

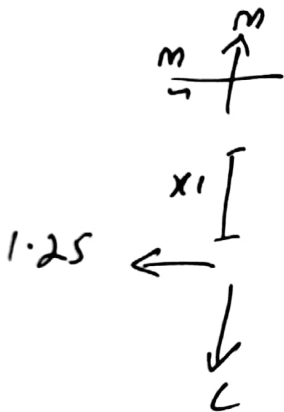
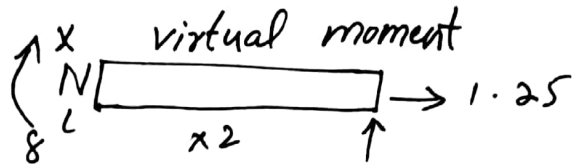
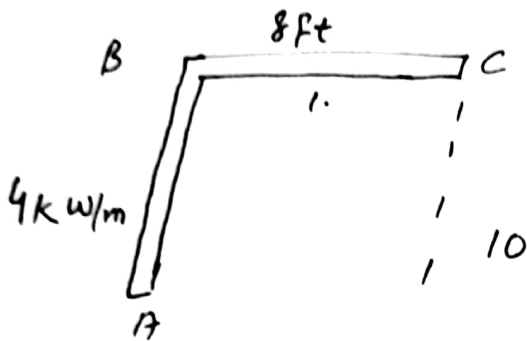
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Subject = Structural Analysis-I

Submitted to = Sir Amjad Islam.

Question No # 1 (1)

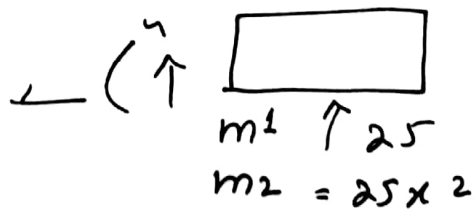


$$m_L = x_2$$

$$m_2 = 1.25x_2$$



real moment



$$m^4 = \frac{40x_1 \cdot \frac{1}{2x} (x_1)(x_1)}{= 40x_3 - 2x_1^2}$$

Now put virtual work equation

$$1 \cdot \Delta L = \int_0^L m \frac{M}{E} dx \quad (2)$$

$$\Delta L = \int_0^{16} 1x_1 \frac{(40x_2 - 2x_2^2)}{E} dx$$
$$+ \int_0^8 \frac{(1.25x_2)(25x_2)}{E_1} dx$$

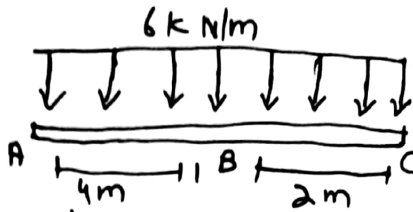
$$\Delta L = \frac{1}{E} \left(\frac{40x^3}{3} - \frac{2x^3}{4} \right) \Big|_0^{16}$$

$$+ \left(\frac{31.25x_2^3}{3} \Big|_0^8 \right) \frac{1}{E_1}$$

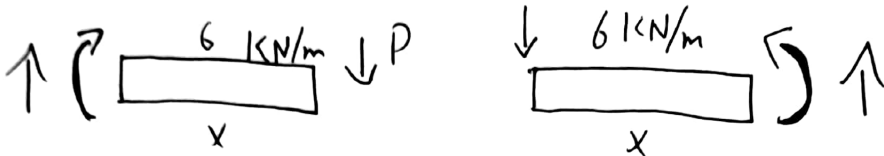
$$\Delta L = 10649.60184$$

Question No #2.

(3)



Displacement



$$-m - \frac{1}{2}(x)(6x) - Px = 0 \quad m + \frac{1}{2}(x)(6x) + Px = 0$$

$$m = -3x^2 - Px$$

$$m = -3x^2 - Px$$

Partial derivation

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

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

$$\Delta B = \int_0^l m (2m) \frac{dx}{EI}$$

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

④

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

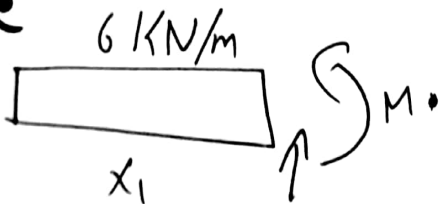
put value of E.I and displacement.

$$\frac{-3x^2}{4(200)(60000000)} \Big|_0^6 + \frac{-3x^4}{4(200)(60000000)} \Big|_0^4$$

$$= \frac{-216 \text{ N}\cdot\text{ft}^3}{4.8 \times 10^{10}} + \frac{-614.4 \text{ KN}\cdot\text{ft}^2}{4.8 \times 10^{10}}$$

$$\Delta P = 5.76 \times 10^{-10} \text{ IN}^{\circ}$$

Slope



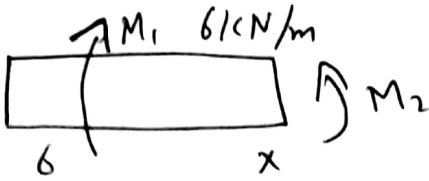
$$M + \frac{1}{2} \times (6x_1) = 0$$

$$M = -\frac{1}{2} \times (6x_1) = -3x^2$$

Now we take partial derivative w.r.t "M"

