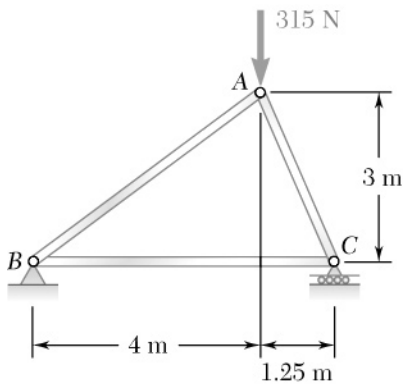
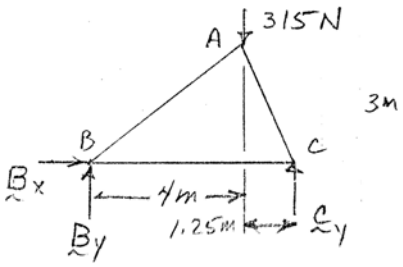


PROBLEM 6.1

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



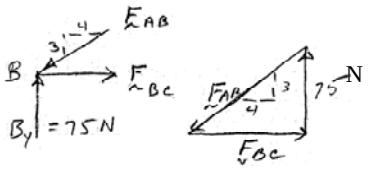
$\circlearrowleft \Sigma M_B = 0$: $(6.25\text{ m})C_y - (4\text{ m})(315\text{ N}) = 0$ $\quad \mathbf{C}_y = 240\text{ N} \uparrow$

$\uparrow \Sigma F_y = 0$: $B_y - 315\text{ N} + C_y = 0$ $\quad \mathbf{B}_y = 75\text{ N} \uparrow$

$\rightarrow \Sigma F_x = 0$: $\quad \mathbf{B}_x = 0$

Joint FBDs:

Joint *B*:



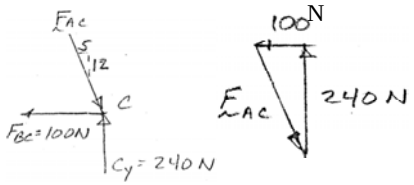
$$\frac{F_{AB}}{5} = \frac{F_{BC}}{4} = \frac{75\text{ N}}{3}$$

$F_{AB} = 125.0\text{ N}$ C ◀

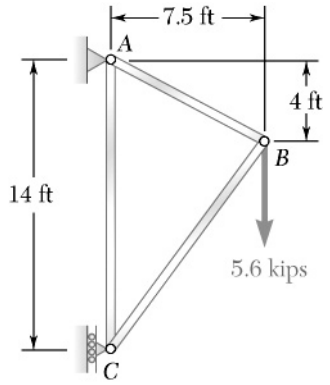
$F_{BC} = 100.0\text{ N}$ T ◀

Joint *C*:

By inspection: $F_{AC} = 260\text{ N}$ C ◀



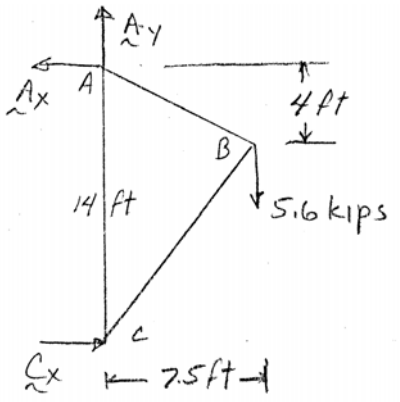
PROBLEM 6.2



Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



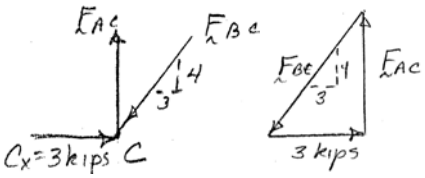
$$\circlearrowleft \Sigma M_A = 0: (14\text{ ft})C_x - (7.5\text{ ft})(5.6\text{ kips}) = 0 \qquad \mathbf{C}_x = 3\text{ kips} \rightarrow$$

$$\rightarrow \Sigma F_x = 0: -A_x + C_x = 0 \qquad \mathbf{A}_x = 3\text{ kips} \leftarrow$$

$$\uparrow \Sigma F_y = 0: A_y - 5.6\text{ kips} = 0 \qquad \mathbf{A}_y = 5.6\text{ kips} \uparrow$$

