

NAME

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Subject

Structure 1

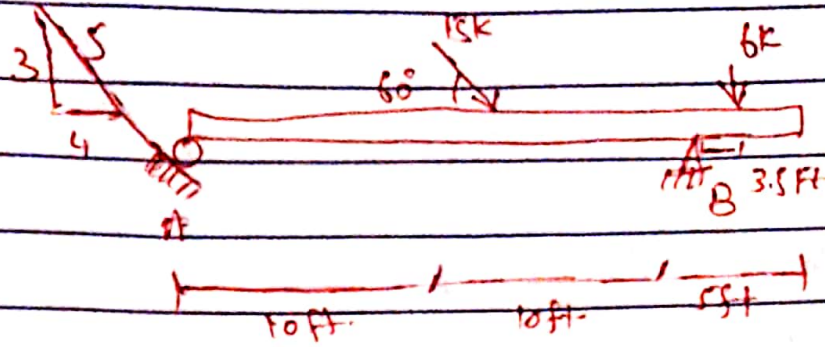
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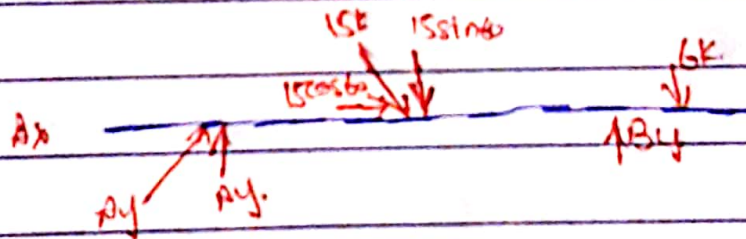
Q1



Support reaction = ?

Using equation of equilibrium
"Step" Drawn Free body diagram
Identify the type of support
Provided.

Resolve the inclined force into its
Component



Now Using equation of equilibrium
As;

