

NAF

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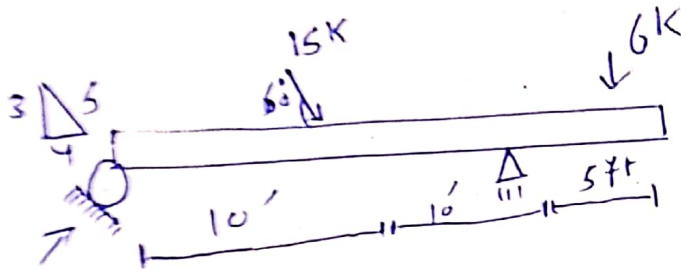
subject : structure analysis I

Date : 22/08/2020

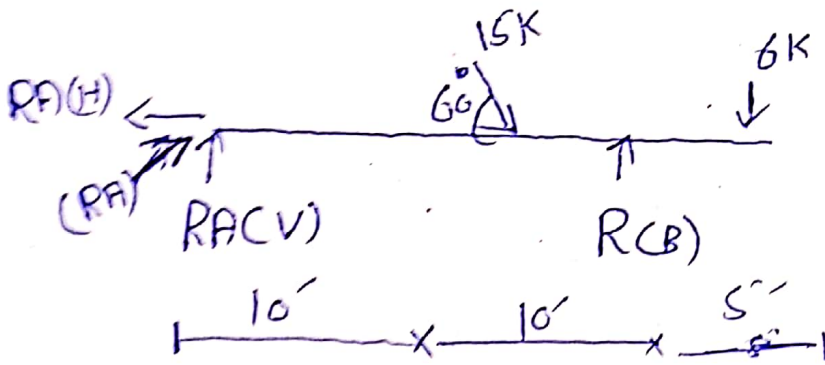
Semester : Summer

Q No 1

(1)



Solution:-



$$\sum F_x = 0 \quad \sum F_y = 0$$

$$\sum F_x = 0$$

$$RA(H) + 15 \cos(60^\circ) = 0$$

$$RA(H) + 15 \cos 60^\circ = 0$$

$$RA(H) + 15 (\cos 60^\circ) = 0$$

$$RA(H) + 7.5 = 0$$

$$RA(H) = -7.5 \text{ kip}$$

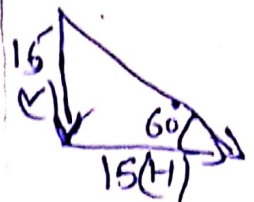
$$\cos \theta = \frac{4}{5}$$

$$\theta = \cos^{-1}\left(\frac{4}{5}\right)$$

$$\theta = 37^\circ$$

$$(\downarrow \quad \uparrow +)$$

$$\rightarrow + \quad \leftarrow -$$



(2)

$$\sum f_y = 0$$

$$R_A(V) = -15(V) + R_B - 6$$

$$R_A(V) = -15 \sin 60^\circ + R_B - 6$$

$$R_A(V) = 13 + R_B - 6$$

$$R_A(V) + R_B = 13 + 6$$

$$R_A(V) + R_B = 19 \quad \text{--- } \textcircled{1}$$

To calculate..

$$R_A(V) = \tan \theta \times R_A(H) \\ = \tan 37^\circ \times 7.5$$

$$R_A(V) = 7.5 \text{ kip}$$

Now put  $R_A(V)$  in eq  $\textcircled{1}$

$$R_A(V) + R_B = 19$$

$$7.5 + R_B = 19$$

$$R_B = 19 - 7.5$$

$$\boxed{R_B = 11.5 \text{ kip}}$$

Check

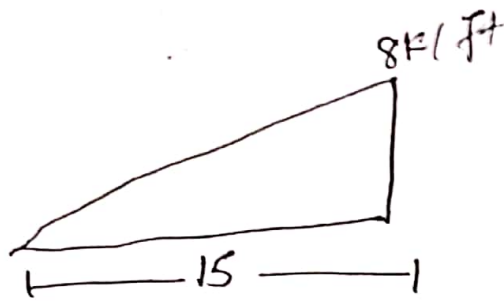
$$\downarrow = \uparrow$$

$$6 + 15 \sin 60^\circ = 11.5 + 7.5$$

$$14 = 14$$

**OK**

Quest(10) # (2) (3)



