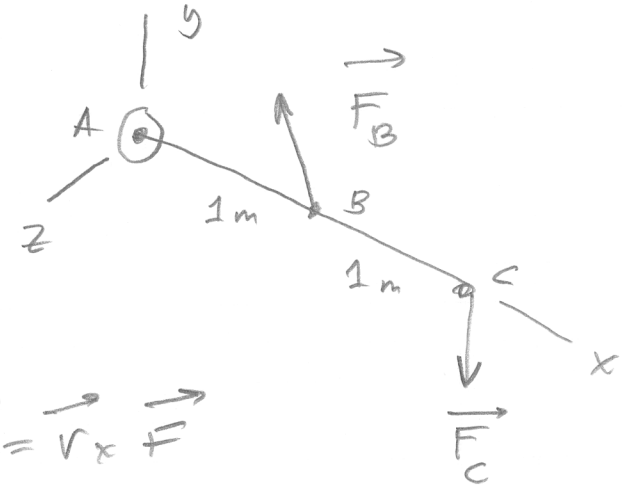
5.77 B&F 4th

G: $\vec{F}_B = 2\hat{i} + 6\hat{j} + 3\hat{k}$ (kN)

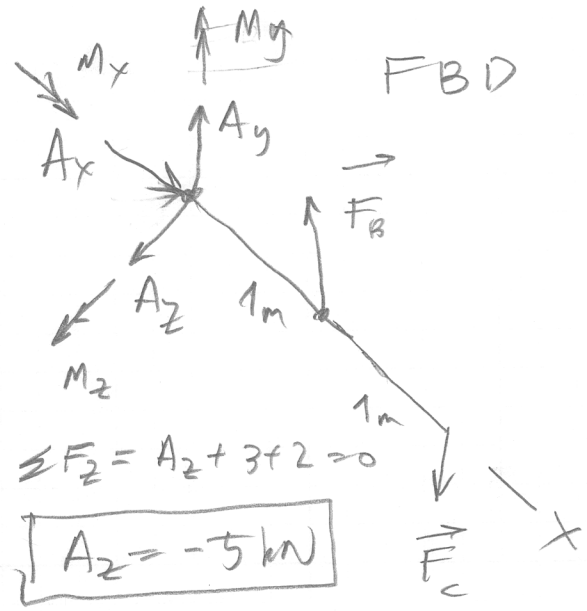
$\vec{F}_c = \hat{i} - 2\hat{j} + 2\hat{k}$ (kN)



F: (a) FBD

(b) Reactions @ A

R: $\Sigma\vec{F} = \vec{0}$, $\Sigma\vec{M} = \vec{0}$, $\vec{M} = \vec{r} \times \vec{F}$



$\Sigma F_x = A_x + 2 + 1 = 0$

$\boxed{A_x = -3 \text{ kN}}$

$\Sigma F_y = A_y + 6 - 2 = 0$

$\boxed{A_y = -4 \text{ kN}}$

$\Sigma F_z = A_z + 3 + 2 = 0$

$\boxed{A_z = -5 \text{ kN}}$

$$\Sigma \vec{M}_A = M_x\hat{i} + M_y\hat{j} + M_z\hat{k} + \vec{r}_{AB} \times \vec{F}_B + \vec{r}_{AC} \times \vec{F}_c$$

$\vec{r}_{AB} = \hat{i}$ $\quad \vec{r}_{AC} = 2\hat{i}$

$$\vec{r}_{AB} \times \vec{F}_B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 0 & 0 \\ 2 & 6 & 3 \end{vmatrix} = 0\hat{i} - 3\hat{j} + 6\hat{k}$$

$$\vec{r}_{AC} \times \vec{F}_C = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 0 & 0 \\ 1 & -2 & 2 \end{vmatrix} = 0\hat{i} - 4\hat{j} - 4\hat{k}$$

Then

$$\Sigma \vec{M}_A = M_x\hat{i} + M_y\hat{j} + M_z\hat{k} - 3\hat{j} + 6\hat{k} - 4\hat{j} - 4\hat{k} = 0$$

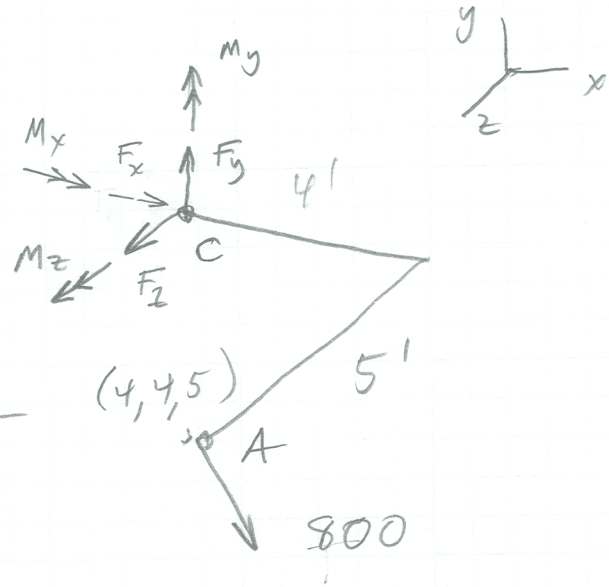
$$\boxed{M_x = 0 \quad M_y = 7 \quad M_z = -2 \text{ kN-m}}$$

G: T = 800 lb

F: Reactions @ Wall

Rel: $\sum \vec{F} = \vec{0}$, $\sum \vec{M} = \vec{0}$

$\vec{M} = \vec{r} \times \vec{F}$



Cable Tension

$$\vec{M}_c^T = \vec{r}_{CA} \times \vec{T}$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 0 & 5 \\ 350 & -698 & -175 \end{vmatrix}$$

$$= \quad$$

$$\sum \vec{M}_A = \vec{M}_R + \vec{M}_c^T = 0$$

$$\Rightarrow \boxed{\begin{aligned} M_x &= -3490 \text{ ft}\cdot\text{lb} \\ M_y &= -2450 \text{ ft}\cdot\text{lb} \\ M_z &= 2792 \text{ ft}\cdot\text{lb} \end{aligned}}$$

$$\vec{r}_{CA} = 4\hat{i} + 5\hat{k}$$

$$\vec{r}_{AB} = 2\hat{i} - 4\hat{j} - \hat{k}$$

$$r_{AB} = 4.58$$

$$\hat{e}_{AB} = 0.437\hat{i} - 0.873\hat{j} - 0.218\hat{k}$$

$$\vec{T} = 350\hat{i} - 698\hat{j} - 175\hat{k}$$

$$\sum F_x = F_x + 350 = 0$$

$$\sum F_y = F_y - 698 = 0$$

$$\sum F_z = F_z - 175 = 0$$

$$\boxed{F_x = -350 \text{ lb} \quad F_y = 698 \text{ lb} \quad F_z = 175 \text{ lb}}$$