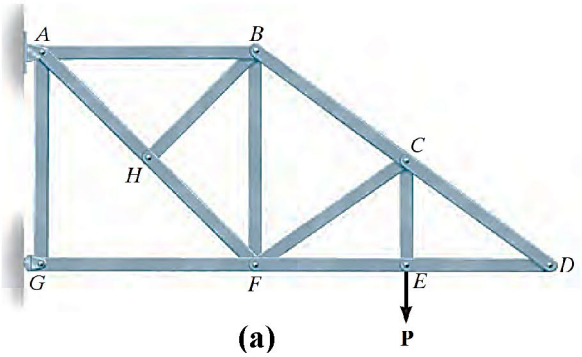
EXAMPLE 4.3.3

Using the method of joints, indicate all the members of the truss shown in **Fig. *a*** that have zero force.



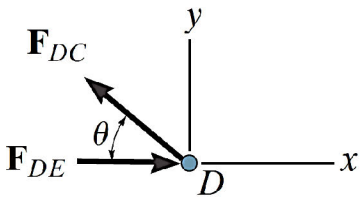
(a)

Solution

Joint D, Fig. b.

$$+\uparrow \sum F_y = 0;\quad F_{DC}\sin\theta = 0 \quad F_{DC} = 0$$

$$+\rightarrow \sum F_x = 0;\quad F_{DE} + 0 = 0 \quad F_{DE} = 0$$



(b)

Joint E, Fig. .

$$+\leftarrow \sum F_x = 0;\quad F_{EF} = 0$$

Note that $F_{EC} = P$ and an analysis of joint *C* would yield a force in member ***CF*.**

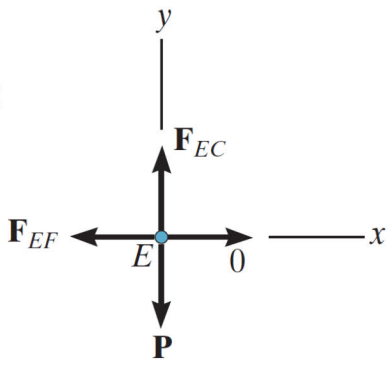
Joint H, Fig. d.

$$+\nearrow \sum F_y = 0;\quad F_{HB} = 0$$

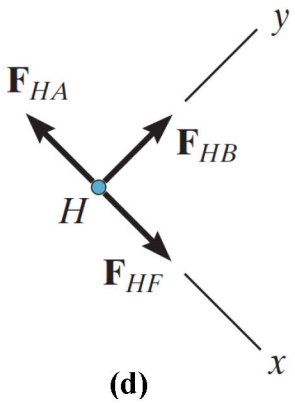
Joint G, Fig. e.

The rocker support at ***G*** can only exert an ***x*** component of force on the joint

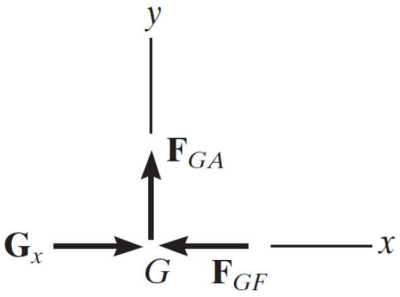
$$+\uparrow \sum F_y = 0;\quad F_{GA} = 0$$



(c)



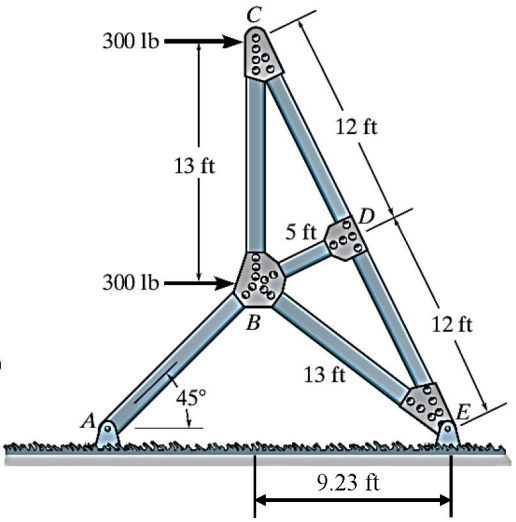
(d)



(e)

EXAMPLE 4.3.4

A sign is subjected to a wind loading that exerts horizontal forces of **300 lb** on joints ***B*** and ***C*** of one of the side supporting trusses. Determine the force in each member of the truss and state if the members are in tension or compression.



