NAME # SHAHKAR SALEEM

ID # 7943

SUBJECT # STRUCTORAL ANALYSIS - I

SECTION # "B"

DATE # 26- JUN- 2020

Q_1

Given data:-

uniform load = 4 k/ft

$E = 29 \times 10^3$ Ksi

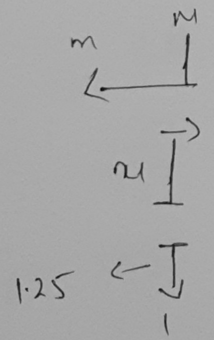
$I = 600 \text{ in}^4$

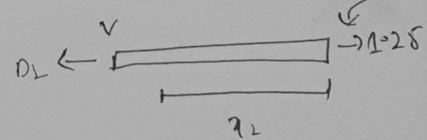
Required

vertical distance.

Solution

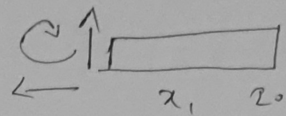
Now vertical moment

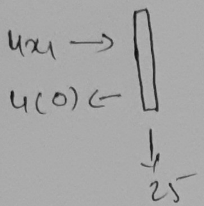




$m_2 = 1.25x$

real moment





x_1

$m_2 = 25x_2.$

$$m'' = \frac{40x_1 - \frac{1}{2} r_1 (x_2)}{40x_1 - 2x_1^2}$$

Now By virtual work equation

$$\Delta DC = \int_0^{l} \frac{m M dx}{E}$$

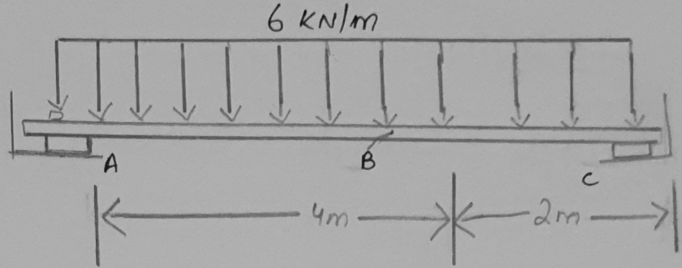
$$\Delta L = \int_0^{10} \frac{(1x_1)(40x_2 - 2x^2)\,dx}{E} + \int_0^{3} \frac{(1.25x_2)(25x_2)\,dx}{EI}$$

(3)

$$\Delta l = \frac{1}{EI}\left|\frac{40x^3}{3} - \frac{2x^3}{4}\right|_0^{10} + \left|\left(\frac{31.25x^3}{3}\right)\right|_0^8$$

$$\boxed{\Delta l = 10649.60184.}$$

Q2 Determine the Slope and displacement at point B. Assume the Support at A is a pin and C is roller. Take $E = 200\,GPa$, $I = 60(10)^6\,mm^4$. Use Castigliano's Theorem.



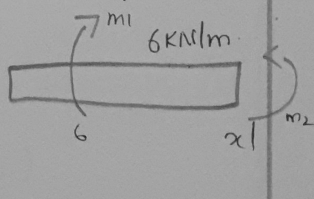
Sol:- Given that:-

$E = 200\,GPa$

$I = 60 \times 10^6\,mm^4$

Required data:-

Solpe and displacement = ?



$$m' - m_2 = \frac{1}{2}(x_2)\,(6 + x_1)$$

$$m' = -m' + + \frac{6x_2 + x_r^2}{2}$$

$$m = -m' + 3x^2 + x_r^2/2$$

Taking partial derivative repsect to m.

$$\frac{\partial m_2}{\partial p} = -x$$

Slope:-

$$m + 1/2\ x\ (6x_1) = 0$$

$$m = 1/2\ x\ (6x_1) = 3x^2$$

So;

$$\frac{\partial m_1}{\partial m_1'} = 0$$

$$m_1' - m_2 - 1/2\ (x_2)\,(6 + x_2)$$

$$m = -m' + 6x_2 + x_2^2$$

$$m = -m' + 3x^2 + x^2/2$$

$$\frac{\partial m_2}{\partial m_1} = -1$$

$$= \int_0^6 \frac{-3x^2\, 10\, dx}{E \cdot I} + \int_0^{10} \left(-2 + 6x^2 + \frac{x^2}{2}\right) dx$$

$$\Delta B = \int_0^2 m \frac{(\partial m)}{\partial p} \frac{du}{E}$$

$$= \int_0^6 -3x^2(-x) \frac{dx}{EI} + \int_0^4 \frac{-3x^2(-x)\, dx}{EI}$$

$$\Delta B = -\frac{3x^2}{4EI}\Big|_0^6 + \frac{-3x^4}{4EI}\Big|_0^4$$

put the valle of EI & I

$$= \frac{-3x^2}{2(260)(60\times10^6)}\Big|_0^6 + \frac{-3x^4}{4(1200)(60\times10^6)}\Big|_0^4$$

$$= \frac{-216\ KNH^3}{\cancel{4\ 8\times 6} \; 48\times10^{10}} + -\frac{614.4KNft^3}{4.8\times10^{10}}$$

$$= -4.5\times10^{-9} + (-1.28\times10^{-8})$$

$$\boxed{\Delta B = 5.76\times10^{-10} \text{ inch}}$$

displacement.

