

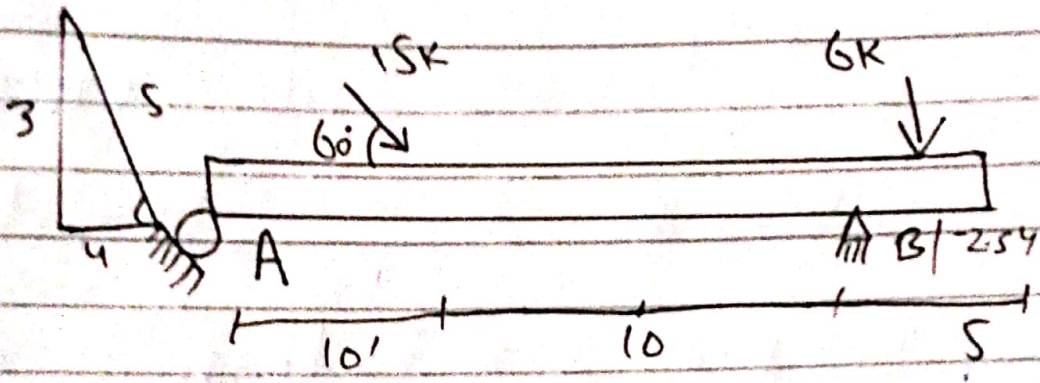
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Sub: Structural analysis  
1

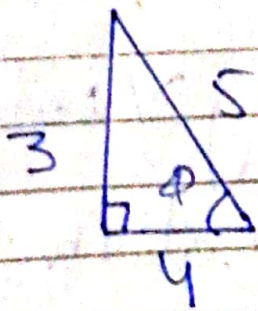
Q: 1: -

①



Sol:-

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



∴ using Trigonometry

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

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

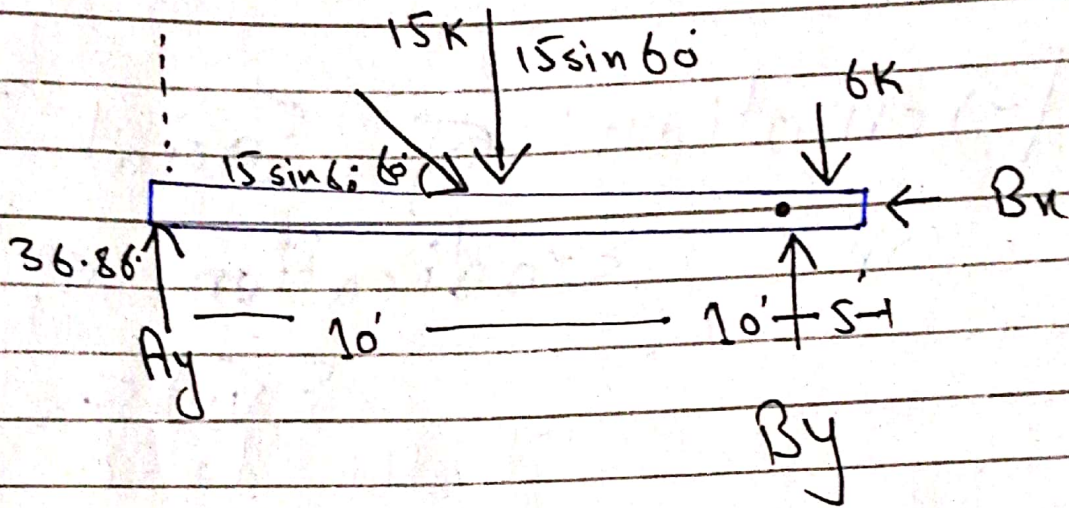
$$\theta = \sin^{-1} \left( \frac{3}{5} \right)$$



(2)

$$\theta = 36.86^\circ$$

So now



$$\textcircled{1} \quad \sum F_x = 0 \quad \rightarrow \leftarrow$$

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

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

$$\textcircled{2} \quad \sum F_y = 0 \quad \uparrow \downarrow$$

$$A_y \cos 36.86^\circ + B_y - 6 \text{ kN} - 15 \sin 60^\circ = 0$$

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

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(3)

