NAME : Syed Azhar jan

ID NUMBER : 7930

SECTION : "A" Civil Deptt.

SEMESTER : 4th

TEACHER NAME : Engr R/SIR Amjad islam

SUBJECT : STructure Analysis - I

STUDENT Sign : S. Azhar

Date : 26-June-2020

Question NO 1st :

Determine the vertical displacement of free end point C on .....

Ans :

Given data

uniform load = 4 k/ft

$E = 29 \times 10^3$ ksi

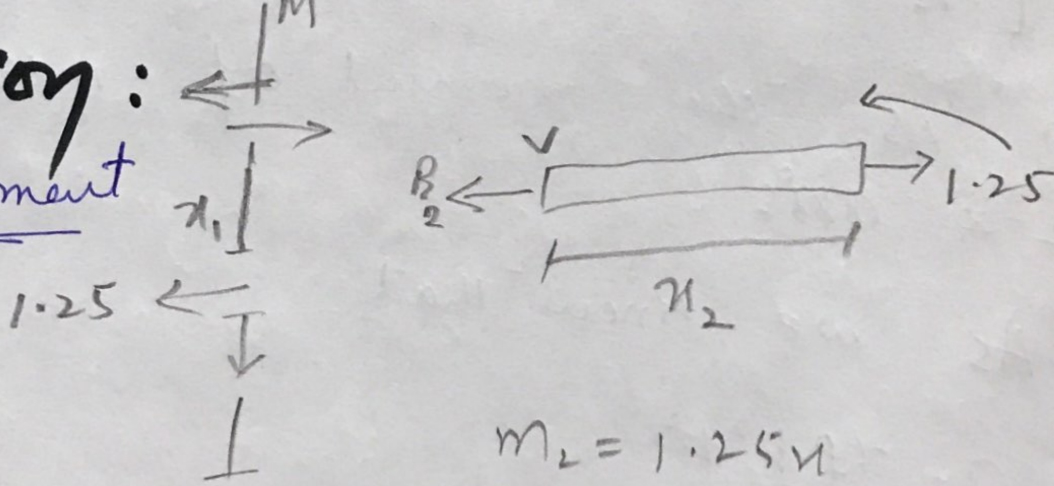
$I = 600 in^4$

Required :

vertual displacement

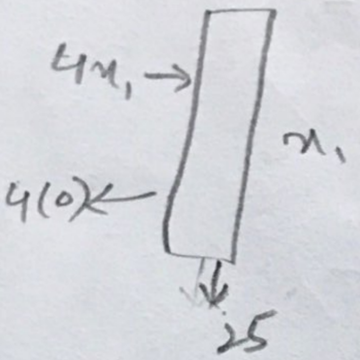
Solution :

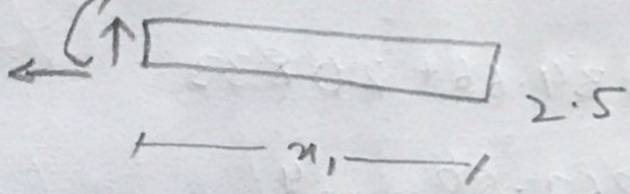
vertual moment



$m_2 = 1.25x$

Real moment





$m_2 = 25 x_2$

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

Now! By virtual work equation

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

$$\Delta L = \int_0^{10} (1 x_1) \left(\frac{40 x_2 - 2x^2}{E} \right) dx + \int_0^{8} \frac{(1.25 x_2)(2.5 x_2) dx}{EI}$$

$$\Delta L = \frac{1}{E\bar{I}} \left| \frac{40x^3}{3} - \frac{2x^3}{4} \right|_0^{10} + \left| \frac{131.25\, x_2^3}{3} \right|_0^{8}$$

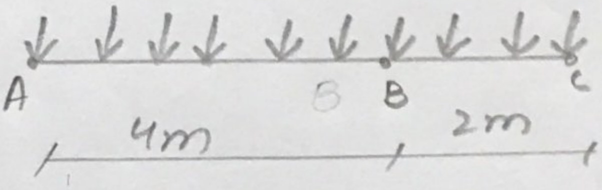
$$\Delta L = 10649.60184$$

Page #

Question NO 2nd

Ans

Given data:

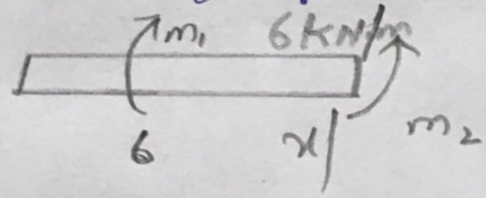


$E = 200\ GPa$

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

Required:

Slope & displacement = ?