$$A = \frac{1}{2} (15 \times 8)$$

$$A = 60 \quad \text{Distance} = \frac{1}{3} \times b$$

$$= \frac{1}{3} \times 15 = 5$$

$$\sum F_x = 0 \quad \text{--- (2)}$$

$$\sum F_y = B_y + A_y \quad \boxed{37.5 \text{ K}}$$

$$\sum M = 0$$

$$(37.5 \times 8) = A_y \times 15$$

$$A_y = \frac{300}{15} = 20$$

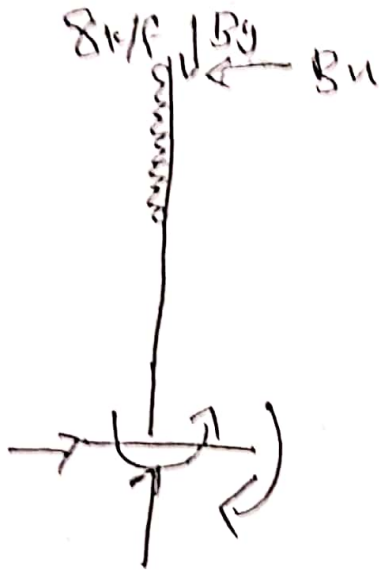
$$B_y + A_y = 37.5 \quad \text{--- eq (2)}$$

$$B_y + 20 = 37.5$$

$$B_y = 37.5 - 20$$

$$B_y = 17.5 \text{ kips}$$

(4)



$$\sum f_x = 0$$

$$A_x + (8 \times 10) - B_x = 0$$

$$A_x - B_x = -40 \quad \text{--- (3)}$$

$$\text{ii) } \sum f_y = 0$$

$$A_y - B_y = 0 \quad \text{--- (4)}$$

$$\text{(iii) } \sum M_A$$

$$(5 \times 8) \times (2.5 + 5) - B_x \times 10 = 0$$

$$(40) \times 7.5 - 10 B_x = 0$$

$$B_x = \frac{300}{10} = 30 \text{ k}$$

$$B_x = 30 \text{ k}$$

Put in eq (3)

$$A_x - B_x = -40$$

$$A_x - 30 = -40$$

$$A_x = -40 + 30$$

$$\boxed{A_x = -10 \text{ k}}$$

Now as we know that C and D are at same point thus load is transferred so

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

$$\boxed{D_y = 20 \text{ kips}}$$

(5)  
Put the value of  $B_y$  in eq(4)

$$A_y - B_y = 0$$

$$A_y - 20 = 0$$

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

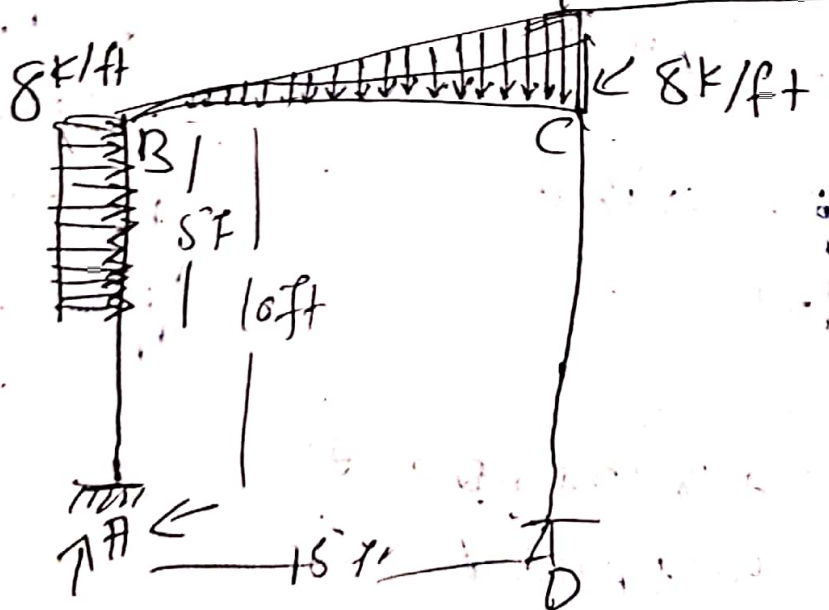
Now put the value of  $B_u$   
in eq(1)

