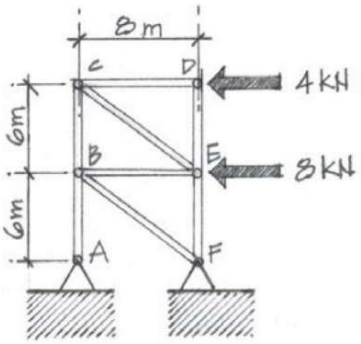
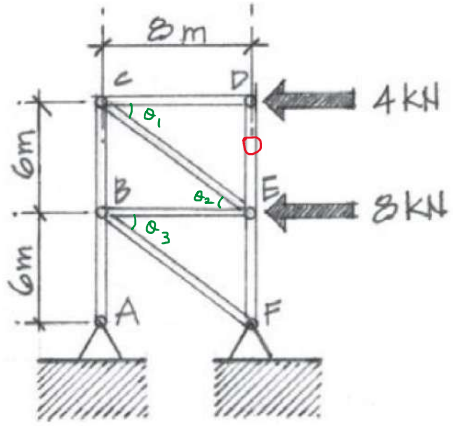
Find Truss Member Forces using Method of Joints

Using the method of joints, determine the force in each member of the truss shown in the drawings below. Summarize the results on a force summation diagram, and indicate whether each member is in tension or compression



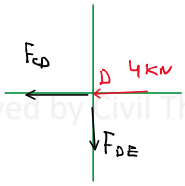


$\theta_1 = \tan^{-1}\frac{6}{8} = 36.87°$

$\theta_2 = \tan^{-1}\frac{6}{8} = 36.87°$

$\theta_3 = \tan^{-1}\frac{6}{8} = 36.87°$

Joint D :



$\overset{+}{\rightarrow}\Sigma f_x = 0$:

$-F_{CD} - 4KN = 0 \Rightarrow f_{CD} = -4KN$

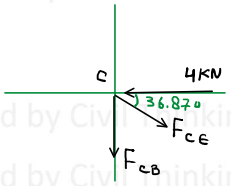
$\Rightarrow f_{CD} = 4KN\,(C)$

$+\uparrow\Sigma f_y = 0$:

$-F_{DE} = 0 \Rightarrow F_{DE} = 0$

$-F_{DE} = 0 \Rightarrow F_{DE} = 0$

Joint C :



$\xrightarrow{+} \Sigma F_x = 0$:

$-4\text{KN} + F_{CE}\cos 36.87^\circ = 0 \Rightarrow F_{CE} = 5\text{KN}$

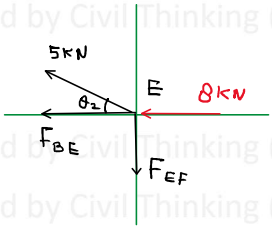
$\Rightarrow F_{CE} = 5\text{KN (T)}$

$+\uparrow \Sigma F_y = 0$:

$-F_{CB} - F_{CE}\sin 36.87^\circ = 0 \Rightarrow F_{CB} = -3\text{KN}$ (F_{CE} = 5KN)

$\Rightarrow F_{CB} = 3\text{KN (C)}$

Joint E :



$+\uparrow \Sigma F_y = 0$:

$-F_{EF} + 5\sin\theta_2 = 0 \Rightarrow F_{EF} = 3\text{ KN}$ ($\theta_2 = 36.87^\circ$)

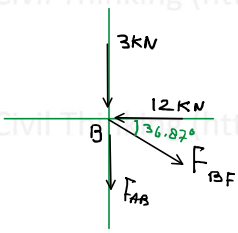
$\Rightarrow F_{EF} = 3\text{KN (T)}$

$\xrightarrow{+} \Sigma F_x = 0$:

$-F_{BE} - 5\cos\theta_2 - 8 = 0 \Rightarrow F_{BE} = -12\text{ KN}$ ($\theta_2 = 36.87^\circ$)

$\Rightarrow F_{BE} = 12\text{KN (C)}$

Joint B :



$\xrightarrow{+} \Sigma F_x = 0$:

$-12 + F_{BF}\cos 36.87^\circ = 0 \Rightarrow F_{BF} = 15\text{KN}$

$\Rightarrow F_{BF} = 15\text{KN (T)}$

$+\uparrow \Sigma F_y = 0$:

$-3 - F_{\quad}\sin 36.87^\circ = 0 \Rightarrow F_{\quad} = -12\text{K}$

F_{AB} ↓ , F_{BF} ↘

$+\uparrow \Sigma F_y = 0$:

$-3 - F_{AB} - F_{BF}\sin 36.87^\circ = 0 \Rightarrow F_{AB} = -12\,KN$

(F_{BF} = 15)

$\Rightarrow F_{AB} = 12\,KN\,(C)$

Summary :

$F_{CD} = 4\,KN\,(C)$

$F_{DE} = 0$

$F_{CE} = 5\,KN\,(T)$

$F_{CB} = 3\,KN\,(C)$

$F_{EF} = 3\,KN\,(T)$

$F_{BE} = 12\,KN\,(C)$

$F_{BF} = 15\,KN\,(T)$

$F_{AB} = 12\,KN\,(C)$