Solution

Joint *C*: Fig *a*.

$$+\rightarrow \sum F_x = 0; \quad 300 - F_{CD}\left(\frac{5}{13}\right) = 0 \quad \Rightarrow F_{CD} = 780 \text{ lb (C)}$$

$$+\uparrow \sum F_y = 0; \quad 780\left(\frac{12}{13}\right) - F_{CB} = 0 \quad \Rightarrow F_{CB} = 720 \text{ lb (T)}$$

Joint *D*: Fig *b*.

$$+\nearrow \sum F_x = 0; \quad F_{DB} = 0$$

$$+\nwarrow \sum F_y = 0; \quad F_{DE} - 780 = 0 \quad \Rightarrow F_{DE} = 780 \text{ lb (C)}$$

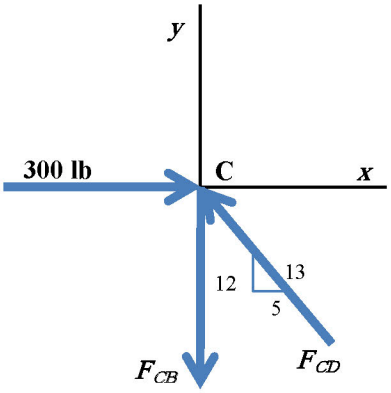
Joint *B*: Fig *b*.

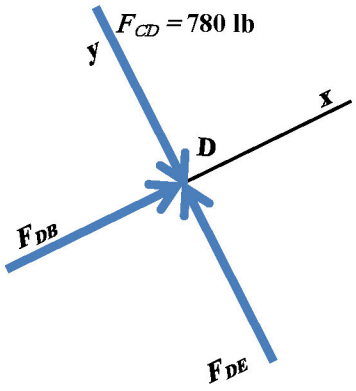
$$+\rightarrow \sum F_x = 0; \quad 300 + F_{BE}\sin 45.24^\circ - F_{BA}\cos 45^\circ = 0$$

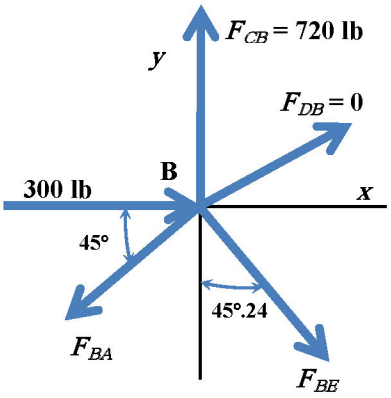
$$+\uparrow \sum F_y = 0; \quad 720 - F_{BE}\cos 45.24^\circ - F_{BA}\sin 45^\circ = 0$$

Solving

$F_{BE} = 296.99 \text{ lb} = 297 \text{ lb (T)}$ $\quad F_{BA} = 722.49 \text{ lb (T)}$

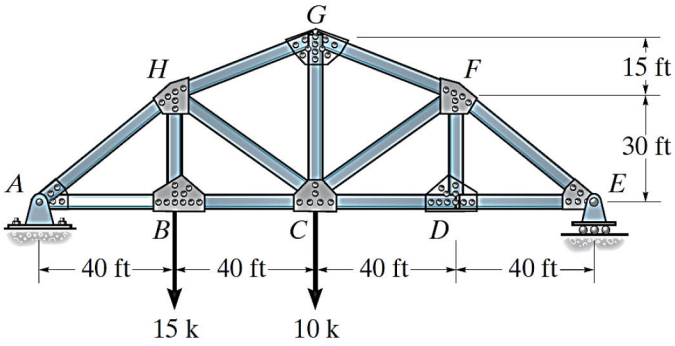






EXAMPLE 4.3.5

Determine the force in members ***GF***, ***FC***, and ***CD*** of the bridge truss. State if the members are in tension of compression. Assume all members are pin connected.