(3)

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

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

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

$$16A_y - 175 = 0$$

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

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

put the value in eq (2)

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

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

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



Put the Value of  
Ay in eq (1)

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

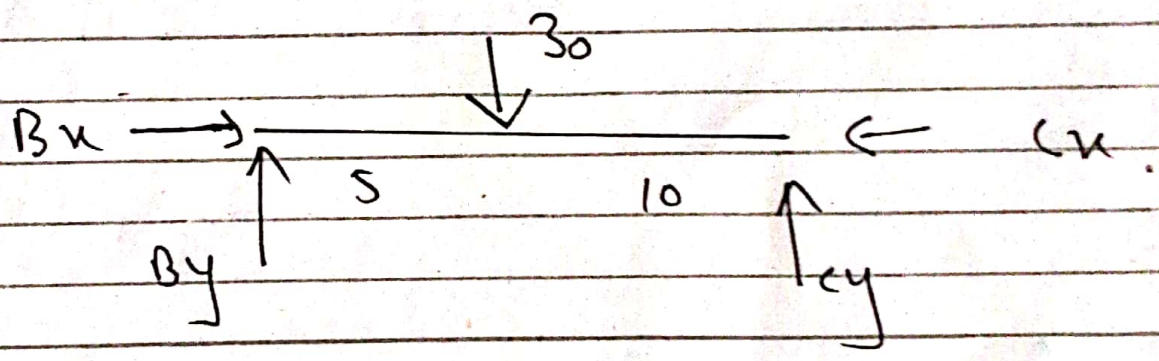
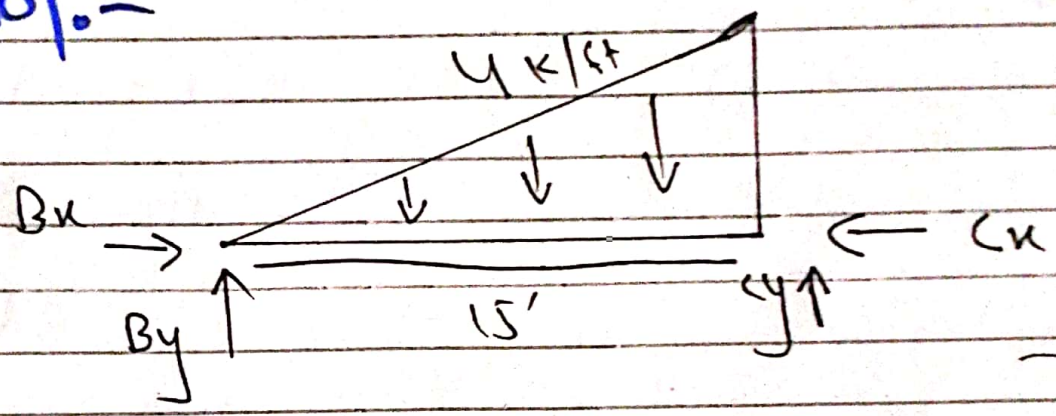
$$Bx = 0.9375 \text{ k}$$



Q: Q:

Sol: -

Ans:



$$\text{Area} = \frac{1}{2} bh = \frac{1}{2} (15)(4)$$

$$= \frac{1}{2} 30$$

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

$$= \frac{1}{3} (15)$$

$$= 5'$$



(6)