$$\tan \theta = \left(\frac{3}{4}\right)$$

$$\theta = \tan^{-1} \left(\frac{3}{4}\right)$$

$$\theta = 36^\circ$$

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

$$A_y + B_y - 15 \sin 60 - 6 = 0$$

$$A_y + B_y - 12.99 - 6 = 0$$

$$A_y + B_y = 18.99 \text{ k}$$

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

$$+ A_x + 15 \cos 60 = 0$$

$$A_x = -7.5 \text{ k} \quad (\text{opposite to the assume direction})$$

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

$$A_y (\cos 36 / 20) - 15 \sin 60 (10) + 6(2.5) = 0$$

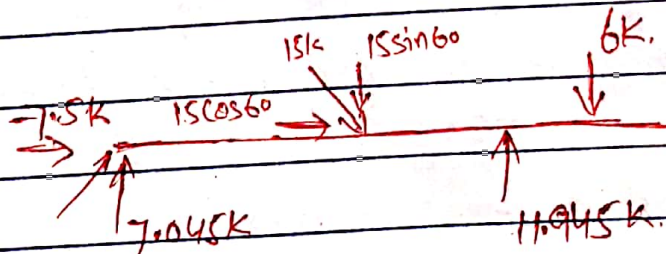
$$A_y (16.78) - 129 + 15 = 0$$

$$A_y = 114 / 16.78$$

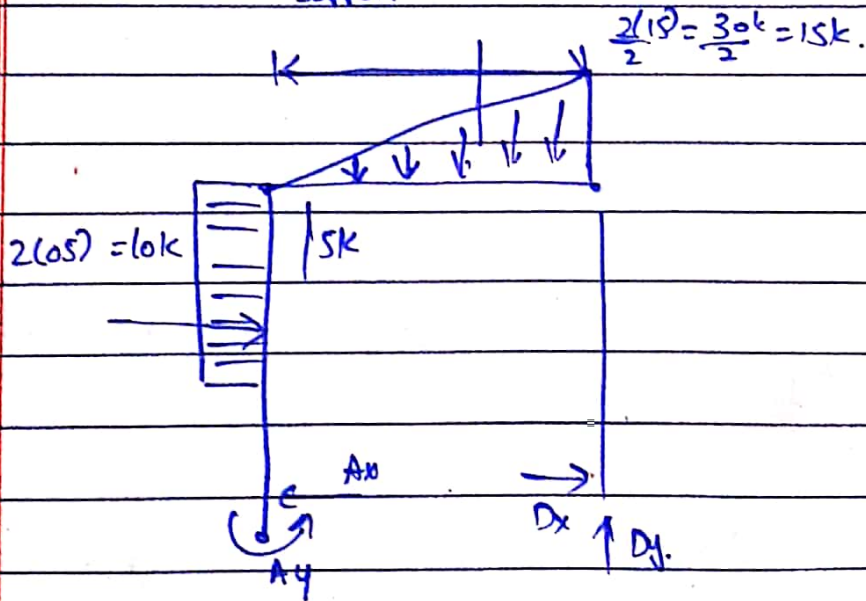
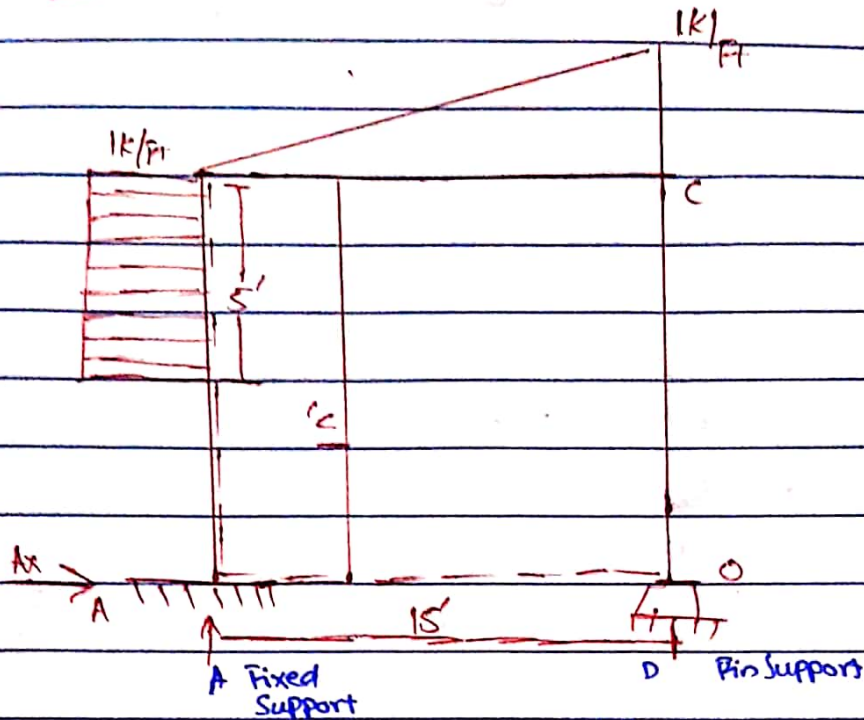
$$A_y = 7.045 \text{ k}$$

By putting in eq (i)

$$B_y = 11.945 \text{ k}$$

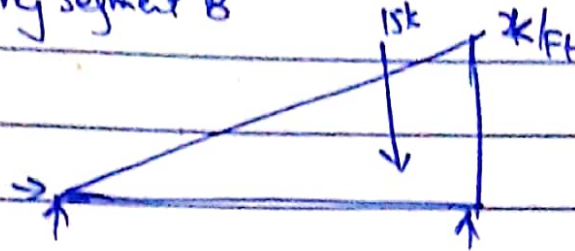


Q2



Support reaction
By applying the equation
of equilibrium

Taking Segment B



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

$$B_y + C_y - 15 = 0$$

$$B_y + C_y = 15k$$

$$\sum M_B = 0$$

$$C_y(15) - 15(10) = 0$$

$$15C_y = 150$$

$$C_y = 10k$$

eq. (i)