Solution

$$+\circlearrowleft \sum M_A = 0; \quad -15(40) - 10(80) + R_E(160) = 0$$

$$\Rightarrow R_E = 8.75\ k$$

$$+\circlearrowleft \sum M_F = 0; \quad -F_{DC}(30) + 8.75(40) = 0$$

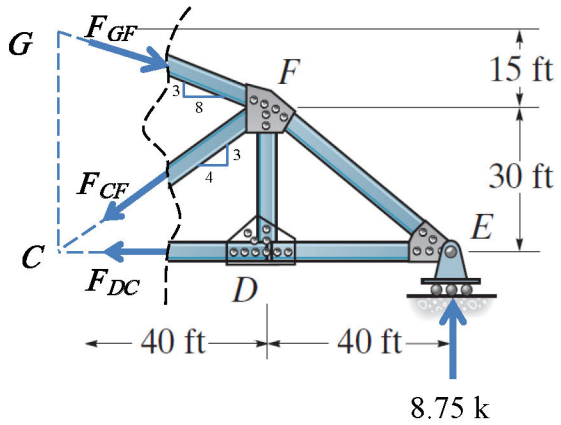
$$\Rightarrow F_{DC} = 11.7\ \text{k (T)}$$

$$+\circlearrowleft \sum M_C = 0; \quad -F_{FG}\left(\frac{8}{\sqrt{73}}\right)(45) + 8.75(80) = 0$$

$$\Rightarrow F_{FG} = 16.6\ \text{k (C)}$$

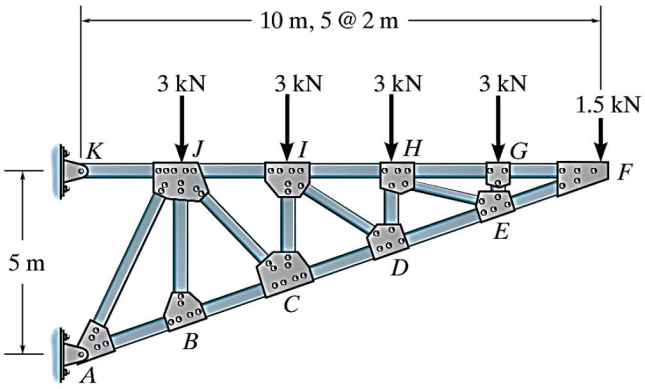
$$+\uparrow \sum F_y = 0; \quad 8.75 - 16.6\left(\frac{3}{\sqrt{73}}\right) - F_{FC}\left(\frac{3}{5}\right) = 0$$

$$\Rightarrow F_{FC} = 4.86\ \text{k (T)}$$



EXAMPLE 4.3.6

Determine the force in members ***IH***, ***ID***, and ***CD*** of the truss. State if the members are in tension or compression. Assume all members are pin connected.



Solution

Referring to the FBD of the right segment of the truss sectioned through, **Fig.**,

$$+\circlearrowleft \sum M_D = 0; \quad F_{IH}(2) - 3(2) - 1.5(4) = 0$$

$$\Rightarrow F_{IH} = 6\ \text{kN (T)}$$

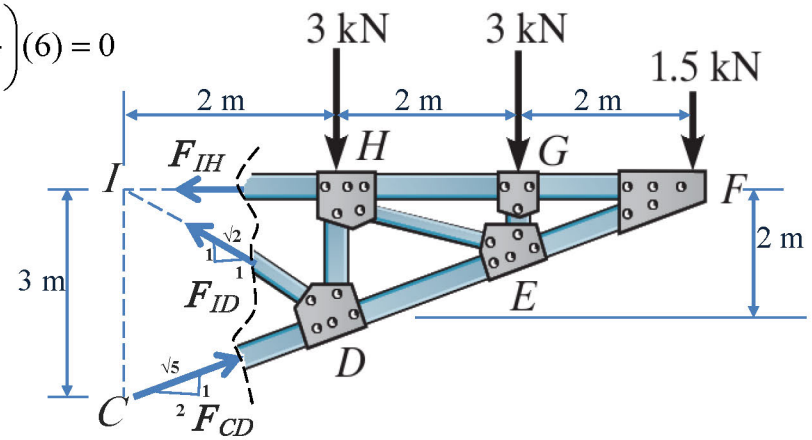
$$+\circlearrowleft \sum M_F = 0; \quad 3(2) + 3(4) - F_{ID}\left(\frac{1}{\sqrt{2}}\right)(6) = 0$$

