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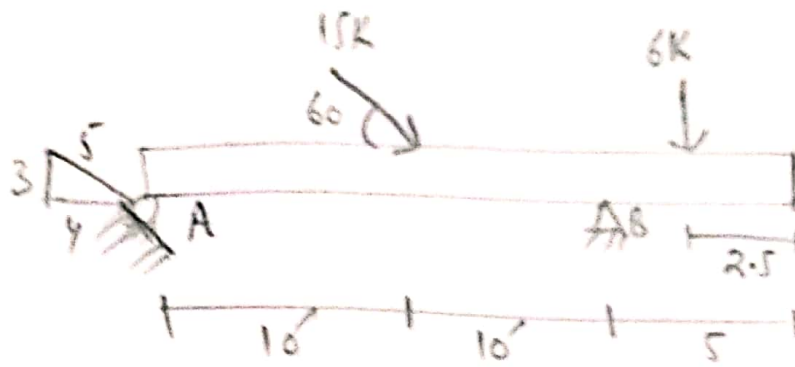
Section :- B

Submitted To :- Engr-Saqib Khan

Subject :- Structure Analysis I

Date :- 29/Aug/2020.

Q No 1



Sol First of all we have to find the angle for the roller support.

  $\therefore$  Using Trigonometry

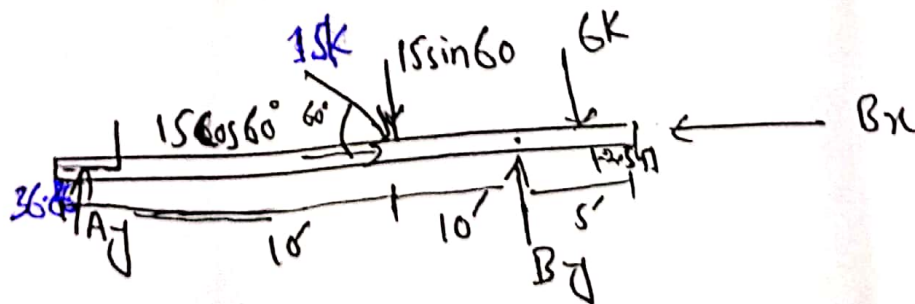
$$\sin \theta = \frac{P}{H}$$

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

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

$$\theta = 36.86^\circ$$

So Now



$$(1) \sum F_x = 0 \quad \begin{matrix} \rightarrow \\ \leftarrow \end{matrix}$$
$$15 \cos 60^\circ - B_x - A_y \sin 36.86^\circ = 0$$

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

$$(2) \sum F_y = 0 \uparrow + \downarrow$$

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

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

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

$$(3) \sum M_B = 0 \downarrow + \uparrow$$

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

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

$$16 A_y - 175 = 0$$

$$A_y = \frac{175}{16} = 10.9375k$$

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

Put the value in eq(2)

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

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

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

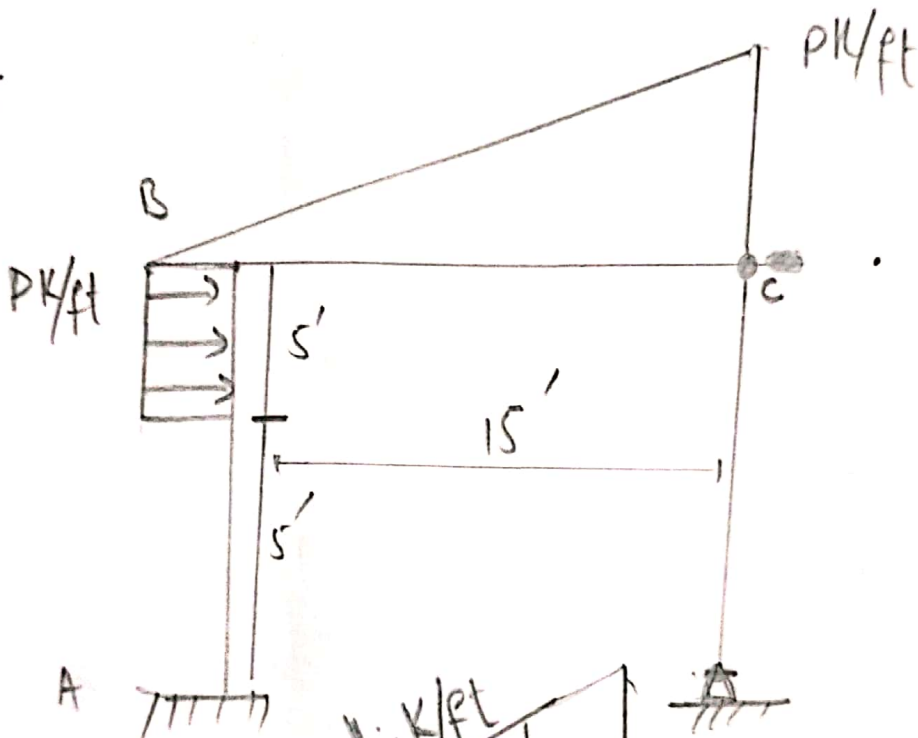
(3)