$$B_y - 15 = 10$$

$$B_y = -5k$$

opposite to assume direction

Taking Segment A

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

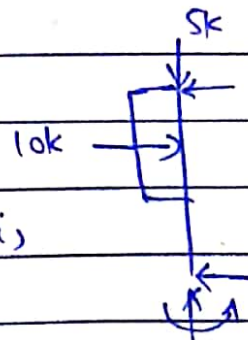
$$-B_x - A_x = 10$$

$$B_x + A_x = -10 \quad \text{--- (ii)}$$

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

$$A_y - 5 = 0$$

$$A_y = 5k$$



$$\sum M_A = 0$$

$$B_x (10) - 10(7.5) = 0$$

$$10B_x - 75 = 0$$

$$B_x = 7.5$$

eq. (ii)

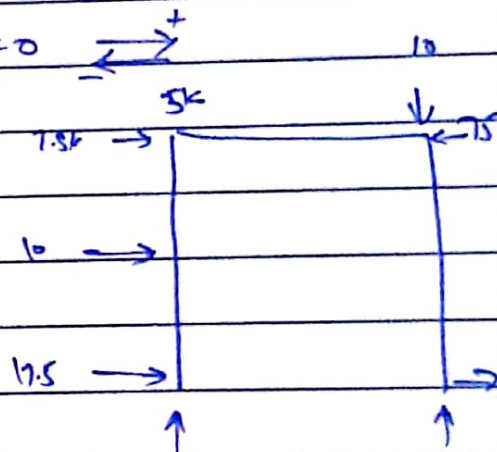
$$B_x + A_y = -10$$

$$7.5 + A_y = -10$$

$$A_y = -17.5 \text{ k}$$

Now

$$\sum F_x = 0 \quad \rightleftarrows^+$$



$$-7.5 - 17.5 + (C_x + D_x) = 0$$

$$C_x + D_x = 25 \quad \text{(iii)}$$

$$\sum M_D = 0 \quad \curvearrowright^+$$

$$-(7.5 \times 10) + (7.5 \times 10) - (5 \times 10) - (25 \times 10) = 0$$

$$-(C_x \times 10) + 75 - 250 - 250 = 0$$

$$-10C_x - 425 = 0$$

$$10C_x = -425$$

12

$$-100x + 425 = 0$$

$$100x = -425$$

$$C_y = -425$$

$$C_y = 425 \leftarrow$$

eq (iii)

$$C_x + D_x = 20k$$

$$42.5 + D_x = 20$$

$$D_x = -22.5k \leftarrow$$

$$D_y = 20k$$

GMA

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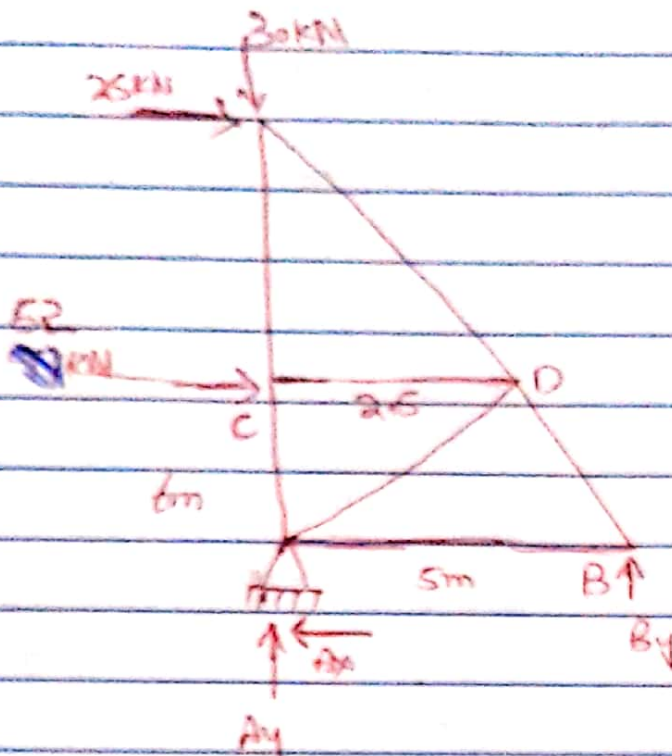
$$M_A = (10 \times 7.5) - (15 \times 10) - (42 \times 5 \times 10) + (25 \times 10) \\ + (20 \times 15) + (20 \times 15)$$