Joint FBDs:

Joint *C*:

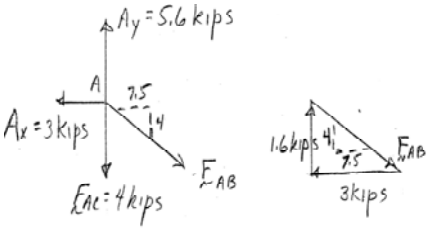


$$\frac{F_{BC}}{5} = \frac{F_{AC}}{4} = \frac{3\text{ kips}}{3}$$

$F_{BC} = 5.00$ kips C ◀

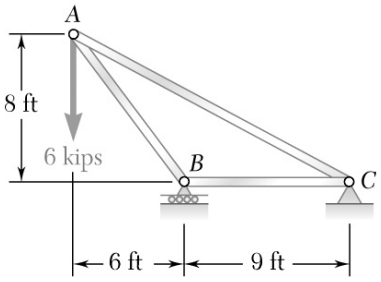
$F_{AC} = 4.00$ kips T ◀

Joint *A*:



$$\frac{F_{AB}}{8.5} = \frac{1.6\text{ kips}}{4}$$

$F_{AB} = 3.40$ kips T ◀

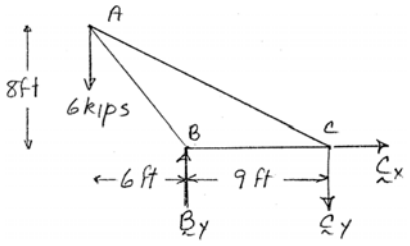


PROBLEM 6.3

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



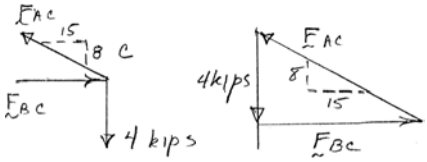
$\circlearrowleft \Sigma M_B = 0$: $(6\text{ ft})(6\text{ kips}) - (9\text{ ft})C_y = 0$ $\quad \mathbf{C}_y = 4\text{ kips} \downarrow$

$\uparrow \Sigma F_y = 0$: $B_y - 6\text{ kips} - C_y = 0$ $\quad \mathbf{B}_y = 10\text{ kips} \uparrow$

$\rightarrow \Sigma F_x = 0$: $\mathbf{C}_x = 0$

Joint FBDs:

Joint *C*:

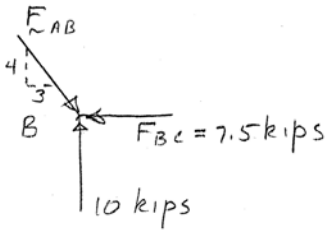


$$\frac{F_{AC}}{17} = \frac{F_{BC}}{15} = \frac{4\text{ kips}}{8}$$

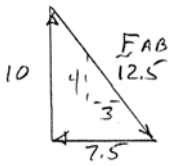
$F_{AC} = 8.50\text{ kips}$ T ◀

$F_{BC} = 7.50\text{ kips}$ C ◀

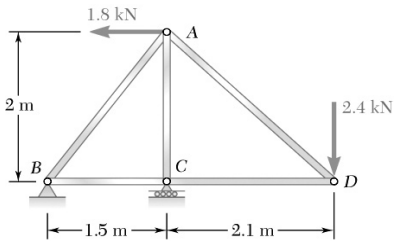
Joint *B*:



By inspection: $F_{AB} = 12.50\text{ kips}$ C ◀



$$\frac{F_{AB}}{5} = \frac{10\text{ kips}}{4}$$

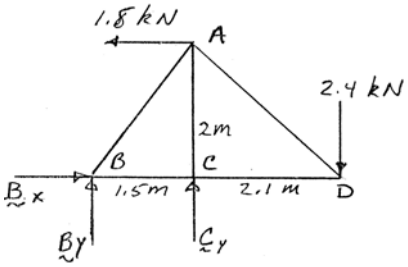


PROBLEM 6.4

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



$$\circlearrowleft \Sigma M_B = 0: (1.5\text{ m})C_y + (2\text{ m})(1.8\text{ kN}) - 3.6\text{ m}(2.4\text{ kN}) = 0$$

