

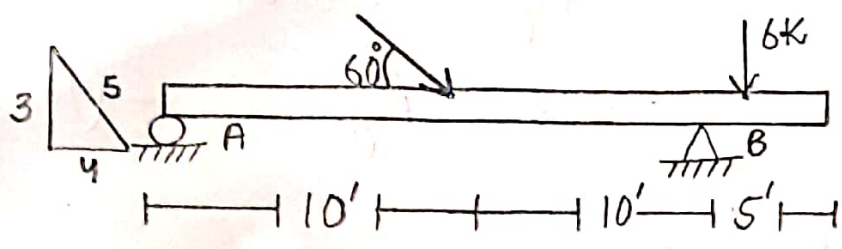
Name :- Ahmad Ali.

ID :- 7746.

Subject :- Structure Analysis-1.

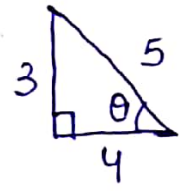
Instructor :- Engr. M. Saqib.

# Q. NO:-1



## Solution:-

First to find the angle for the roller support.



∴ Using trigometry.

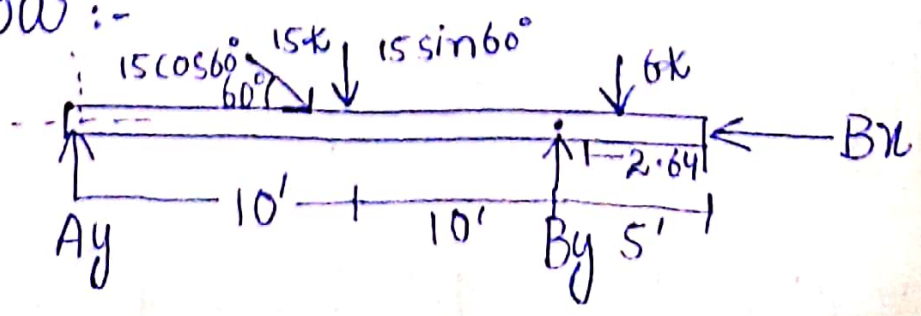
$$\sin \theta = \frac{P}{H}$$

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

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

$$\theta = 36.86^\circ$$

So, Now :-



$$\rightarrow \sum F_x = 0 \quad \begin{matrix} + \\ \rightarrow \\ - \\ \leftarrow \end{matrix} \quad (2)$$

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

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

$$\rightarrow \sum F_y = 0 \quad \begin{matrix} \uparrow + \\ \downarrow - \end{matrix}$$

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

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

$$0.80 A_y + B_y = 18.99 \quad (2)$$

$$\rightarrow \sum M_B = 0 \quad \begin{matrix} \curvearrowright + \\ \curvearrowleft - \end{matrix}$$

