_x = -C_x = -80N$

$B_y = -A_y - C_y = -22.5N$

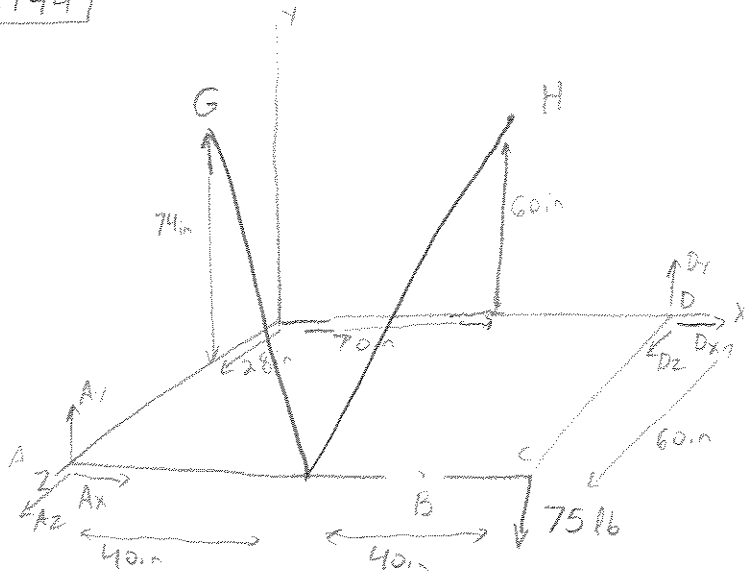
$\vec{A} = -12.5N\,\hat{\jmath} + 60.0N\,\hat{k}$

$\vec{B} = -80.0N\,\hat{\imath} - 22.5N\,\hat{\jmath}$

$\vec{C} = 80.0N\,\hat{\imath} + 35.0N\,\hat{\jmath}$

MAE 206 | HW 4 | # 4.144

4.144]



$\overrightarrow{BH} = 30\hat{\imath} + 60\hat{\jmath} - 60\hat{k}$ $\quad |BH| = 90$ in

$\overrightarrow{T_{BH}} = T\left(\frac{1}{3}\hat{\imath} + \frac{2}{3}\hat{\jmath} - \frac{2}{3}\hat{k}\right)$

$\overrightarrow{BG} = -40\hat{\imath} + 74\hat{\jmath} - 32\hat{k}$ $\quad |BG| = 90$ in

$\overrightarrow{T_{BG}} = T\left(-\frac{40}{90}\hat{\imath} + \frac{74}{90}\hat{\jmath} - \frac{32}{90}\hat{k}\right)$

$\Sigma F_x: \; A_x + D_x + T_{BHx} + T_{BGx} = 0$

$\Sigma F_y: \; A_y + D_y + T_{BHy} + T_{BGy} = 0$

$\Sigma M_x|_A: \; D_y = 0 \qquad D_y = 0$

$\Sigma M_y|_A: \; -D_z \cdot 80\text{in} - D_x \cdot 60\text{in} - T_{BHz} \cdot 40\text{in} - T_{BGz} \cdot 40\text{in} = 0$

$\Sigma M_z|_A: \; D_y \cdot 80\text{in} - 75 \cdot 80\text{in} + T_{BHy} \cdot 40\text{in} + T_{BGy} \cdot 40\text{in} = 0$

$T\left(\frac{2}{3} \cdot 40\text{in} + \frac{74}{90} \cdot 40\text{in}\right)$

$T = 101$ lb