Nâme : Bilâl Hussâin

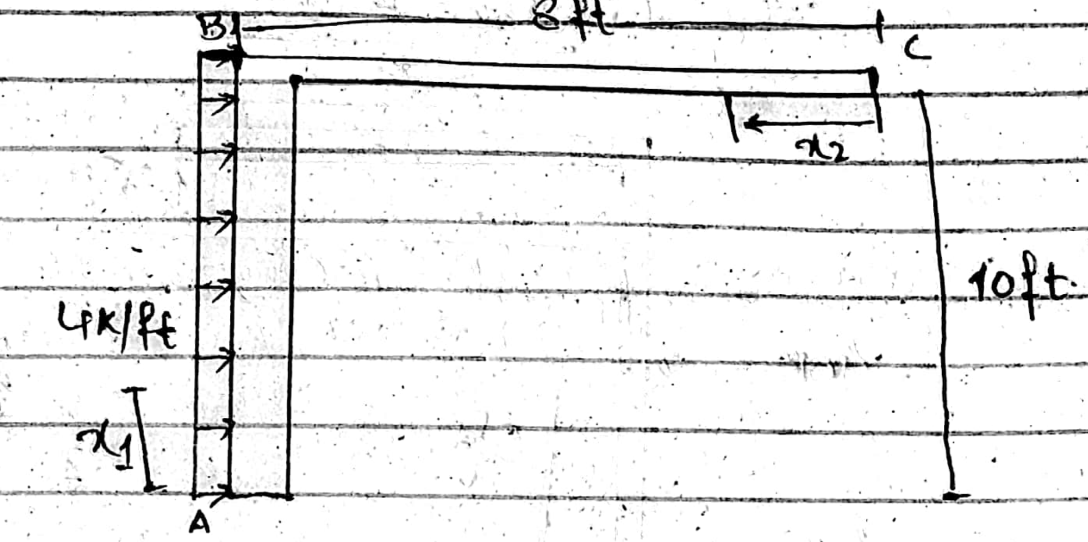
I.D # 7493

Depârtment : BE(C)