Put the value of  $A_y$  in eqn (1)

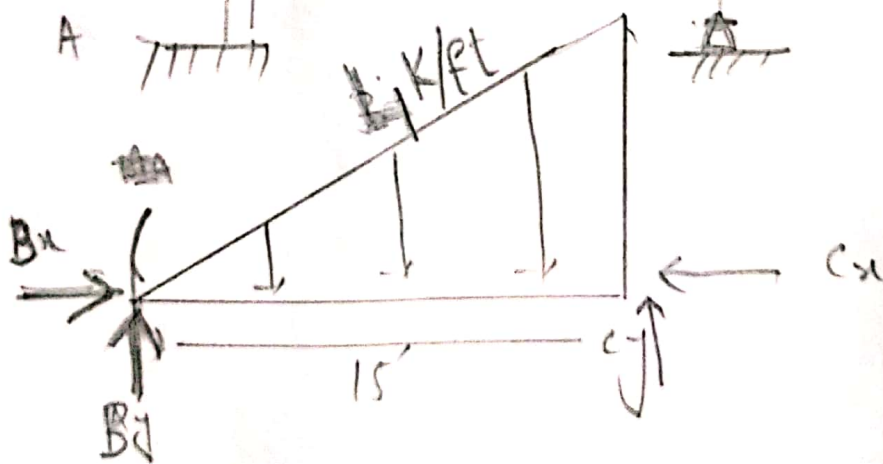
$$7.5 - B_x - 0.599(10.9375) = 0$$

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

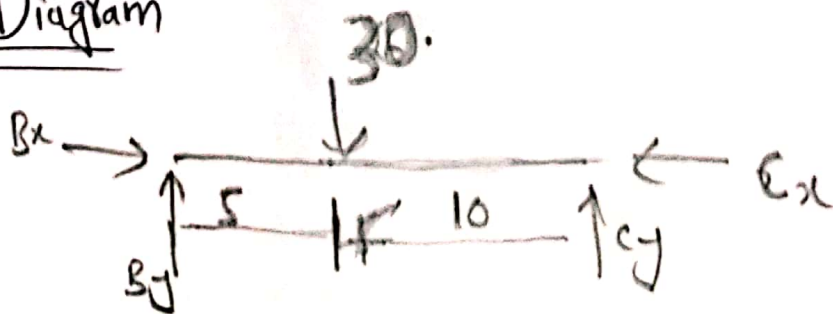
Q No 2



sol



F.B. Diagram



$$A_{\text{area}} = \frac{1}{2} b h = \frac{1}{2} (15)(4) \\ = \frac{1}{2} 30$$

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

$$(i) \sum F_x = 0 \rightarrow + \leftarrow -$$

$$B_x - C_x = 0 \rightarrow (1)$$

$$(ii) \sum F_y = 0 \uparrow + \downarrow -$$

$$B_y + C_y = 30 \rightarrow (2)$$

$$(iii) \sum M_B = 0 \downarrow + \uparrow -$$

$$(30 \times 5) - C_y \times 15 = 0$$

$$150 = 15 C_y$$

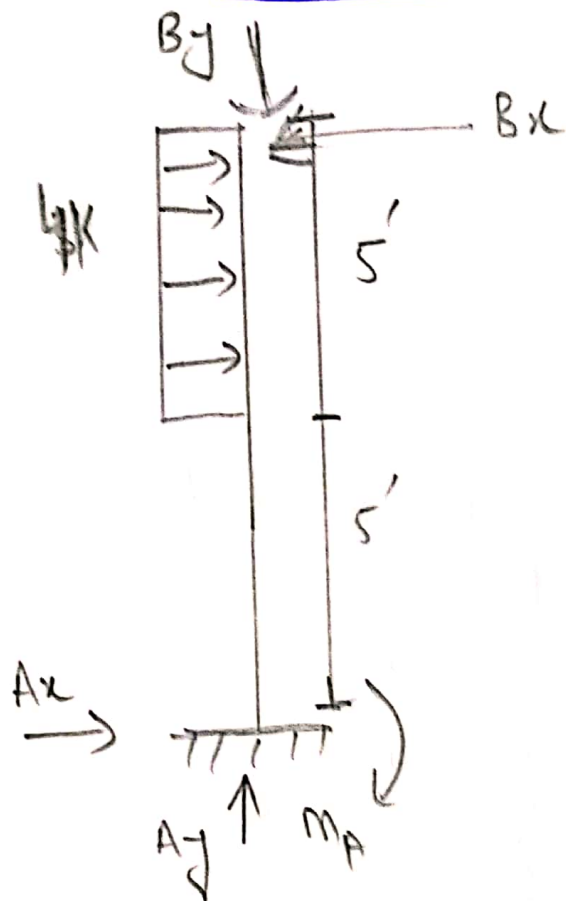
$$\boxed{C_y = 10 \text{ K}}$$

Put the value in eq (2)

$$B_y + 10 = 30$$

$$B_y = 30 - 10$$

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



$$(i) \sum F_x = 0 \rightarrow \leftarrow$$