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

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

$$16 A_y - 175 = 0$$

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

$$\boxed{A_y = 10.9375k}$$

put values in equation (2) :-

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

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

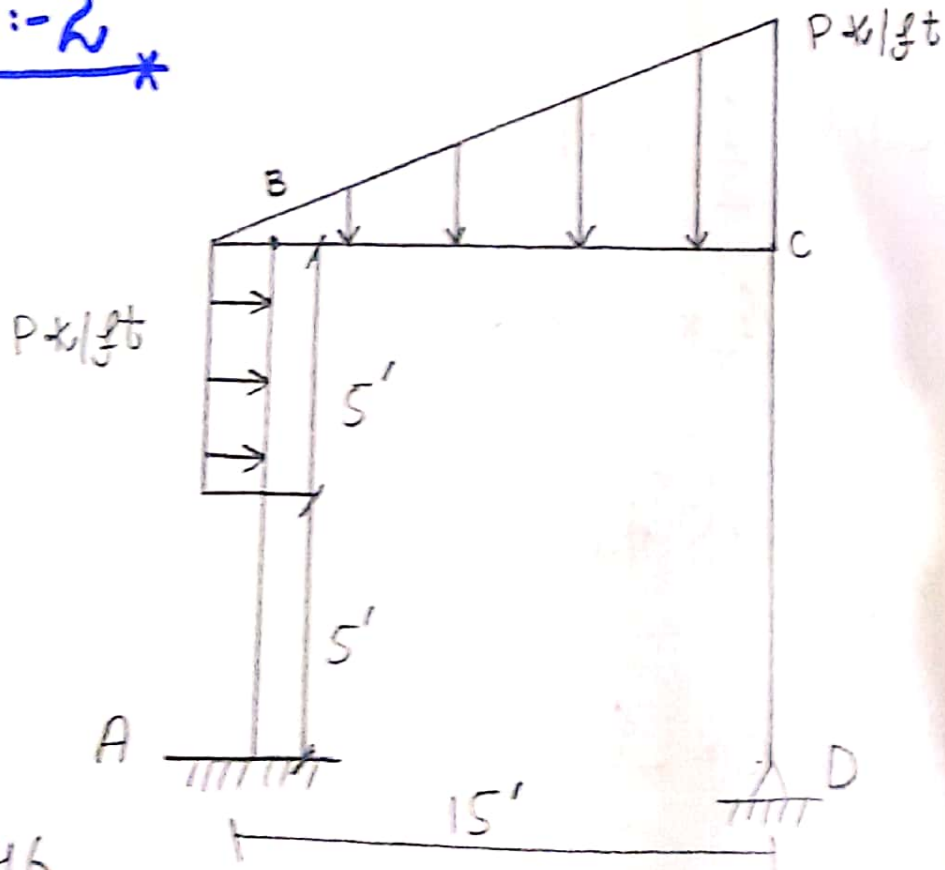
$$B_y = 10.25 \text{ k}$$

put value of  $A_y$  in eqn (1) :-

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

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

Q. NO:-2



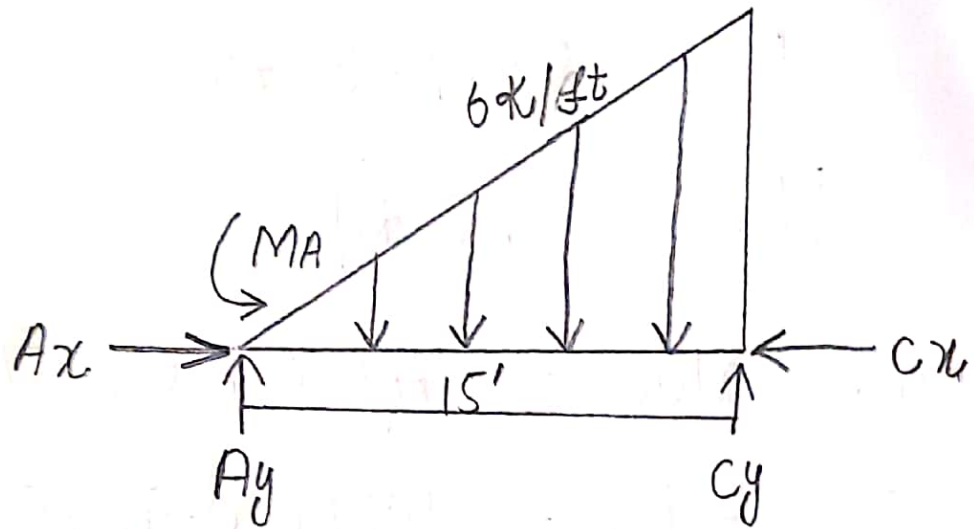
ID:- 7746  
P:- 6

# \* Solution:- \*

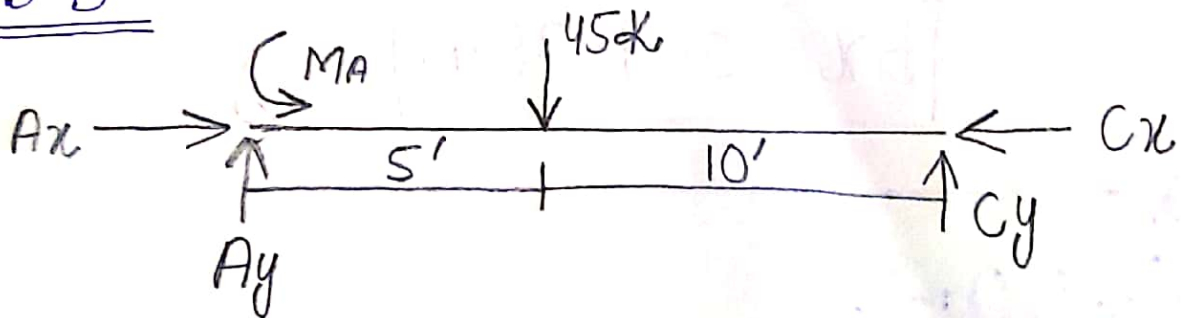
(4)

