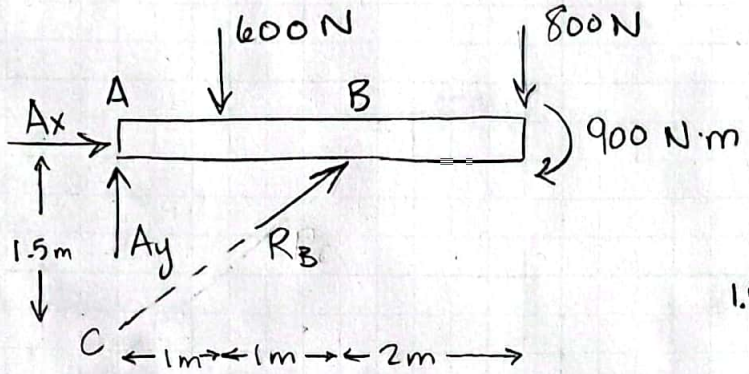
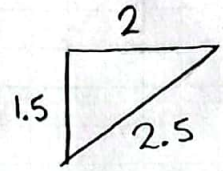
First Problem

FBD:





$$\circlearrowleft_A \quad \Sigma M = \emptyset = -(600\,N)(1\,m) - (800\,N)(4\,m) - 900\,N\cdot m + \frac{1.5}{2.5} R_B (2\,m)$$

$$\Rightarrow \frac{3}{2.5} R_B = 4.7\,kN \Rightarrow \boxed{R_B = 3.9\,kN}$$

$$\circlearrowleft_B \quad \Sigma M = \emptyset = (600\,N)(1\,m) - A_y(2\,m) - (800\,N)(2\,m) - 900\,N\cdot m$$

$$\Rightarrow \boxed{A_y = -.95\,kN}$$

$$\Sigma F_x = \emptyset = A_x + \frac{2}{2.5} R_B \Rightarrow A_x = -\frac{2}{2.5}(3.9\,kN)$$

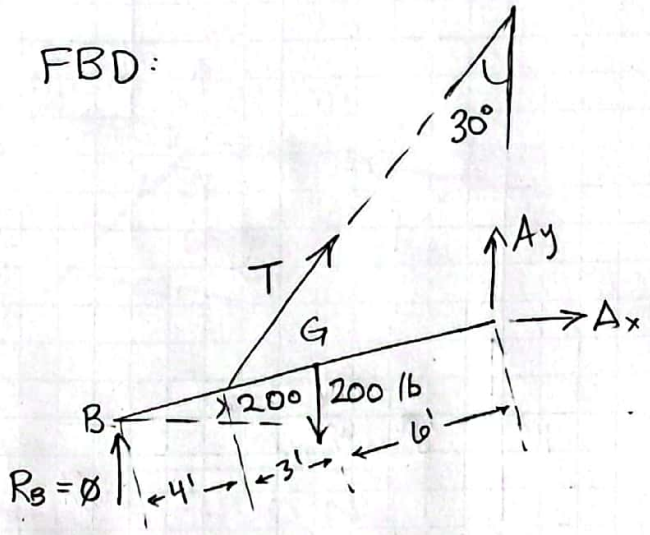
$$\Rightarrow \boxed{A_x = -3.1\,kN}$$

Second Problem

Find T when $R_B = \emptyset$

And reactions at pin A

FBD:



$$\circlearrowleft_A \quad \Sigma M = \emptyset = 200\,\text{lb}\,(6\,\text{ft}\cos 20^\circ) - (T\cos 30^\circ)(9\,\text{ft}\cos 20^\circ) + (T\sin 30^\circ)(9\,\text{ft}\sin 20^\circ)$$

$$\Rightarrow T(\cos 30^\circ \cos 20^\circ - \sin 30^\circ \sin 20^\circ) = (200\,\text{lb})\frac{2}{3}\cos 20^\circ$$

$$\Rightarrow T = \frac{400\,\text{lb}\cos 20^\circ}{3(\cos 30^\circ \cos 20^\circ - \sin 30^\circ \sin 20^\circ)}$$

$$\Rightarrow \boxed{T = 195\,\text{lb}}$$

$$\Sigma F_x = \emptyset = A_x + T\sin 30^\circ$$

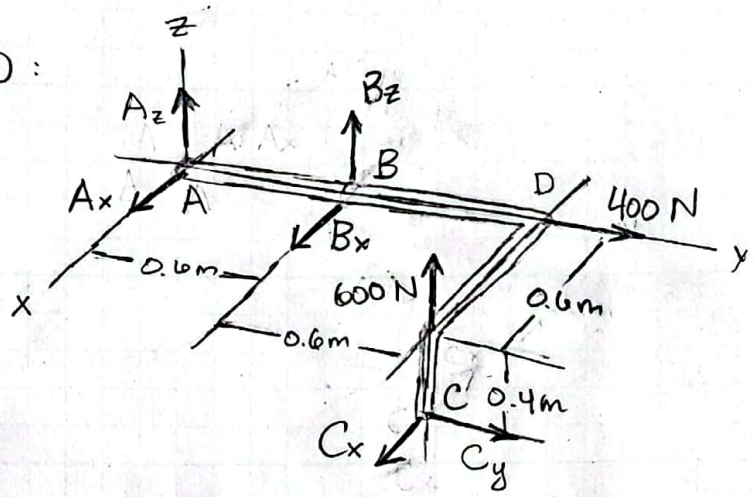
$$\Rightarrow \boxed{A_x = -97.5\,\text{lb}}$$

$$\Sigma F_y = \emptyset = A_y + T\cos 30^\circ - 200\,\text{lb} \Rightarrow \boxed{A_y = 31.2\,\text{lb}}$$

