

## MID EXAM

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ID : 7812

Sec : "A"

Subject : Structure Analysis - 1

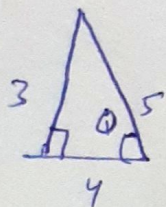
Teacher : Sir Saqib Khan



QNO: 1

Sol:-

To find the angle for the roller support.



by using Trigonometry

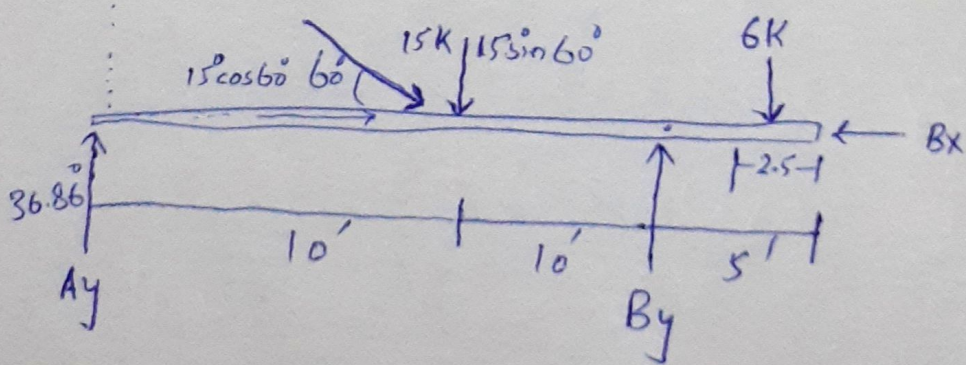
$$\sin \theta = \frac{P}{H}$$

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

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

$$\theta = 36.86^\circ$$

So,





$$\textcircled{1} \quad \Sigma F_x = 0 \quad \xrightarrow{+} \xleftarrow{-}$$

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

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

$$\textcircled{2} \quad \Sigma F_y = 0 \quad \uparrow_+ \downarrow_-$$

$$A_y \cos 36.86^\circ + B_y - 6k - 15 \sin 60^\circ = 0$$

$$0.80 A_y + B_y - 18.99 = 0$$

$$0.80 A_y + B_y = 18.99 \quad \longrightarrow \textcircled{2}$$

$$\textcircled{3} \quad \Sigma M_B = 0 \quad \downarrow_+ \uparrow_-$$

$$(A_y \cos 36.86^\circ \times 20) - (15 \sin 60^\circ \times 10) + 6 \times 2.5 = 0$$

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

$$16 A_y - 175 = 0$$

$$A_y = \frac{175}{16}$$

$$\boxed{A_y = 10.9375 \text{ K}}$$

put the value in eq  $\textcircled{2}$



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

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

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

put the value of  $A_y$  in eq (1)

