

$$d = 3$$

$$b = 3$$

$$j = 3$$

$$d + b = 2 \times j$$

$$3 + 3 = 2 \times 3$$

$$6 = 6 \text{ St}$$

SolReactions

$$\sum M_A = 0 \downarrow +$$

$$= 500 \times 2 - c_y \times 2 = 0$$

$$c_y = 1000 / 2$$

$$c_y = 500$$

$$\sum F_x = 0 \rightarrow +$$

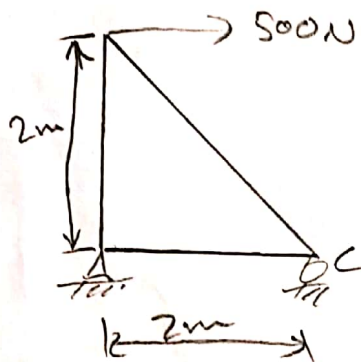
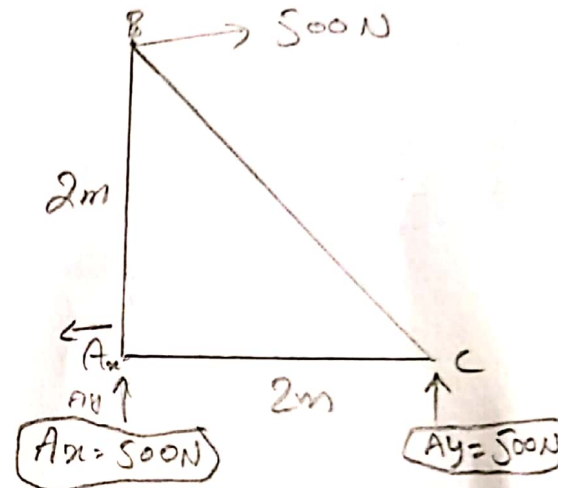
$$\Rightarrow A_x - 500 = 0$$

$$A_x = +500 \text{ N}$$

$$\sum F_y = 0 \uparrow$$

$$-A_y + 500 = 0$$

$$A_y = 500 \text{ N}$$



Joints

$$\sum F_x = 0$$

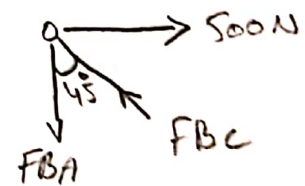
$$500 - F_{BC} \sin 45 = 0$$

$$F_{BC} = \frac{500}{\sin 45}$$

$$F_{BC} = 707.1 \text{ N}$$

(C)

