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ID No# : 7734

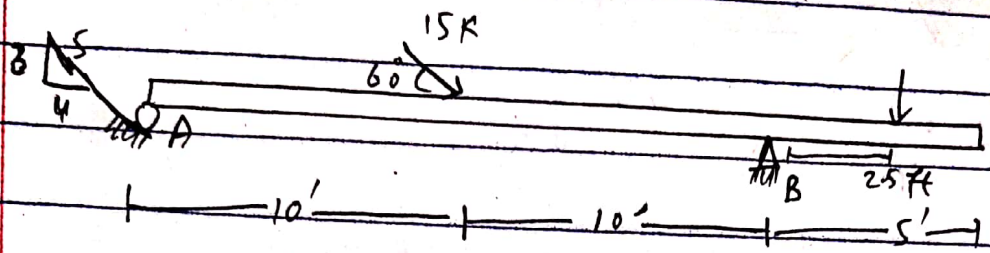
Subject : Structure Analysis-1

Instructor : Engr. M. Saqib

Department : Civil Engineering

Date : 22 August 2020.

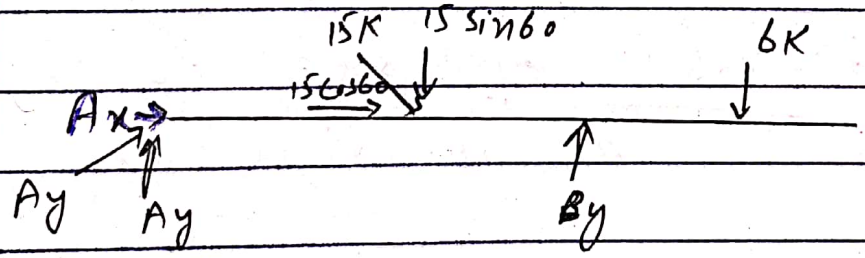
Q NO 2.



Support Realtions = ?

"Using equation 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;

$$\text{Tan}\,\theta = (3/4)$$

$$\theta = \text{Tan}^{-1}(3/4)$$

$\Rightarrow$ $\theta = 36°$

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

$A_y + B_y - 15\sin 60° - 6 = 0$

$A_y + B_y - 12.99 - 6 = 0$

$A_y + B_y = 18.99$ — (1)