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

$$B_u - C_u = 0 \rightarrow (1)$$

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

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

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

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

$$150 = 15C_y$$

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

Put the value in eq (2)

$$B_y + 10 = 30$$

$$B_y = 30 - 10$$

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



ii

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

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

$$A_x - B_x = -20 \rightarrow \textcircled{3}$$

ii

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

$$A_y - B_y = 0$$

iii

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

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

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

$$150 = B_x \times 10$$

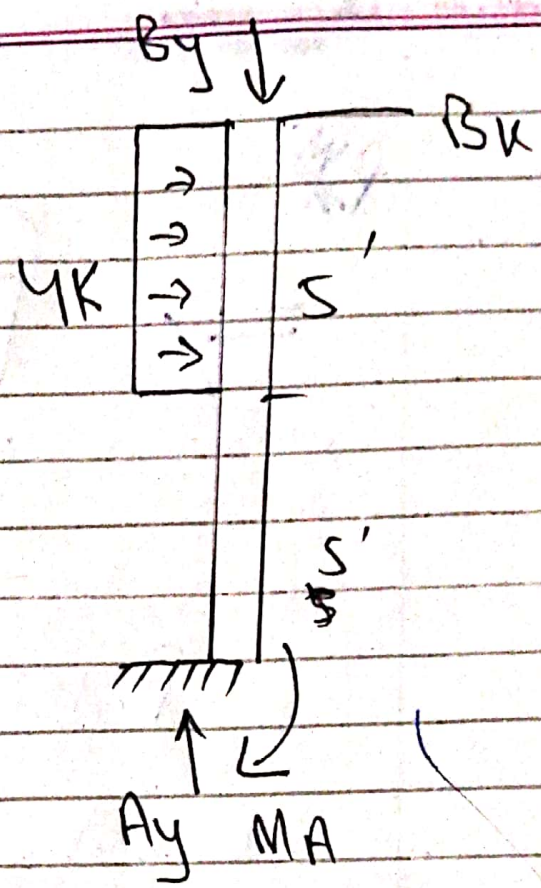
$$B_x = 15 \text{ K}$$

Put Value in eq (3)

$$A_x - 15 = -20$$

$$A_x = -5$$

Now Since C and D are at same line then load is transferred So





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

So  $D_y = -10 \text{ K}$

Put the value of  $B_y$  in (4)

$$A_y - 20 \text{ K} = 0$$

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

Put value of  $B_x$  in eq (1)

$$15 - C_x = 0$$

$$C_x = 15$$

lies on same line

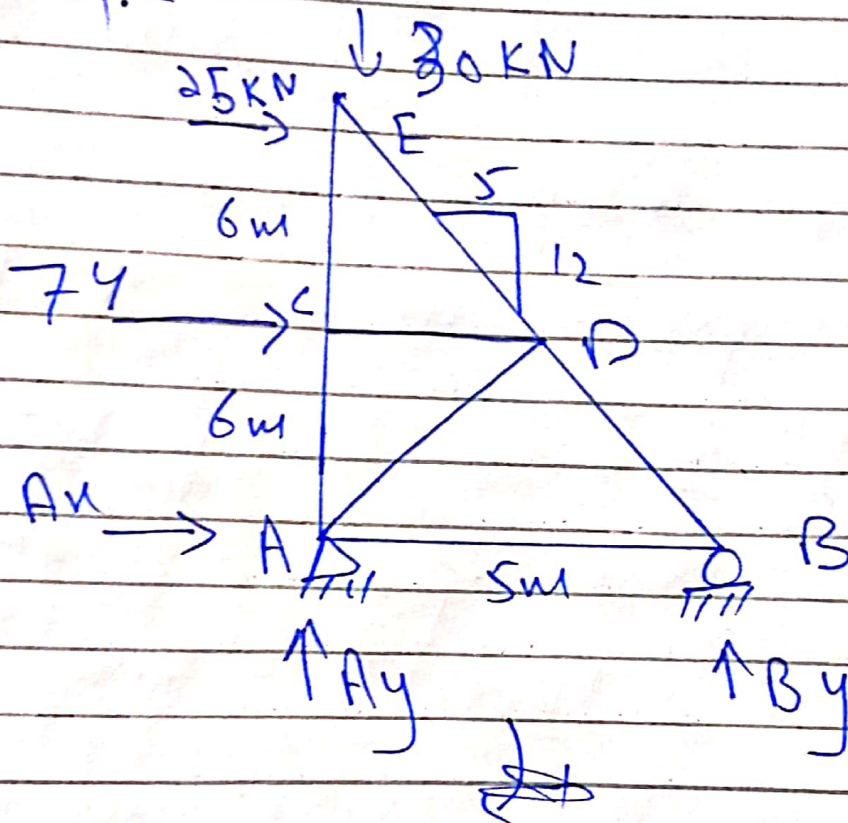
So

$$D_x = -15$$



Q: 3:

