

Mid exam

Name

Ashfaq Hussain

ID

7854

Section

B

Subject

Structure analysis I

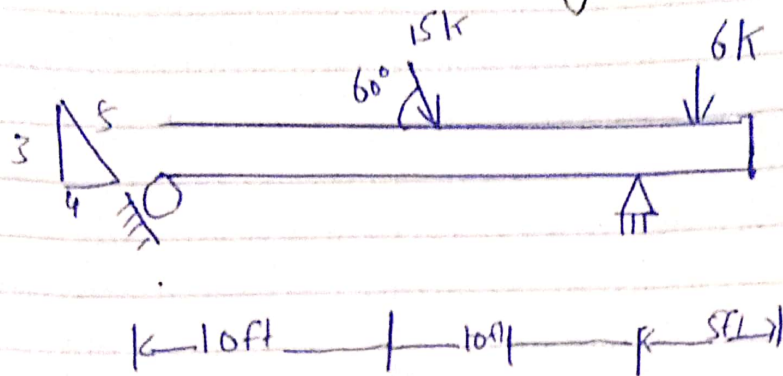
Submitted To

Engr. Muhammad Saib

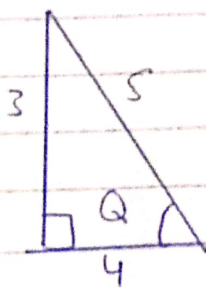
Date

22.08.2020

QNo1:- Determine the support reaction in the beam given below in fig 1 the roller support at point A is inclined to beam where the inclination is given in figure.



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



∴ Using Trigonometry

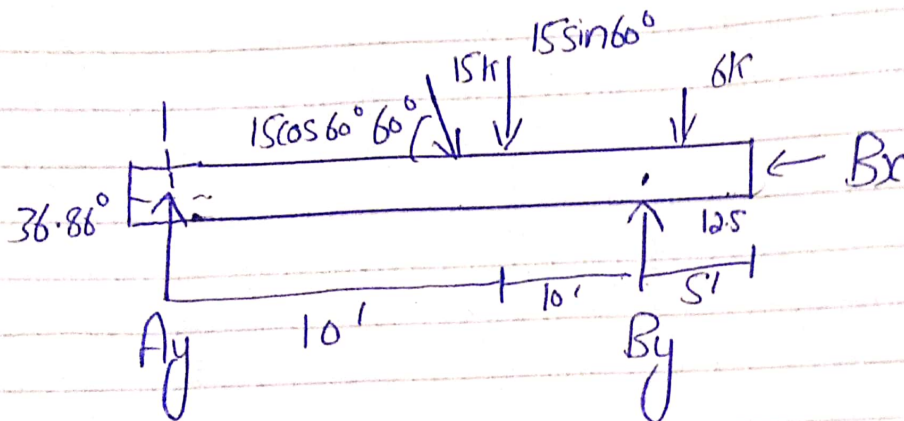
$$\sin Q = \frac{P}{H}$$

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

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

$$Q = 36.86^\circ$$

So Now



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

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

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

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

$$A_y \cos 36.86^\circ + B_y - 6k - 15 \sin 60^\circ = 0$$

$$0.80 A_y + B_y - 18.99 = 0$$

$$0.80 A_y + B_y = 18.99 \rightarrow (2)$$

$$3. \quad \Sigma M_B = 0 \rightarrow (+)$$

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

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

$$16 A_y - 175 = 0$$

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

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

Put the value in eq (2)