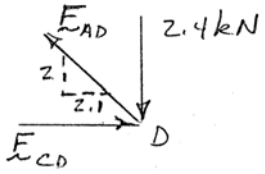
$$\mathbf{C}_y = 3.36\text{ kN} \uparrow$$

$$\uparrow \Sigma F_y = 0: B_y + 3.36\text{ kN} - 2.4\text{ kN} = 0$$

$$\mathbf{B}_y = 0.96\text{ kN} \downarrow$$

Joint FBDs:

Joint *D*:

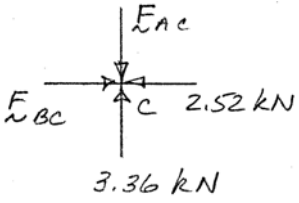


$$\uparrow \Sigma F_y = 0: \frac{2}{2.9}F_{AD} - 2.4\text{ kN} = 0 \qquad F_{AD} = 3.48\text{ kN T} \blacktriangleleft$$

$$\rightarrow \Sigma F_x = 0: F_{CD} - \frac{2.1}{2.9}F_{AD} = 0$$

$$F_{CD} = \frac{2.1}{2.9}(3.48\text{ kN}) \qquad F_{CD} = 2.52\text{ kN C} \blacktriangleleft$$

Joint *C*:

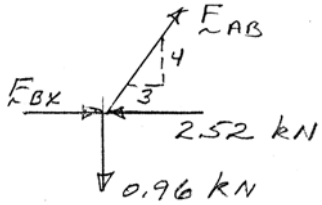


By inspection:

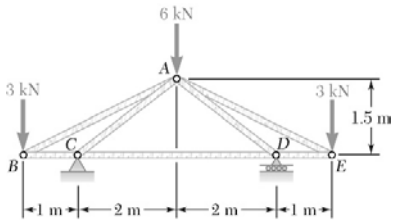
$$F_{AC} = 3.36\text{ kN C} \blacktriangleleft$$

$$F_{BC} = 2.52\text{ kN C} \blacktriangleleft$$

Joint *B*:



$$\uparrow \Sigma F_y = 0: \frac{4}{5}F_{AB} - 0.9\text{ kN} = 0 \qquad F_{AB} = 1.200\text{ kN T} \blacktriangleleft$$

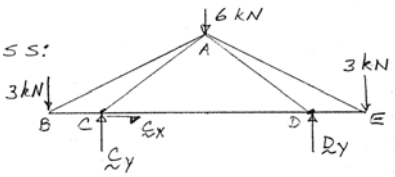


PROBLEM 6.5

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:

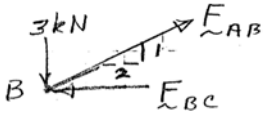


$$\rightarrow \Sigma F_x = 0: \ \mathbf{C}_x = 0$$

By symmetry: $\mathbf{C}_y = \mathbf{D}_y = 6 \text{ kN} \uparrow$

Joint FBDs:

Joint *B*:

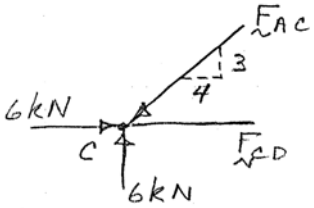


$$\uparrow \Sigma F_y = 0: -3 \text{ kN} + \frac{1}{\sqrt{5}} F_{AB} = 0$$

$$F_{AB} = 3\sqrt{5} = 6.71 \text{ kN T} \blacktriangleleft$$

$$\rightarrow \Sigma F_x = 0: \frac{2}{\sqrt{5}} F_{AB} - F_{BC} = 0 \qquad F_{BC} = 6.00 \text{ kN C} \blacktriangleleft$$