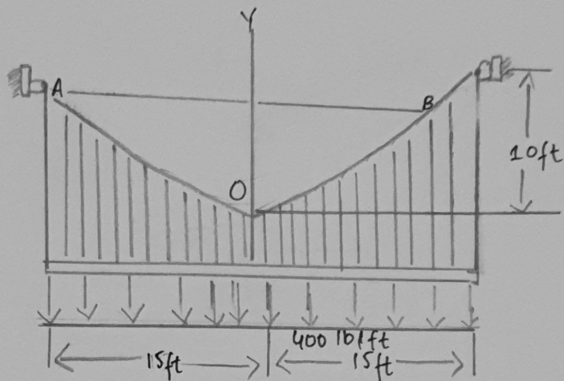
$$\theta + \left(-x + \frac{6x^3}{3} + \frac{x^3}{6}\right)\Big|_0^{10} \left(\frac{1}{EI}\right)$$

$$= \frac{1}{200\times(60\times10^{6})} \left|-x + \frac{6x^3}{3} + \frac{x^3}{6}\right|_6^{10}$$

$$\Rightarrow \boxed{\theta = 4.125\times10^{-7} \text{ inch.}}$$

Ans

Q3 The Cable is Subjected to the uniform loading. If the Slope of the Cable at point O is zero, determine the equation of the Curve and the force in the Cable at O and B.



Sol

$$y = \frac{h}{L^2}x^2 = \frac{8}{(15)^2}x^2$$

$$Y = 0.0356x^2 \text{ Ans.}$$

Now we know that

$$T_O = F_B = \frac{W_O L^2}{2h}$$

$$= \frac{(400)(15)^2}{2(10)}.$$

$= 4500 lb$

$= 4.500K$ ANS

Now

$$T_B = T_{max} = \sqrt{(F_H)^2 + (W_0L)^2}$$

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

$$= 7500 lb = 7.50K$$

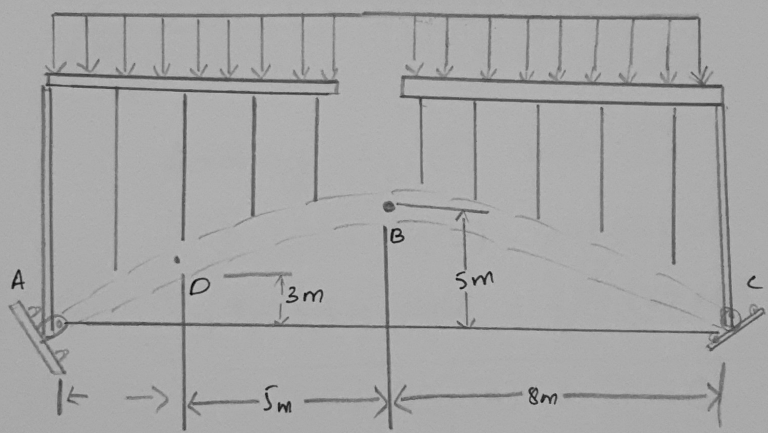
Now

$$T_B = T_{max} = W_0L\sqrt{1 + (L/2h)^2}$$

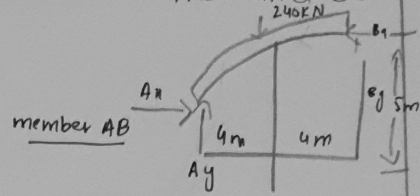
$$= 400(15)\sqrt{1 + \left(\frac{15}{2(10)}\right)^2}$$

$$= 7500 lb = 7.500K$$ ANS.

Q4:- The three-hinged Spandrel arch is subjected to the uniform load of 30 KN/m. Determine the internal moment in the arch at point D.

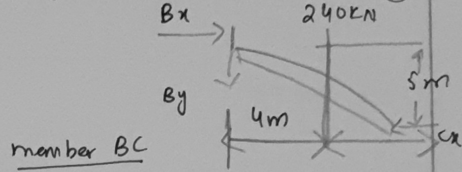


Sol Dividing into two member AB and BC.



AB :-

$\circlearrowright + \sum M_A = 0 \quad B_x(5) + B_y(8) - 240(4) = 0$ — ⓐ



BC :-

$\circlearrowleft + \sum M_C = 0 \quad -B_x(5) + B_y(8) + 240(4) = 0 \rightarrow$ Ⓑ

Adding eq ⓐ and ⓑ

$$\cancel{B_x(5)} + B_y(8) - \cancel{240(4)} = 0$$
$$-\cancel{B_x(5)} + B_y(8) + \cancel{240(4)} = 0$$
$$\overline{0 + 2B_y(8) + 0 = 0.}$$

$$2B_y(8) = 0$$

$$\Rightarrow B_y = 0\,KN.$$

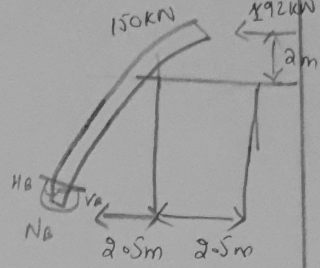
Putting the vale of "By" in equ Ⓑ

eq (B) $\Rightarrow$ $-B_x(5) + 0(8) + 960 = 0$

$B_x(5) = 960$

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

$\boxed{B_x = 192\,kN}$



member DB.

"Now at segment DB"

$\circlearrowright^{+}$ $\Sigma M_D = 0$

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

$384 - 375 - M_D = 0$

$9 - M_D = 0$

$\Rightarrow M_D = 9\,kN.m.$