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ID = 7901

Sec = A

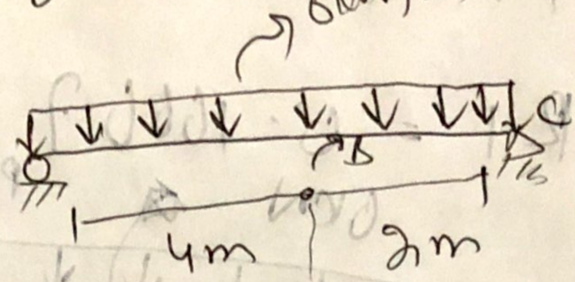
Date = 26 - 6 - 2020

Sir = Amjad Islam.

paper = Structure Analysis

Question # 02:

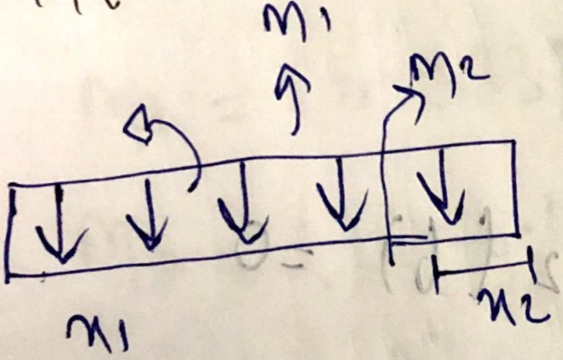
Given data:



Required:-

Slope and displacement at point B

Solution:-



$R_1 + R_2 = 0$ — (1)

$\Sigma M_A = 0$ ↻+

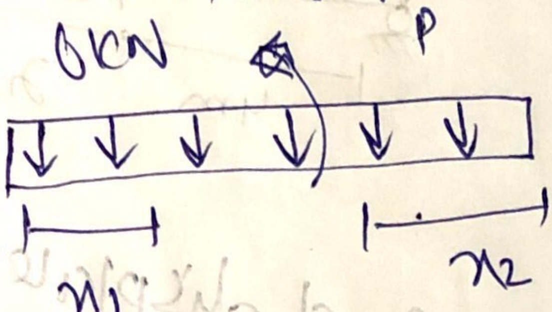
$1 + R_2(6) = 0$

$\Rightarrow -0.16667$ put in eq (1)

P.T.O

$R_1 + (-0.1667) = 0$

$R_1 = 0.16667$ kN



(b)

$R_1 + R_2 = 1$

$\circlearrowleft + \sum M_A = 0$

$-(1)(4) + R_2(6) = 0$

$R_1 = 0.6607$ kN

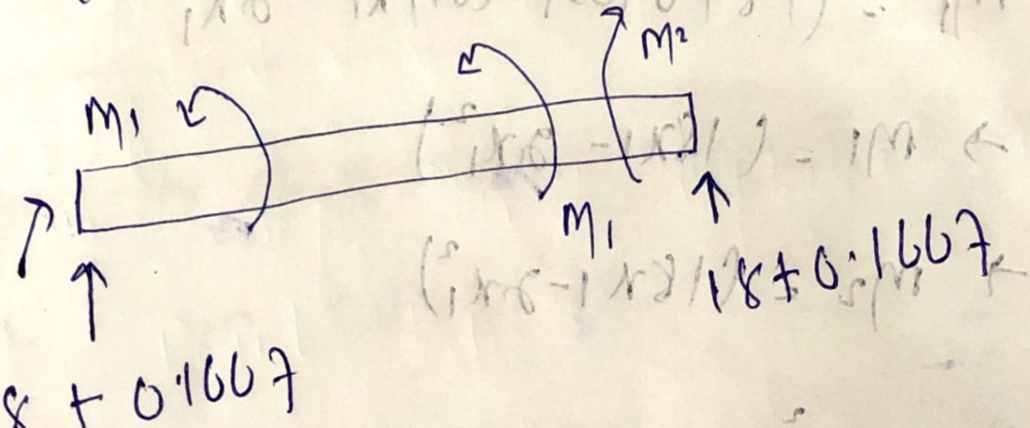
$R_2 = 1 - 0.6607$ kN

$R_2 = 0.333$ kN

P.T.O.