Sol:-



$$\sum M_A = \downarrow +$$

$$\rightarrow 25 \times 12 + 74 \times 6 - B_y \times 5 = 0$$

$$B_y = \frac{300 + 444}{5}$$

$$B_y = 148.8 \text{ kN}$$



$$\rightarrow Ay + By = 30$$

$$Ay = 30 - 14 \cdot 8$$

$$Ay = -118.3$$

↳ Means downward

$$\Sigma f_x = 0 \rightarrow +$$

$$Ax + 25 = 0$$

$$Ax = -99$$

$$Ax = -99$$

↳ Means

in opposite

Joint E:

25kN

30k

direction

67.38

FCE

FDE



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

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

$$\Rightarrow F_{DE} = -25 / \cos 67.38$$

$$F_{DE} = -65 \text{ kN}$$

Compression

$$\theta = 67.38^\circ$$

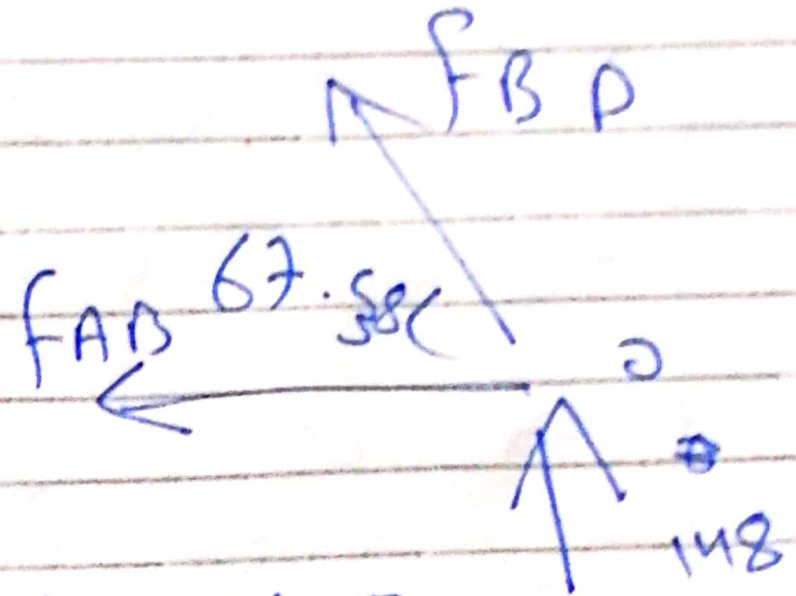
$$u = 2.5$$

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



Joint B

$$\Sigma y = 0 \uparrow +$$



$$FBD \sin(67.38) + 148.8 = 0$$

$$-99 + F_{AB} = 0$$

~~$$F_{BD} = \frac{148.8}{\sin 67.38}$$~~

$$F_{AB} = 99 \text{ N}$$

Tension

~~$$\sin 67.38$$~~



Joint C

$$F_{AC} = 81.938 \text{ N}$$

Joint D

$$\sum F_x = 0 \rightarrow \leftarrow$$
$$F_{DE} \times 0.94 = 118.8$$
$$F_{DE} = 126.384$$

Joint A

$$F_{AD} = -99 / 0.94$$
$$F_{AD} = -105.320$$

Compression



$$\sum f_y = 0 \quad \uparrow^+ \quad \downarrow^-$$

$$-118.8 + F_A C + F_A D (\cos$$

$$69.38^\circ = 0$$

$$F_A C = 81.938$$