→ compression



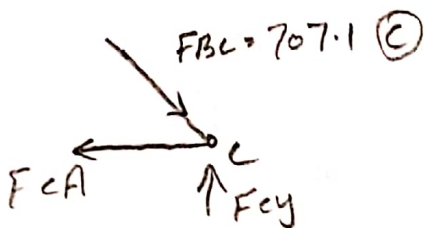
Q1

$$\sum F_y = \uparrow^+ 0$$

$$F_{BC} \cos 45^\circ - F_{AB} = 0$$

$$F_{AB} = 707.1 \cos 45^\circ$$

$$F_{AB} = 500 \text{ N } (\text{T}) \rightarrow \text{Tension}$$



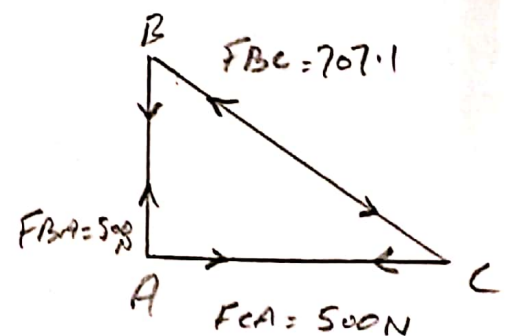
$$\sum F_x = 0 \rightarrow^+$$

$$-F_{CA} + F_{BC} \cos(45^\circ)$$

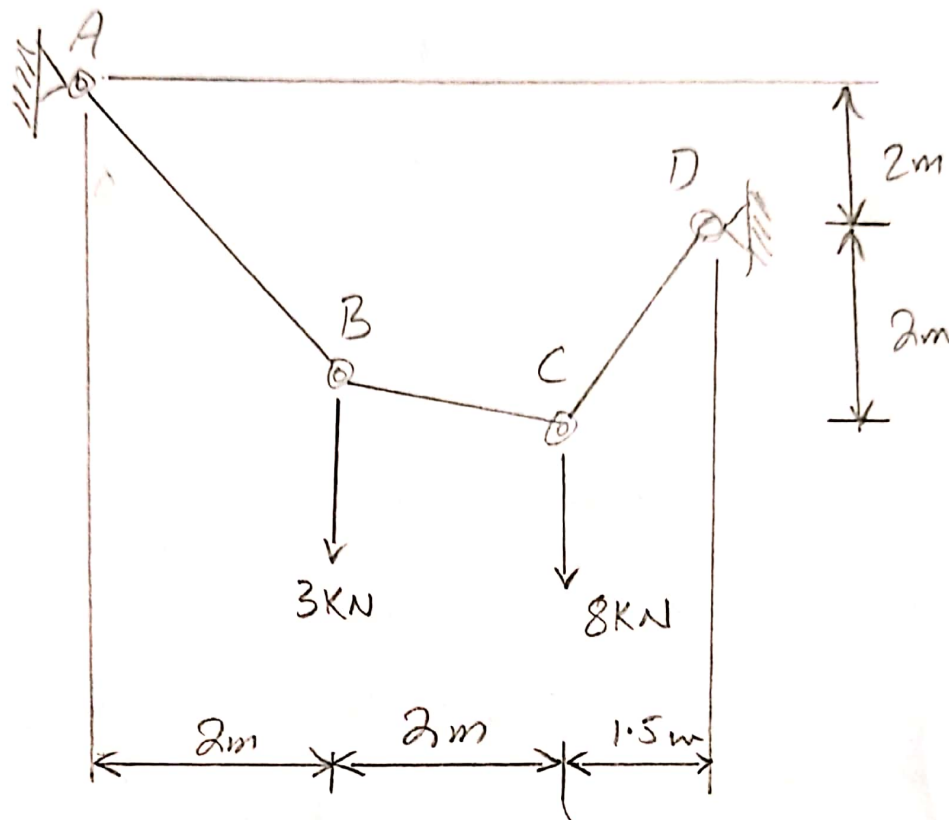
$$-F_{CA} + 707.1 \cos(45^\circ)$$

$$F_{CA} = 707.1 \cos(45^\circ)$$

$$F_{CA} = 500 \text{ N (T)}$$

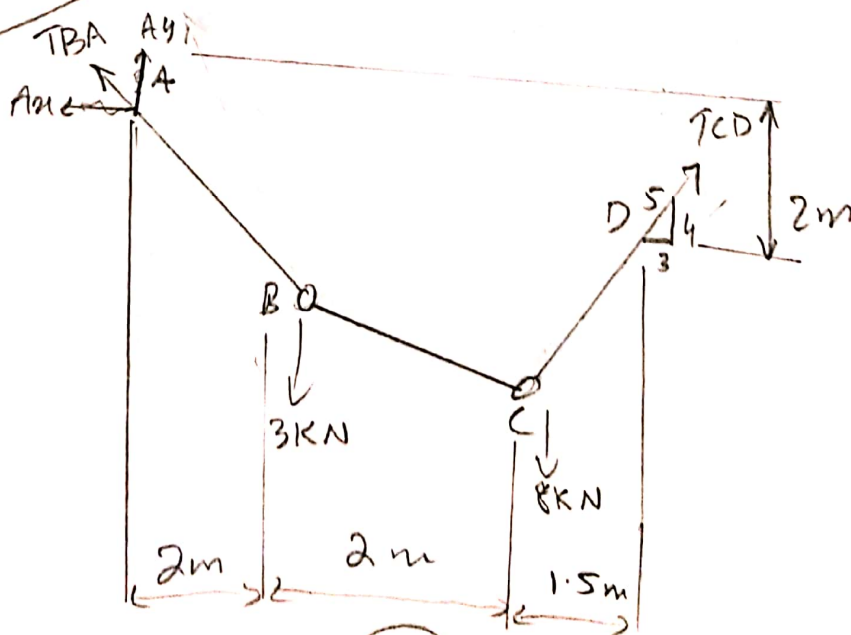


Amul



5.2 (A)

Free Body Diagram



5.2 (B)

Q3

$$\sum M_A = 0$$

$$T_{CD} (3/5)(2m) + T_{CD} (4/5)(5.5m) - 3kN(2m) - 8kN(4m) = 0$$