$$M_A = -460 \text{ k}\cdot\text{ft}$$

$$M = 450 \text{ k}\cdot\text{ft}$$

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

$$\Rightarrow 25 \times 12 + 52 \times 6 = B_y \times 5$$

$$B_y = 122.4$$

$$\text{Now } A_y + B_y = 30$$

$$\Rightarrow A_y = 30 - 122.4$$

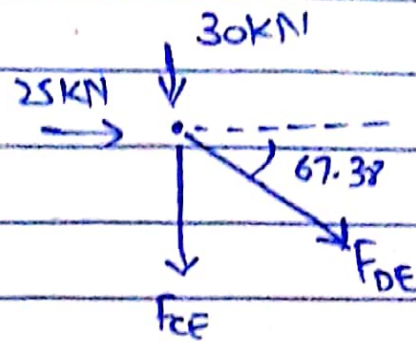
$$= -92.4$$

$$A_y = -92.4 \quad \text{Means downward}$$

$$A_x = 25 + 52$$

$$A_x = 77 \text{ kN}$$

Joint E



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

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

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

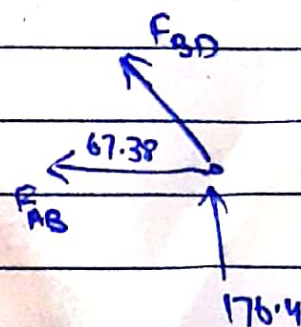
$$F_{DE} = -65 \text{ kN (compression)}$$

$$\sum F_y = 0$$

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

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

Now Joint B.



$$\sum F_y = 0$$

$$\Rightarrow F_{BD} \sin 67.33 = -116.4$$

$$\Rightarrow F_{BD} = -191.1 \text{ kN. Compression}$$

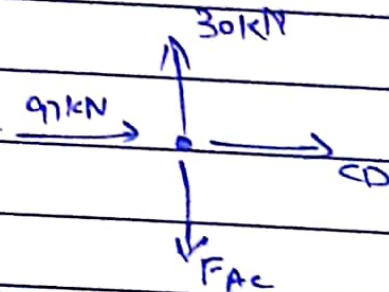
$$\sum F_x = 0 \quad \longrightarrow +$$

$$\Rightarrow -F_{AB} + 191.1 \times \cos 67.33 = 0$$

$$\boxed{F_{AB} = 73.5 \text{ kN}} \quad \text{Tension}$$

Now

Joint c



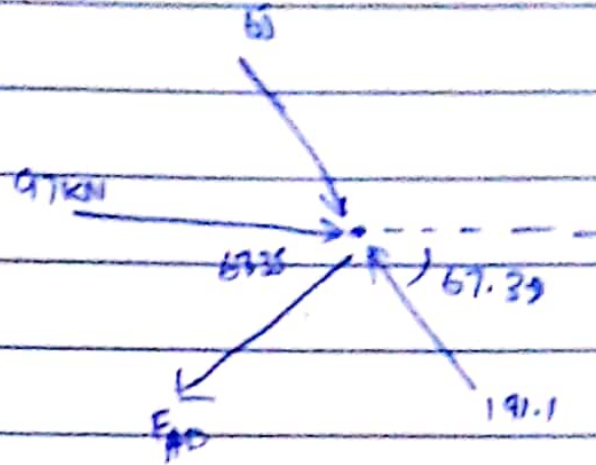
$$\sum F_x = 0$$

$$\boxed{F_{CD} = -97 \text{ kN}} \quad \text{Compression}$$

$$\sum F_y = 0$$

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

Now Joint D



$$\sum F_y = 0 \uparrow$$

$$= 191.1 \times \sin 67.38$$

$$= 65 + F_{AD} \sin 67.38$$

$$F_{AD} = 126.1 \text{ kN} \quad \text{Tension}$$

Q2

$$-100x + 425 = 0$$