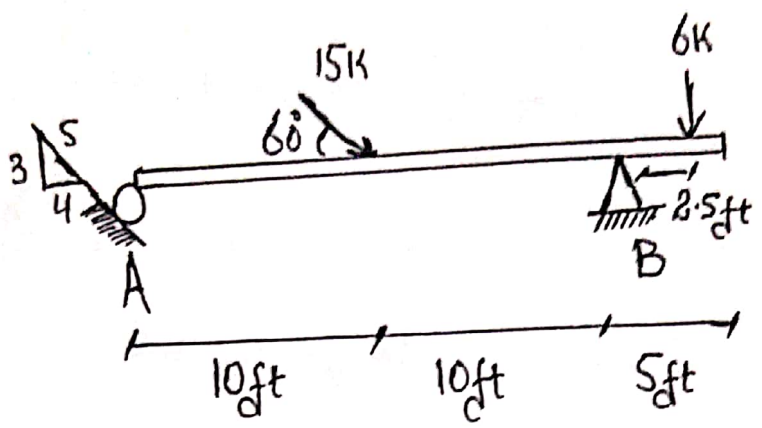


NAME ✂ "JUNAID AHMAD"  
ID ✂ 6872  
SECTION ✂ B  
SUBJECT ✂ STRUCTURAL ANALYSIS I  
SUBMITTED ✂ "ENGG; M-SAQIB"  
DATE ✂ 22/08/020

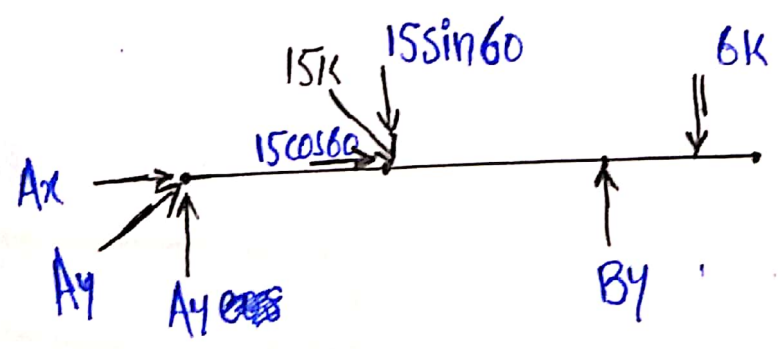
"Ans: 01"



Support reaction = ?

"Using equations of Equilibrium"

- "Steps":
- Draw free-body diagram.
  - Identify the type of support provided.
  - Resolve the inclined force into its component.



"Now using Equation of Equilibrium"

As;

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

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

$\theta = 36^\circ$

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

"2"

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

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

$$A_y + B_y = 18.99 \text{ k} \quad \text{--- "1"}$$

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

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

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

opposite to the assume direction

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

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

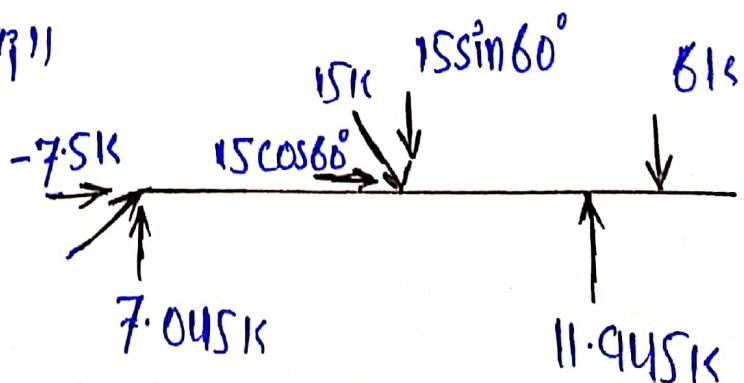
$$A_y (16.18) - 129 + 15 = 0$$

$$A_y = 114 / 16.18$$

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

By putting in eq "1"