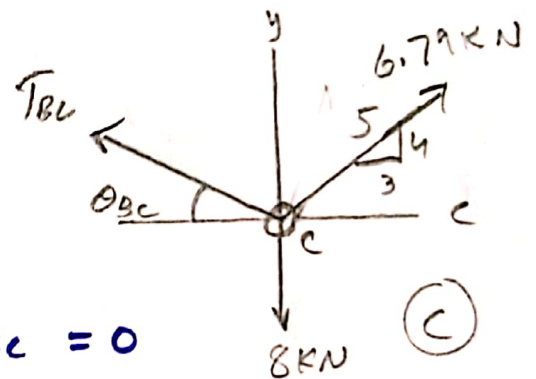
$$T_{CD} = 6.79 \text{ kN}$$

Equilibrium of Points C and B in Sequence

Point C - Fig

$$+\sum F_x = 0$$

$$6.79 \text{ kN} (3/5) - T_{BC} \cos \theta_{BC} = 0$$



$$+\uparrow \sum F_y = 0$$

$$6.79 \text{ kN} (4/5) - 8 \text{ kN} + T_{BC} \sin \theta_{BC} = 0$$

$$\theta_{BC} = 32.3^\circ \text{ and } T_{BC} = 4.82 \text{ kN}$$

Q3Point B → Fig

$$\pm \Sigma F_x = 0$$

$$= -T_{BA} \cos \theta_{BA} + 4.82 \text{ kN} \cdot \cos 32.3^\circ = 0$$

$$+\uparrow \Sigma F_y = 0$$

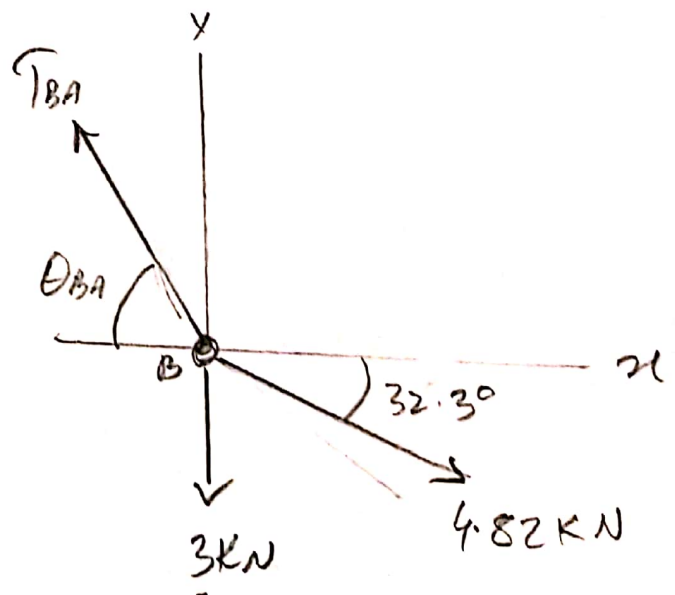
$$= T_{BA} \sin \theta_{BA} - 4.82 \text{ kN} \cdot \sin 32.3^\circ - 3 \text{ kN} = 0$$

