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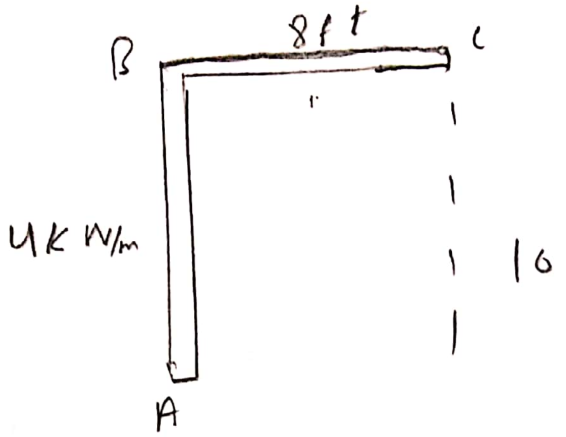
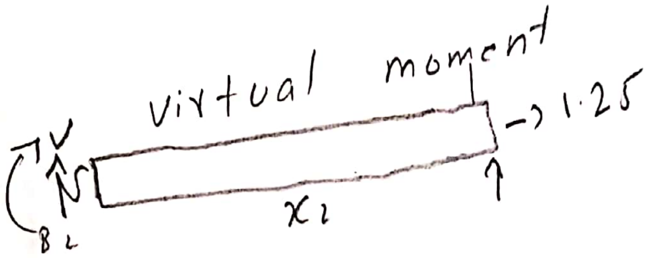
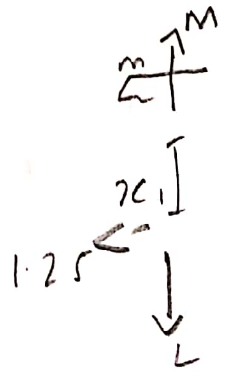
Section	"A"
Semister	4th
paper	Structure Anylisis
Department	Civil Engineering

Q1 : Page (1)



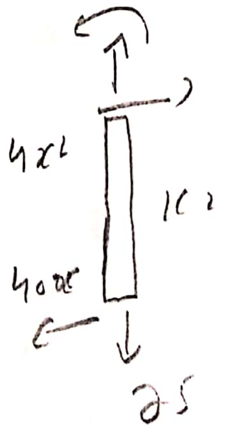




$m_2 = x_2$

$m_2 = 1.25x$

real moment



m1 ↑25

$m_2 = 25x_2$

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

=

Now put virtual work

equation

$$1 \cdot \Delta_{Cb} = \int_0^L m \frac{M}{E} dx$$

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

$$+ \int_0^8 \frac{(1.25x_2)(25x_2)}{E1} dx_2$$

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

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

$$\boxed{\Delta L = 10649.60184}$$

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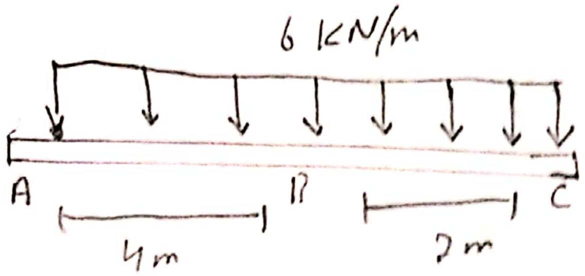
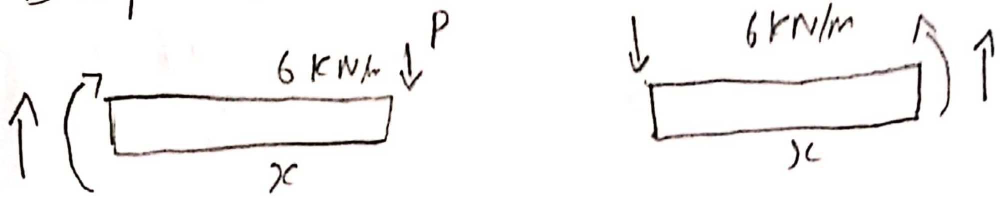
Q2 Page (3)



Displacement



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

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

$m = -3x^2 - Px$

$m = -3x - Px$

Partial derivation

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

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

$$\Delta_B = \int_0^L m \left(\frac{\partial m}{\partial P}\right) \frac{dx}{E}$$

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

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

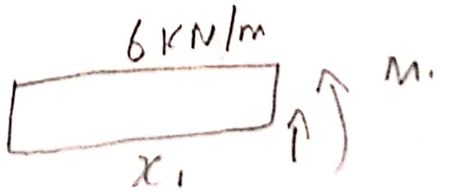
Put value of E, I and displacement

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

$$= \frac{-2161\,w \cdot ft^3}{4.8\times10^{10}} + \frac{-614.4\,KN ft^2}{4.8\times10^{10}}$$

$$\boxed{\Delta B = 5.76\times10^{-10}\ IN.}$$ Ans

Slope

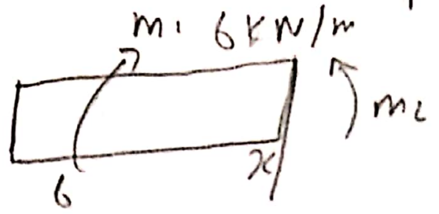


$$M + \tfrac{1}{2}x(6x_1) = 0$$

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

Now we take partial derivative w.r.t m'

