

Name : Sarmad Mahmood

ID : F828

Subject : Structure Analysis I

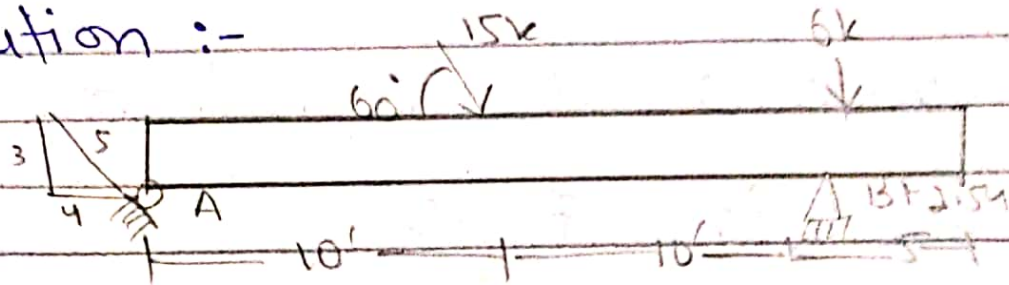
Section : A

Submitted to : Engr Muhammad Saqib

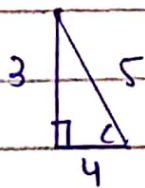
Date : 22 / Aug / 2020 .

Q # 1

→ Solution :-

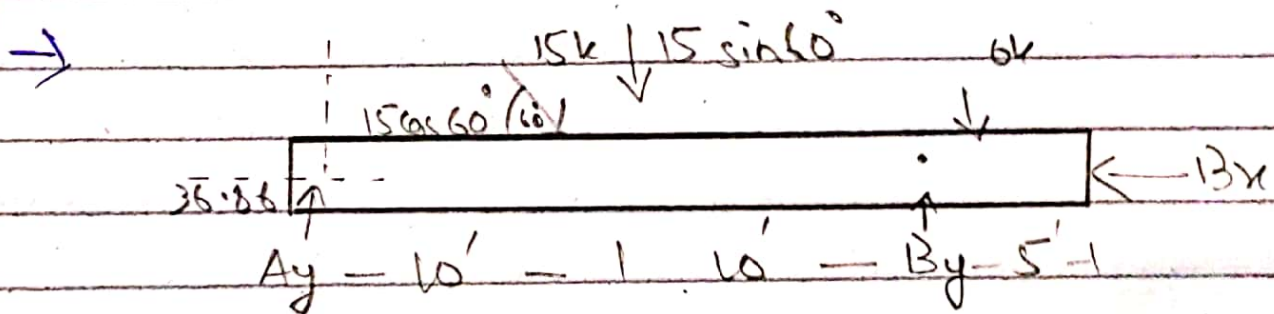


So now, Find the angle of the roller support.



$$\sin \theta = \frac{P}{h} = \frac{3}{5}$$

$$\theta = \sin^{-1}\left(\frac{3}{5}\right) = 36.86^\circ$$



$$1) \sum F_x = 0 \quad \begin{matrix} + \\ \rightarrow \end{matrix} \quad \begin{matrix} - \\ \leftarrow \end{matrix}$$

$$15 \cos 60^\circ - B_x - A_y \sin 36.86^\circ = 0$$

$$7.5 - B_x - 0.599 A_y = 0 \quad \text{--- (1)}$$

$$2) \sum F_y = 0 \quad \uparrow^+ \downarrow^-$$

$$= A_y \cos 36.86 + B_y - 6k - 15 \sin 60 = 0$$
$$= 0.80 A_y + B_y - 18.99 = 0$$

$$= 0.80 A_y + B_y = 18.99 \quad \text{--- (2)}$$

$$3) \sum M_B = 0 \quad \curvearrowright^+ \curvearrowleft^-$$

$$(A_y \cos 36.86 \times 20) - (15 \sin 60 \times 6) + 6 \times 2.5 = 0$$

$$16 A_y - 190 + 15 = 0$$

$$16 A_y - 175 = 0$$

$$A_y = 175/16$$
$$= 10.9375 \text{ k}$$

Put the value in eq (2)

$$\rightarrow 0.80 (10.9375) + B_y = 18.99$$

$$8.75 + B_y = 18.99$$

$$B_y = 10.25 \text{ k}$$

Put A_y in eq (1)