$$\theta_{BA} = 53.8^\circ \text{ and } T_{BA} = 6.90 \text{ kN}$$

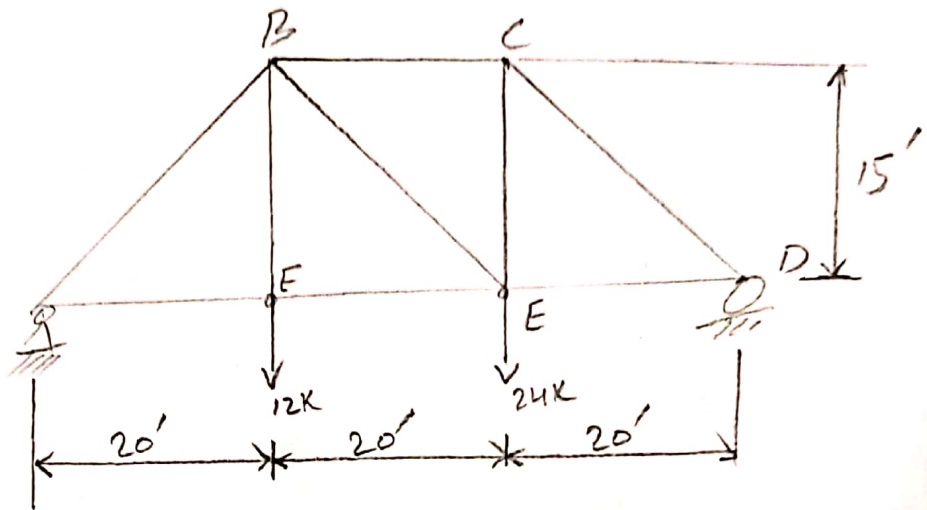
Hence from Fig 5.2(a)

