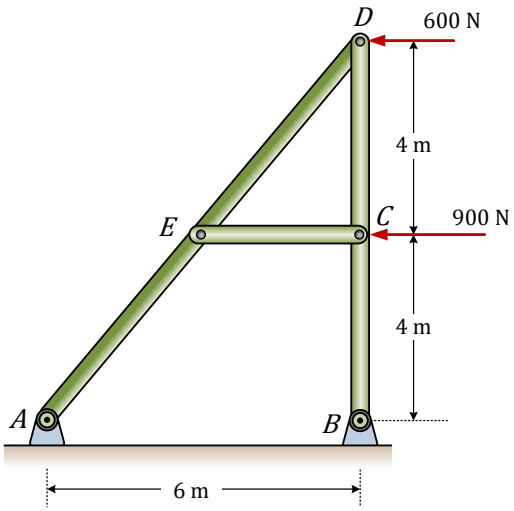
Question 3.6.

Determine the magnitude and nature of forces in each member of the loaded truss.



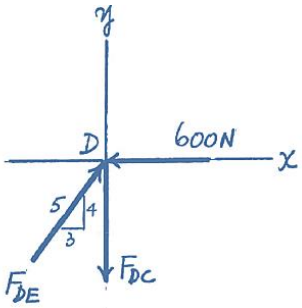
Solution

Joint D

$+\rightarrow \sum F_x = 0$

$F_{DE}\left(\frac{3}{5}\right) - 600 = 0$

$F_{DE} = 1000$ N (C) (Answer)



$+\uparrow \sum F_y = 0$

$F_{DE}\left(\frac{4}{5}\right) - F_{DC} = 0$

$(1000)\left(\frac{4}{5}\right) - F_{DC} = 0$

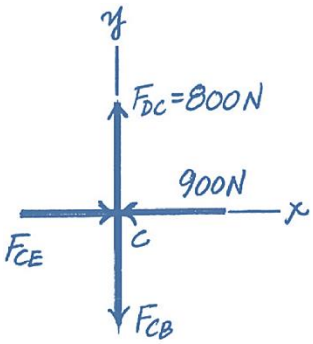
$F_{DC} = 800$ N (T) (Answer)

Joint C

$+\rightarrow \sum F_x = 0$

$F_{CE} - 900 = 0$

$F_{CE} = 900$ N (C) (Answer)



$+\uparrow \sum F_y = 0$

$F_{DC} - F_{cB} = 0$

$800 - F_{CB} = 0$

$F_{CB} = 800$ N (T) (Answer)

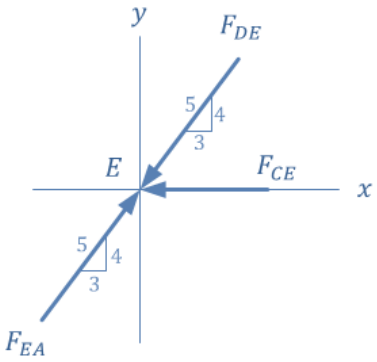
Joint E

$+\uparrow \sum F_y = 0$

$F_{EA}\left(\frac{4}{5}\right) - F_{DE}\left(\frac{4}{5}\right) = 0$

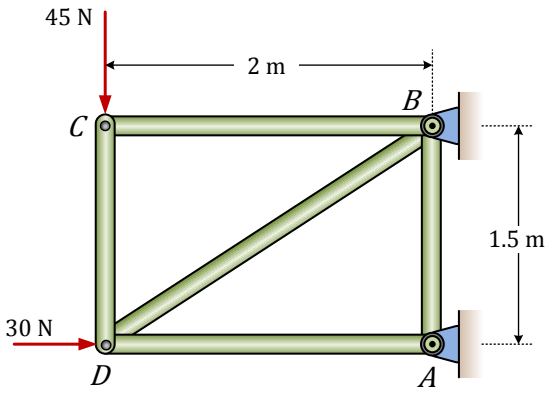
$F_{EA}\left(\frac{4}{5}\right) - 1000\left(\frac{4}{5}\right) = 0$

$F_{EA} = 1000$ N (C) (Answer)



Question 3.7.

Determine the force in each member of the truss and state if the members are in tension or compression.

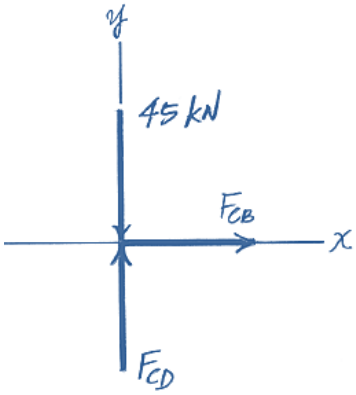


Solution

Joint C

$+\rightarrow \sum F_x = 0$

$F_{BC} = 0$ (Answer)



$+\uparrow \sum F_y = 0$

$F_{CD} - 45 = 0$

$F_{CD} = 45 \text{ N (C)}$ (Answer)

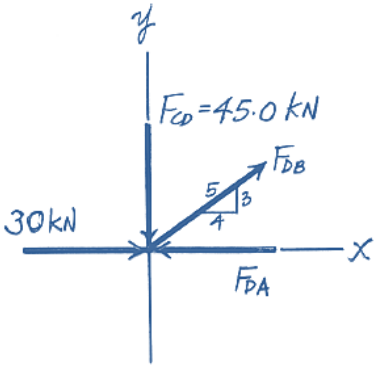
Joint D

$+\uparrow \sum F_y = 0$

$F_{DB}\left(\frac{3}{5}\right) - F_{CD} = 0$

$F_{DB}\left(\frac{3}{5}\right) - 45 = 0$

$F_{DB} = 75 \text{ N (T)}$ (Answer)



