

PROBLEM 6-6

$P_1 = 40 \text{ kN}$ $P_2 = 20 \text{ kN}$

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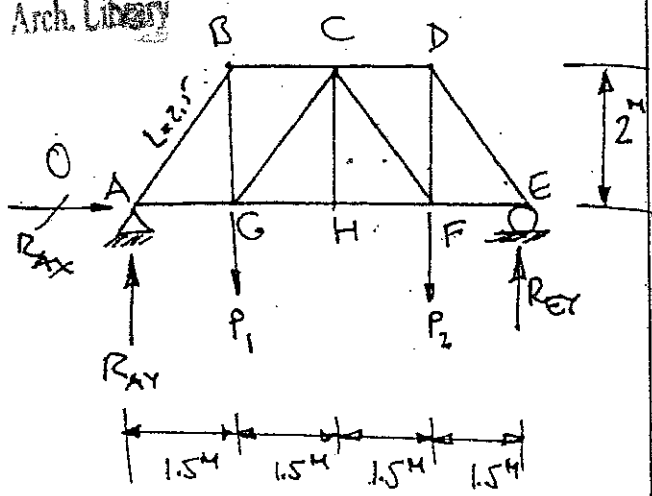
GLOBAL EQUILIBRIUM

$\sum M_A = 0, \quad 6R_{EY} = 4.5P_2 + 1.5P_1$

$R_{EY} = 25 \text{ kN} \uparrow$

$\sum F_Y = 0, \quad R_{AY} = 60 \text{ kN} - 25 \text{ kN}$

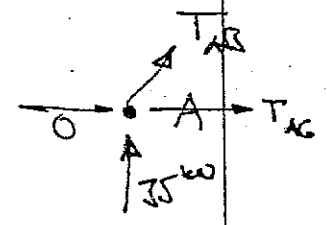
$R_{AY} = 35 \text{ kN} \uparrow$



FBD AT A: ASSUME ALL TENSION MEMBERS

$\sum F_x = 0, \quad T_{AB} \frac{1.5}{2.5} = -T_{AG} \quad \left\{ \begin{array}{l} T_{AG} = 26.25 \text{ kN (T)} \\ T_{AB} = 43.75 \text{ kN (C)} \end{array} \right.$

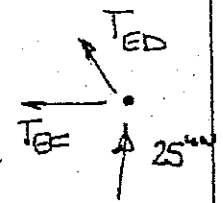
$\sum F_y = 0, \quad T_{AB} \frac{2}{2.5} = -35$



FBD AT E:

$\sum F_y = 0, \quad -T_{ED} \frac{2}{2.5} = 25 \quad T_{ED} = +31.25 \text{ kN (C)}$

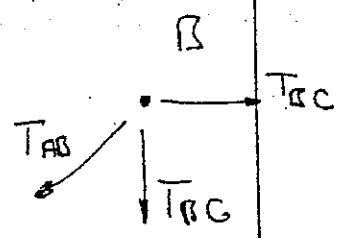
$\sum F_x = 0, \quad T_{ED} \frac{1.5}{2.5} = -T_{EF} \quad T_{EF} = 18.75 \text{ kN (T)}$



FBD AT B:

$\sum F_y = 0, \quad T_{BG} = -T_{AB} \frac{2}{2.5} = 35 \text{ kN (T)} = T_{BG}$

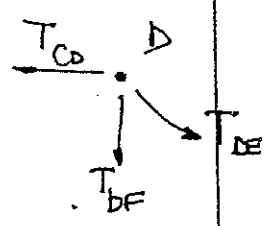
$\sum F_x = 0, \quad T_{AG} \frac{1.5}{2.5} = T_{BC} = 26.25 \text{ kN (C)}$



FBD AT D:

$\sum F_y = 0, \quad T_{DF} = -\frac{2}{2.5} T_{DE} = 25 \text{ kN (T)} = T_{DF}$