$$\Rightarrow F_{ID} = 4.24\ \text{kN (T)}$$

$$+\circlearrowleft \sum M_I = 0;$$

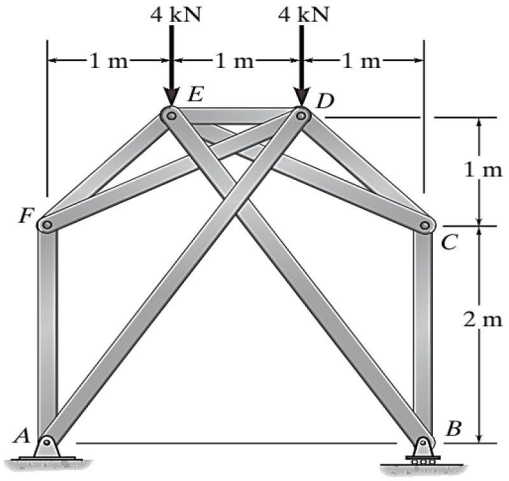
$$F_{CD}\left(\frac{2}{\sqrt{5}}\right)(3) - 3(2) - 3(4) - 1.5(6) = 0$$

$$\Rightarrow F_{CD} = 10.06\ \text{kN (C)}$$



EXAMPLE 4.3.7

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



Solution

Reactions

$\sum M_B = 0, \quad \Rightarrow A_y = \mathbf{4.00\ kN}$

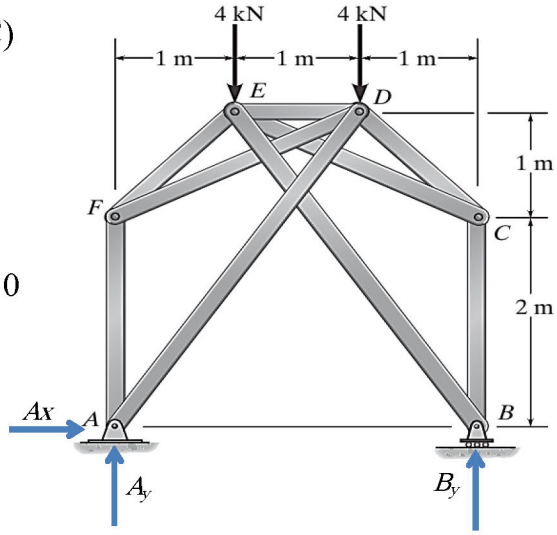
$\sum F_y = 0, \quad \Rightarrow B_y = \mathbf{4.00\ kN}$

$\sum F_x = 0, \quad \Rightarrow A_x = 0$

Joint *A*:

$+\rightarrow \sum F_x = 0; \quad F_{AD} = 0$

$+\uparrow \sum F_y = 0; \quad 4.00 - F_{AF} = 0; \quad F_{AF} = 4.00\ \text{kN (C)}$



Joint *F*:

$+\nwarrow \sum F_y = 0; \quad 4.00 \sin 45^\circ - F_{FD} \sin 18.43^\circ = 0$

$F_{FD} = 8.944\ \text{kN} = 8.94\ \text{kN (T)}$

$+\nearrow \sum F_x = 0; \quad 4.00 \cos 45^\circ - 8.94 \cos 18.43^\circ - F_{FE} = 0$

$F_{FE} = 11.313\ \text{kN} = 8.94\ \text{kN (C)}$

Due to symmetrical loading and geometry

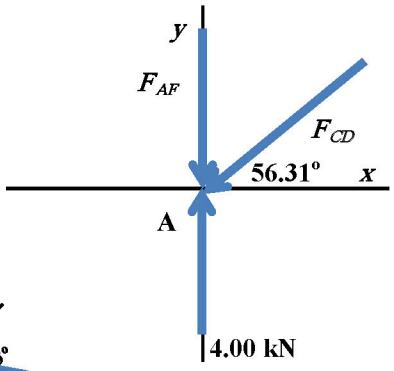
$F_{BC} = 4.00\ \text{kN (C)}, \quad F_{CE} = 8.94\ \text{kN (T)}$