→ Free body diagram:-

U.V.L:-



F.B.D:-



$$\begin{aligned} \text{Area} &= \frac{1}{2} b \cdot h \\ &= \frac{1}{2} \times 15 \times 6 \end{aligned}$$

$$= 45 \text{ kip}$$

$$\begin{aligned} \text{Distance} &= \frac{1}{3} (b) \\ &= \frac{1}{3} (15) = 5' \end{aligned}$$

5

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

$$Ax - Cx = 0 \quad \text{--- (a)}$$

Now,

$$\rightarrow \sum F_y = 0 \quad \begin{matrix} + \uparrow \\ - \downarrow \end{matrix}$$

$$Ay + Cy - 45 = 0$$

$$Ay + Cy = 45 \text{ k} \quad \text{--- (1)}$$

$$\rightarrow \sum MA = 0 \quad \begin{matrix} + \uparrow \\ - \downarrow \end{matrix}$$

$$(45 \times 5) - Cy \times 15 = 0$$

$$225 - Cy \times 15 = 0$$

$$15 \times Cy = 225$$

$$Cy = \frac{225}{15}$$

$$\boxed{Cy = 15 \text{ k}}$$

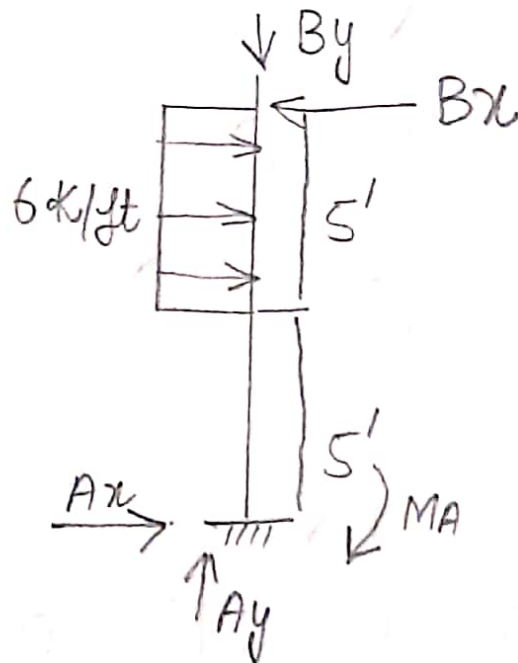
put value in eqn (1) :-

6

$$A_y - 15 = 45 \text{ k}$$

$$A_y = 45 + 15$$

$$A_y = 60 \text{ k}$$



$$\rightarrow \sum \mathcal{F}_x = 0 \quad \begin{matrix} + \\ \rightarrow \\ - \\ \leftarrow \end{matrix}$$

$$A_x + (6 \times 5) - B_x = 0$$

$$(A_x - B_x) = -6 \times 5$$

$$A_x - B_x = -30 \quad \text{--- (1)}$$

$$\rightarrow \sum \mathcal{F}_y = 0 \quad \begin{matrix} \uparrow + \\ \downarrow - \end{matrix}$$

$$A_y - B_y = 0 \quad \text{--- (2)}$$

$$\rightarrow \Sigma M_A = 0 \quad \downarrow \quad \downarrow$$

(7)

$$(6 \times 5) \times (2.5 + 5) - B_x \times 10 = 0$$

$$30 \times 7.5 - B_x \times 10 = 0$$

$$225 - B_x \times 10 = 0$$

$$\frac{B_x \times 10}{10} = \frac{225}{10}$$

$$\boxed{B_x = 22.5 \text{ k}}$$

put value of  $B_x$  in (1) :-

$$A_x - 22.5 = 30$$

$$A_x = -30 + 22.5$$

$$\boxed{A_x = 7.5 \text{ k}}$$

Put the value of  $A_y$  in (2) :-

$$60 - B_y = 0$$

$$\boxed{B_y = 60}$$



put the value of  $A_x$  in (8)