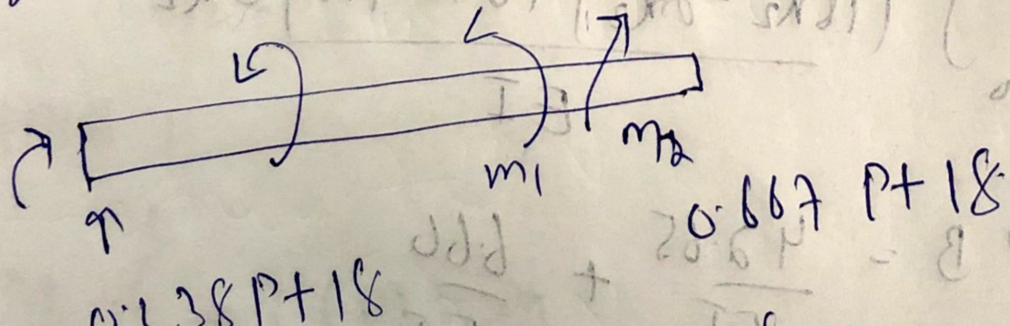
$$M_1 = (18 + 0.1667 M')x_1 - 2x_1^2$$

$$M_2 = (18 - 0.1667 M')x_2 - 2x_2^2$$



$$M_1 = (0.333P + 18)x_1 - 2x_1^2$$

$$M_2 = (18 - 0.1667 M')x_2 - 2x_2^2$$



The displacement function shown in the figure "a" above.

9

$\frac{\delta m_1}{\delta m_1} = 0.1667 x_1$ and $\frac{\delta m_2}{\delta m'} = 0.1667 x_2$.

set $m' = 0$ - then

$$M_1 = (18 + 0.1667\,(0))x_1 - 2x_1^2$$

$$\rightarrow M_1 = (18x_1 - 2x_1^2)$$

$$\rightarrow M_2 = (18x_1 - 2x_1^2)$$

$$\textcircled{1}\, B = \int_0^2 \left(m_1 \frac{\delta m}{\delta m_1}\right) \frac{dx}{EI} = \int_0^4 \frac{(18x_1 - 2x_1^2)(0.1667x_1)\,dx_1}{EI} +$$

$$\int_0^2 \frac{(18x_2 - 2x_2^2)(0.1667x_2)\,dx_2}{EI}$$

$$\textcircled{1}\, B = \frac{42.65}{EF} + \frac{6.66}{EF}$$

$$\textcircled{1}\, B = \frac{49.31}{EI}$$

p-T-0

(5)

(i) $\beta = \dfrac{49.31}{(200 \times 10^6 \text{ kPa})(0.0006)} = 0$

$$\boxed{(i)\ B = 0.4411 \text{ rad}}$$

→ for the displacement function are Shown. in figure "b"

$\dfrac{\partial m_1}{\partial m_p} = 0.333 x_1$ and $\dfrac{\delta m_2}{\delta P} = 0.0667 x_2$ also $p = 0$

then $M_1 = (18x_1 - 2x_1^2)$ kN·m

$M_2 = (18x_2 - 2x_2^2)$ kN·m

thus,

$$\Delta B = \int_0^L m \left(\frac{\delta M}{\delta P}\right) \frac{dx}{EI}$$

$$\Delta B = \int_0^4 \frac{(30 x_1 - 2x_1^2)(0.333 x_1)\,dx}{EI} + \int_0^2 \frac{(30x_2 - 2x_2^2)(0.0667 x_2)\,dx}{EP}$$