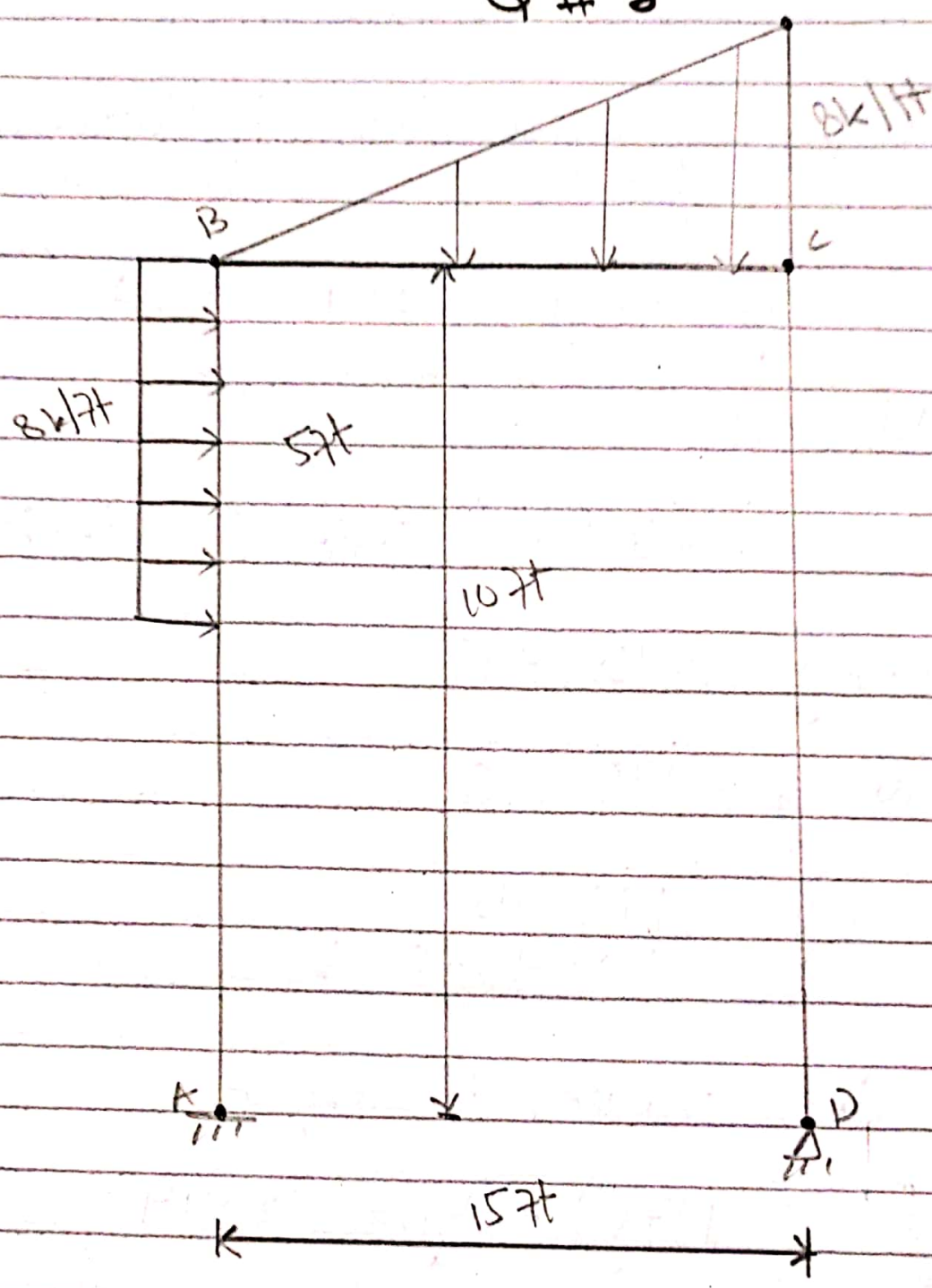
$$7.5 - B_x - 0.599 (10.9375)$$

$$B_x = 0.9375 \text{ k} \quad \text{--- Ans.}$$

3

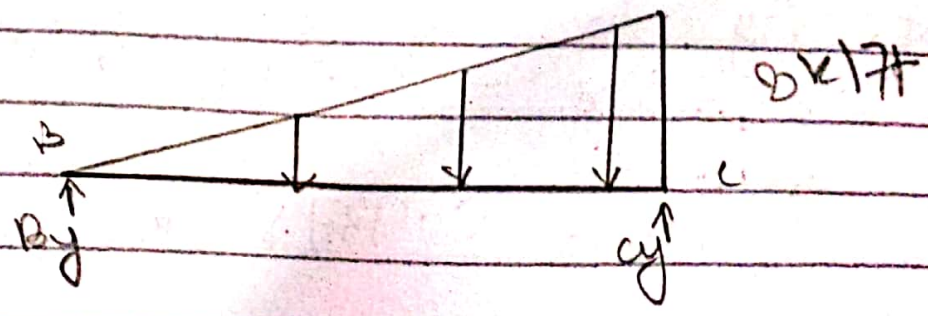
Q # 2

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Solution :-

Member (1)



$$\rightarrow \sum M_B = 0 \quad \downarrow +$$

$$= \frac{1}{2} \times 15 \times 8 \times \frac{2}{3} \times 15 = C_y \times 15$$