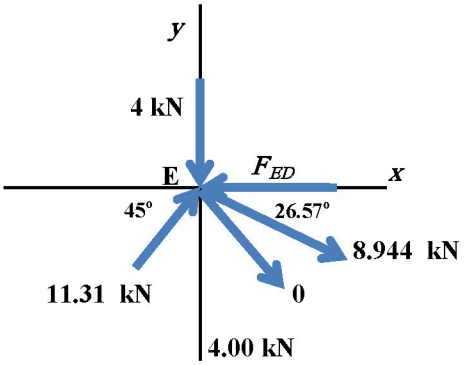
$F_{BE} = 0, \quad F_{CD} = 11.3\ \text{kN (C)}$

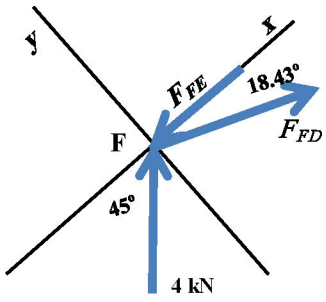
Joint *E*:

$+\rightarrow \sum F_x = 0; \quad -F_{ED} + 8.944 \cos 26.56^\circ + 11.31 \cos 45^\circ = 0$

$F_{ED} = 16.0\ \text{kN (C)}$

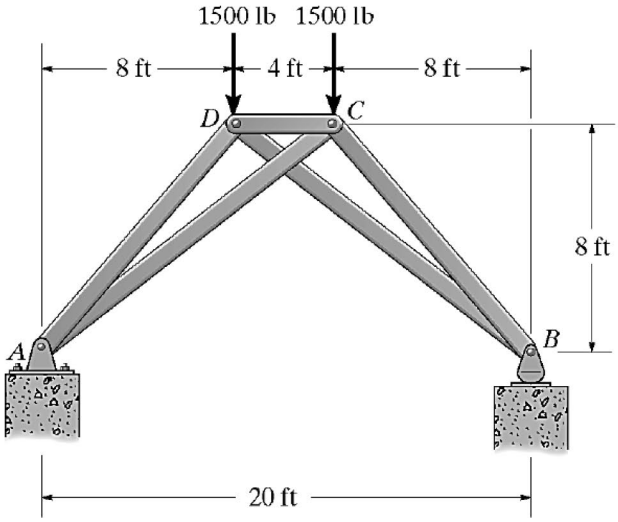






EXAMPLE 4.3.8

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



Solution

Reactions

$\sum M_B = 0, \quad \Rightarrow A_y = 1500 \text{ lb}$

$\sum F_y = 0, \quad \Rightarrow B_y = 1500 \text{ lb}$

$\sum F_x = 0, \quad \Rightarrow A_x = 0$

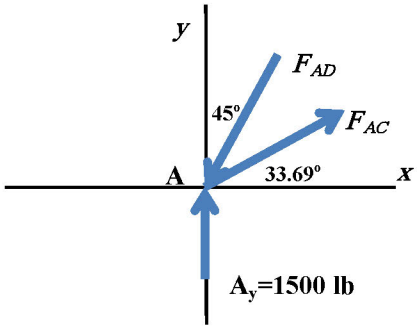
Joint *A*:

$+\rightarrow \sum F_x = 0; \quad F_{AC}\cos 33.69^\circ - F_{AD}\cos 45^\circ = 0$

$+\uparrow \sum F_y = 0; \quad 1500 - F_{AD}\sin 45^\circ + F_{AC}\sin 33.69^\circ = 0;$

$F_{AC} = 5408.3 \text{ lb} = 5.41 \text{ k (T)}$

$F_{AD} = 6363.9 \text{ lb} = 6.36 \text{ k (C)}$



Joint *D*:

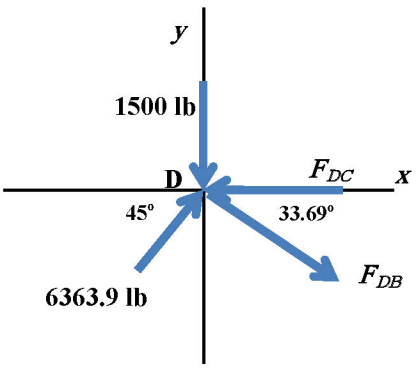
$+\uparrow \sum F_y = 0; \quad 6363.9\sin 45^\circ - 1500 - F_{DB}\sin 33.69^\circ = 0$

