QNO (3)

Given DATA:-

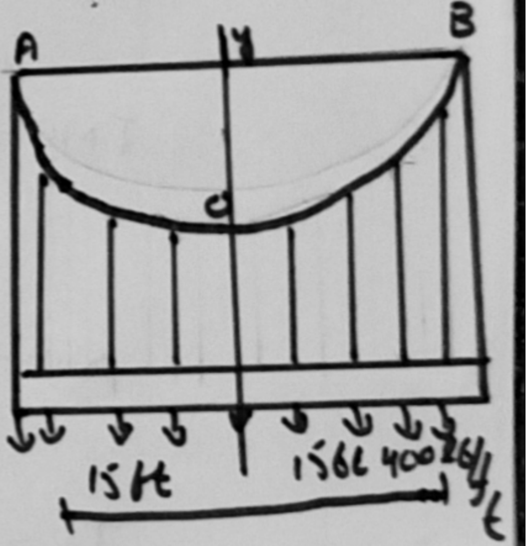
W_0 = uniform Load = 400lb/ft

h = ~~~~ 10 ft

L = 15 ft

Required DATA:-

equation of curve and force in cable = ?



Solution:-

we know that

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

Putting the values

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

$$y = 0.044 x^2$$

P.T.O

$$T_O = F_H = \frac{W_O L^2}{2h} = \frac{400 \times (15)^2}{2 \times 10}$$

$$T_O = 4500\,lb = 4.5\,k$$

$$T_B = T_{Max} = \sqrt{(F_H)^2 + (W_O L)^2}$$

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

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

Now "TMax" By another equation.

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

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

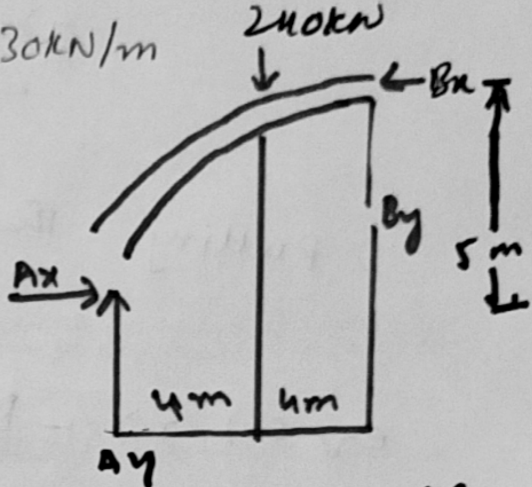
$$\boxed{T_{max} = 7500\,lb = 75\,k}$$

P3

Q No (4)

Given DATA:-

uniform Load = 30kN/m



membe AB

Required:-

internal moment at D = ?

Solution:-

Dividing int two members

AB and BC

AB →

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

BC :-

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

Adding eq (a) and (b)

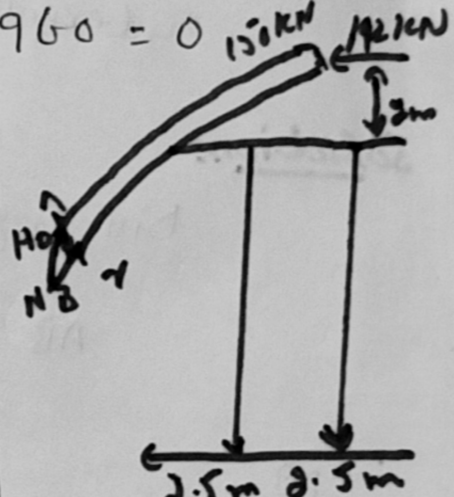
$$\begin{aligned} &\cancel{B_x(5)} + B_y(8) - \cancel{240(4)} = 0 \\ &\underline{-\cancel{B_x(5)} + B_y(8) + \cancel{240(4)} = 0} \\ &0 + 2B_y(8) + 0 = 0 \end{aligned}$$

$$2B_y(8) = 0$$

$$\Rightarrow \; B_y = 0\,kN$$

Putting the value of "B_y" in eq (b)

$$\text{eq (b)} \Rightarrow -B_x(5) + 0(8) + 960 = 0$$



member DB

$$B_x(5) = 960$$

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

$$\boxed{B_x = \cancel{120}\; 192\,kN}$$

"Now at segment DB"

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

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

$$384 - 375 - M_D = 0$$

$$9 - M_D = 0$$

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

P5

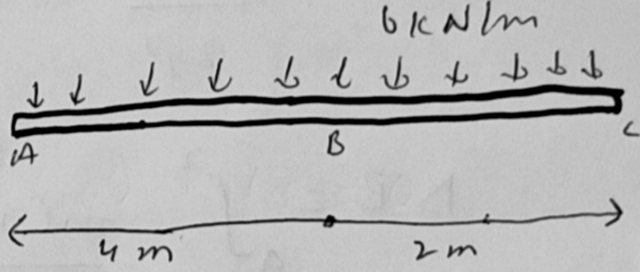
Question No 2:-

Sol:

Given That

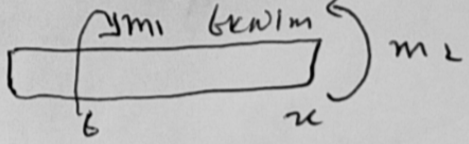
$E = 200$ Gpa

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



Required:-

Slope and displacement = ?