$$7.5 - B_x - 0.599(10.9375) = 0$$

$$B_x = 0.9375 \text{ k}$$

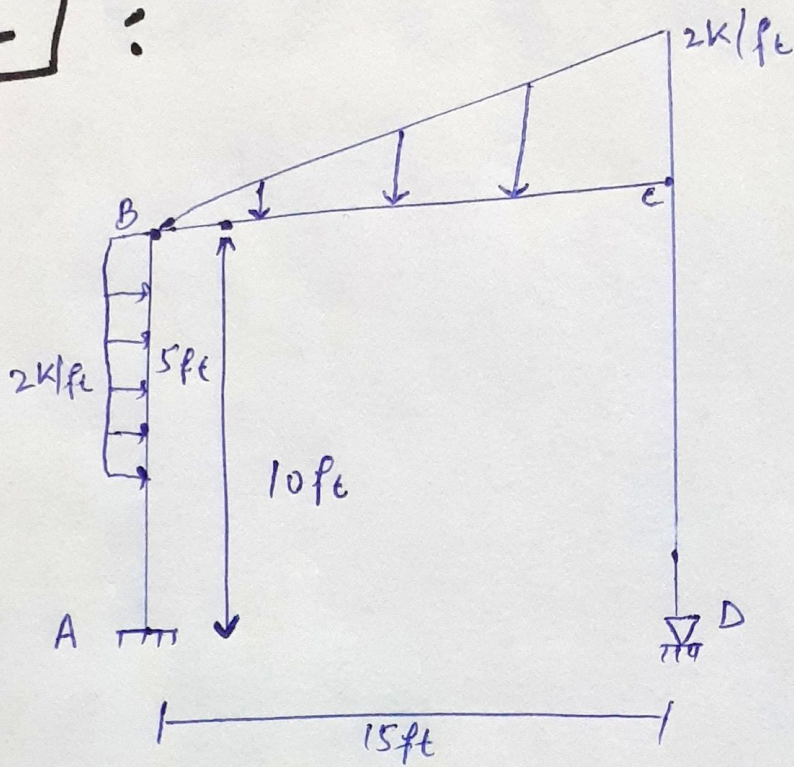
P-T-O →



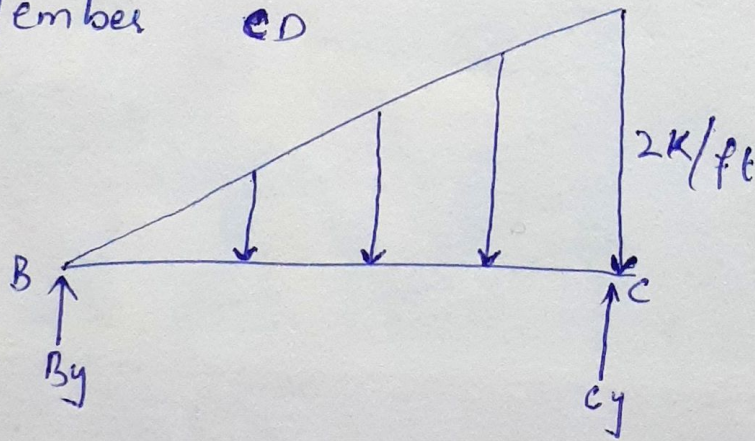
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Q NO: 02 :



Member  $BC$



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

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

$$150 = C_y \times 15$$

$$C_y = \frac{150}{15} \quad \Rightarrow \boxed{10K}$$



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$$\sum f_y = 0$$

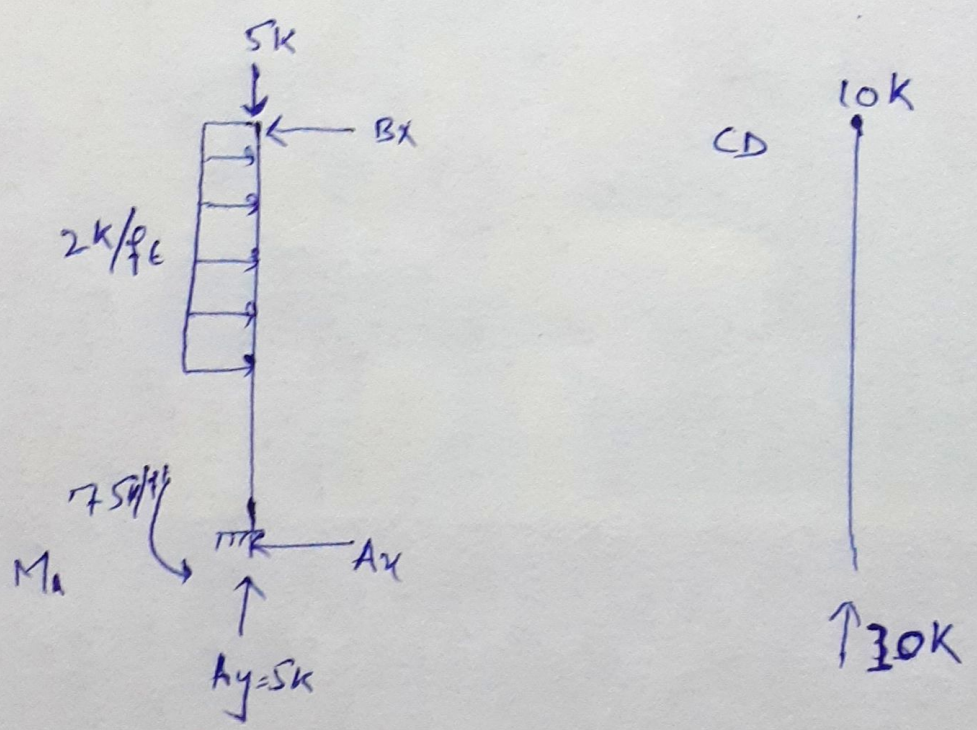
$$B_y + C_y = \frac{1}{2} \times 15 \times 2$$