$$h = (2 \text{ m}) \tan 53.8^\circ$$

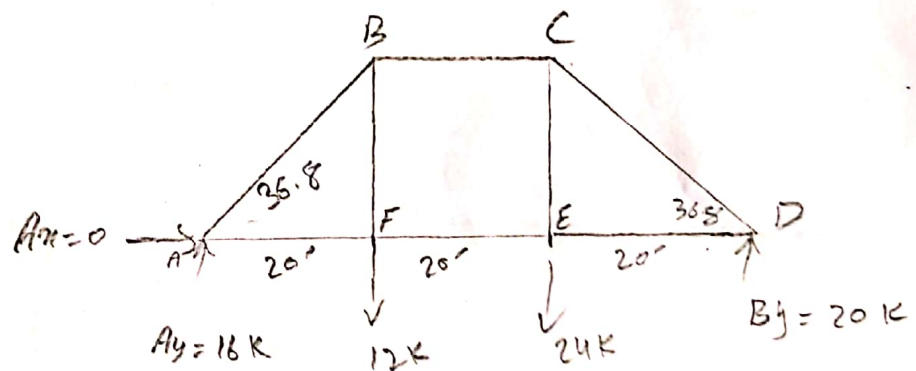
$$h = 2.74 \text{ m}$$

Ans

d



Free  
Body diagram



$$\sum F_x = 0 \rightarrow$$

$$A_x = 0$$

$$A_y + D_y - 12 - 24 = 0$$

$$A_y + D_y - 36 = 0$$

$$A_y + D_y = 36$$

$$\therefore \tan \theta = P/B$$

$$= 15/20$$

$$\tan \theta = 0.75$$

$$\theta = \tan^{-1}(0.75)$$

$$\theta = 36.8^\circ$$

Q2

$$\sum M_A = 0 \curvearrowright +$$

$$(12 \times 20) + (24 \times 40) - D_y (60) = 0$$

$$240 + 960 = D_y 60$$

$$D_y = \frac{1200}{60}$$

$$D_y = 20 \text{ K}$$

$$A_y + 20 = 36$$

$$A_y = 36 - 20$$

$$A_y = 16 \text{ K}$$

Joint A

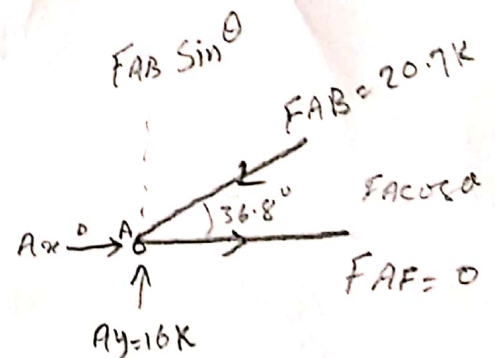
$$\sum F_y = 0 \uparrow +$$

$$16 - F_{AB} \sin 36.8^\circ = 0$$

$$F_{AB} = \frac{16}{\sin(36.8^\circ)}$$

$$F_{AB} = 20.7 \text{ K}$$

(C)