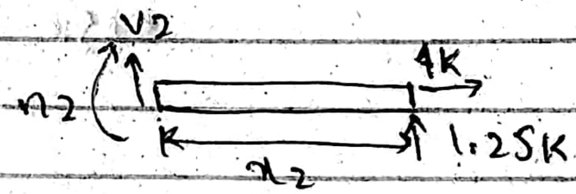
Dâte : 26-June-2020

Subject: Structure Analysis -I

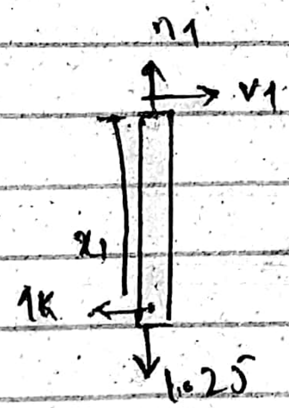
Q# 01:-

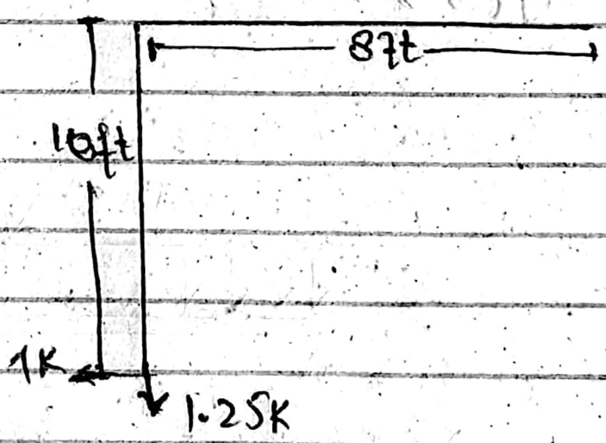


Sol:- Vertual Moment (m):→



$$\boxed{m_2 = 1.25x_2}$$

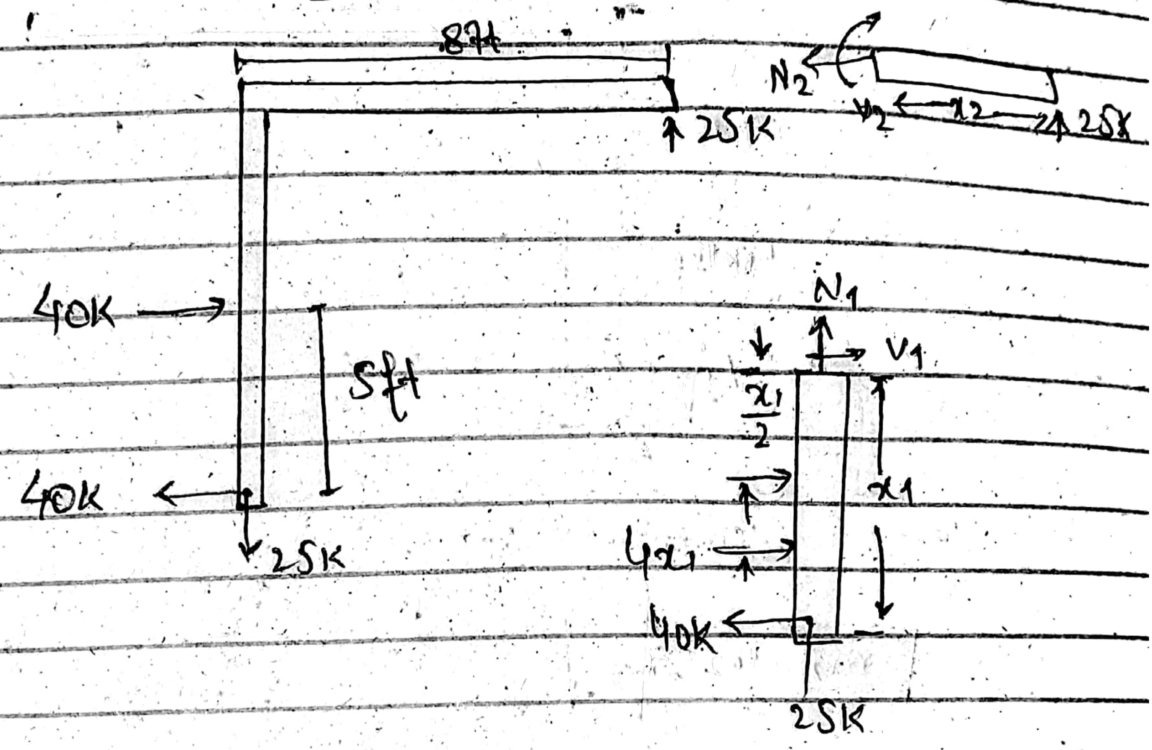




$$\boxed{m_1 = 1x_1}$$

Real Moment M:→

$$\boxed{M_2 = 25x_2}$$



$$M_1 = 40x_1 - 2x_1^2$$

Virtual Work Equation

$$\Delta C_h = \int_0^L \frac{mM}{EI}\,dx$$

$$= \int_0^{10} \frac{(1x_1)(40x_1 - 2x_1^2)\,dx_1}{EI} + \int_0^{8} \frac{(1.25x_2)(25x_2)\,dx_2}{EI}$$

$$\Delta C_h = \frac{8333.3}{EI} + \frac{5333.3}{EI}$$

$$= 1366.7\ k\cdot ft^3$$

Therefore

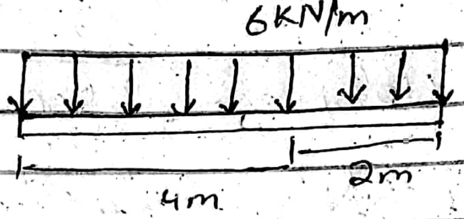
$$\int mM\,dx = 13666.7\ k^2 ft^3$$

$$\Delta C_h = \frac{13666.7}{[29(10)^3)\ k/in^2((12)^2 in^2/ft^2)][600 in^4(ft^4/(12)^4 in^4]}$$

$$\Delta ch = 0.113\ ft$$

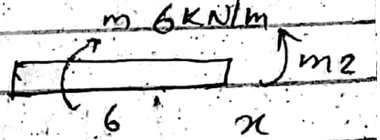
$$\boxed{\Delta C_h = 1.36\ in}$$ Answer.