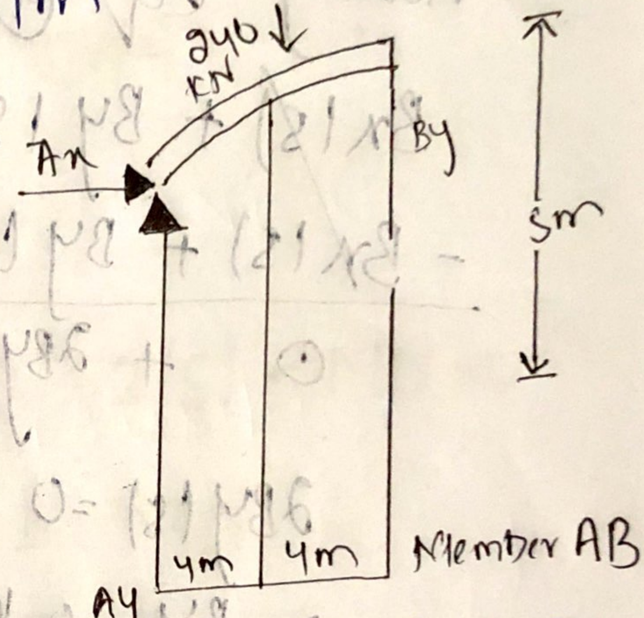
$$\Delta B = \frac{218.5}{EI} \Rightarrow \frac{218.5}{(200 \times 10^6)(0.0006)} = 0.018\,m = \boxed{18\,mm}$$

Q NO 4

Ans:-

Given data:-

uniform load = 30 kN/m

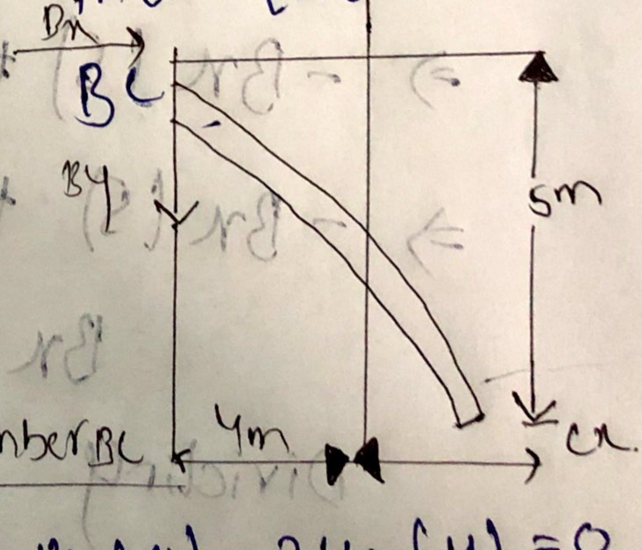


Required data:

Internal Moment at D = ?

Solution:-

Dividing into two members AB and BC



AB:- $\circlearrowleft + \Sigma M_A = 0 \quad B_x(5) + B_y(8) - 240(4) = 0$

4(a)

②

BC:..

$\circlearrowright + \Sigma M_C = 0$

$-Bx(5) + By(8) + 240(4) = 0 \rightarrow$ ⓑ

Adding eq ⓐ and ⓑ

$$\cancel{Bx(5)} + By(8) - \cancel{240(4)} = 0$$
$$\underline{-\cancel{Bx(5)} + By(8) + \cancel{240(4)} = 0}$$
$$0 + 2By(8) + 0 = 0$$

$2By(8) = 0$

$\Rightarrow By = 0\ kN$

putting the value of "By" in eq ⓑ

$\Rightarrow -Bx(5) + By(8) + 240(4) = 0$

$\Rightarrow -Bx(5) + 0(8) + 960 = 0$

$Bx(5) = 960$

Dividing eq ① both sides by 5

P.T.O

(3)

$$\frac{Bx(\cancel{5})}{\cancel{5}} = \frac{960}{5}$$

$$\boxed{Bx = 192\ kN}$$

"At segment DB"

$\rightarrow \Sigma M_D = 0$

$$192(2) - 150(2.5) - M_D = 0$$

$$384 - 375 = M_D$$

$$\boxed{M_D = 9\ kN \cdot m}$$

Ans.

(P.T.O)

(4)

Q NO 3

Given data: W_0 = uniform load = 400 lb/ft

$h = 10$ ft, $L = 15$ ft

Required:

Equation of curve and force in cable = ?

Solution:

We know that

$$y = \frac{h}{L^2} x^2$$

putting the values

$$y = \frac{h}{L^2} x^2$$

$$= \frac{10}{(15)^2} x^2 = 0.044 x^2$$

$$\frac{\quad}{2 \times 10}$$

$$T_0 = F_H = \frac{W_0 L^2}{2h} = \frac{400 \times 15)^2}{2 \times 10}$$

p.t.o.