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



~o~

$$A_y + B_y - 15 \sin 60 - 6 = 0 \quad \text{--- (1)}$$

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

$$A_y + B_y = 18.99 \text{ k} \quad \text{--- (1)}$$

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

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

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

opposite to the assume direction

$$\sum M_B = 0 \quad (\curvearrowright)^+$$

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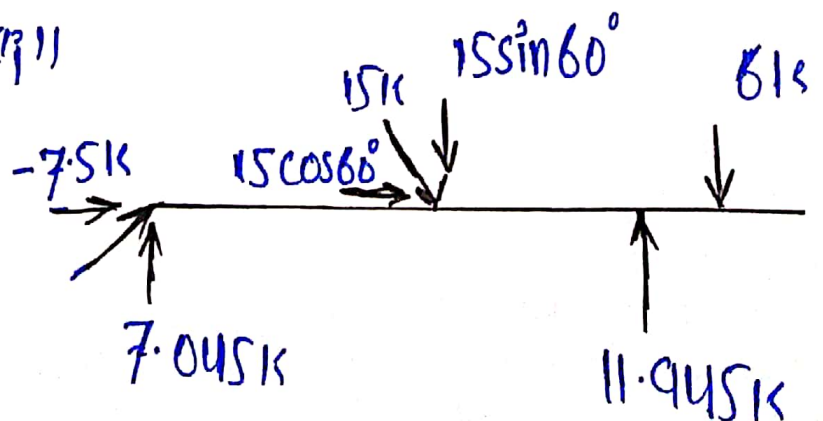
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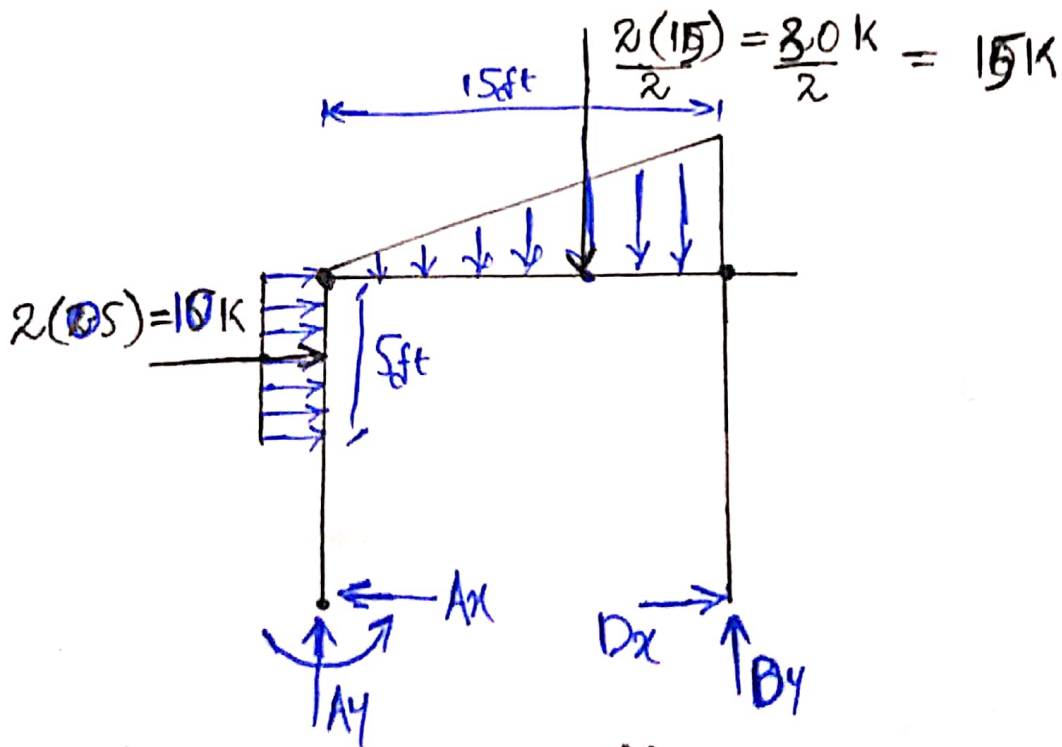
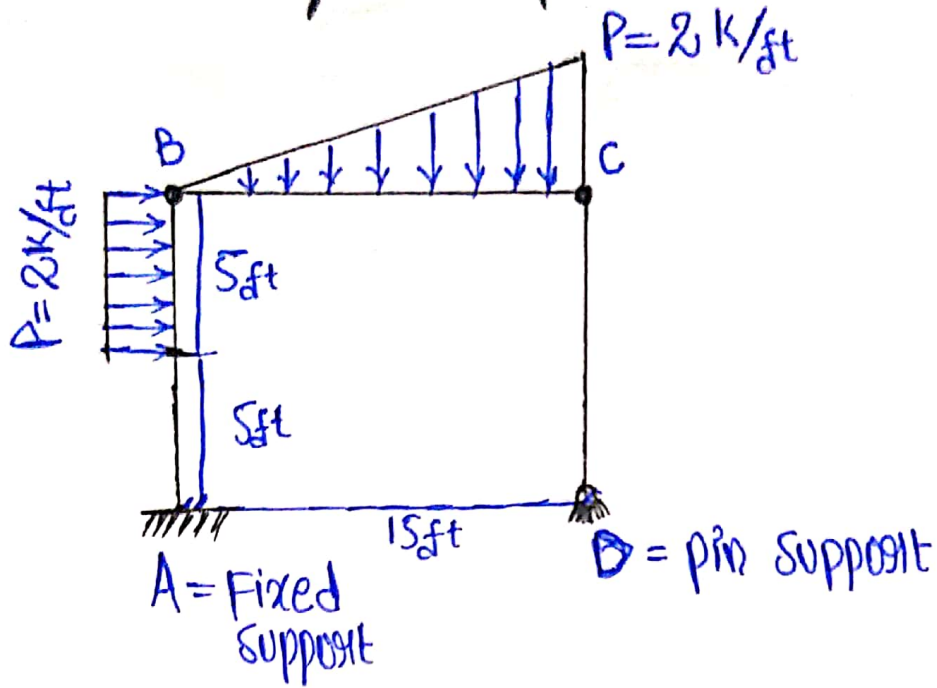