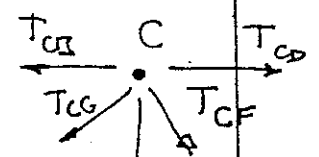
$\sum F_x = 0, \quad T_{CD} = \frac{1.5}{2.5} T_{DE} = 18.75 \text{ kN (C)} = T_{CD}$



FBD AT C: $T_{CH} = 0$ FROM $\sum F_y = 0$ w/ FBD AT H

$\sum F_y = 0, \quad T_{CG} = -T_{CF}$

$\sum F_x = 0, \quad \frac{1.5}{2.5} T_{CG} + T_{CB} = \frac{1.5}{2.5} T_{CF} + T_{CD} \quad \left\{ \begin{array}{l} \frac{3}{2.5} T_{CF} = -26.25 + 18.75 \\ T_{CF} = 6.25 \text{ kN (C)} \\ T_{CG} = 6.25 \text{ kN (T)} \end{array} \right.$



PROBLEM 6-11

$P_1 = 600 \text{ lb}$

$P_2 = \frac{800 \text{ lb}}{2}$

ASSUME ALL MEMBER FORCES ARE TENSILE

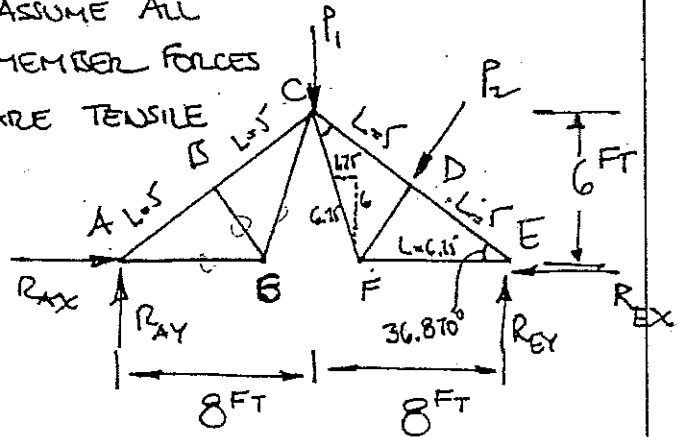
GLOBAL EQUILIBRIUM

$\sum M_C = 0, 6R_{AX} = 8R_{AY}$

$\sum M_E = 0, 16R_{AY} = 8P_1 + 5P_2$

$R_{AY} = 425 \text{ lb} \uparrow$

$R_{AX} = 567 \text{ lb} \rightarrow$



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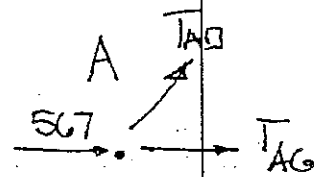
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FBD AT A:

$\sum F_y = 0, T_{AB} \cdot \frac{6}{10} = -425$

$T_{AB} = 708.3 \text{ lb (C)}$

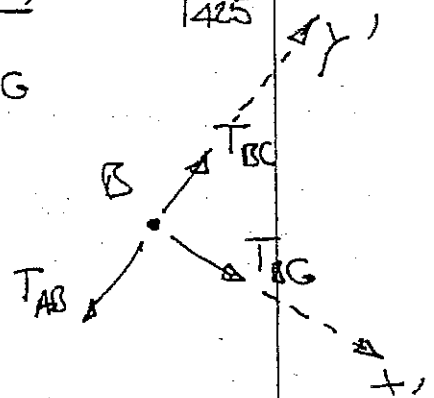
$\sum F_x = 0, \text{ NO NEED, } T_{AG} = 0 \text{ FROM FBD G}$



FBD B:

$\sum F_x' = 0, T_{BG} = 0$

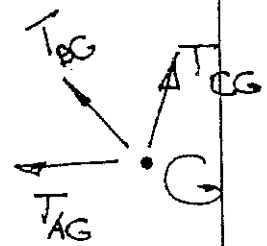
$\sum F_y' = 0, T_{BC} = T_{AB} = 708.3 \text{ lb (C)} = T_{BC}$



FBD G:

$\sum F_y = 0, T_{CG} = 0$

$\sum F_x = 0, T_{AG} = 0$



FBD AT C:

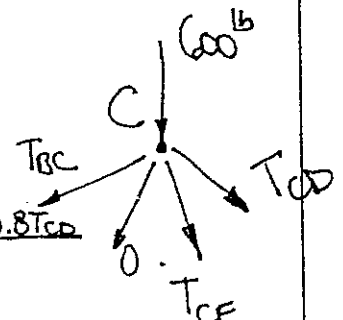
$\sum F_x = 0, T_{CF} \cdot \frac{1.75}{6.15} + T_{CD} \cdot \frac{8}{10} = T_{BC} \cdot \frac{8}{10} \Rightarrow T_{CF} = \frac{-566.67 - 0.8T_{CD}}{0.28}$ (1)

$\sum F_y = 0, T_{CF} \cdot \frac{6}{6.15} + T_{CD} \cdot \frac{6}{10} + T_{BC} \cdot \frac{6}{10} = -600$

$\frac{6}{6.15} \left(\frac{-566.67 \text{ lb} - 0.8T_{CD}}{0.28} \right) + 0.6T_{CD} - 425 = -600$

$T_{CD} = 8 \text{ lb (C)}$

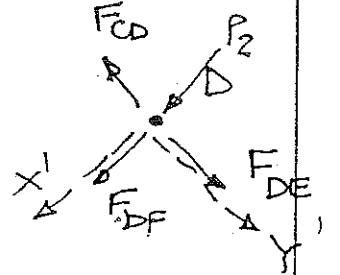
$T_{CF} = + \text{ lb (C)}$



FBD AT D:

$$\sum F_x = 0, F_{DF} = -P_2 \Rightarrow \underline{+400 \text{ lb (C)}} = F_{DF}$$

$$\sum F_y = 0, F_{CD} = F_{DE} = \underline{800 \text{ lb (C)}}$$

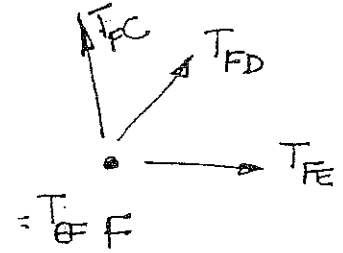


FBD AT F:

$$\sum F_x = 0, T_{FE} = \frac{1.75}{0.25} T_{FC} - T_{DF} = \frac{6}{10}$$

$$T_{FE} = 0.28 \cdot 400 + 400 \cdot \frac{6}{10} \Rightarrow 3$$

$$\underline{T_{FE} = 3 \text{ (T)}}$$



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PROBLEM # 6-22

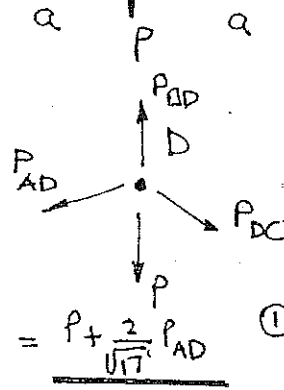
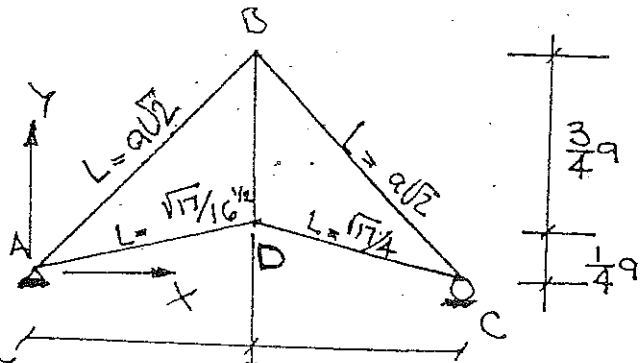
$C_{AD} = C_{DC} = 800 \text{ lb}$