$$= 600 = C_y \times 15$$

$$= C_y = 40 \text{ k}$$

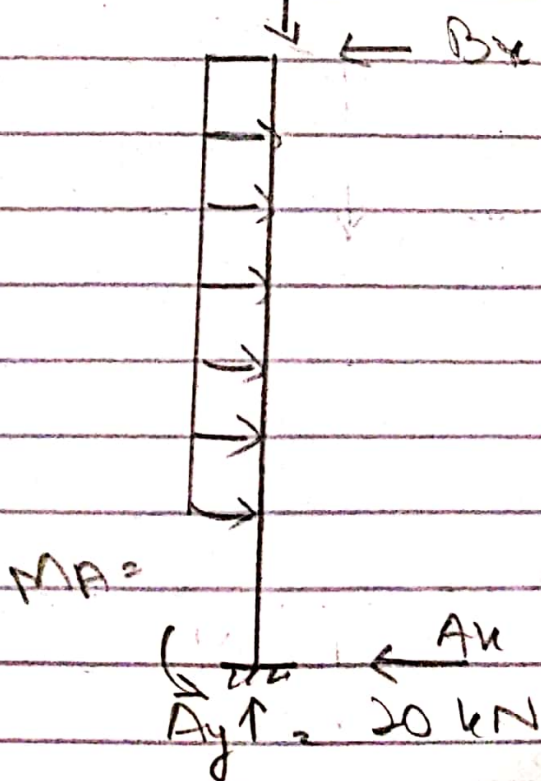
$$\sum F_y = 0$$

$$B_y + C_y = \frac{1}{2} \times 15 \times 8$$

$$B_y = 60 - 40$$

$$B_y = 20 \text{ k}$$

→ Now 20 k Member.



For whole structure

$$\sum M_A = 0 \quad \downarrow$$

$$\rightarrow -M_A + 8 \times 5 \times 7.5 + 1/2 \times 8 \times 15 \times 2/3 - 40 \times 15 = 0$$