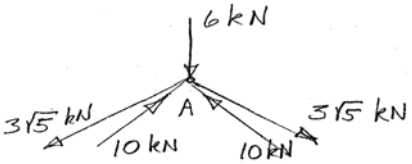
Joint *C*:



$$\uparrow \Sigma F_y = 0: 6 \text{ kN} - \frac{3}{5} F_{AC} = 0 \qquad F_{AC} = 10.00 \text{ kN C} \blacktriangleleft$$

$$\rightarrow \Sigma F_x = 0: 6 \text{ kN} - \frac{4}{5} F_{AC} + F_{CD} = 0 \qquad F_{CD} = 2.00 \text{ kN T} \blacktriangleleft$$

Joint *A*:



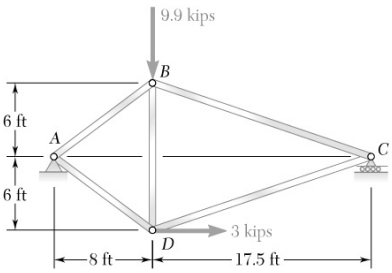
$$\uparrow \Sigma F_y = 0: -2\left(\frac{1}{\sqrt{5}} 3\sqrt{5} \text{ kN}\right) + 2\left(\frac{3}{5} 10 \text{ kN}\right) - 6 \text{ kN} = 0 \text{ check}$$

By symmetry:

$$F_{AE} = F_{AB} = 6.71 \text{ kN T} \blacktriangleleft$$

$$F_{AD} = F_{AC} = 10.00 \text{ kN C} \blacktriangleleft$$

$$F_{DE} = F_{BC} = 6.00 \text{ kN C} \blacktriangleleft$$

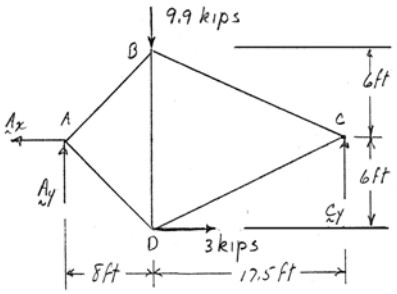


PROBLEM 6.6

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



$$\circlearrowleft \Sigma M_A = 0: (25.5\text{ ft})C_y + (6\text{ ft})(3\text{ kips}) - (8\text{ ft})(9.9\text{ kips}) = 0$$

$$\mathbf{C}_y = 2.4\text{ kips} \uparrow$$

$$\uparrow \Sigma F_y = 0: A_y + 2.4\text{ kips} - 9.9\text{ kips} = 0$$

$$\mathbf{A}_y = 7.4\text{ kips} \uparrow$$

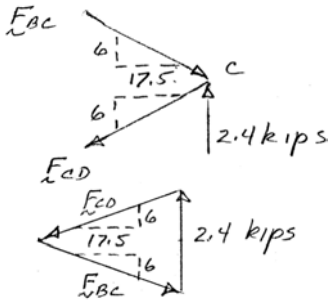
$$\rightarrow \Sigma F_x = 0: -A_x + 3\text{ kips} = 0$$

$$\mathbf{A}_x = 3\text{ kips} \leftarrow$$

$$\frac{2.4\text{ kips}}{12} = \frac{F_{CD}}{18.5} = \frac{F_{BC}}{18.5}$$

Joint FBDs:

Joint *C*:



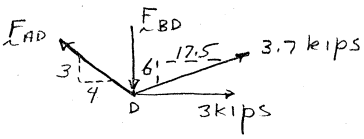
$$F_{CD} = 3.70\text{ kips T} \blacktriangleleft$$

$$F_{BC} = 3.70\text{ kips C} \blacktriangleleft$$

or: $\Sigma F_x = 0: F_{BC} = F_{CD}$ $\quad \uparrow \Sigma F_y = 0: 2.4\text{ kips} - 2\frac{6}{18.5}F_{BC} = 0$

same answers

Joint *D*:



$$\rightarrow \Sigma F_x = 0: 3\text{ kips} + \frac{17.5}{18.5}(3.70\text{ kips}) - \frac{4}{5}F_{AD} = 0$$