$$B_u - C_u = 0$$

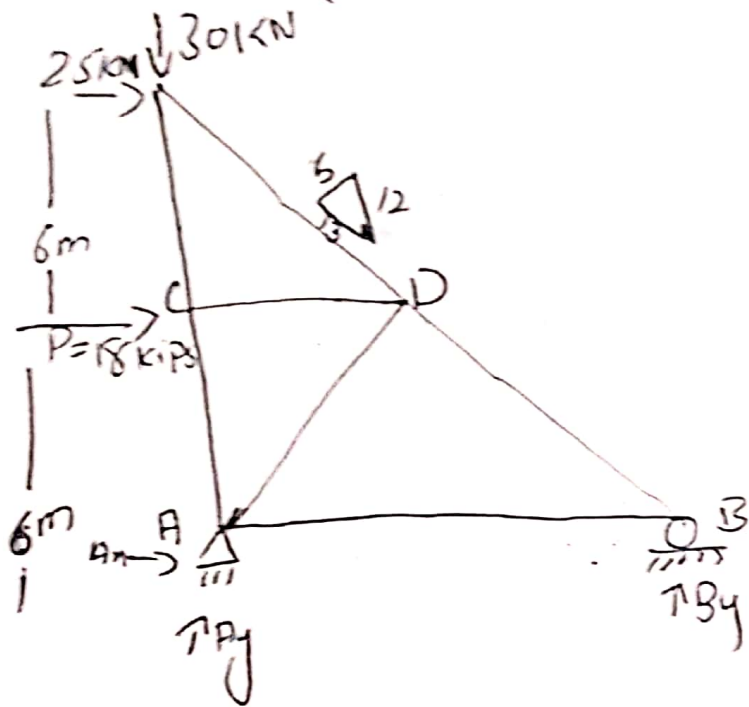
$$30 - C_u = 0$$

$$C_u = 30 \text{ kips}$$

So it lies at some  
point so  $D_u = -30 \text{ kips}$



## Question #3



Determinacy:

$$m + R = 2N + J$$

$$7 + 3 = 2 \times 5$$

$$10 = 10$$

$$\boxed{10}$$

This is statically determinate truss

$$\sum f_n = 0$$

$$A_n + 18 + 25 = 0$$

$$A_n = -(25 + 18)$$

$$\boxed{A_n = -43 \text{ kips}}$$

(7)

$$\sum f_y = 0$$

$$A_y + B_y - 30 =$$

$$\boxed{A_y + B_y = 30 \text{ kips}} \quad \text{eqn (1)}$$

(8)

$$\sum M_A = 0$$

$$(B_y \times 5) - (18 \times 6) - (25 \times 12) = 0$$

$$5B_y - 108 - 300 = 0$$

$$5B_y = 408$$

$$B_y = \frac{408}{5}$$

$$\boxed{B_y = 81.6 \text{ kips}}$$

put  $B_y$  in eqn (1)