$\Sigma F_x = 0$ $\overset{+}{\rightleftarrows}$

$+A_x + 15\cos 60° = 0$

$A_x = -7.5\,K$ opposite to the assume direction

$\Sigma M_B = 0$ $\overset{-}{\circlearrowright}\overset{+}{\circlearrowleft}$

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

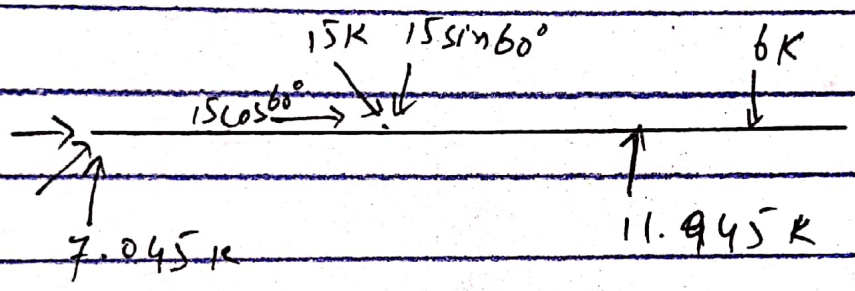
$A_y(16.18) - 129 + 15 = 0$

$A_y = 114/16.18$

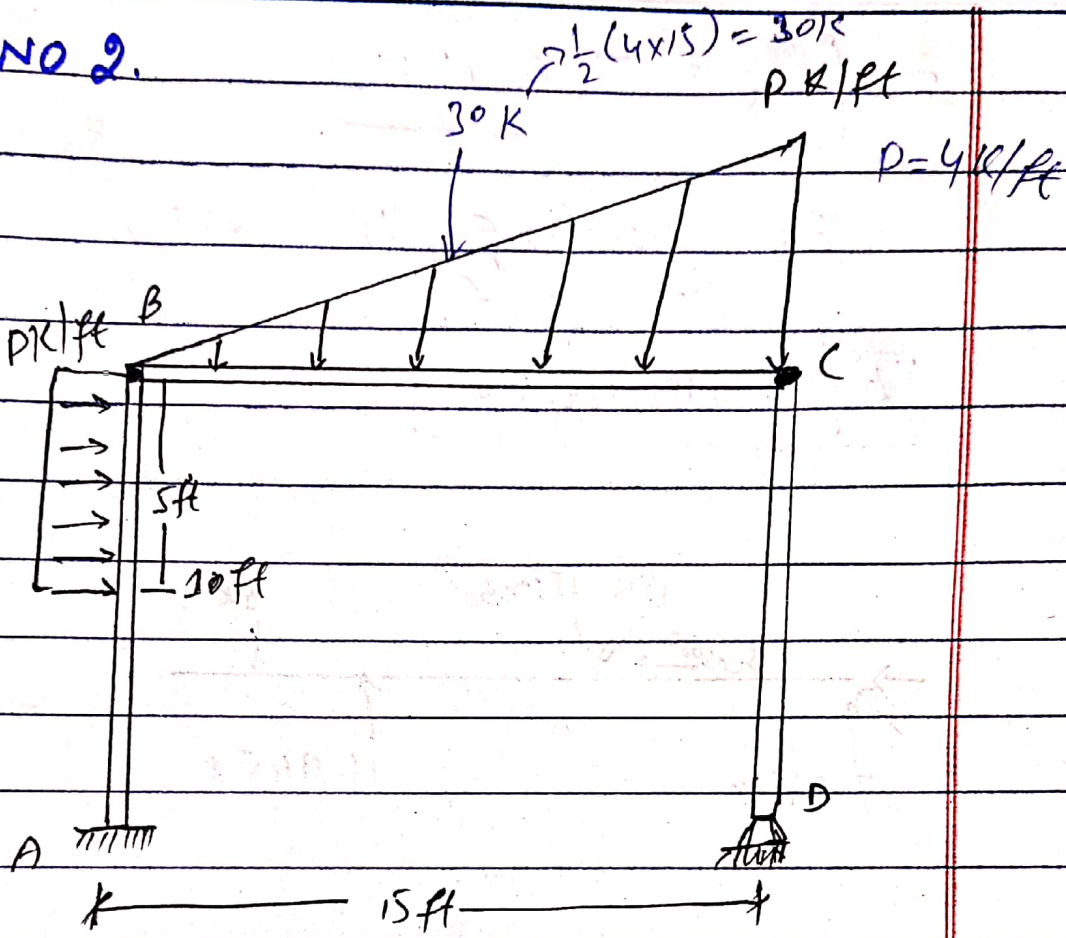
$\Rightarrow$ $\boxed{A_y = 7.045\,K}$

By puting in eq (1) we get.

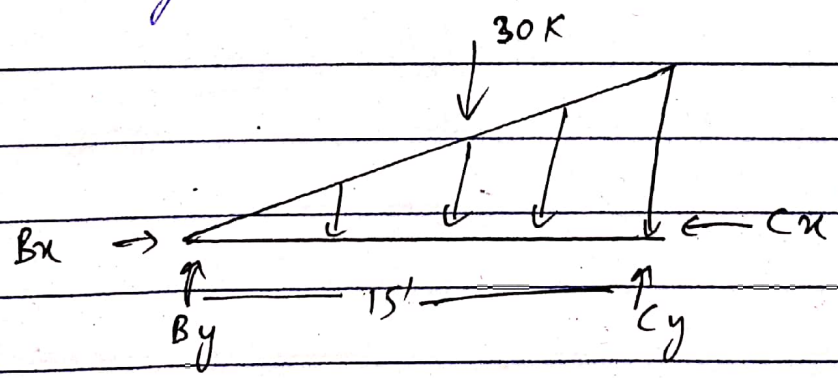
$\boxed{B_y = 11.945\,K}$



Q No 2.



Dividing the structure/frame in segments.