$$B_y + 10 = 15$$

$$B_y = 15 - 10 = 5$$

$B_y = 5k$

⇒ Now member AB



for whole structure

$$\sum M_A = 0 \rightarrow \text{Taking } M \text{ at } A$$



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$$= -M_A + 2 \times 5 \times 7.5 \times \frac{1}{2} \times 2 \times 15 \times \frac{2}{3} \times 15 - 10 \times 15 = 0$$

$$= -M_A + 75 + 150 - 150 = 0$$

$$M_A = 75 \text{ k/ft}$$

Taking moment about B.

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

$$2 \times 5 \times 2.5 + 75 = A_x \times 10$$

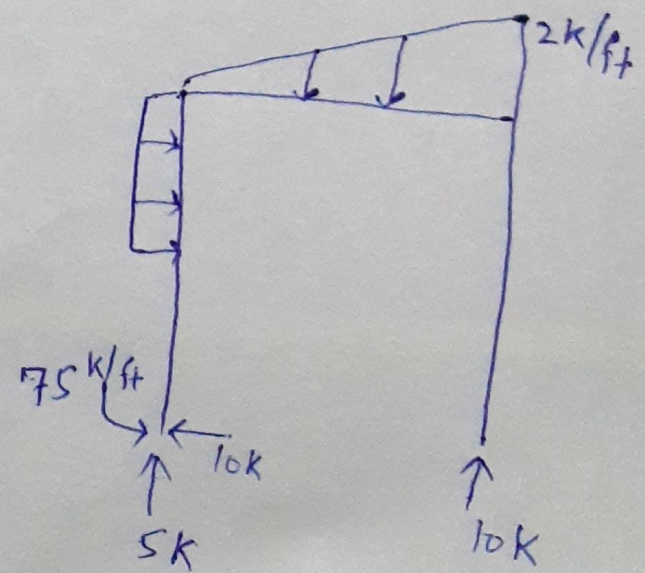
$$25 + 75 = A_x \times 10$$

$$A_x = \frac{100}{10} = 10 \text{ k}$$

Now  $\sum f_x = 0$

$$A_x + B_x = 10$$

$$B_x = 0$$

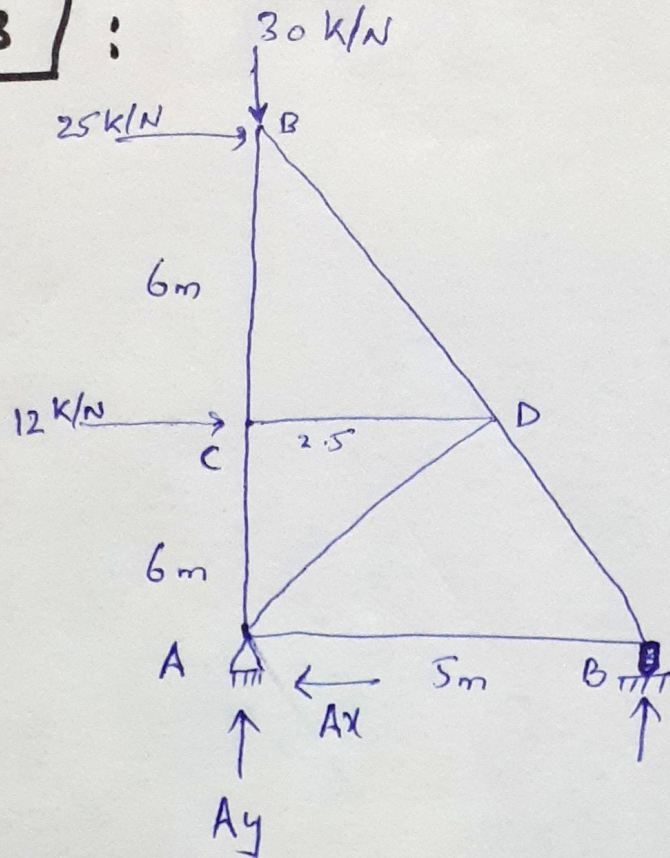




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QNO: 03 :