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

(5)



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

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

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

Now we take partial derivative
w.r. to "M₁"

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

$$\int_0^L \frac{-3x^2(0)}{EI} dx + \int_0^{10} (-1 + 6x^2 + \frac{x^3}{2}) dx$$

$$0 + \left(-x + \frac{6x^3}{3} + \frac{x^3}{6}\right) \int_0^{10} \frac{1}{EI}$$

$$0 = 4.125 \times 10^{-7} \text{ in}$$

END.



Question No # 3

(6)

Given Data:-

$$W_0 = \text{Uniform Load} = 400 \text{ lb/ft}$$

$$h = 10 \text{ ft}$$

$$L = 15 \text{ ft}$$

Required:-

equation of curve and force in cable = ?

Sol:-

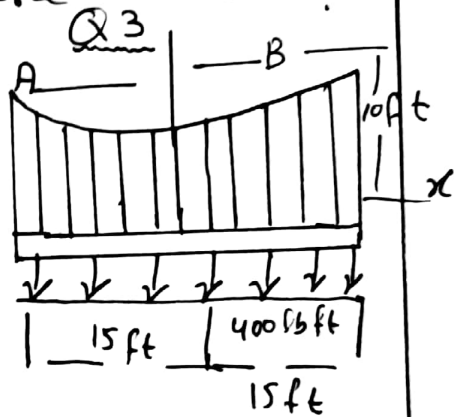
We know that

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

putting values in equation

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

$$y = 0.044 x^2$$



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

$$T_0 = 4500 \text{ lb} = 4.5 \text{ k}$$

$$T_B = T_{\text{max}} = \sqrt{(F_H)^2 + (W_0 L)^2} = \sqrt{(4500)^2 + (400 \times 15)^2}$$

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

(7)

Now " T_{max} " By another equation

$$T_B = T_{max} = W_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2} = 400 \times 15 \sqrt{1 + \left(\frac{15}{2 \times 6}\right)^2}$$

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

← END →

Question No # 4

Given Data:-

Uniform load = 30 kN/m

Required:-

Internal moment at D = ?

Sol:-

Dividing into two members

AB & BC

AB :-

$$\sum M_A = 0 \quad B_x(5) + B_y(8) - 240(4) = 0 \quad \text{--- (a)}$$

BC :-

$$\sum M_C = 0 \quad -B_x(5) + B_y(8) + 240(4) = 0 \quad \text{--- (b)}$$

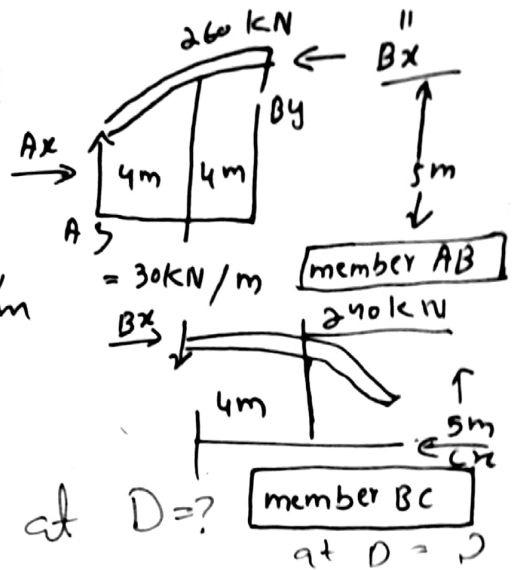
Adding eq (a) & (b)

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

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

$$2B_y(8) = 0$$

$$B_y = 0$$



8

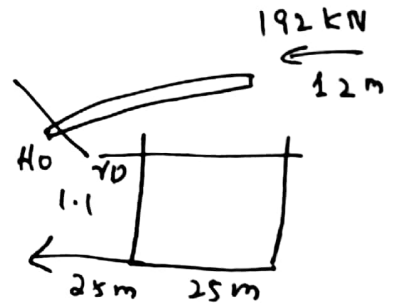
Putting the value of "By" in eq (b)

(9)

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

$$B_x(5) = 960$$

$$B_x = \underline{192 \text{ kN}}$$



"Now at Segment DB"

Member DB

$$\sum M_0 = 0$$

$$192(2) - 150(2.5) - M_0 = 0$$

$$384 - 375 - M_0 = 0$$

$$9 - M_0 = 0$$

$$M_0 = 9 \text{ kN}\cdot\text{m}$$

END