$$A_x + (4 \times 5) - B_x = 0$$

$$A_x - B_x = -20 \rightarrow (3)$$

$$(ii) \sum F_y = 0 \uparrow + \downarrow -$$

$$A_y - B_y = 0$$

$$(iii) \sum M_A = 0 \uparrow + \downarrow$$

$$(4 \times 5) \times (2.5 + 5) - B_x \times 10 = 0$$

$$20 \times 7.5 - B_x \times 10 = 0$$

$$150 = B_x \times 10$$

$$B_x = 15 \text{ k}$$

Put the value in eq (3)

$$A_x - 15 = -20$$

$$A_x = -5$$

Now since C and D are at same line  
thus load is transferred so

(6)

$$C_y = 10k$$

$$\text{So } \boxed{D_y = -10k}$$

Put the value of  $B_y$  in (4)

$$A_y - 20k = 0$$

$$\boxed{A_y = 20k}$$

Put the value of  $B_x$  in eq (1)

$$15 - C_x = 0$$

$$\boxed{C_x = 15k}$$

∴ lies on same plane

$$\text{So } \boxed{D_x = -15k}$$

$$M_B = 0 \quad \checkmark +$$

$$- (4 \times 5)(2.5) - (A_x \times 10) + M_A = 0$$

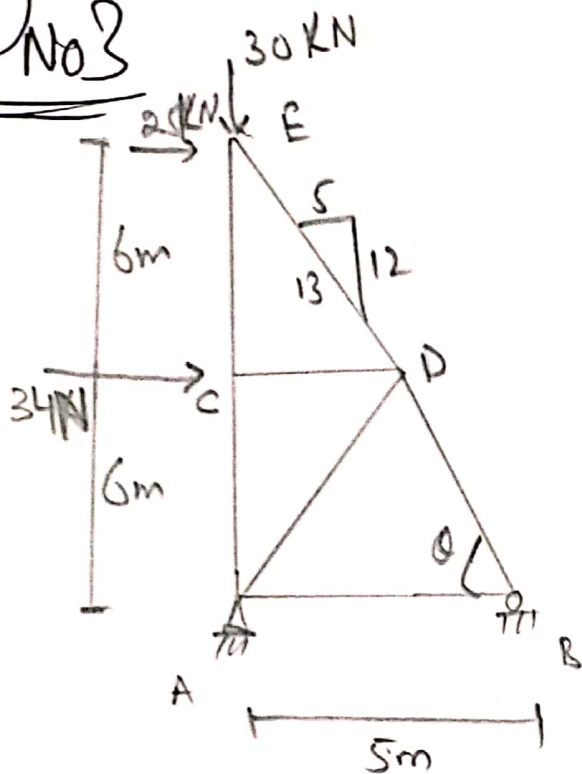
$$-(50) - (-5 \times 10) + M_A = 0$$

$$-50 + 50 + M_A = 0$$

$$M_A = 0$$

(7)