Solution:-

$m_1 = m_2 = \frac{1}{2}(x_2)(6 + x_1)$

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

Taking partial derivative with respect to m.

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

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

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

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

Put the value of EI and I.

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

$$= \frac{-216\ KNft^3}{4.8\times10^{10}} + \frac{-614.4\ KNft^3}{4.8\times10^6}$$

Page #

$\Delta B = 5.76\times10^{-10}$ inch → Displacement

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

NOW!

Slope :-

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

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

So;

$\partial m_1 / \partial m_1 = 0$

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

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

$\partial m_1 / \partial m_1 = -1$

$$= \int_0^6 \frac{-3x^2(1)\,dx}{EI} + \int_0^{10}\left(-2+6\times2+\frac{x^2}{2}\right)dx$$

Page #

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

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

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

Slope $= 4.125 \times 10^{-7}$ inch

(5)

Question NO 3rd.

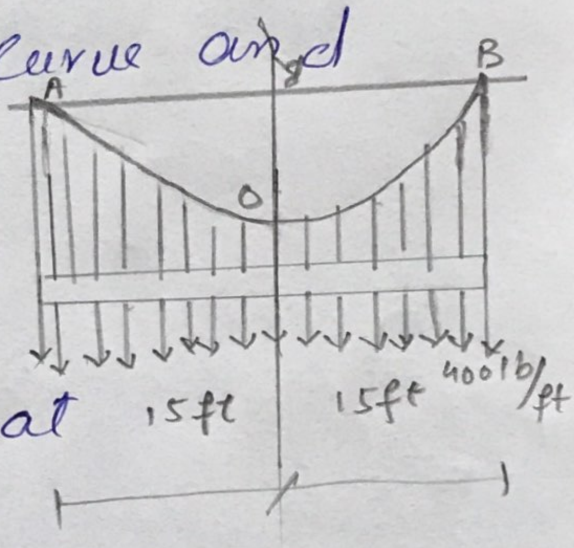
Given data:

W_o = 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

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

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

(32)

$T_0 = 4500 \, lb = 4.5 K$

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

$T_{max} = 7500 \, lb = 7.5 K.$

NOW!

"T_{max}" By anather equation

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

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

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

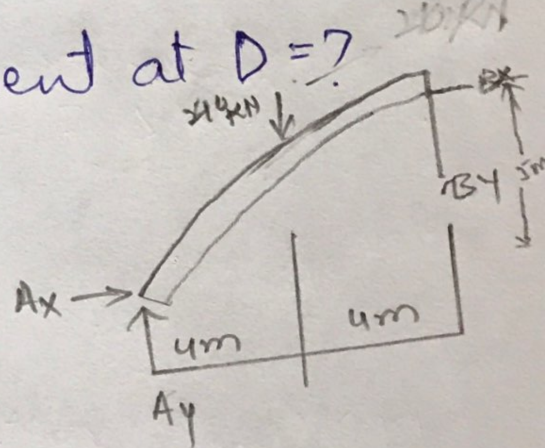
Question NO 4th:

Given data

uniform load = 30 KN/m

Required:-

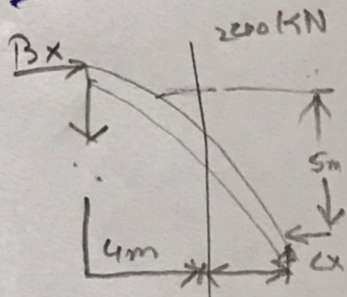
internal moment at D = ?



Solution:

Dividing into two members AB & BC

Member AB



member BC

- AB

$\circlearrowleft^+ \Sigma M_A = 0$

$Bx(5) + By(8) - 240(4) = 0$ — (*)

- BC

$\circlearrowleft^+ \Sigma M_c = 0$

$-Bx(5) + By(8) + 240(4) = 0$ — (**)

Adding equation (*) & (**)

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

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

$$0 + 2By(8) + 0 = 0$$

$$2By(8) = 0$$

$$\Rightarrow By = 0 \text{ kN}$$

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

$$\text{eq (**)} = -Bx(5) + 0(8) + 960 = 0$$

$$Bx(5) = 960$$

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

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

Now!

at Segment DB"

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

$384 - 375 - M_D = 0$

$9 - M_D = 0$

$\Rightarrow M_D = 9\ kN \cdot m$