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



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

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

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

Now we take partial derivative with respect to m_1

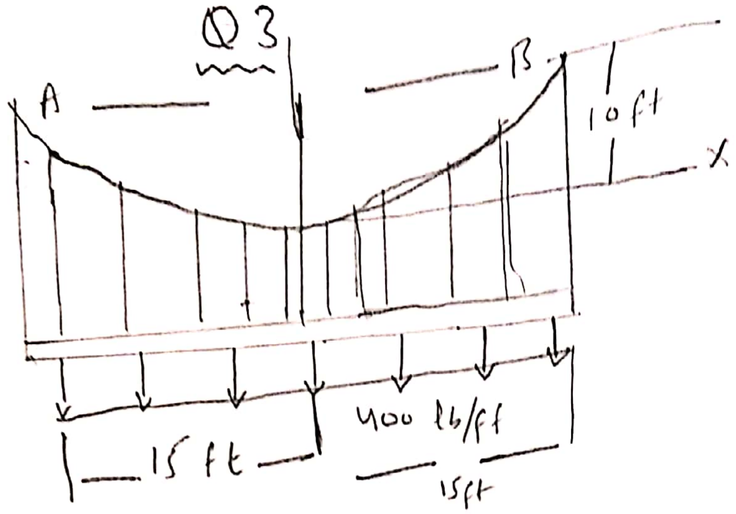
$$\frac{\partial m_2}{\partial m'} = -1$$

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

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

$$\theta = \boxed{4.125 \times 10^{-7}\,\text{in}}$$ Ans

Q3



Sol :

We know that

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

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

$$y = 0.0444 x^2$$

from eq of

$$T_A = F_H = \frac{w_0}{2h} L^2$$

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

$$F_H = 4500$$

from equation of

$$T_B = T_{max} = \sqrt{F^2 H + (W_o L)^2}$$

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

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

Now T_{max} by another equation

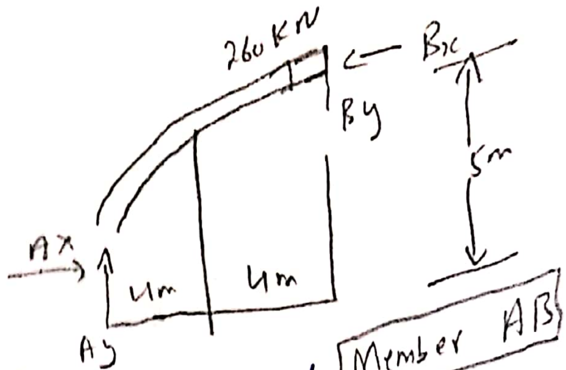
$$T_B = T_{max} = W_o L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

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

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

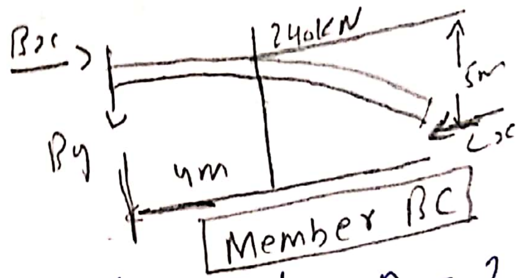
——— X ———

Q4



Given data:

Uniform load = 30 KN/m



Required:

Internal moment at D = ?

Sol: Divided into two members AB and BC

AB

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

BC

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

Adding eq (a) and (b)

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

$2By(8) = 0$

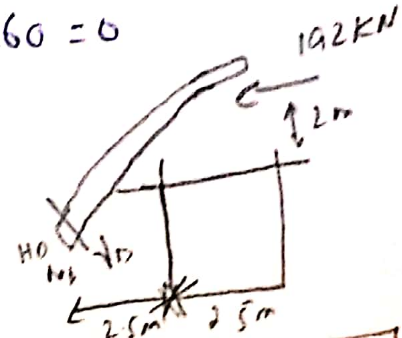
$\Rightarrow \boxed{By = 0\,KN}$

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

eq (b) $\Rightarrow -Bx(5) + 0(8) + 960 = 0$

$Bx(5) = 960$

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



Member DB

$\boxed{Bx = 192\,KN}$

"Now at Segment DB"

$\Sigma M_D = 0$

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

$384 - 375 - M_D = 0$

$9 - M_D = 0$

$\Rightarrow \boxed{M_D = 9\,KN.m}$