

Ques 1.

Determine the force in each member of the truss shown in fig-1. Indicate whether the members are in tension or compression.

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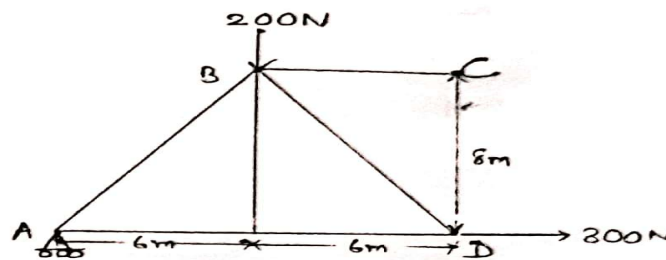


Fig-1

Solution:

Applying the equations of equilibrium, we have

$$\Sigma F_x = 0$$

$$\Rightarrow 300 - C_x = 0$$

$$\Rightarrow C_x = 300 \text{ N}$$

$$\Sigma M_C = 0$$

$$\Rightarrow -A_y \times 12 + 200 \times 6 + 300 \times 8 = 0$$

$$\Rightarrow A_y = 300 \text{ N}$$

$$\Sigma F_y = 0$$

$$\Rightarrow 300 - C_y - 200 = 0$$

$$\Rightarrow C_y = 100 \text{ N}$$

The analysis can now start at either joint A or C. The choice is arbitrary since there are one known and two unknown member forces acting on the pin at each of these joints.

Joint A (fig-1(a)):

Applying the equations of equilibrium, we have

$$\Sigma F_y = 0$$

$$\Rightarrow 300 - \frac{8}{10} \times F_{AB} = 0$$

$$\Rightarrow F_{AB} = 375 \text{ N (C)}$$

$$\Sigma F_x = 0$$

$$\Rightarrow F_{AD} - \frac{6}{10} \times 375 = 0$$

$$\Rightarrow F_{AD} = 225 \text{ N (T)}$$

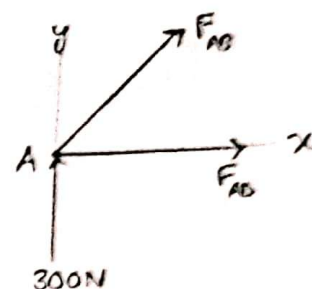


Fig-1(a)

Joint D. (fig-1(b)):

Using the result for F_{AD} and summing forces in

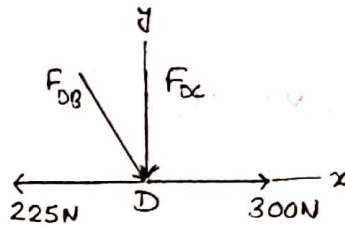


Fig-1(b)

the horizontal direction, we have,

$$\begin{aligned}\Sigma F_x &= 0 \\ \Rightarrow -F_{AD} + \frac{6}{10} \times F_{DB} + 300 &= 0 \\ \Rightarrow -225 + \frac{6}{10} \times F_{DB} + 300 &= 0 \\ \Rightarrow F_{DB} &= -125 \text{ N}\end{aligned}$$

The negative sign indicates that F_{DB} acts in the opposite sense to that shown in fig-1(b)

Hence, $F_{DB} = -125 \text{ N}$.

$$\begin{aligned}\Sigma F_y &= 0 \\ \Rightarrow -F_{DC} - \frac{8}{10} \times F_{DB} &= 0 \\ \Rightarrow -F_{DC} - \frac{8}{10} \times (-125) &= 0 \\ \Rightarrow F_{DC} &= 100 \text{ N (C)}\end{aligned}$$

Joint C (fig.1(c)):

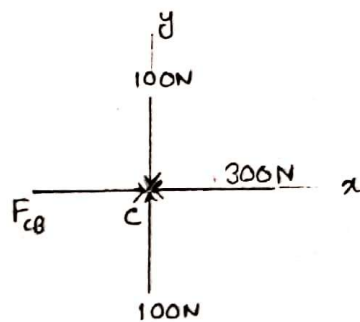


Fig-1(c)

$$\begin{aligned}\Sigma F_x &= 0 \\ \Rightarrow F_{CB} - 300 &= 0 \\ \Rightarrow F_{CB} &= 300 \text{ N (C)}\end{aligned}$$