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

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

$$300 + 72 = B_y \times 5$$

$$B_y = \frac{372}{5} = \boxed{74.4 \text{ k/N}}$$

Now:

$$A_y + B_y = 30$$

$$A_y = 30 - 74.4$$

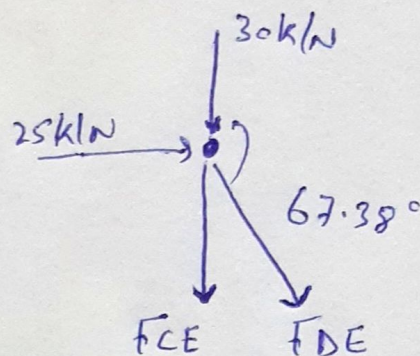
$$A_y = -44.4 \quad (\text{Downward})$$



$$A_x = 25 + 12$$

$$A_x = 37 \text{ kN}$$

Joint E :



$$\sum F_x = 0 \quad \longrightarrow +$$

$$25 + F_{DE} \cos 67.38 = 0 \Rightarrow 25 + F_{DE} 0.38 = 0$$

$$\Rightarrow F_{DE} = \frac{-25}{0.38} = -65.78$$

Say: -66 kN (compression)

Now:

$$\sum f_y = 0 \quad \uparrow$$

$$\Rightarrow -30 - F_{CE} + 66 \sin 67.38 = 0$$

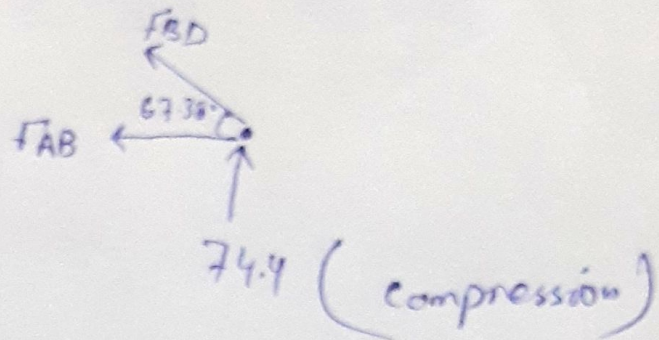
$$-30 - F_{CE} + 66 \times 0.92 = 0$$

$$-30 + 60.72 = F_{CE}$$

$$\boxed{F_{CE} = 30.72} \quad \text{--- (Tension)}$$



Now Joint B



$$= F_{BD} \sin 67.38 = -74.4$$

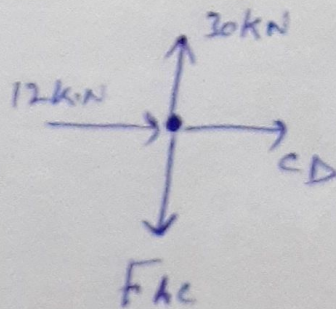
$$F_{BD} = -80.86 \text{ kN (Compression)}$$

Now  $\sum F_x = 0 \rightarrow +$

$$\Rightarrow -F_{AB} + 74.4 \times \cos 67.38 = 0$$

$$F_{AB} = 28.27 \text{ kN (Tension)}$$

Now Joint C



$$\sum F_x = 0$$

$$F_{CD} = -12 \text{ kN (compression)}$$

Also:

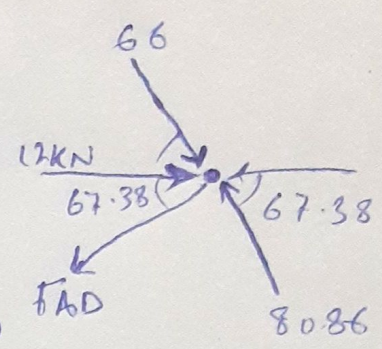
$$F_{AC} = 30 \text{ kN}$$



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⇒ Now Joint "D"

Σfy = 0 ↑



= 66 + FAD Sin 67.38

FAD = 71.7 kN (Tension)

THE END