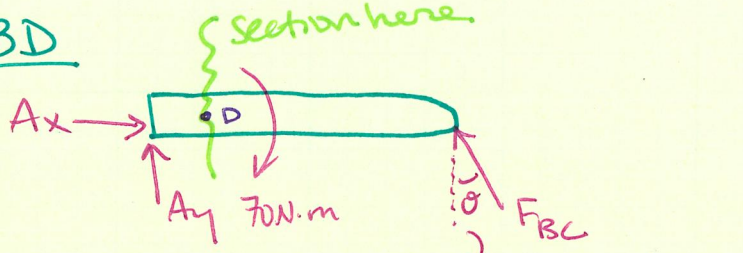
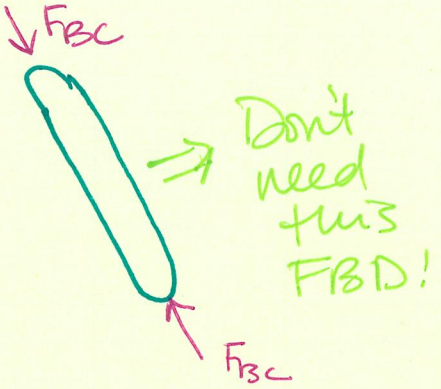
Homework #1

#1 Find external forces first!

FBD



$\theta = \tan^{-1}\left(\frac{150}{200}\right) = 36.87°$



Don't need this FBD!

$\rightarrow \Sigma F_x: \; A_x - F_{BC}\sin 36.87° = 0$

$\Rightarrow A_x = 131.25N$

$+\uparrow \Sigma F_y: \; A_y + F_{BC}\cos 36.87° = 0$

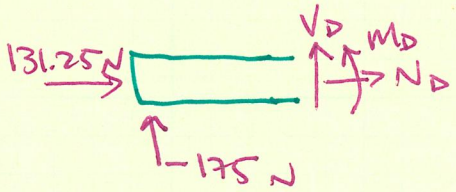
$\Rightarrow A_y = -175N$

$\curvearrowleft + \Sigma M_A: \; -70 + F_{BC}\cos 36.87°(0.4m) = 0$

(convert from mm to m)

$\Rightarrow F_{BC} = 218.75N$

look at section on left



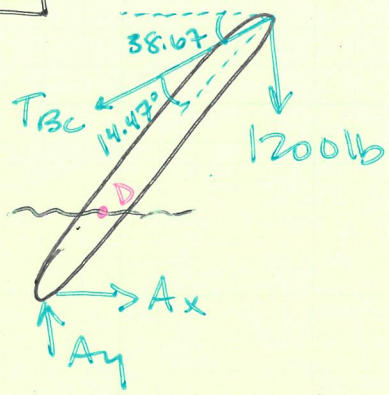
$\rightarrow \Sigma F_x: \; 131.25 + N_D = 0 \Rightarrow \boxed{N_D = -131.25N}$

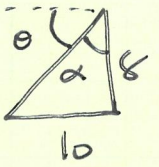
$+\uparrow \Sigma F_y: \; -175 + V_D = 0 \Rightarrow \boxed{V_D = 175N}$

$\curvearrowleft + \Sigma M_D: \; -(175)(.05) + M_D = 0 \quad \boxed{M_D = -8.75N\cdot m}$

Homework #1

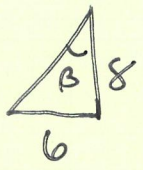
#2





$\alpha = \tan^{-1}\left(\frac{10}{8}\right) = 51.34°$

$\theta = 90° - 51.34° = 38.67°$



$\beta = \tan^{-1}\left(\frac{6}{8}\right) = 36.87°$

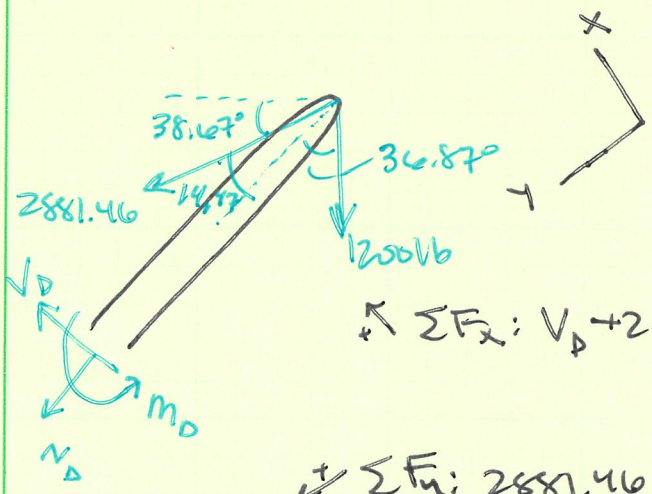
$51.34 - 36.87 = 14.47°$

$\Sigma F_x: -T_{BC}\cos 38.67 + A_x = 0$

$\Sigma F_y: -T_{BC}\sin 38.67 - 1200 + A_y = 0$

$\Sigma M_A: T_{BC}\sin 14.47(10) - 1200(6) = 0 \Rightarrow T_{BC} = 2881.46\,lb$