"Ans:02"

"Given Frame"

q1)



State Support reaction; ~

By applying the equation of equilibrium

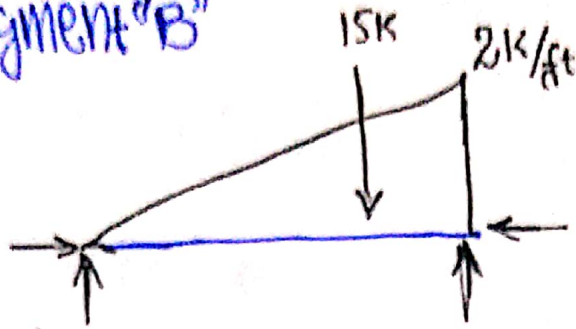
$$\sum F_x = 0$$

$$D_x - A_x + 10 = 0$$

$$D_x + A_x = 10 \text{ k}$$

Assume direction is okay.

"Talking Segment 'B'"



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

$$B_y + C_y - 15 = 0$$

$$B_y + C_y = 15K \quad \text{--- "i"}$$

$$\sum M_B = 0$$

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

$$15C_y = 150$$

$$C_y = 10K$$

$C_y$  "i"  $\Rightarrow$

$$B_y - 15 = 10$$

$$B_y = 25K$$

~~Opposite to assume direction.~~

Talking Segment 'A'; -

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

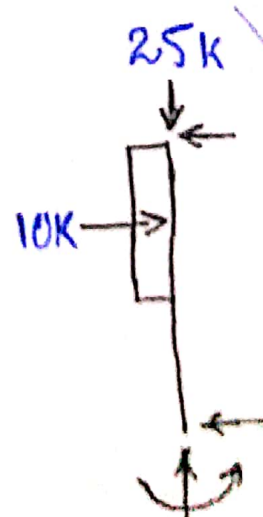
$$-B_x - A_x = 10$$

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

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

$$A_y - 25 = 0$$

$$A_y = 25K$$



$$\sum M_A = 0$$

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

$$10Bx - 75 = 0$$

$$Bx = 7.5$$

eq (ii)  $\Rightarrow$

$$Bx + Ax = -10$$

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

$$Ax = 17.5 \text{ k}$$

Now;