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

$\cancel{m_2' = m' + \frac{6x_2 + x_1^2}{2}}$ ~~~~ sir

$\cancel{m = m'}$

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

$m = m' + 3x^2 + \frac{x_1^2}{2}$

$\Omega \cdot t^2$

$\frac{P6}{2}$

Taking partial derivation with respect to m

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

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

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

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

put the value of EI and I.

$$= \frac{-3x^2}{2(200)(60\times10^6)}\Bigg|_0^6 + \frac{-3x^4}{4000(60\times10^6)}\Bigg|_0^4$$

P. T. O

$$= \frac{-216\ KN\ ft^3}{4.8N6^0} + \frac{-614.4\ KN.ft^3}{4.8N6^0}$$

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

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

Displacement :.

Slope:.

$$m + \frac{1}{2}\times(6x_1) = 0$$

$$m = -\frac{1}{2}x(6x_2) = 3x^2$$

$$\text{So};\quad \frac{2m_1}{2m_1'} = 0$$

$$\Rightarrow m_1' = m_2 - \frac{1}{2}(x_2)(6+x_2)$$

P.t.o

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

$$m = -m' + 3x^2 + x_2^2/_2$$

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

$$= \int_0^6 \frac{-3x^2 \, 0 \, dx}{E \cdot I} + \int_0^{10} (-2 + 6x^2 + \frac{x^2}{2}) dx$$

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

$$= \frac{1}{200 \times (60 \times 10^6)} \left(-x + \frac{6x^3}{3} + \frac{x^3}{6}\right) \Big|_0^{10}$$

$$\boxed{\Rightarrow q = 4.125 \times 10^{-7} \text{ inch}}$$

QUESTION NO 07

Given DATA:-

Uniform Load = 4K/ft

$E = 29 \times 10^3$ ksi

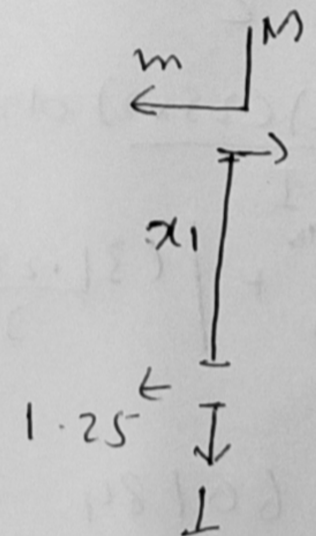
$I = 600 in^4$

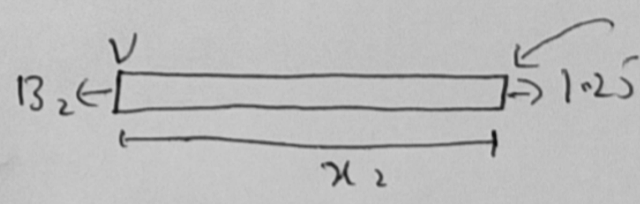
Required:-

Vertical displacment = ?

Solution:-

Now virtual moment



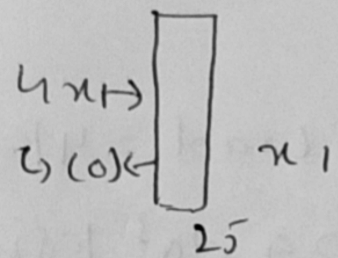


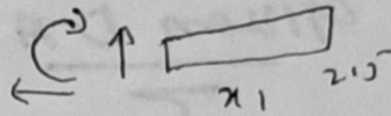
$m_2 = 1.25x$

p.t.o

P10

real moment





$m_2 = 25\,x_2$

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

$$40x_1 - 2x_1^2$$

Now By virtual work equation

$$\Delta DC = \int_0^L \frac{m M dx}{EI}$$

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

$$\int_0^3 \frac{(1.25 x2)(25x2)}{EI} dx$$

$$\Delta 2 = \frac{1}{EI} \left| \frac{40x^3}{3} - \frac{2x^3}{4} \right|_0^{10} + \left| (3 \frac{1.25 x 2^3}{3}) \right|_0^8$$

$$\Delta 2 = 10649.60184$$