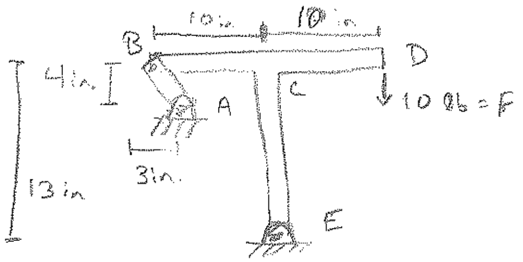
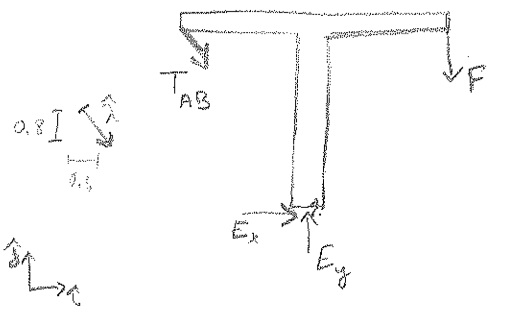
5.4.10





$$\sum M_{/E} = \vec{r}_{ED} \times (-F\hat{j}) + \vec{r}_{EB} \times T_{AB}\hat{\lambda} = 0$$

$$= (10\,in)(-10\,lb)\hat{k} + 10\,in\left(\tfrac{4}{5}\right)T_{AB}\hat{k}$$

$$+ 13\,in\left(\tfrac{3}{5}\right)T_{AB}(-\hat{k}) = 0$$

$$T_{AB} = 500\,lb.$$

a) Reaction force at A: $\bar{R}_A = T_{AB}\hat{\lambda}$

$$500\,lb\left(\tfrac{3}{5}\hat{i} - \tfrac{4}{5}\hat{j}\right)$$

$$= \boxed{100\,lb\,(3\hat{i} - 4\hat{j})}$$

b) $\sum F = -F\hat{j} + T_{AB}\hat{\lambda} + E_x\hat{i} + E_y\hat{j}$

$$= -10\,lb\,\hat{j} + 100\,lb\,(3\hat{i} - 4\hat{j}) + E_x\hat{i} + E_y\hat{j}$$

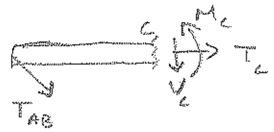
$$E_x = -300\,lb$$

$$E_y = 410\,lb$$

Reaction force at E:

$$\boxed{-300\,lb\,\hat{i} + 410\,lb\,\hat{j}}$$

c)

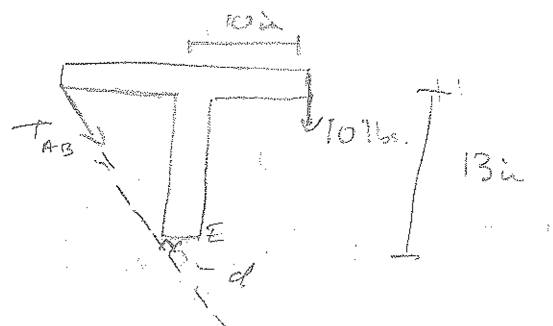


$$\Sigma M_{/c} = M_c \hat{k} + (10 \text{ in})(-\hat{\imath}) \times T_{AB} \hat{\lambda} = 0$$

$$M_c \hat{k} + 10 \text{ in} (-\hat{\imath}) \times 100 \text{ lb} (.3\hat{\imath} - .4\hat{\jmath}) = 0$$

$$\boxed{M_c = -4000 \text{ in-lb}}$$

d) Forces are amplified due to the associated moment arms.



The trajectory of $\vec{T}_{AB}$ from point B passes just below point E. The effective distance from point E, the perpendicular distance d, is much smaller than the lever arm of the applied force, 10 in. Thus, the force has to be much greater than 10 lbs. in order to balance moments.

$$d \ll 10 \text{ in} \Rightarrow T_{AB} \gg 10 \text{ lbs}$$

$$\Sigma M_{/E} = 0 \Rightarrow d\, T_{AB} = (10 \text{ in})(10 \text{ lbs}) \; \hat{k}$$