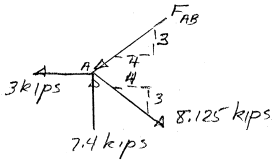
$$F_{AD} = 8.125\text{ kips} \qquad F_{AD} = 8.13\text{ kips T} \blacktriangleleft$$

$$\uparrow \Sigma F_y = 0: \frac{6}{18.5}(3.7\text{ kips}) + \frac{3}{5}(8.125\text{ kips}) - F_{BD} = 0$$

$$F_{BD} = 6.075\text{ kips} \qquad F_{BD} = 6.08\text{ kips C} \blacktriangleleft$$

PROBLEM 6.6 CONTINUED

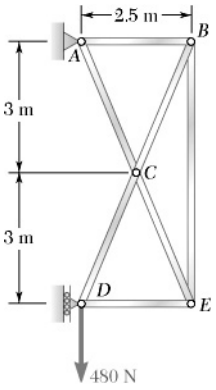
Joint *A*:



$$\rightarrow \Sigma F_x = 0: -3 \text{ kips} + \frac{4}{5}(8.125 \text{ kips}) - \frac{4}{5}F_{AB} = 0$$

$F_{AB} = 4.375$ kips

$F_{AB} = 4.38$ kips C ◀

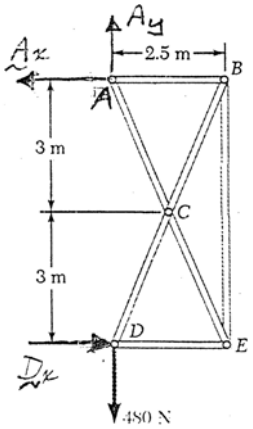


PROBLEM 6.7

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



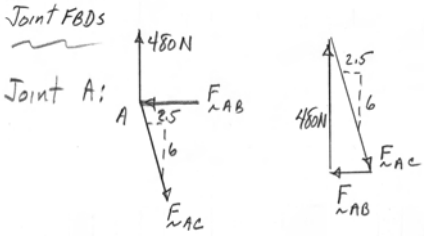
$\uparrow \Sigma F_y = 0: A_y - 480\ \text{N} = 0 \qquad \mathbf{A}_y = 480\ \text{N} \uparrow$

$\circlearrowleft \Sigma M_A = 0: (6\ \text{m}) D_x = 0 \qquad \mathbf{D}_x = 0$

$\rightarrow \Sigma F_x = 0: -A_x = 0 \qquad \mathbf{A}_x = 0$

Joint FBDs:

Joint *A*:

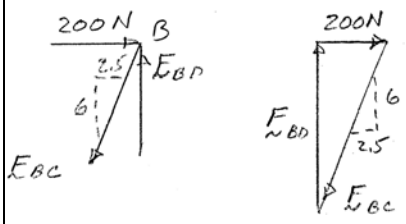


$$\frac{480\ \text{N}}{6} = \frac{F_{AB}}{2.5} = \frac{F_{AC}}{6.5}$$

$F_{AB} = 200\ \text{N}\ \text{C} \blacktriangleleft$

$F_{AC} = 520\ \text{N}\ \text{T} \blacktriangleleft$

Joint *B*:



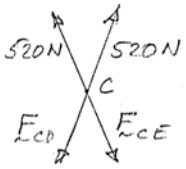
$$\frac{200\ \text{N}}{2.5} = \frac{F_{BE}}{6} = \frac{F_{BC}}{6.5}$$

$F_{BE} = 480\ \text{N}\ \text{C} \blacktriangleleft$

$F_{BC} = 520\ \text{N}\ \text{T} \blacktriangleleft$

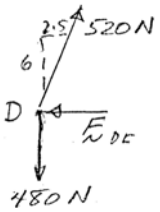
PROBLEM 6.7 CONTINUED

Joint *C*:

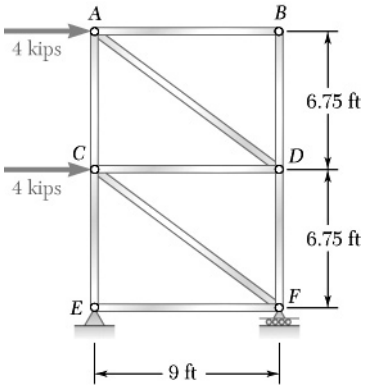


By inspection: $F_{CD} = F_{CE} = 520 \text{ N T}$ ◀

Joint *D*:



$$\rightarrow \Sigma F_x = 0: \frac{2.5}{6.5}(520 \text{ N}) - F_{DE} = 0 \qquad F_{DE} = 200 \text{ N C}$$ ◀

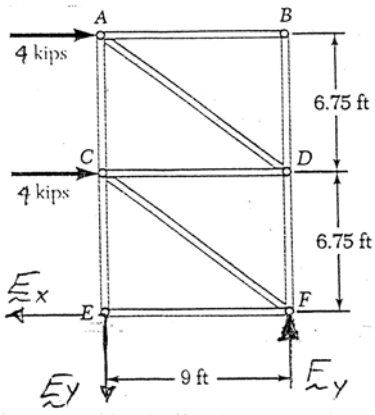


PROBLEM 6.8

Using the method of joints, determine the force in each member of the truss shown. State whether each member is in tension or compression.

SOLUTION

FBD Truss:



$$\circlearrowleft \Sigma M_E = 0: (9\text{ ft})F_y - (6.75\text{ ft})(4\text{ kips}) - (13.5\text{ ft})(4\text{ kips}) = 0$$

$$\mathbf{F}_y = 9\text{ kips} \uparrow$$

$$\uparrow \Sigma F_y = 0: -E_y + 9\text{ kips} = 0 \qquad \mathbf{E}_y = 9\text{ kips} \downarrow$$

$$\rightarrow \Sigma F_x = 0: -E_x + 4\text{ kips} + 4\text{ kips} = 0 \qquad \mathbf{E}_x = 8\text{ kips} \leftarrow$$

By inspection of joint *E*: $F_{EC} = 9.00\text{ kips}$ T ◀

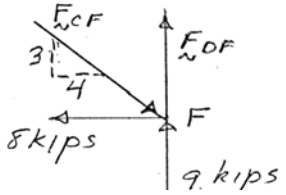
$F_{EF} = 8.00\text{ kips}$ T ◀

By inspection of joint *B*: $F_{AB} = 0$ ◀

$F_{BD} = 0$ ◀

Joint FBDs:

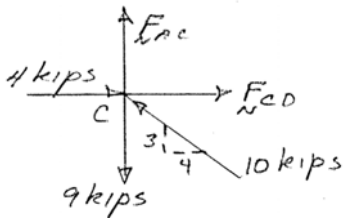
Joint *F*:



$$\rightarrow \Sigma F_x = 0: \frac{4}{5}F_{CF} - 8\text{ kips} = 0 \qquad F_{CF} = 10.00\text{ kips}$$ C ◀

$$\uparrow \Sigma F_y = 0: F_{DF} - \frac{3}{5}(10\text{ kips}) = 0 \qquad F_{DF} = 6.00\text{ kips}$$ T ◀

Joint *C*:



$$\rightarrow \Sigma F_x = 0: 4\text{ kips} - \frac{4}{5}(10\text{ kips}) + F_{CD} = 0$$

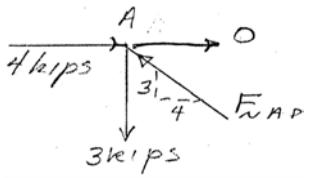
$F_{CD} = 4.00\text{ kips}$ T ◀

$$\uparrow \Sigma F_y = 0: F_{AC} - 9\text{ kips} + \frac{3}{5}(10\text{ kips}) = 0$$

$F_{AC} = 3.00\text{ kips}$ T ◀

PROBLEM 6.8 CONTINUED

Joint *A*:



$$\rightarrow \Sigma F_x = 0: \quad 4 \text{ kips} - \frac{4}{5} F_{AD} = 0 \qquad F_{AD} = 5.00 \text{ kips C} \blacktriangleleft$$