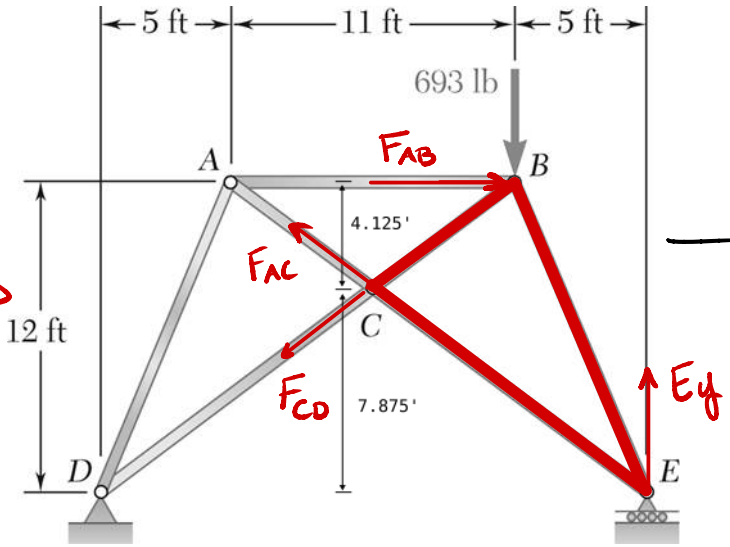
Name: _____ **Section:** _____

AEM 2011 Quiz #9
Tuesday, March 28, 2023

A non-communicating calculator is allowed. Full credit will only be given if all steps used are clearly communicated (free body diagrams, algebra, etc).

While constructing the new recreational-center building, the construction company erected a temporary platform as shown in the figure. The equipment kept on the platform at point B weighs 693 lb. The platform can be modeled as a truss.
Use the **method of sections** to determine the force in member AB. State whether the member is in tension or compression. *(Clearly indicate the cut/section and draw the FBD of the portion under analysis.)*



METHOD OF SECTIONS

→ alternative soln: solve rxn at D and select ACD as section.

reaction at E

$$\circlearrowleft + \Sigma M_D = -693\text{lb}(16\text{ft}) + E_y(21\text{ft})$$

$$\rightarrow E_y = \frac{693\text{lb}(16\text{ft})}{21\text{ft}} = 528\text{lb}$$

analyze section BCE

$$\Sigma M_C = E_y(10.5\text{ft}) - F_{AB}(4.125\text{ft}) - 693\text{lb}(5.5\text{ft})$$

$$\rightarrow F_{AB} = \frac{528\text{lb}(10.5\text{ft}) - 693\text{lb}(5.5\text{ft})}{4.125\text{ft}}$$

$$\boxed{F_{AB} = 420\text{lb C}}$$

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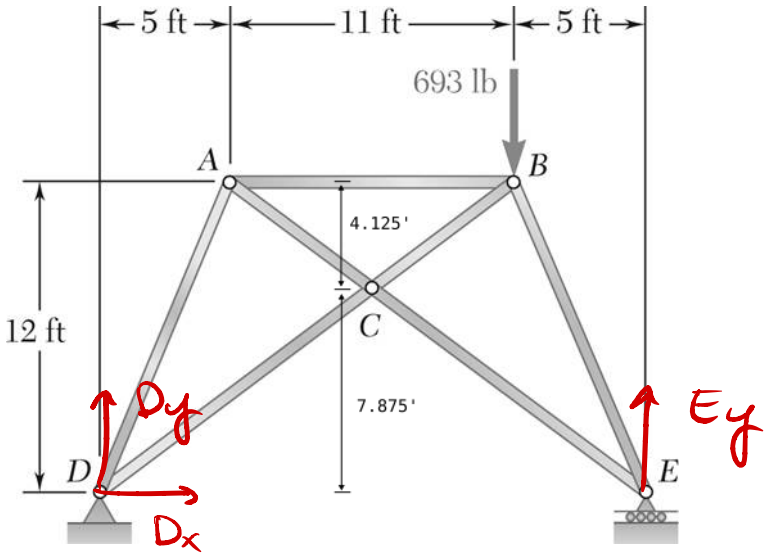
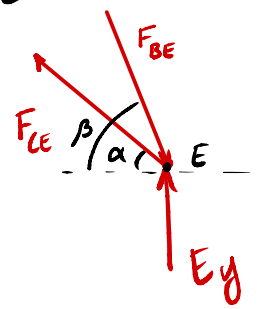


METHOD OF JOINTS

reaction at E (same as before)

$\circlearrowleft \Sigma M_D = -693\text{lb}(16\text{ft}) + E_y(21\text{ft}) \rightarrow E_y = 528\text{lb} \uparrow$

Joint E (we are guessing if F_{BE}, F_{CE} are T/C but at least know must be opposite)



$\alpha = \arctan\left(\frac{12}{16}\right) = 36.87°$

$\beta = \arctan\left(\frac{12}{5}\right) = 67.38°$

$\Sigma F_x = F_{BE}\cos\beta - F_{CE}\cos\alpha$

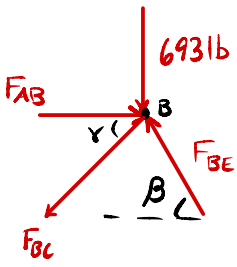
$\Sigma F_y = E_y + F_{CE}\sin\alpha - F_{BE}\sin\beta$

$\rightarrow F_{BE} = \frac{\cos\alpha}{\cos\beta}\left(\frac{F_{BE}\sin\beta - E_y}{\sin\alpha}\right) = \frac{\cos\alpha}{\cos\beta\sin\alpha}\left(F_{BE}\sin\beta - E_y\right)$

$= 3.2F_{BE} - 3.47E_y \rightarrow F_{BE} = 832.8\text{lb}\ C$

(initial guess correct)

Joint B



$\gamma = \arctan\left(\frac{12}{16}\right) = \alpha = 36.87°$

$\Sigma F_y = F_{BE}\sin\beta - 693\text{lb} - F_{BC}\sin\gamma$

$\rightarrow F_{BC} = 126.23\text{lb}\ T$

$\Sigma F_x = F_{AB} - F_{BE}\cos\beta - F_{BC}\cos\gamma$

$\rightarrow \boxed{F_{AB} = 420\text{lb}\ C}$