eqn (a) :-

$$A_x - C_x = 0$$

$$7.5 - C_x = 0$$

$$\boxed{C_x = 7.5 \text{ k}}$$

Since D is hinge and in the projection of point C thus

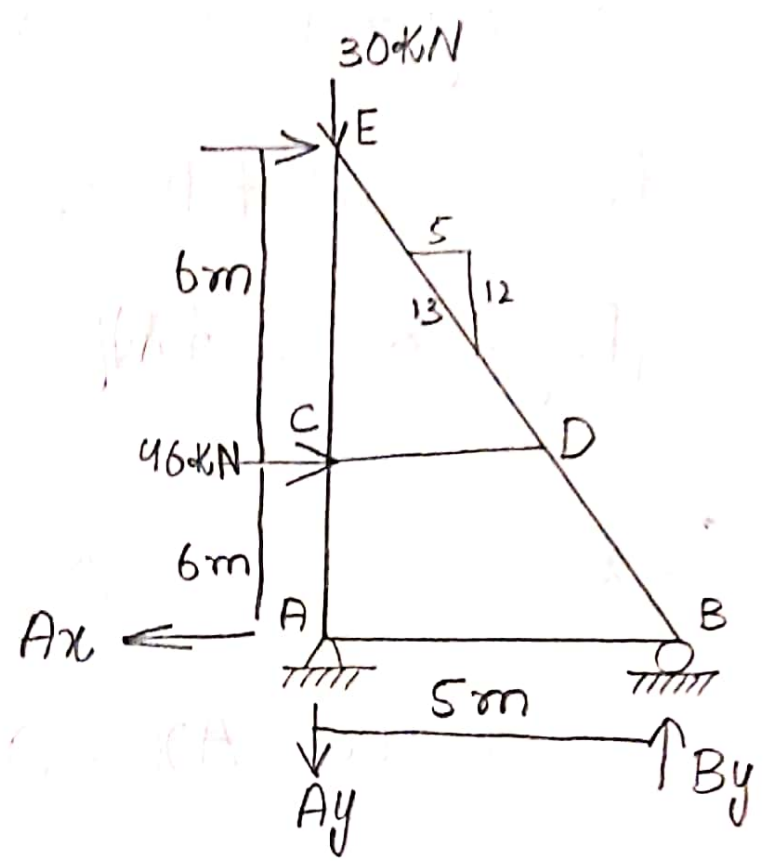
$$\boxed{D_x = -7.5 \text{ k}}$$

$$\boxed{D_y = 15 \text{ k}}$$



Q. NO:-3

Solution:-



First find reactions:-

$$\sum M = 0 \quad \downarrow \ominus$$

$$(46 \times 6) + (25 \times 12) - B_y \times 5 = 0$$

$$276 + 300 = B_y \times 5$$

$$\frac{576}{5} = \frac{B_y \times 5}{5}$$

$$B_y = 115.2 \text{ kN}$$

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

(10)

$$-30 - A_y + 115 \cdot 2 = 0$$

$$A_y = -30 + 115 \cdot 2$$

$$\boxed{A_y = 85 \cdot 2 \text{ kN}}$$

$$\sum F_x \rightarrow \leftarrow = 0$$

$$25 + 46 - A_x = 0$$

$$A_x = 25 + 46$$

$$\boxed{A_x = 71 \text{ kN}}$$

Also,

$$\tan \theta = \frac{12}{5}$$

$$\theta = \tan^{-1} \left( \frac{12}{5} \right)$$

$$\boxed{\theta = 67.38^\circ}$$

Joint :- B

(11)