Section at D: Use top section → don't need A_x & A_y



$\nearrow \Sigma F_x: V_D + 2881.46\sin 14.47 - 1200\sin 36.87 = 0$

$V_D = 0\,lb$

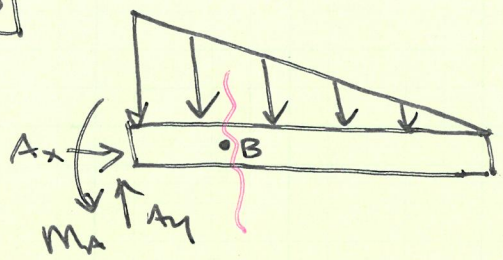
$\swarrow \Sigma F_y: 2881.46\cos 14.47 + 1200\cos 36.87 + N_D = 0$

$N_D = -3750.05\,lb$

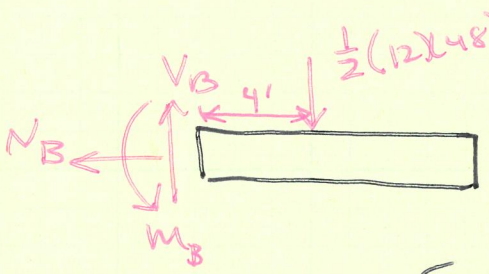
$\curvearrowleft \Sigma M_D: M_D + 2881.46\sin 14.47(10) - 1200\sin 36.87(10) = 0$

$M_D = 0\,lb\cdot ft$

#3



Notice if you use the right section you don't need the forces/moment at A.

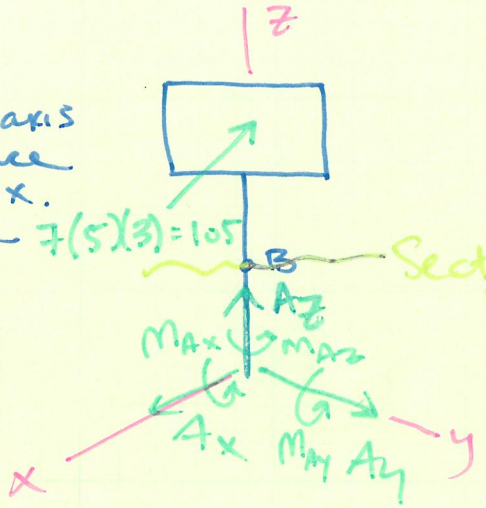


$\stackrel{+}{\rightarrow}\sum F_x: -N_B = 0 \rightarrow N_B = 0$

$+\uparrow\sum F_y: V_B - 288 = 0 \quad V_B = 288$ lb

$\curvearrowleft + \sum M_B: M_B - 288(4) = 0 \quad M_B = 1152$ lb·ft

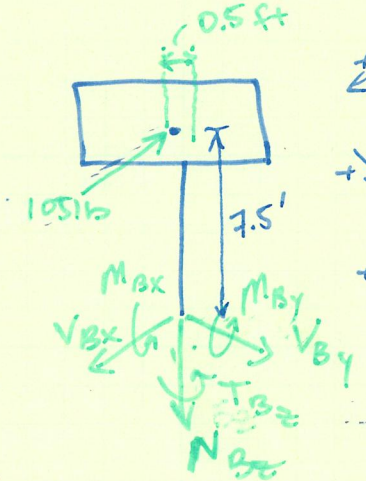
#4 | Resultant internal loadings = ?



Note: this is parallel to x axis so won't produce moment about x.

→ Notice: If we use the top section we don't need the external forces/moments at A.

internal loadings:



$\swarrow \Sigma F_x = V_{Bx} - 105 = 0 \Rightarrow \boxed{V_{Bx} = 105 \text{ lb}}$

$+\searrow \Sigma F_y : \boxed{V_{By} = 0}$

$+\uparrow \Sigma F_z : -N_{Bz} = 0 \Rightarrow \boxed{N_{Bz} = 0}$

$$\Sigma M_A = 0 : M_{Bx}\hat{i} + M_{By}\hat{j} + T_{Bz}\hat{k} + \underbrace{(-0.5\hat{j} + 7.5\hat{k}) \times -105\hat{i}}_{-52.5\hat{k} - 787.5\hat{j}} = 0$$

$\hat{i}: \boxed{M_{Bx} = 0}$

$\hat{j}: M_{By} - 787.5 = 0 \Rightarrow \boxed{M_{By} = 787.5 \text{ lb}\cdot\text{ft}}$

$\hat{k}: T_{Bz} - 52.5 = 0 \Rightarrow \boxed{T_{Bz} = 52.5 \text{ lb}\cdot\text{ft}}$