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

$$8.75 + B_y = 18.99$$

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

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

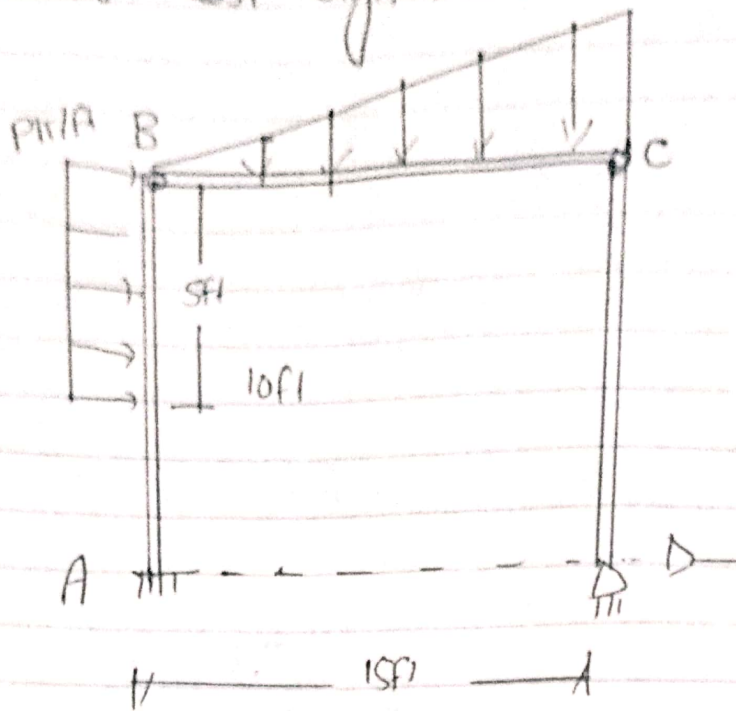
Put the value of A_y in eqn ①

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

$$\boxed{B_x = 0.9375 \text{ k}}$$

Q No 2) Determine the support reaction of given frame in figure 2 where the support reaction at point A is fixed and Point B, C, D are all pin supports and the value of P is the last digit of your registration number if your last digit is zero then take

Second last digit

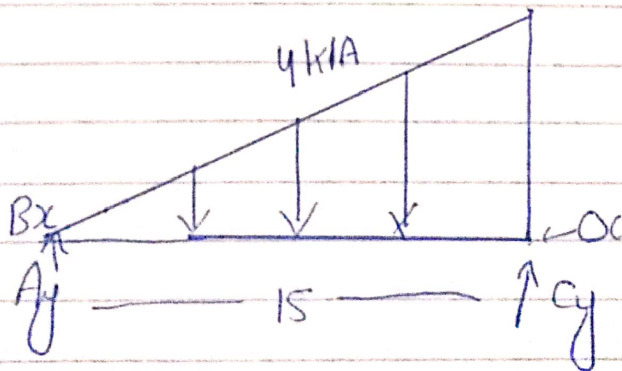


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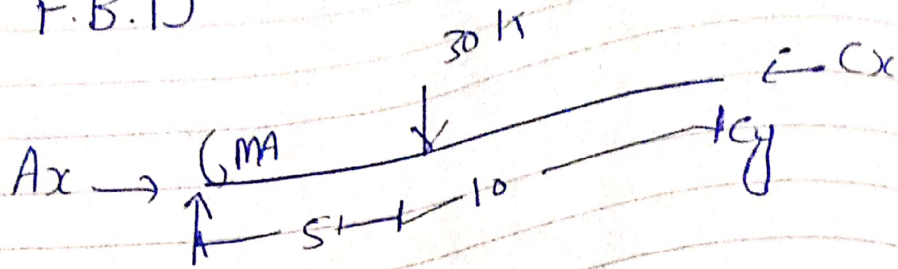
SOP = 4

1 Free body diagram

UVL



F.B.D



$$Area = \frac{1}{2} bh$$

$$= \frac{1}{2} \cdot 15 \cdot 4$$

$$= 30 \text{ k}$$

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

$$= \frac{1}{3} (18) =$$

$$= 6$$

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

$$Ax - Cx = 0 \quad \text{--- (a)}$$

Now

$$\text{ii } \sum F_y = 0 \uparrow \downarrow$$

$$A_y + C_y - 30 = 0$$

$$A_y + C_y = 30 \text{ k} \rightarrow \text{①}$$

$$\text{iii } \sum M_A = 0 \curvearrowright$$

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

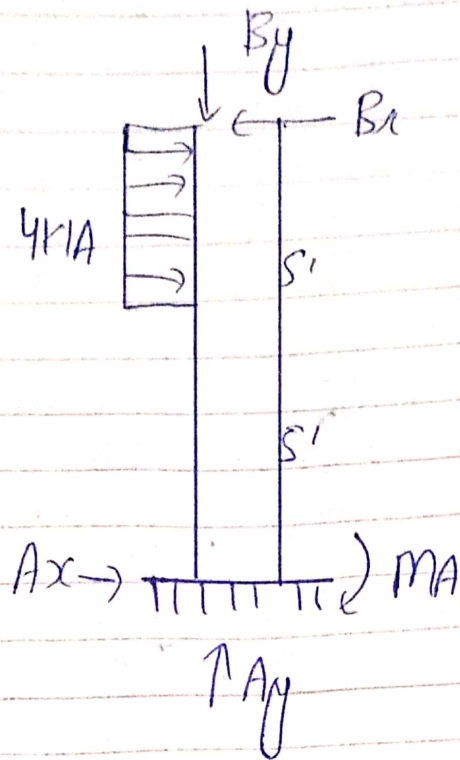
$$C_y = -10 \text{ k}$$

Put the value in ①

$$A_y - 10 = 30 \text{ k}$$

$$A_y = 40 \text{ k}$$

(4)