$$M_A = 300 \text{ k/ft}$$

→ Now in member AB

$$\sum M_B = 0 \quad \downarrow +$$

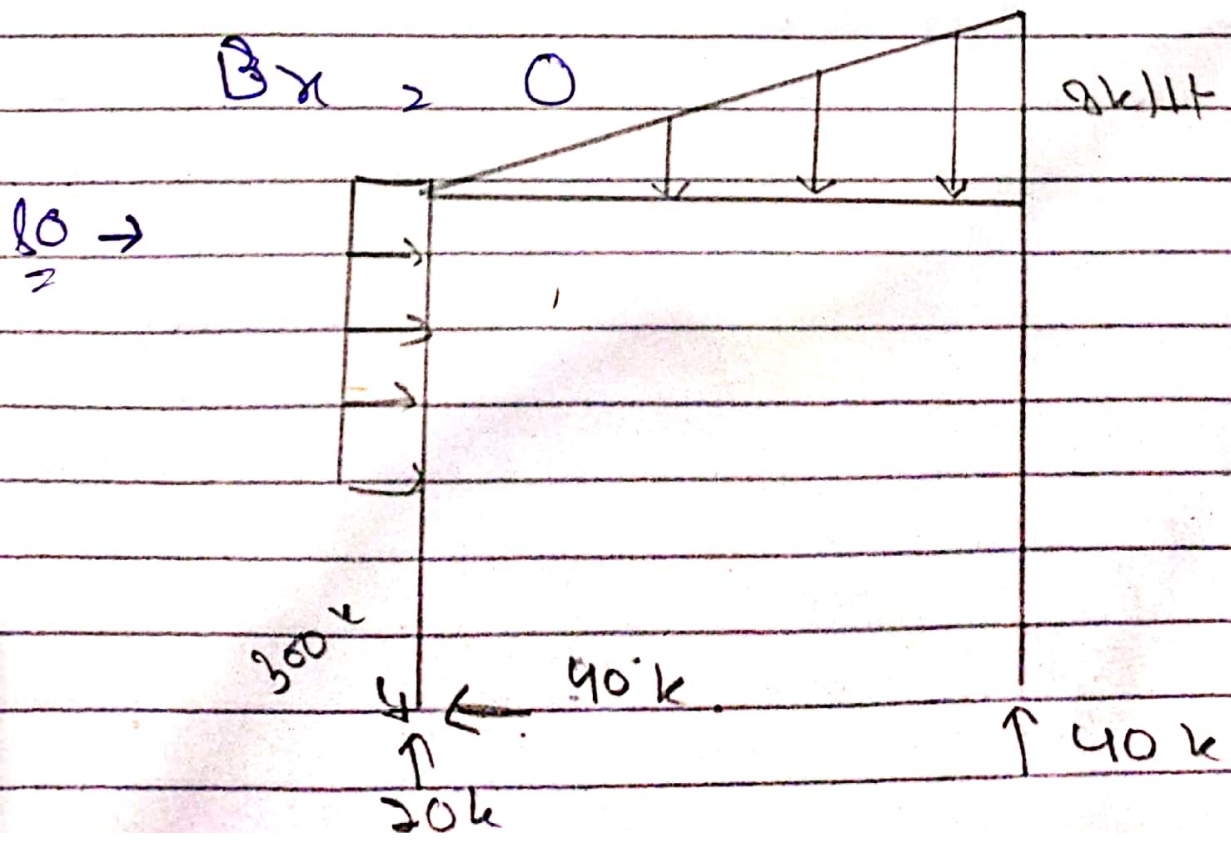
$$8 \times 5 \times 2.5 + 300 = A_x \times 10$$