$\Sigma F_x = 0 \uparrow +$

$B_y + C_y - 30K = 0$

$\Rightarrow$ $B_y + C_y = 30$ ——(1)

$\circlearrowleft^{+} \Sigma M_B = 0$

$C_y \times 15 - (30 \times 10) = 0$

$C_y \times 15 = 300$

$C_y = 300/15$ $\boxed{C_y = 20K}$

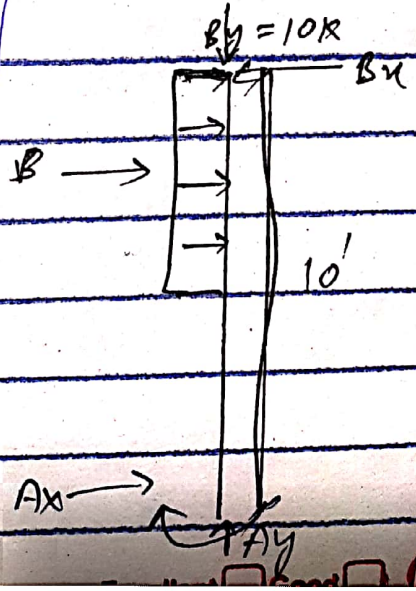
put C_y in eq (1)

$B_y + C_y = 30K$

$B_y = 30 - C_y$

$B_y = 30 - 20$

$\boxed{B_y = 10K}$



$\Rightarrow \Sigma F_x = 0$

$A_x + 20 - B_x = 0$

$A_x - B_x = -20$ — (II)

$\Sigma f_y = 0 \uparrow +$

$\Rightarrow 10 + A_y = 0$

$\boxed{A_y = 10K}$

$\circlearrowleft^{+} \Sigma M_A = 0$

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

$B_x \times 10 - (150) = 0$

$B_x \times 10 = 150/10$

$\boxed{B_x = 15K}$

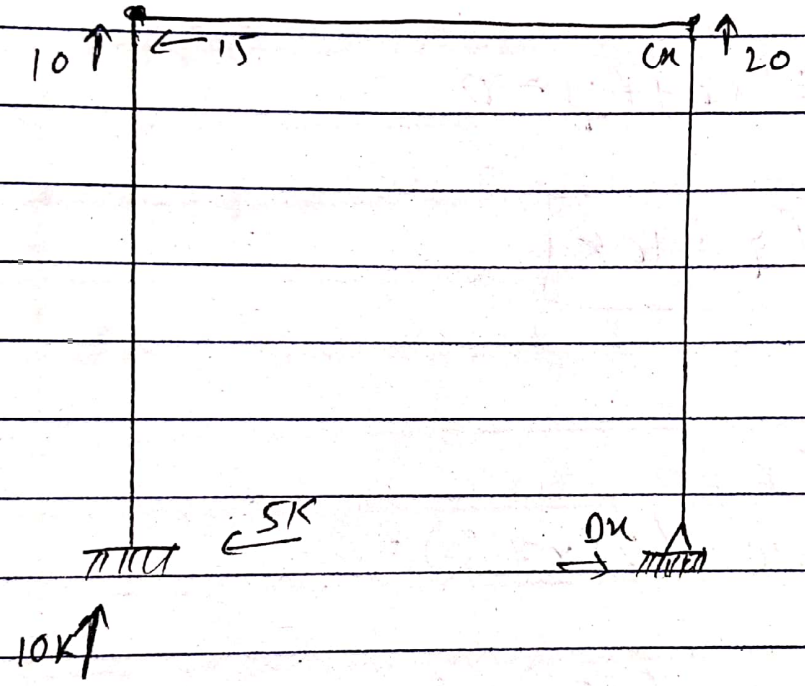
put B_x in eq (II)

$A_x - 15 = -20$

$\Rightarrow A_x = -20 + 15$

$A_x = -5K$

$\boxed{A_x = 5K \leftarrow}$



$\xrightarrow{+} \Sigma F_x = 0$

$-15 - 5 + C_x + D_x = 0$

$C_x + D_x = 20K$ — (II)

$(+\circlearrowleft) \Sigma M_D = 0$

$B_x \quad B_y \quad A_y$

$-C_x + 10 + (15 \times 10) - (10 \times 15) - (10 \times 15) = 0$

$\Rightarrow -C_x \times 10 + 150 - 150 - 150 = 0$

$-C_x \times 10 = 150$

$C_x = \frac{-150}{10}$

$C_x = -15$

$\boxed{C_x = 15 \leftarrow}$

Eq (iii)

$C_x + D_x = 20K$

put C_x.