$$\sum f_x = 0 \iff$$

$$-7.5 - 17.5 + (Cx + Dx) = 0$$

$$Cx + Dx = 20 \text{ k} \quad \text{--- (iii)}$$

$$\sum M_D = 0 \quad (+)$$

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

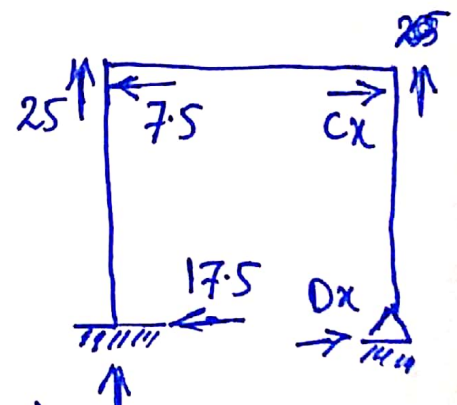
$$-(Cx \times 10) + 75 - 250 - 250 = 0$$

$$-10Cx - 425 = 0$$

$$10Cx = -425$$

$$Cx = -42.5$$

$$Cx = 42.5 \quad \leftarrow$$



"4"

eq (iii)  $\Rightarrow$

$$C_x + D_x = 20 \text{ k}$$

$$42.5 + D_x = 20$$

$$D_x = -22.5 \text{ k}$$

$$D_x = 22.5 \text{ k} \leftarrow$$

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

$\sum M_A =$

$$M_A - (10 \times 7.5) - (15 \times 10) - (42.5 \times 10) + (25 \times 10) + (20 \times 15) + (20 \times 15)$$

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

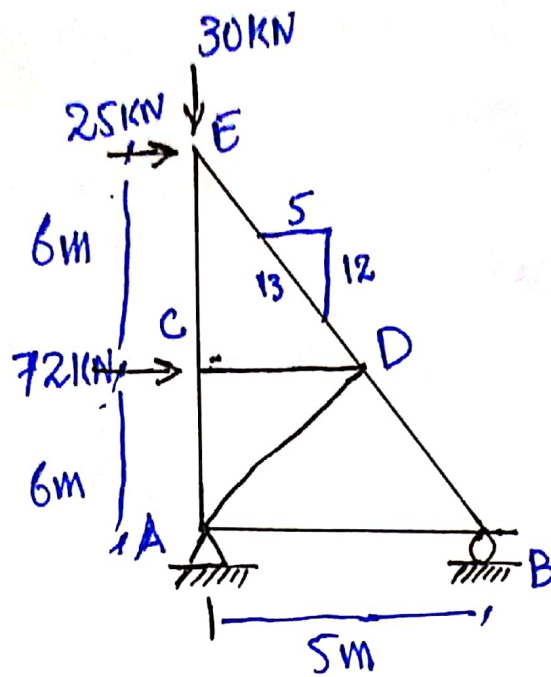
$$M_A = 460 \text{ k}\cdot\text{ft} \downarrow$$





Ans: 03

(11)



Determine the forces in each member.  
First we will find the support reaction.