$$\cancel{A_x} \quad A_x = \frac{400}{10} = 40 \text{ k}$$

$$\sum F_x = 0$$

$$A_x + B_x = 40$$

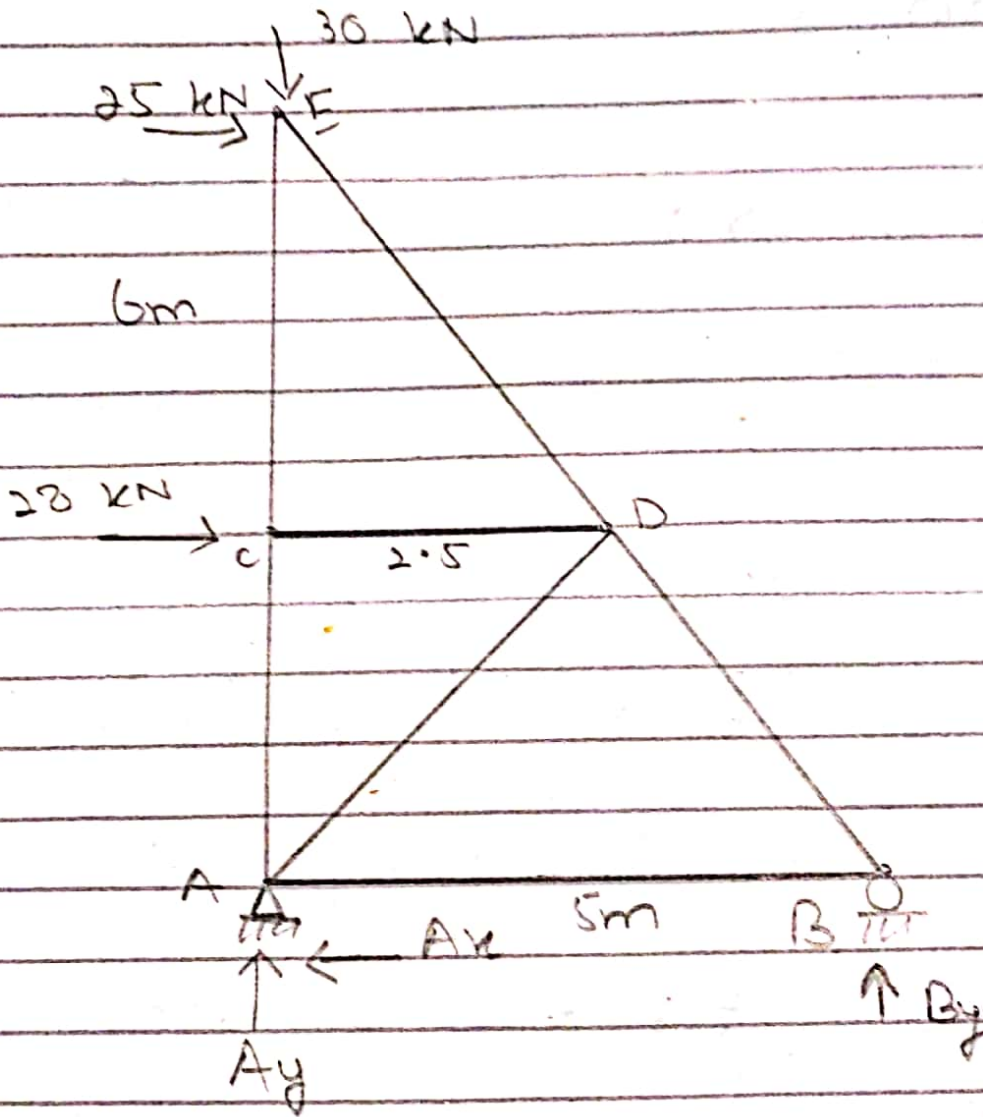
$$B_x = 0$$



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Q# 3

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

$$= 25 \times 12 + 28 \times 6 = B_y \times 5$$

$$\rightarrow B_y = 93.6 \text{ kN}$$

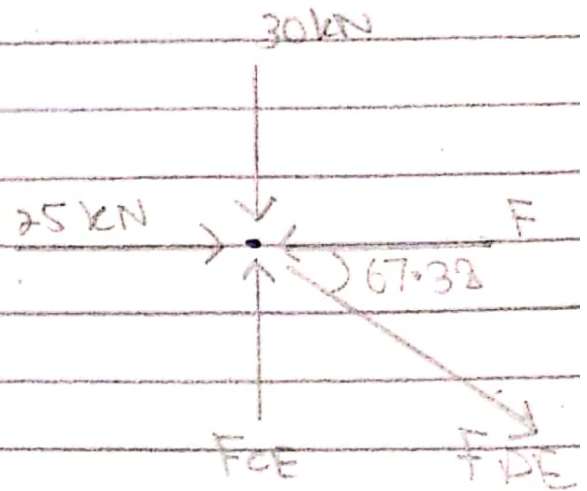
$$\rightarrow A_y + B_y = 30$$

$$A_y = 30 - 93.6$$

$$= -63.6 \text{ (Means downward)}$$

$$A_x = 25 + 28 = 53 \text{ kN}$$

→ Joint E



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

$$\rightarrow 25 + F_{DE} \cos 67.38$$

$$F_{DE} = \frac{-25}{\cos 67.38}$$

$$= -65 \text{ kN (Compression)}$$

$$\sum F_y = 0 \uparrow$$

$$\rightarrow -30 - F_{CE} + 65 \sin 67.38$$

$$F_{CE} = 30 \text{ kN (Tension)}$$

→ Joint B

$$F_{BD} \sin 67.38 = 93.6$$

$$F_{BD} = \frac{93.6}{\sin 67.38} = \frac{93.6}{0.923076}$$

$$F_{BD} = 101.4 \text{ kN (Compression)}$$

$$\Sigma F_x = 0 \rightarrow +$$

$$-F_{AB} + 101.4 \times \cos 67.38 = 0$$

$$F_{AB} = 39 \text{ kN (Tension)}$$

→ Joint C

$$\rightarrow \Sigma F_x = 0$$

$$\rightarrow F_{CD} = -28 \text{ kN} \\ \text{(Compression)}$$

$$\Sigma F_y = 0$$

$$F_{AC} = 30 \text{ kN (Tension)}$$

→ Joint D

$$\Sigma F_y = 0$$

$$= 101.4 \times \sin 67.38$$

$$= 101.4 \sin(67.38) - 65 \cdot \sin(67.38) - F_{AD} \sin(67.38)$$

$$= 93.8 - 59.99 - F_{AD} (0.92) = 0$$

$$F_{AD} = 33.81 / 0.92 = 36.75 \text{ kN-Act}$$