$15 + D_x = 20K$

$D_x = 20 - 15$

$\boxed{D_x = 5}$

Also $\boxed{D_y = 20K}$

$\zeta^+ M_A$.

$= (-20 \times 7.5) - (15 \times 10) - (30 \times 10) +$ (B_x)
$(15 \times 10) - (20 \times 15) + (20 \times 15)$
(C_x) (C_y) (D_y)

$\Rightarrow \quad -150 - 150 - 300 + 150 - 300 + 300$

$\Rightarrow \quad -450$ K ft.

$M_A = 450$ K.ft)

$A_x = 5K$

$A_y = 10K$

$B_x = 15K$

~~$B_x = 15K$~~

$B_y = 10K$

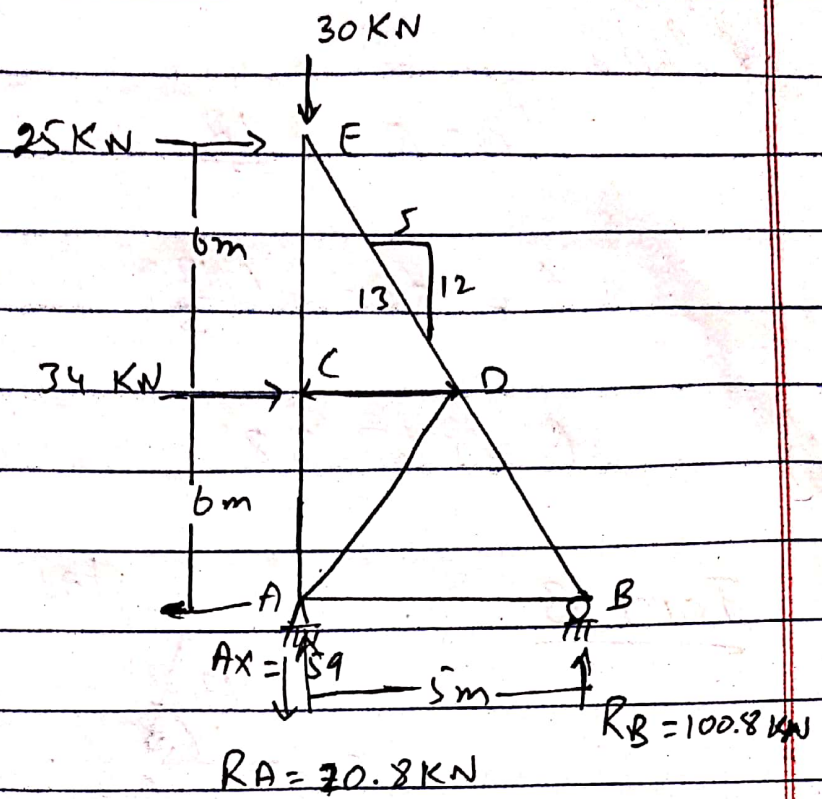
$C_x = 15K$

$C_y = 20K$

$D_x = 5K$

$D_y = 20K$

Q NO 3.