10/28/21 | SI Statics Worksheet #8 | Solution

Third Problem

FBD:



$\Sigma F_y = \emptyset = C_y + 400\ N \Rightarrow \boxed{C_y = -400\ N}$

$\overset{\text{y-axis}}{\Sigma M} = \emptyset = -600lb(0.6m) + C_x(0.4m) \Rightarrow \boxed{C_x = -900\ N}$

$\overset{\text{x-axis}}{\Sigma M} = \emptyset = B_z(0.6m) + 600\ N(1.2m) + C_y(0.4m)$

$\Rightarrow \boxed{B_z = -933\ N}$

$\Sigma F_z = \emptyset = A_z + B_z + 600\ N \Rightarrow \boxed{A_z = 333\ N}$

$\overset{\text{z-axis}}{\Sigma M} = \emptyset = -B_x(0.6m) + C_y(0.6m) - C_x(1.2m)$

$\Rightarrow \boxed{B_x = 1400\ N}$

$\Sigma F_x = \emptyset = A_x + B_x + C_x \Rightarrow \boxed{A_x = -500\ N}$

Fourth Problem Alternate Solution

$F_{EC} = F_{ED} = 800\ lb$

$r_{EC} = r_{ED} = \sqrt{4^2 + 8^2 + 4^2}\ ft$

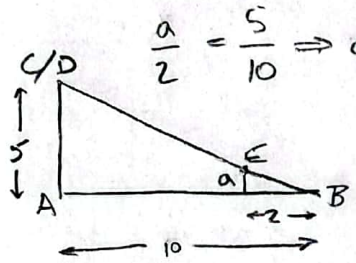
$= 9.798\ ft$

$\hat{e}_{EC} = \frac{\bar{r}_{EC}}{r_{EC}} = \frac{-4\hat{i} - 8\hat{j} + 4\hat{k}\ ft}{9.798\ ft}$

$\hat{e}_{ED} = \frac{\bar{r}_{ED}}{r_{ED}} = \frac{4\hat{i} - 8\hat{j} + 4\hat{k}\ ft}{9.798\ ft}$

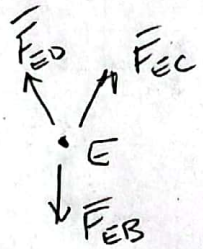
$r_{EB} = \sqrt{0^2 + 2^2 + 1^2}\ ft = 2.236\ ft$

$\hat{e}_{EB} = \frac{0\hat{i} + 2\hat{j} - \hat{k}\ ft}{2.236\ ft}$



$\frac{a}{2} = \frac{5}{10} \Rightarrow a = 1$ similar triangles

FBD



Equilibrium: $\bar{F}_{EC} + \bar{F}_{ED} + \bar{F}_{EB} = 0$

$\hat{x}$: ~~$800lb\left(\frac{4}{9.798}\right) + 800lb\left(\frac{-4}{9.798}\right)$~~ $+ F_{EB}\left(\frac{0}{2.236}\right) = 0$ trivial

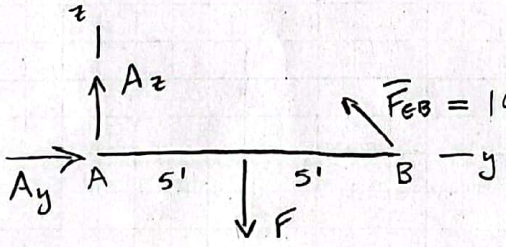
$\hat{y}$: $800lb\left(\frac{-8}{9.798}\right) + 800lb\left(\frac{-8}{9.798}\right) + F_{EB}\left(\frac{2}{2.236}\right) = 0$

$\Rightarrow F_{EB} = 1460.5\ lb$

check $\hat{z}$: $800lb\left(\frac{4}{9.798}\right) + 800lb\left(\frac{4}{9.798}\right) + F_{EB}\left(\frac{-1}{2.236}\right) = 0$

$\Rightarrow F_{EB} = 1460.5\ lb$ ✓

FBD yz-plane



by inspection $\boxed{A_x = 0}$

$\circlearrowleft_A \sum M = 0 = -F(5\ ft) + 1460.5\ lb\left(\frac{1}{2.236}\right)(10\ ft)$

$\Rightarrow \boxed{F = 1.3\ kips}$

$\sum F_z = 0 = -F + A_z + 1460.5\ lb\left(\frac{1}{2.236}\right) \Rightarrow \boxed{A_z = 0.65\ kips}$

$\sum F_y = 0 = A_y - 1460.5\ lb\left(\frac{2}{2.236}\right) \Rightarrow \boxed{A_y = 1.3\ kips}$