Q#02:- Given Data



$E = 200\,GPa$
$I = 60 \times 10^6\,mm^4$

Required:- Slope & Displacement = ?



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

$m' = m' - 1 \quad \frac{6x_2 + x_1^2}{2}$

$m = -m' + 3x^2 + x_1^2/2$

taking Partial deravative with respect to m.

$\frac{2m_2}{2P} = -x.$

$\Delta B = \int_6^2 m\frac{(2m)}{2P}\frac{dx}{E}$

$= \int_0^6 -3x^2(-x)\frac{dx}{EI} + \int_6^4 \frac{-3x^2(-x)\,dx}{EI}$

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

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

Put the Value of EI & I

$$= \frac{-3x^2}{2(260)(60\times10^6)}\Big|_0^6 + \frac{-3x^4}{(4000)(60\times10^6)}\Big|_0^4$$

$$= \frac{-216\,KN\,ft^3}{4.8\times10^{10}} + \frac{-614.4\,KN.ft^3}{4.8\times10^{10}}$$

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

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

Displacement

Slope:-

$$m + 1/2\,x(6x1) = 0$$

$$m = -1/2\,x(6x_2) = 3x^2$$

So, $\frac{2m1}{2m_1} = 0$

$$m'_1 - m_2 - 1/2(x_2)(6+x_2)$$

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

$$m = -m' + 3x^2 + x_2^2/2$$

$$\frac{2m2}{2m1} = -1$$

$$= \int_0^6 \frac{-3x^2(1dx)}{E.I} + \int_0^{10}\left(-2+6x^2+\frac{x^3}{2}\right)dx$$

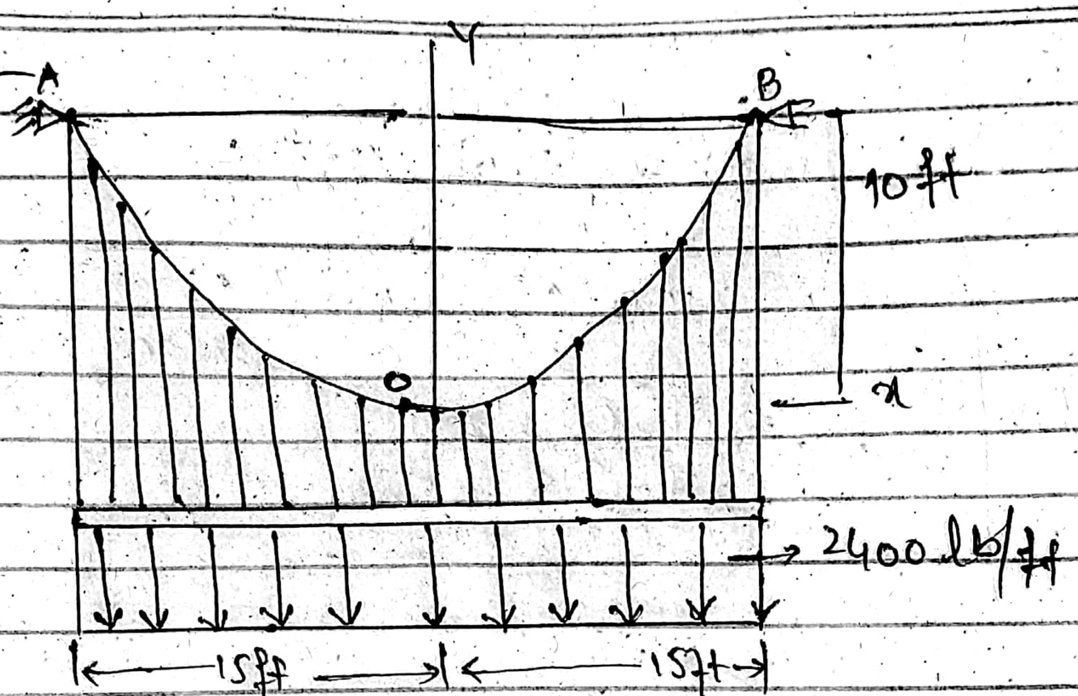
$$= 0 + \left(-x + \frac{6x^3}{3} + \frac{x^3}{6}\right)\Big|_0^{10}\left(\frac{1}{EI}\right)$$