$T_O = 4500\, lb = 4.5k$

$T_B = T_{max} = \sqrt{(F_H)^2 + (w_0 L)^2}$

$= \sqrt{(4500)^2 + (400 \times 15)^2}$

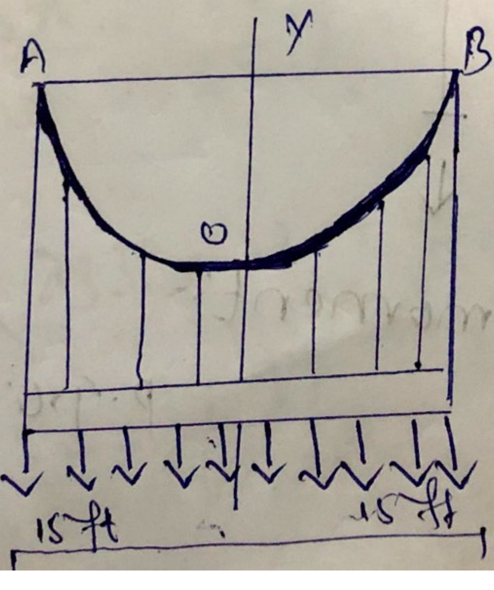
$T_{max} = 7500\, lb = 7.5k$

Now "T_{max}" by another Equation

$T_B = T_{max} = w_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2} \Rightarrow$