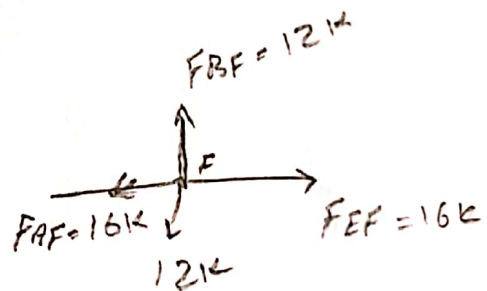
Q2

$$F_{AF} - F_{AB} \cos 36.8 = 0$$

$$F_{AF} - 20 (\cos 36.8) = 0$$

$$F_{AF} = 16.014 \text{ K} \quad (T)$$

Joint F



$$\sum F_y = 0 \uparrow +$$

$$-12 \text{ K} + F_{BF} = 0$$

$$F_{BF} = 12 \text{ K} \quad (T) \rightarrow \text{Tension}$$

$$F_x = 0 \rightarrow +$$

$$-F_{AF} + F_{EF} = 0$$

$$-16 + F_{EF} = 0$$

$$F_{EF} = 16 \text{ K} \quad (T)$$

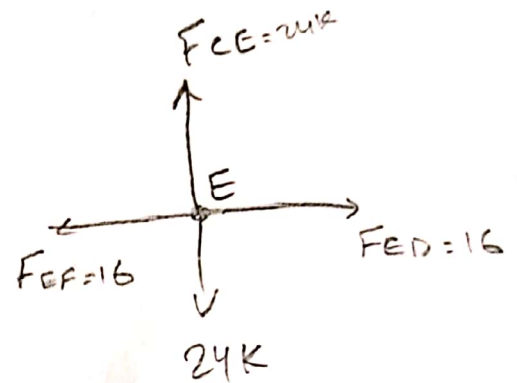
Q2Joint E

$$\sum F_x = 0 \rightarrow^+$$

$$F_{EF} + F_{ED} = 0$$

$$-16 + F_{ED} = 0$$

$$F_{ED} = 16 \text{ K} \quad (\text{T})$$



$$\sum F_y = 0 \uparrow^+$$

$$F_{CE} - 24 = 0$$

$$F_{CE} = 24 \text{ K}$$

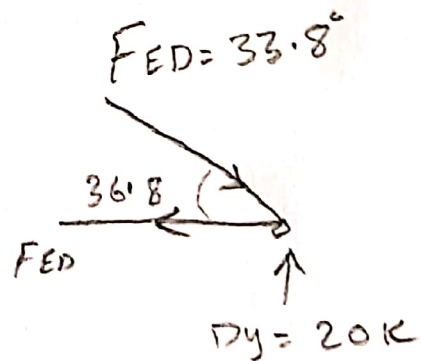
Joint D

$$\sum F_y = 0 \uparrow^+$$

$$-F_{CD} \sin 36.8^\circ + 20 = 0$$

$$F_{CD} = 20 / \sin 36.8$$

$$F_{CD} = 33.3 \text{ K} \quad (\text{C}) \quad \text{compression}$$



11 Q2

$$\sum F_x = 0 \rightarrow +$$

$$33.8 \cos 36.8 - F_{ED} = 0$$

$$F_{ED} = 26.72 \text{ K} \quad (T)$$

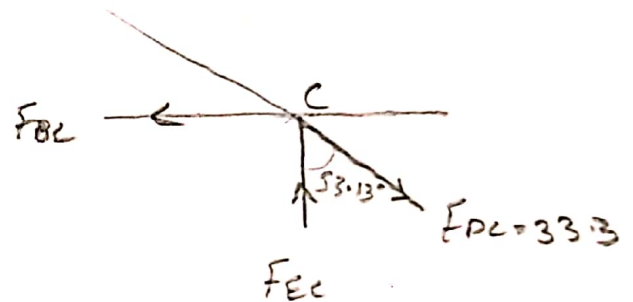
Joint C

$$\sum F_x = 0 \rightarrow +$$

$$F_{DC} \cos 36.8 - F_{BC} = 0$$

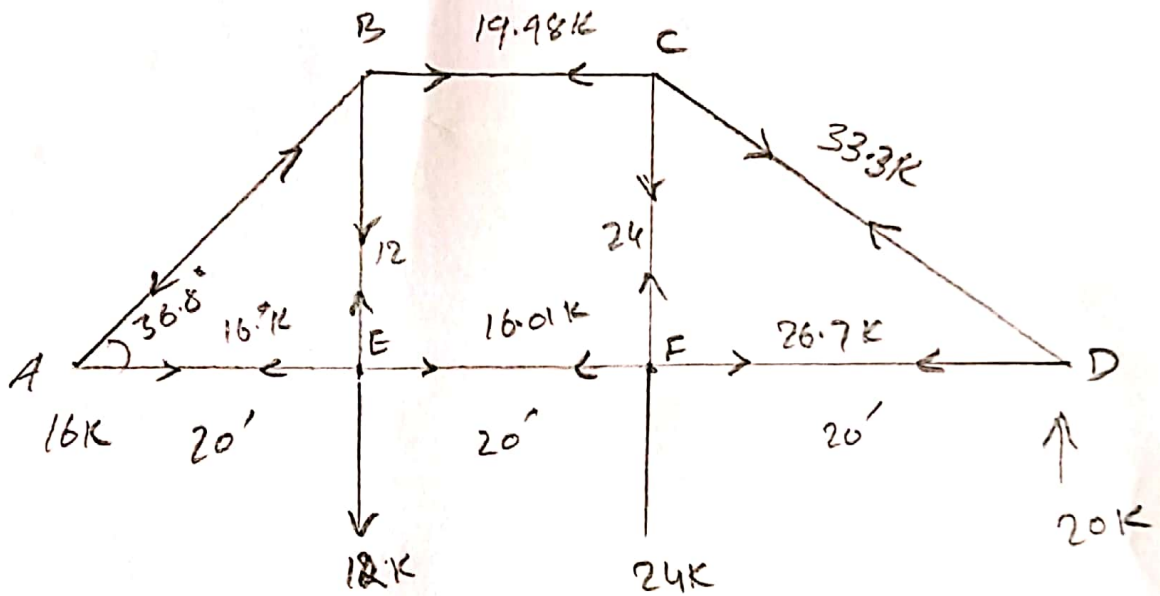
$$F_{BC} = 33.3 \cos 53.13^\circ$$

$$F_{BC} = 19.98 \text{ K}$$



$$\begin{aligned} \therefore \tan \theta &= P/B \\ &= 20/15 \\ \theta &= \tan^{-1}(1.33) \end{aligned}$$

$$\theta = 53.13^\circ$$



Ans