$+\rightarrow \sum F_x = 0$

$F_{DB}\left(\frac{4}{5}\right) - F_{DA} + 30 = 0$

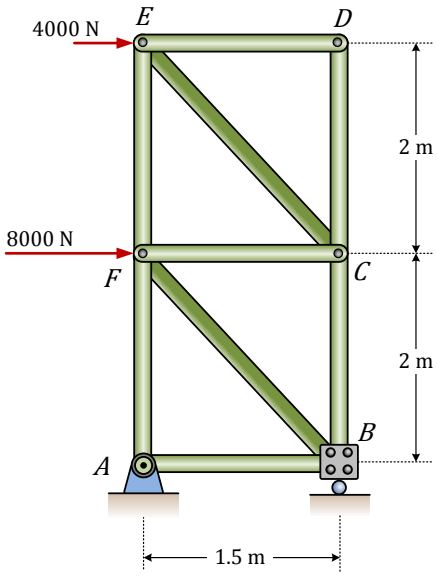
$75\left(\frac{4}{5}\right) - F_{DA} + 30 = 0$

$F_{DA} = 90 \text{ N (C)}$ (Answer)

Note: Assume AB to be a zero-force member else the system is statically indeterminate.

Question 3.8.

Determine the magnitude and nature of force in members AF, BF, and BC.



Solution

Support Reactions. Not required.

Method of Sections: Referring to the FBD of the upper portion of the truss section through a–a shown, FAF and FBC can be determined directly by writing the moment equations of equilibrium about points B and F, respectively.

$+\circlearrowleft \sum M_B = 0$

$F_{AF}(1.5) - 8(2) - 4(4) = 0$

$F_{AF} = 21.3 \text{ kN (T)}$ (Answer)

$+\circlearrowleft \sum M_F = 0$

$F_{BC}(1.5) - 4(2) = 0$

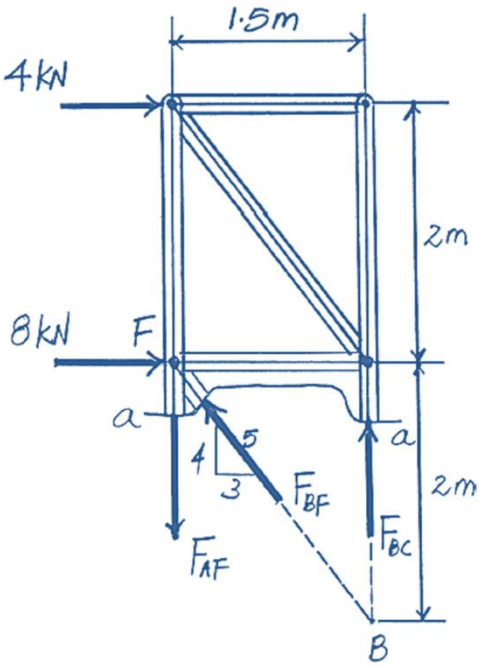
$F_{AF} = 5.33 \text{ kN (C)}$ (Answer)

Also, write the force equation of equilibrium along the x axis, we can obtain F_{BF} directly.

$+\rightarrow \sum F_x = 0$

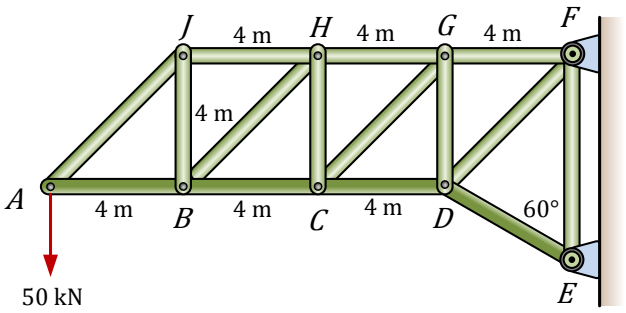
$4 + 8 - F_{BF}\left(\frac{3}{5}\right) = 0$

$F_{BF} = 20 \text{ kN (C)}$ (Answer)



Question 3.9.

Determine the force in members GH and CG, for the truss shown and also state if the members are in tension and compression. Does the statical indeterminacy of the supports affect your calculation?



Solution

Considering the FBD

$+\uparrow \sum F_y = 0$

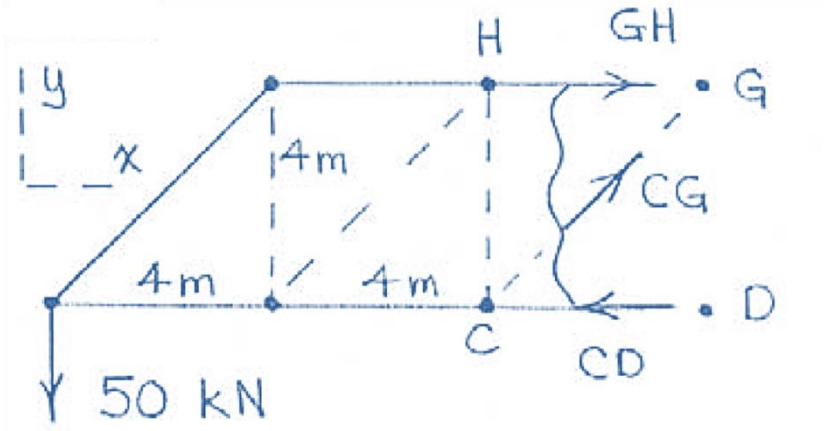
$F_{CG} \sin 45° - 50 = 0$

$F_{CG} = 70.7$ kN (T) (Answer)

$+\circlearrowleft \sum M_C = 0$

$50(8) - F_{GH}(4) = 0$

$F_{GH} = 100$ kN (T) (Answer)



All, member except EF are statically determinate so the above solution is unaffected by the redundant support.