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

$$115.2 - F_{DB} \sin(67.38^\circ) = 0$$

$$115.2 - F_{DB} (0.92) = 0$$

$$\frac{115.2}{0.92} = \frac{F_{DB} (0.92)}{0.92}$$

$$\boxed{F_{DB} = 125.21 \text{ kN}}$$

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

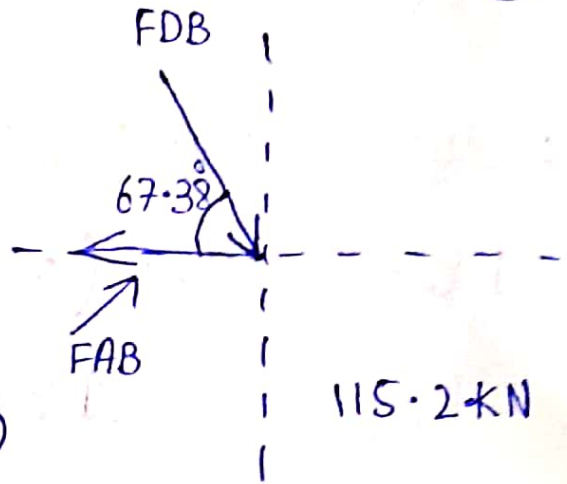
$$-F_{AB} + 125.21 \cos(67.38) = 0$$

$$F_{AB} = 125.21 (0.38)$$

$$\boxed{F_{AB} = 47.57 \text{ kN}}$$

Joint :- A

P.T.O  $\rightarrow$



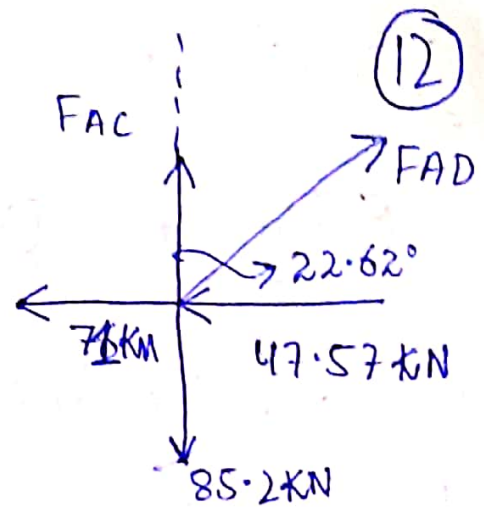
$$\sum F_x = 0 \quad (\rightarrow +)$$

$$-71 - 47.57 + F_{AD} \sin(22.62) = 0$$

$$+ 118.57 + F_{AD} (0.38)$$

$$F_{AD} = \frac{-118.57}{0.38}$$

$$F_{AD} = 312.02 \text{ kN}$$



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

$$F_{AC} - 85.2 + 312.02 \cos(22.62) = 0$$

$$F_{AC} = -85.2 + 312.02 (0.38)$$

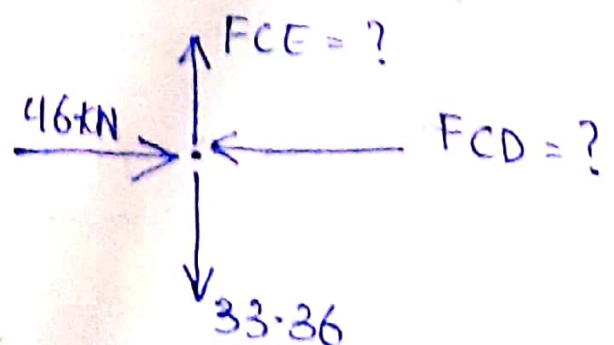
$$F_{AC} = -85.2 + 118.56$$

$$F_{AC} = 33.36 \text{ kN} \downarrow +$$

Joint :- C

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

$$46 - F_{CD} = 0$$



(13)

$$F_{CD} = 46 \text{ kN}$$

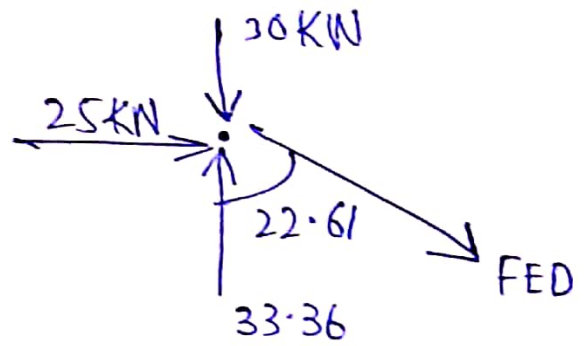
$$\sum F_y \uparrow = 0$$

$$F_{CE} - 33.36 = 0$$

$$F_{CE} = 33.36 \text{ kN}$$

Joint :- E

$$\sum F_y (\uparrow) = 0$$



$$-30 + 33.36 - F_{ED} \cos(22.61) = 0$$

$$3.36 - F_{ED}(0.92) = 0$$

$$F_{ED} = \frac{3.36}{0.92}$$

$$F_{ED} = 3.652 \text{ kN}$$