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

$$72(6) + 25(12) - B_y(5) = 0$$

$$732 - 5B_y = 0$$

$$B_y = 146.4 \text{ kN}$$

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

$$25 + 72 - A_x = 0$$

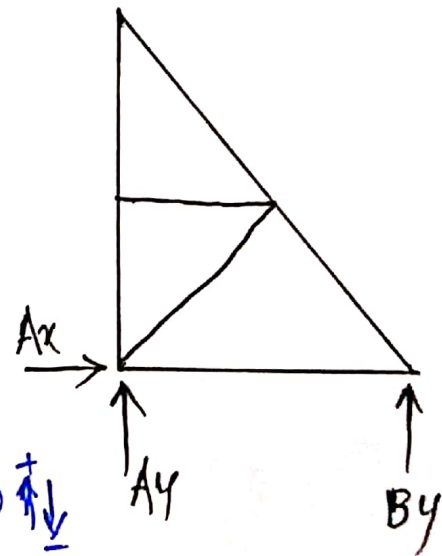
$$A_x = 97 \text{ kN}$$

Now;

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

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

$$\theta = 67.38^\circ$$



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

$$-30 + A_y + 146.4 = 0$$

$$A_y = -116.4$$

opposite to assume direction.

"Joint: B"

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

$$146.4 - F_{DB} \sin(67.38^\circ) = 0$$

$$F_{DB} = 146.4 / \sin(67.38^\circ)$$

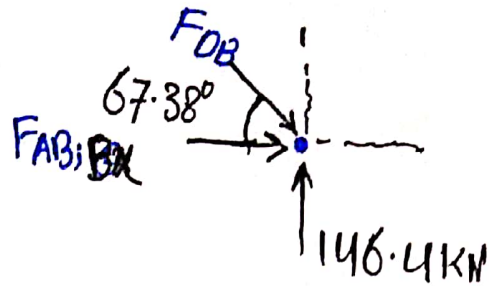
$$F_{DB} = 158.60 \text{ KN}$$

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

$$F_{AB} + F_{DB} \cdot \cos(67.38^\circ)$$

$$F_{AB} = -158.60 \cdot \cos(67.38^\circ)$$

$$F_{AB} = 61.1 \text{ KN}$$



"Joint: A"

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

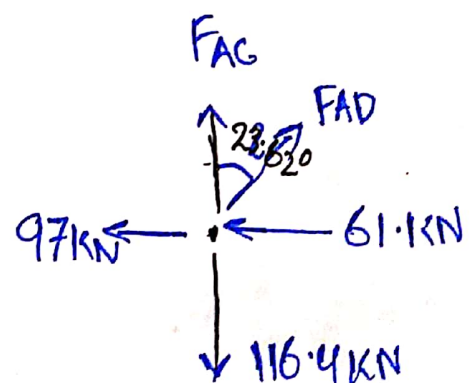
$$F_{AC} - 116.4 + F_{AD} \cos(22.62^\circ) = 0$$

$$F_{AC} - 116.4 + 0.923 F_{AD} = 0 \quad \text{--- (1)}$$

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

$$-97 - 61 + F_{AD} \sin(22.62^\circ) = 0$$

$$F_{AD} (0.384) = 158 \quad \Rightarrow \quad F_{AD} = 411 \text{ KN}$$



Now, eq (9)  $\Rightarrow$

$$F_{AC} = 116.4 - 0.923(411)$$

$$F_{AC} = -262.953 \text{ kN}$$

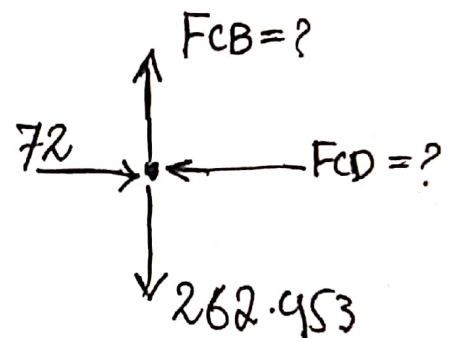
$$F_{AC} = 262.953 \text{ kN } (\downarrow_+)$$

"Joint: c"

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

$$F_{CB} - 262.953 = 0$$

$$F_{CB} = 262.953 \text{ kN}$$



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

$$-F_{CD} + 72 = 0$$

$$F_{CD} = 72 \text{ kN}$$

Joint: E;

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

$$-30 + 262.953 - F_{ED} \cos(22.62^\circ) = 0$$

$$(0.923)F_{ED} = 232.953$$

$$F_{ED} = 252.38 \text{ kN}$$