$$A_y + 81.6 = 30$$

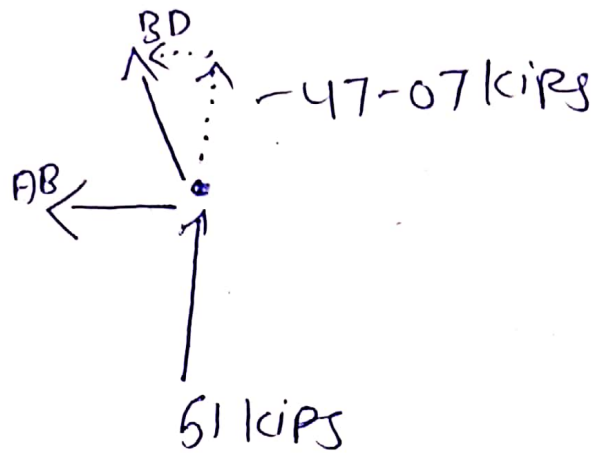
$$A_y = -51.6$$

$$\boxed{A_y = -51.6 \text{ kips}}$$



(8)

Joint B:



$$\sum F_y = 0$$

$$51 + BD \sin \theta = 0$$

$$BD = \frac{-51}{\sin(67.38^\circ)}$$

$$BD = -47.07 \text{ kips}$$

$$\sum F_x = 0$$

$$-AB - BD \cos \theta = 0$$

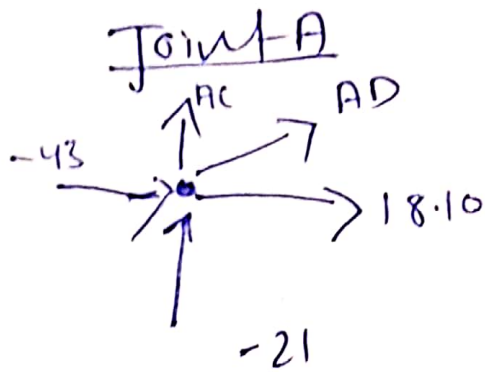
~~$$AB = +47$$~~

$$AB = -(-47.07 \times \cos 67.38^\circ)$$

$$AB = (47.07 \times \cos 67.38^\circ)$$

$$AB = 18.10 \text{ kips}$$

(9)



$$\sum F_x = 0$$

$$-43 + 18.10 + AD \cos \theta$$

$$-24.9 + AD \cos \theta$$

$$AD = \frac{24}{\cos 45^\circ} = 19.97K$$

$$\sum F_y = 0$$

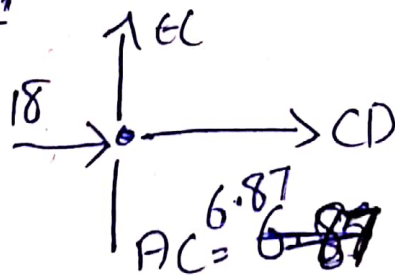
$$-21 + AC + AD \sin \theta$$

$$-21 + AC + 19.97 \sin \theta$$

$$AC = 21 - 19.97 \sin 45^\circ$$

$$AC = 6.87 \text{ KIPS}$$

Joint C



$$\sum F_x = 0$$

$$CD + 18 = 0$$

$$CD = -18 \text{ KIPS}$$

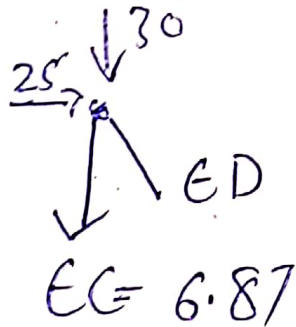
(10)

$$\sum F_y = 0$$

$$EC = 6.87$$

$$\boxed{EC = -6.87 \text{ kips}}$$

Joint E :-



$$\sum F_x = 0$$

$$25 + ED \cos \theta = \frac{5}{13} = 0$$

$$ED = \frac{-25}{\cos \frac{5}{13}}$$

$$\boxed{ED = -25 \text{ kips}}$$

(17)

final diagram