$F_{DB} = 5408.3 \text{ lb} = 5.41 \text{ k (T)}$

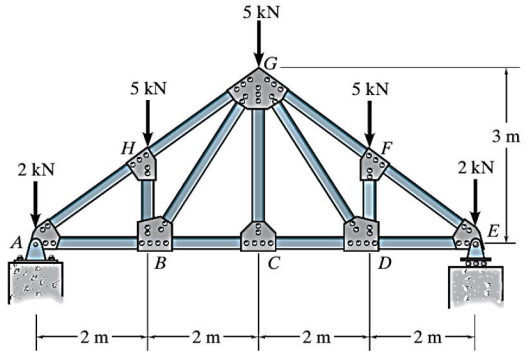
$+\rightarrow \sum F_x = 0; \quad 6363.9\cos 45^\circ - F_{DC} - F_{DB}\sin 33.69^\circ = 0;$

$F_{DC} = 9000 \text{ lb} = 9.00 \text{ k (C)}$

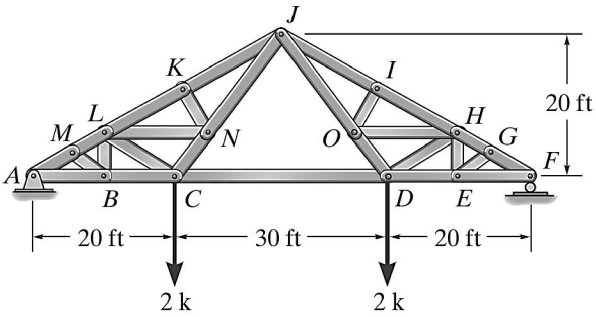
by symmetry, $F_{CB} = 6363.9 \text{ lb} = 6.36 \text{ k (C)}$



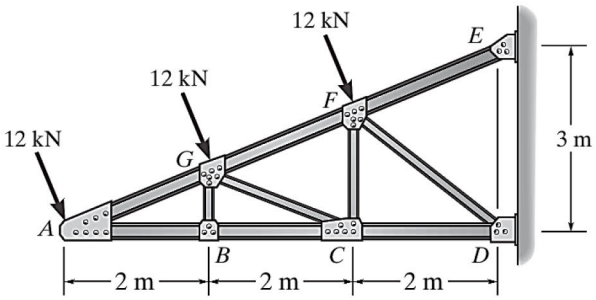
Hw.10 The Howe truss is subjected to the loading shown. Determine the forces in members **GF**, **CD**, and **GC**. State if the members are in tension or compression. Assume all members are pin connected.



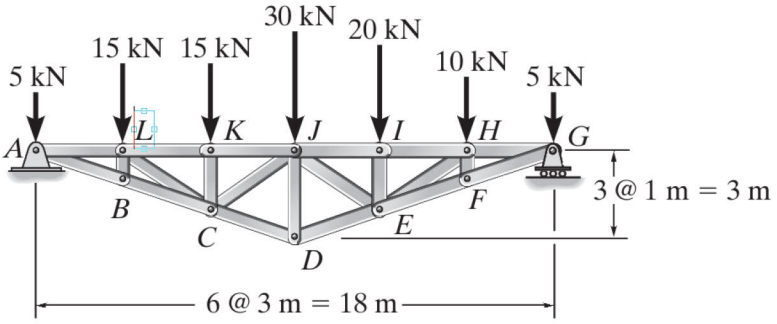
Hw.11
Determine the force in members ***JK***, ***JN***, and ***CD***. State if the members are in tension or compression. Identify all the zero-force members.



Hw.12
Determine the force in members ***GF***, ***FC***, and ***CD*** of the cantilever truss. State if the members are in tension or compression. Assume all members are pin connected.



Hw.13
Determine the forces in members ***KJ***, ***CD***, and ***CJ*** of the truss. State if the members are in tension or compression.



Hw.14
Determine the force in members ***GF***, ***CF***, and ***CD*** of the roof truss and indicate if the members are in tension or compression.