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

$$\Rightarrow \boxed{Q = 4.125 \times 10^{-7} \text{ inch}} \text{ Ans.}$$

Scanned with CamScanner

Q # 03:—



Sol:-

$$Y = \frac{h}{L^2} x^2 = \frac{10}{15} x^2$$

$$\boxed{Y = 0.666 x^2} \text{ Ans.}$$

As we Know that

$$T_o = F_B = \frac{w_o L^2}{2h}$$

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

$$\boxed{\Rightarrow 4500 \text{ lb} = 4.5K} \text{ Ans.}$$

Now

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

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

$$\boxed{\Rightarrow 7500 \text{ lb} = 7.5K} \text{ Ans.}$$

Also

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

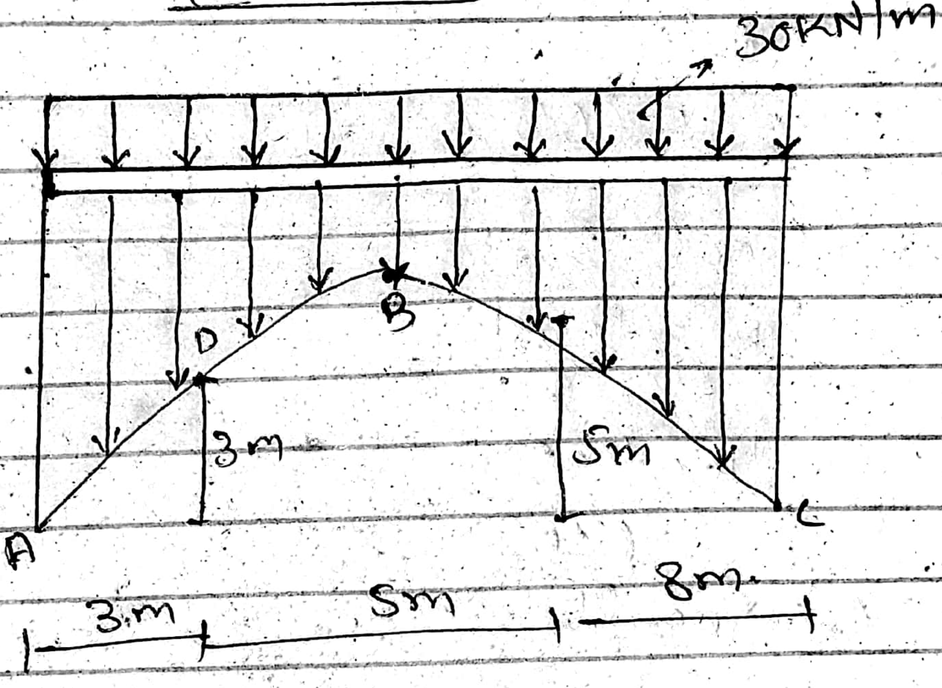
$$= 400(15)\sqrt{1 + \left(\frac{15}{2(10)}\right)^2}$$