i- $\sum F_x = 0 \rightarrow + \leftarrow -$

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

$$A_x - B_x = -20 \rightarrow \textcircled{1}$$

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

$$A_y - B_y = 0 \rightarrow \textcircled{2}$$

iii- $\sum MA = 0 \downarrow + \uparrow -$

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

0

$$150 - 10B_x = 0$$

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

Put the value of B_x in (1)

$$A_x - 15 = -20$$

$$A_x = 5 \text{ k}$$

Put the value of A_y in eq (2)

$$40 - B_y = 0$$

$$B_y = 40 \text{ k}$$

Put the value of A_x in eq (3)

$$5 - C_x = 0$$

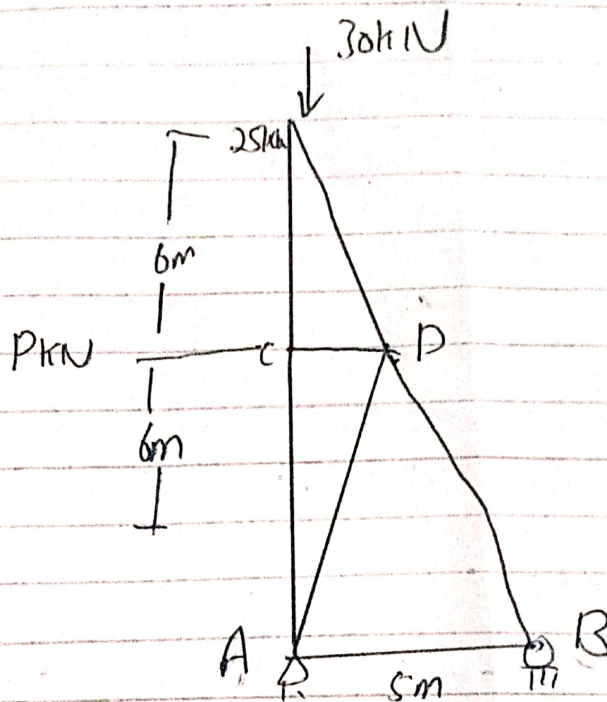
$$C_x = 5 \text{ k}$$

(6)

Since D is hinge and in
the projection of point c thus

$$Dx = -Sk$$

QNo 3 Find the member forces in the given truss shown in fig 3. Value of P (loading at point C) is last two digits of your registration number and loading at point E is given where 30 kN vertical and 25 kN horizontal.



①

Sol:- $\Sigma MA = 0 \uparrow$

$$-5B_y + 54 \times 6 + 25 \times 12 = 0$$

$$B_y = 124.8 \text{ kN}$$

$$\Sigma F_y = 0 \uparrow$$

$$-30 + A_y + B_y = 0$$

$$\begin{aligned} A_y &= 30 - B_y \\ &= 30 - 124.8 \end{aligned}$$

$$A_y = -94.8$$

$$\Sigma F_x = 0$$

$$A_x = 25 + 54 = 79 \text{ kN}$$

$$\boxed{A_x = 79 \text{ kN}}$$

2

$$Q = ?$$

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

$$Q = \tan^{-1} \left(\frac{12}{5} \right) = 67.38^\circ$$

$$Q = 67.38^\circ$$

Using Method of Joint.

Joint B:-

$$\sum F_x = 0 \uparrow +$$

$$124.8 + BD \sin Q = 0$$

$$BD = \frac{-124.8}{\sin(67.38)}$$

$$= -135.2 \text{ kN}$$

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

~~0.9230~~

①

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

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

$$= -(-135.2) \cos(67.38)$$

$$AB = 52.00 \text{ kN}$$

Joint E:-

$$\sum F_x = 0$$

$$25 + ED \cos(22.62) = 0$$

$$ED = -27.08 \text{ kN}$$

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

$$-30 - CE - ED \sin(22.62) = 0$$

$$-30 - CE - (-27.08) \sin 22.62$$

$$CE = -19.58 \text{ kN}$$

Joint C :-

$$\sum F_x = 0$$

$$CD = -54 \text{ kN}$$

$$54 \text{ kN}$$

$$-19.58$$



AC

CD

$$\sum F_y = 0$$

$$AC = -19.58 \text{ kN}$$

Joint A :-

Let θ is angle b/w
AD and AB

$$x = 2.5$$

$$\tan \theta = \frac{6}{2.5}$$

$$\theta = \tan^{-1} \left(\frac{6}{2.5} \right) = 67.38^\circ$$

$$\text{Now } \sum F_x = 0 \rightarrow +$$

$$= 32128.5, AD \cos(67.38)$$

$$AD = 9.1 \text{ kN}$$

So the forces on each member are calculated