Q No 3



$$\sin \theta = P/H$$

$$\theta = \sin^{-1}(5/13)$$

$$\theta = 22.62^\circ$$

$$\theta = ?$$

Sol

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

$$(25 \times 12) - (B_y \times 5) + (34 \times 6) = 0$$

$$300 + 204 = 5B_y$$

$$B_y = 100.8 \text{ k}$$

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

$$A_y + B_y - 30 = 0$$

$$A_y + 100.8 - 30 = 0$$

$$A_y + 70.8 = 0$$

$$A_y = -70.8$$

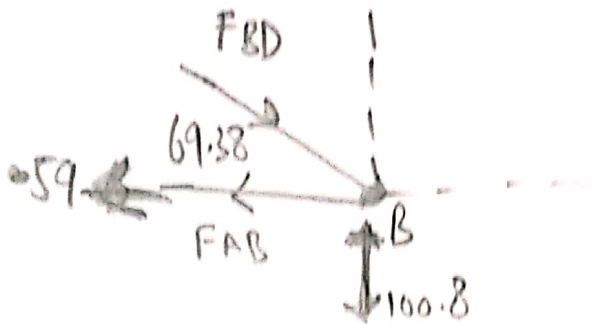


$$\sum F_x = 0 \rightarrow + \leftarrow - \quad (8)$$

$$25 + 34 + Ax = 0$$

$$\boxed{Ax = -59}$$

Joint B



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

$$-59 + F_{AB} = 0$$

$$\boxed{F_{AB} = +59 \text{ k}} \quad (7)$$

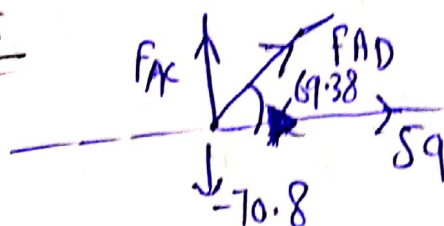
$$\sum F_y = 0 \uparrow + \downarrow -$$

$$-F_{BD} \cos 69.38 + 100.8 = 0$$

$$0.35 F_{BD} = 100.8$$

$$F_{BD} = 288$$

Joint A



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

$$= +59 + F_{AD} \sin 69.38 = 0$$

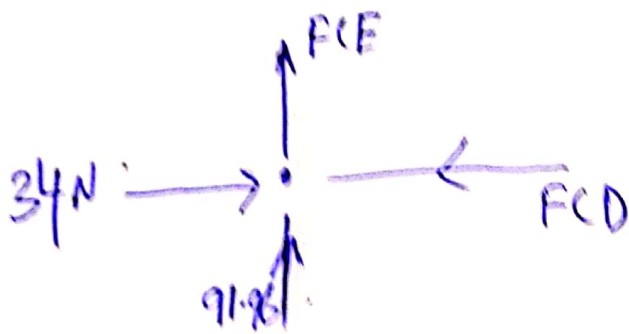
$$\boxed{F_{AD} = -62.76 \text{ N}}$$

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

$$= -70 + F_{AC} + F_{AD} \cos 69.38^\circ = 0$$

$$\boxed{F_{AC} = 91.96 \text{ N} = AC}$$

Joint C

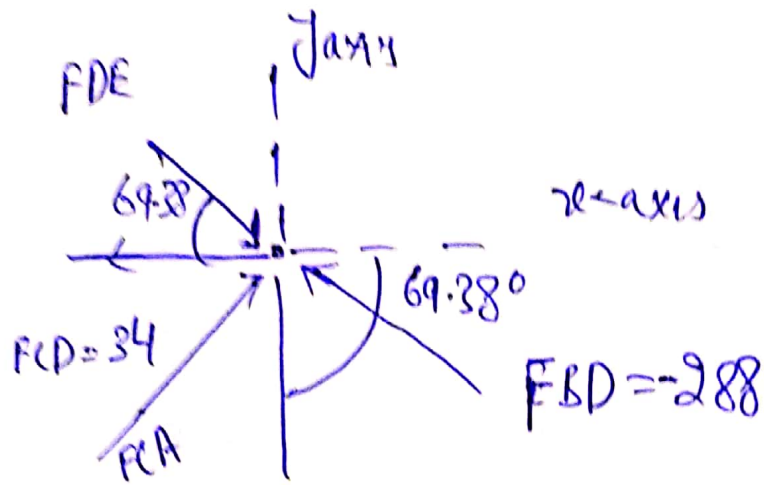


$$\sum F_x = 0 \rightarrow + \leftarrow -$$

$$\boxed{F_{CD} = 34 \text{ N}} \quad T$$

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

$$\boxed{F_{CE} = 91.96 \text{ N}}$$

Joint-D

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

$$-34 - FDE \sin 69.38 - 288 \cos 69.38 = 0$$

$$FDE = 143.40 \text{ N}$$