$$= 7500 \text{ lb}$$

$$\boxed{\Rightarrow 7.5K \text{ Ans}}$$

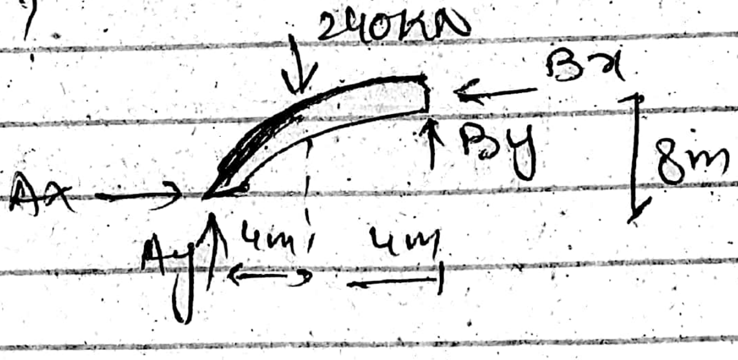
Scanned with CamScanner

Q#04:→ Given Data:-



Required: Internal moment in the arch at point D?

Sol:



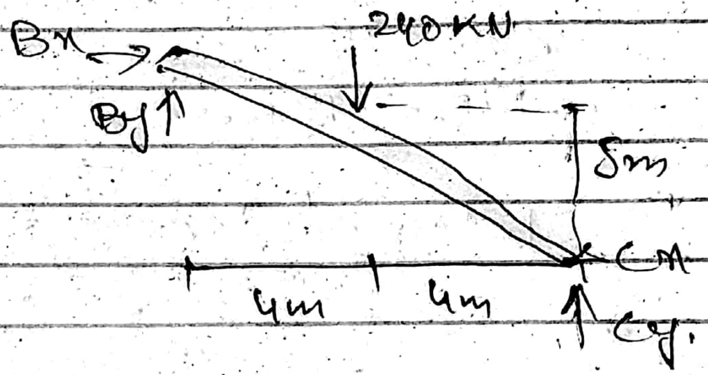
Member AB:-

$\circlearrowright + \quad \sum M_A = 0$

$B_x(5) + B_y(8) - 240(4) = 0$

$5B_x + 8B_y - 960 = 0 \quad \text{--- (1)}$

Member BC:-



$\circlearrowleft + \quad \sum M_C = 0$

$-B_x(5) + B_y(8) + 240(4) = 0$

$-5B_x + 8B_y + 960 = 0 \quad \text{--- (2)}$

Solving equation (1) and (2) for B_x & B_y

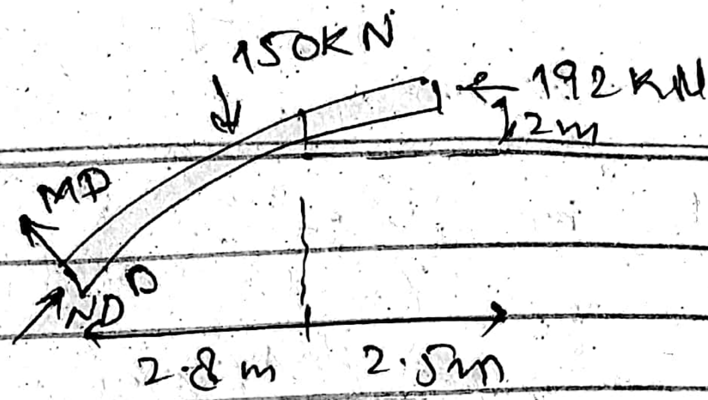
$$\cancel{5B_x} + 8B_y - \cancel{960} = 0$$
$$-\cancel{5B_x} + 8B_y + \cancel{960} = 0$$
$$16B_y = 0$$
$$B_y = 0$$

Put B_y in eq (1)

$5B_x + 8(0) - 960 = 0$

$5B_x = 960$

$\boxed{B_x = 192\ kN}$



Segment DB :

$\circlearrowleft + \Sigma M_D = 0.$

$192(2) - 150(2.5) - MD = 0.$

$384 - 375 = MD$

$\boxed{MD = 9KN\text{-}m}$

Is Internal Moment At D.