Sol:-

First we find reations;

$\Sigma M_A = 0$ $\circlearrowleft +$

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

$R_B = 100.8$ KN

$\Rightarrow R_A = 70.8$

$\Sigma F_x = 0$ $\rightarrow +$

$25 + 34 - A_x = 0$

$A_x = 59$ KN

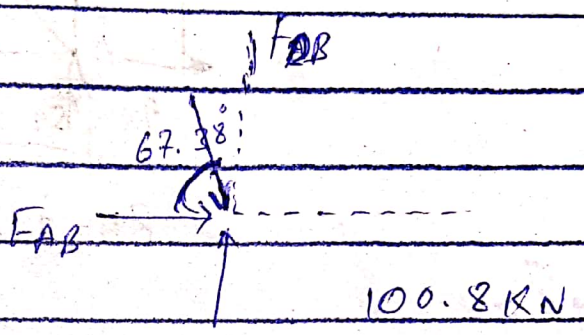
Also;

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

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

$$\theta = 67.38^\circ$$

Join B :



$$\Sigma F_y \uparrow + = 0$$

$$100.8 - F_{DB} \sin(67.38^\circ) = 0$$

$$F_{DB} = 100.8 / \sin(67.38^\circ)$$

$$F_{DB} = 109.2 \text{ KN}$$

$$\Sigma F_x \overset{+}{\rightarrow} = 0$$

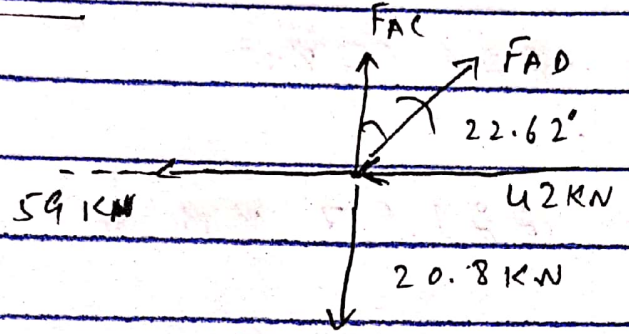
$$F_{AB} + F_{DB} \cos(67.38^\circ) = 0$$

$$F_{AB} = -109.2 \cos(67.38)$$

$\Rightarrow F_{AB} = -42\ KN$

$F_{AB} = 42\ KN\ (\leftarrow^{+})$.

Joint A:



$\theta = \tan^{-1}\left(\frac{2.5}{6}\right)$

$\theta = 22.62^{\circ}$

$\Sigma F_y = 0$

$F_{AC} - 20.8 + F_{AD}\cos(22.62) = 0$

$F_{AC} - 20.8 + 0.923\,F_{AD} = 0 \longrightarrow (1)$

$\Sigma F_x\ (\pm\rightarrow) = 0$

$-59 - 42 + F_{AD}\sin(22.62) = 0$

$F_{AD} = \frac{59 + 42}{\sin(22.62)}$

$\Rightarrow F_{AD} = 262.6\,KN$

Eq (1) $\Rightarrow$

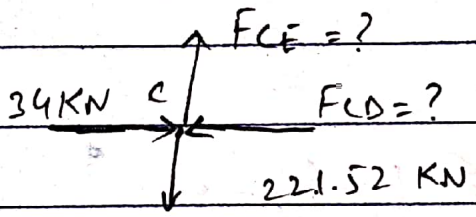
$F_{AC} = 20.8 - 0.923(262.6)$

$F_{AC} = -221.57\,KN$

$F_{AC} = 221.57\,KN\,(\downarrow +)$

Join C:

$\Sigma F_y\,\uparrow + = 0$



$F_{CE} - 221.52 = 0$

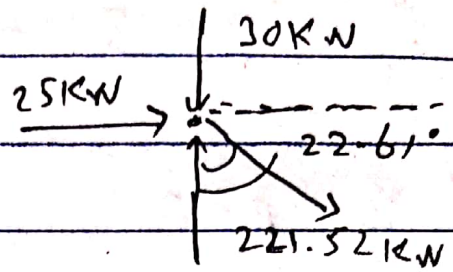
$F_{CE} = 221.52\,KN$

$\Sigma F_x\,(\pm\rightarrow) = 0$

$-F_{CD} + 34 = 0$

$F_{CD} = 34\,KN$

Joint E :



$\Sigma F_y \uparrow + = 0$

$-30 + 221.52 - F_{ED} \cos(22.61) = 0$

$$F_{ED} = \frac{221.52 - 30}{\cos(221.61)}$$

$F_{ED} = -256.15\ KN$

$F_{ED} = 256.15\ KN\ (\uparrow +)$. Ans.