$T_{AD} = T_{BD} = T_{DC} = 2000 \text{ lb}$

ASSUME TENSILE FORCES IN ALL MEMBERS. FROM SYMMETRY

$P_{AB} = P_{BC} >$

$P_{DC} = P_{AD}$



FBD AT D

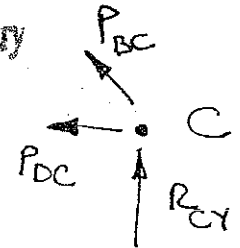
$\sum F_x = 0, P_{AD} = P_{DC}$

$\sum F_y = 0, P + 2P_{AD} \cdot \frac{\sqrt{4}}{\sqrt{17}/4} = P_{BD} = P + \frac{2}{\sqrt{17}} P_{AD}$ (1)

FBD AT C:

$\sum F_x = 0, P_{DC} \frac{1}{(\sqrt{17}/4)} = -P_{BC} \frac{\sqrt{2}}{2}$

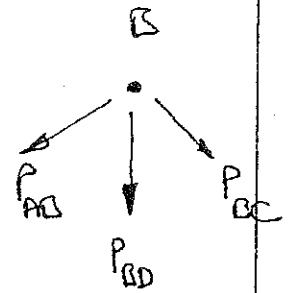
$P_{DC} = P_{AD} = -P_{BC} \frac{\sqrt{34}}{8}$ (2)



FBD AT B:

$\sum F_y = 0, 2P_{BC} \frac{\sqrt{2}}{2} = -P_{BD}$ (3)

$P_{BD} = -P_{BC} \sqrt{2}$ (3)



(1) $\rightarrow -P_{BC} \sqrt{2} = P + \frac{2}{\sqrt{17}} \left(-P_{BC} \frac{\sqrt{34}}{8} \right) = P - \frac{\sqrt{2}}{4} P_{BC}$

$P = -\frac{3\sqrt{2}}{4} P_{BC}$ (4)

$(P_{BC})_{max} = -800 \text{ lb} \rightarrow P_{max} = +\frac{3\sqrt{2}}{4} (800) \text{ lb} = 848.5 \text{ lb} = P_{max}$

(3) $\rightarrow P_{BD} = \left(\frac{4}{3\sqrt{2}} P \right) \sqrt{2} = \frac{4}{3} P \rightarrow P_{BD} = \frac{4}{3} P, P = \frac{3}{4} P_{BD}$ (5)

$(P_{BD})_{max} = 2000 \text{ lb} \rightarrow P_{max} = \frac{3}{4} \times 2000 = 1500 \text{ lb} = P_{max}$

(2) $\rightarrow P_{DC} = \left(\frac{4}{3\sqrt{2}} P \right) \frac{\sqrt{34}}{8} \rightarrow P = \frac{6}{\sqrt{17}} P_{DC}, P_{max} = \frac{6}{\sqrt{17}} \times 2000 = 2910 \text{ lb}$ (6)

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CONTROLS

PROBLEM # 6-26

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$P_1 = 800 \text{ lb}$

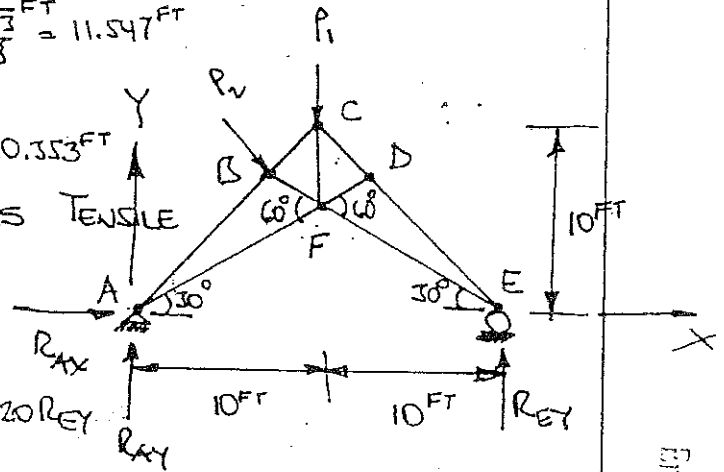
$P_2 = 600 \text{ lb}$

$AF \frac{\sqrt{2}}{2} = 10 \Rightarrow AF = 20 \frac{\sqrt{2}}{2} = 14.142 \text{ FT}$

