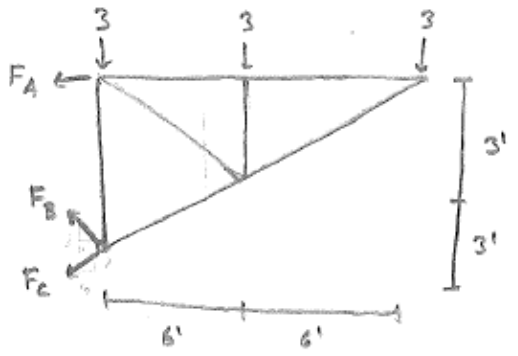
Homework 2 solutions

Problem 1:



$\pm \Sigma F_x = 0$: $-F_A - \frac{6}{\sqrt{72}} F_B - \frac{6}{\sqrt{45}} F_C = 0$

$+\uparrow \Sigma F_y = 0$: $\frac{6}{\sqrt{72}} F_B - \frac{3}{\sqrt{45}} F_C - 3 - 3 - 3 = 0$

$\circlearrowleft \Sigma M_A = 0$: $F_A(6) - 3(6) - 3(12) = 0$

$\Rightarrow$

$F_A = 9\ k$

$F_B = 4.24\ k$

$F_C = -13.42\ k$

Problem 2:

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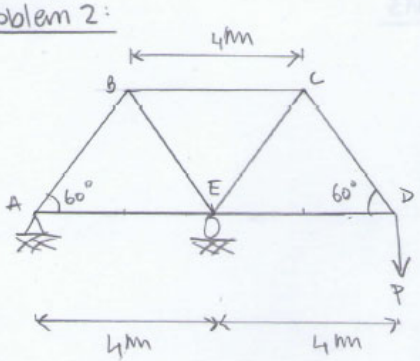


If the maximum force that any member can support is 8KN in tension and 6KN in compression, determine the maximum force P that can be supported at D.

Determine support reactions:

$+\circlearrowleft \Sigma M_A = 0$

$E_y(4m) - P(8m) = 0$

$E_y = 2P$

$+\uparrow \Sigma F_y = 0$

$E_y + A_y - P = 0$

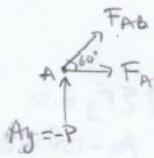
$A_y = -P$

$\pm \Sigma F_x = 0$

$A_x = 0$

Method of joints:

Joint A:



$+\uparrow \Sigma F_y = 0$

$F_{AB}\sin 60° + (-P) = 0$

$\boxed{F_{AB} = 1.1547\,P\ (T)}$

$\pm \Sigma F_x = 0$

$F_{AE} + F_{AB}\cos 60° = 0$

$\boxed{F_{AE} = -0.57735\,P\ (C)}$

Joint C:

$\pm \Sigma F_x = 0$

$-F_{BC} + F_{CD}\cos 60° - F_{CE}\cos 60° = 0$

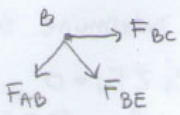
$+\uparrow \Sigma F_y = 0$

$-F_{CE}\sin 60° - F_{CD}\sin 60° = 0$

$\boxed{F_{CE} = 1.1547\,P\ (T)}$

$\boxed{F_{CD} = 1.1547\,P\ (T)}$

Joint B:



$+\uparrow \Sigma F_y = 0$

$-F_{AB}\sin 60° - F_{BE}\sin 60° = 0$

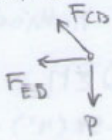
$\boxed{F_{BE} = -1.1547\,P\ (C)}$

$\pm \Sigma F_x = 0$

$F_{BC} + F_{BE}\cos 60° - F_{AB}\cos 60° = 0$

$\boxed{F_{BC} = 1.1547P\ (T)}$

Joint D:



$\pm \Sigma F_x = 0$

$-F_{CD}\cos 60° - F_{ED}\cos 60° = 0$

$\boxed{F_{ED} = 0.57735\,P}$

From the above analysis, the maximum compression and tension in the truss members is $1.1547P$.

Compression: $1.1547P = 6KN$

$P = 5.19615\,KN$

$P \approx 5.2KN$ (governs)

Tension: $1.1547P = 8KN$

$P = 6.9282\,KN$

In this case, compression controls which requires $\boxed{P = 5.2\,KN}$