$= 400 \times 15 \sqrt{1 + \left(\frac{15}{2 \times 10}\right)^2}$

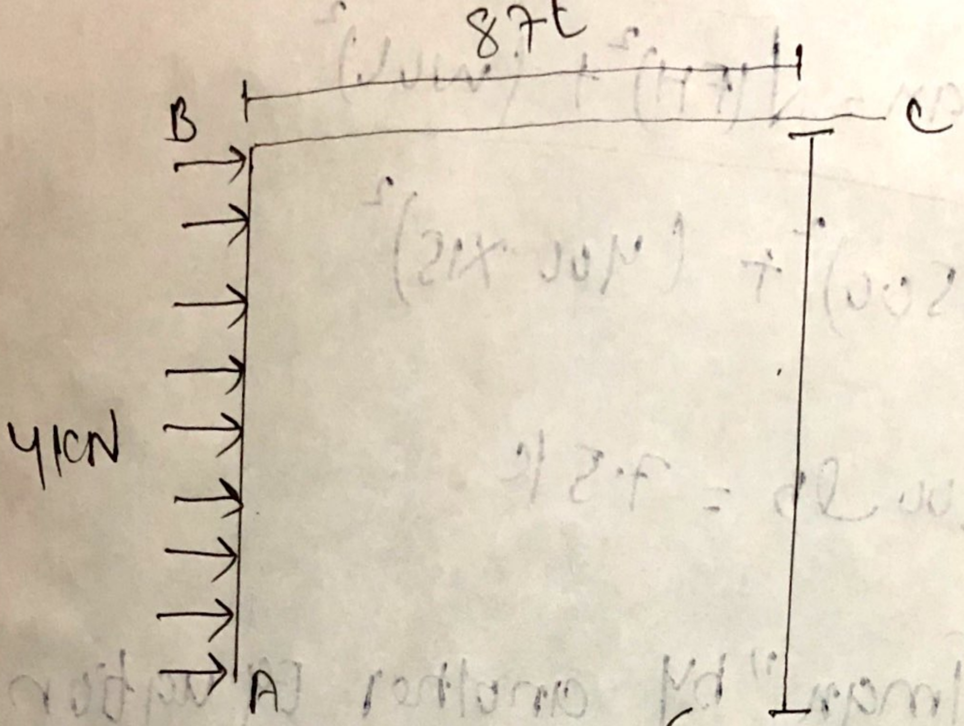
$T_{max} = 7500\, lb = 7.5k$

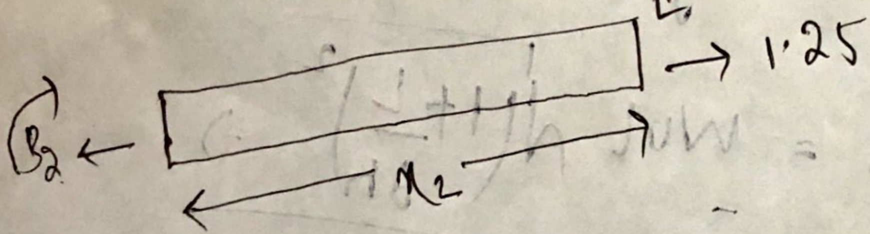


R. (1.6)

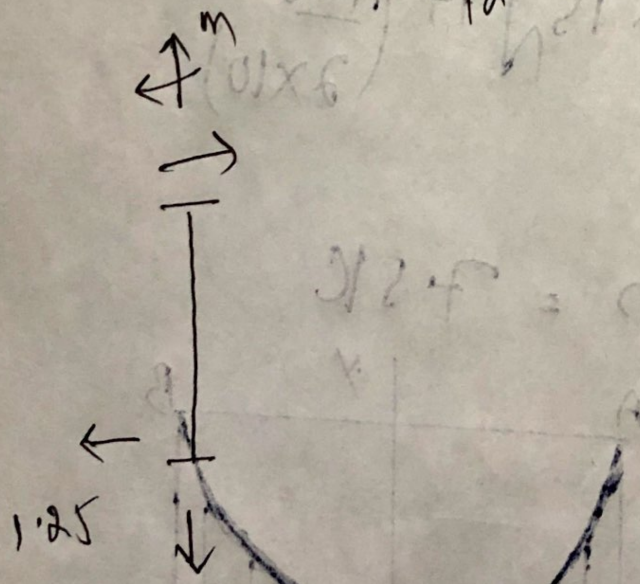
(6)

Question #1



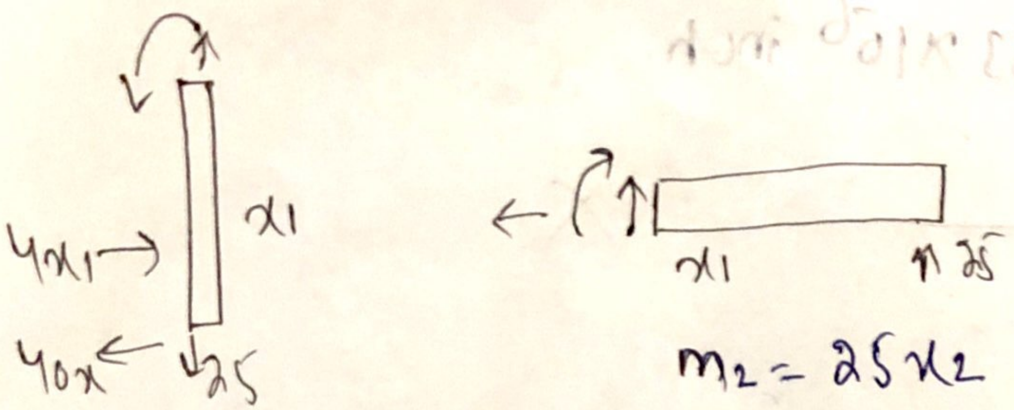


$m_2 = x_2$



Real moment:-

P.T.O



$m_2 = 25x_2$

$$M = \frac{40x_1 - \frac{1}{2}x_1(x_2)}{40x_1 - 2x^2}$$

Now put virtual work

$$1 \cdot \Delta C = \int_0^2 m \frac{M}{E} \, dx$$

$$= \int_0^{16} 1x_1 \frac{(40x_2 - 2x^2)}{E} dx + \int_0^8 \frac{(1.25x_1)(25x_2)}{EI} dx_2$$

$$\Delta C = \frac{1}{EI}\left(\frac{40x^3}{3} - \frac{2x^3}{4}\right)\int_0^{10} + \left(\frac{31.25x_2^3}{3}\right)\int^8$$

$$\Rightarrow \Delta C = \frac{1}{EI}(23333.33 + 10666.66)$$

$$\Delta C = \frac{33999.99}{(200)\cdot(60 \times 10^6)}$$

P.T.O

$\Delta I = 2.833 \times 10^{-6}$ inch.

(P.T.O)