$AC = 10\sqrt{2} = 14.142 \text{ FT}$

$\frac{AB}{\sin 30} = \frac{20}{\sin 105} \Rightarrow AB = 10.353 \text{ FT}$

ASSUME FORCE IN ALL MEMBERS TENSILE



GLOBAL EQUILIBRIUM:

$\sum M_A = 0 \rightarrow 10 \cdot 800 + 10.353 \cdot 600 = 20 R_{EY}$

$R_{EY} = \frac{14211.8}{20} = 710.6 \text{ lb}$

FBD AT E:

$\sum F_x = 0, T_{FE} \cos 30 = -T_{DE} \cos 45, T_{DE} = -1.225 T_{FE}$

$\sum F_y = 0, T_{FE} \sin 30 + T_{DE} \sin 45 = -R_{EY}$

$T_{FE} (\sin 30 + (-1.225) \sin 45) = -R_{EY}$

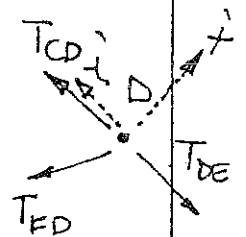
$T_{FE} = 1941.5 \text{ lb (T)}$

$T_{DE} = 2378.3 \text{ lb (C)}$

FBD AT D:

$\sum F_x = 0, T_{FD} = 0 \text{ lb}$

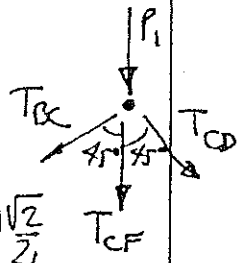
$\sum F_y = 0, T_{CD} = T_{DE} \Rightarrow T_{CD} = +2378.3 \text{ lb (C)}$



FBD AT C:

$\sum F_x = 0, T_{BC} = T_{CB} = 2378.3 \text{ lb (C)}$

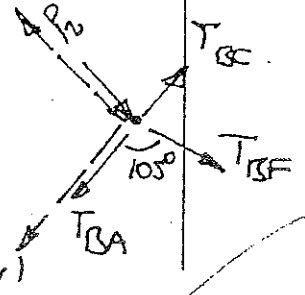
$\sum F_y = 0, T_{CF} + 2T_{BC} \frac{\sqrt{2}}{2} = -P_1 \Rightarrow T_{CF} = -800 - 2(-2378.3) \frac{\sqrt{2}}{2}$
 $T_{CF} = 2563.4 \text{ lb (T)}$



FBD AT B:

$\sum F_x = 0, T_{BF} \cos 15 = -P_2, T_{BF} = 621.2 \text{ lb (C)}$

$\sum F_y = 0, T_{BA} = T_{BC} + T_{BF} \sin 15 = 2539.1 \text{ lb (C)} = T_{AB}$



PROBLEM 6-26: CONT'D

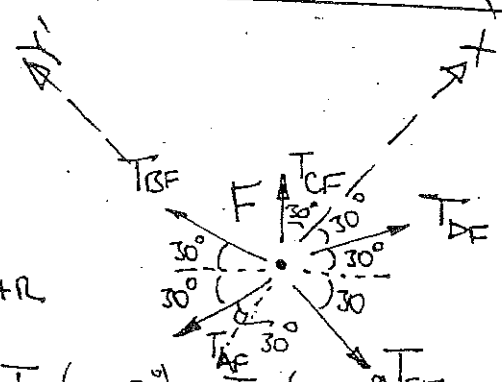
FBD AT F:

T_{BF} & T_{EF} ARE COLINEAR

$$\sum F_x = 0, T_{DF}(\cos 30^\circ) = T_{AF}(\cos 30^\circ) - T_{CF}(\cos 30^\circ) T_{EF}$$

$$T_{DF} = 0 = T_{AF} - 2563.4^{lb}$$

$$\underline{T_{AF} = 2563.4^{lb} (T)}$$



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