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→ 7986

→ Section "A"

→ Sem:. → "4th"

→ Structure Autiry

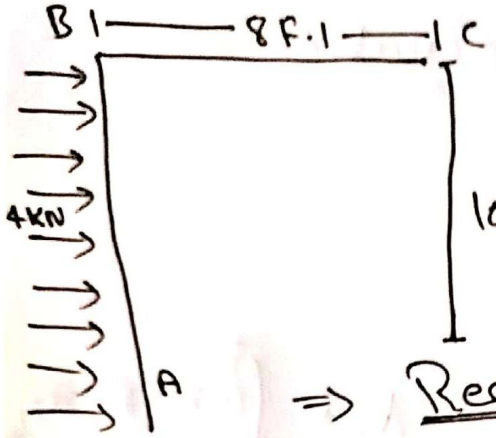
→ Final Paper.

→ 26 - 06 - 2020.

Q No # 1 :->

Answer :->

⇒ Given Data :->



uniform load = 4 K/ft

$E = 29 \times 10^3$ KSi

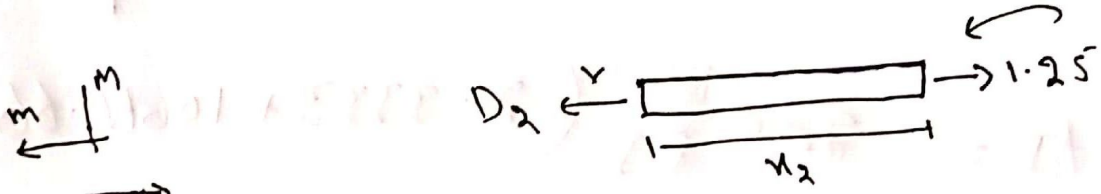
$I = 600 in^4$

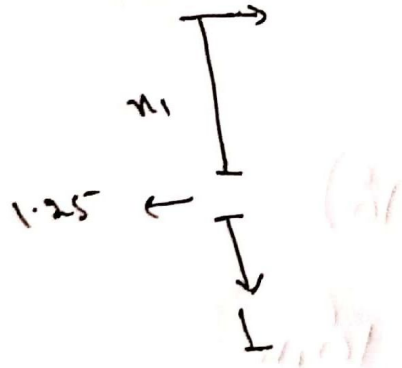
⇒ Required :->

Vertical Displacement.

⇒ Solution :->

Now virtical moment.

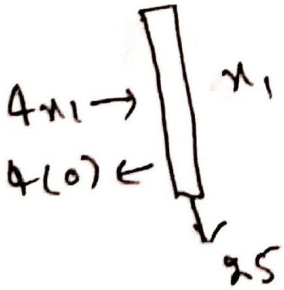




$m_2 = 1.25x$

real moment

$m_2 = 2.5 x_2$



(P -T-O) ⇒

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

Now By virtual work equation.

$$\Delta \cdot D_I = \int_0^L \frac{mM\,dx}{E}$$

$$\Delta I = \int_0^{10} \frac{(1x_1)(40x_2 - 2x^2)}{E}\,dx + \int_0^8 \frac{(1.25x_2)(25x_2)}{EI}\,dx$$

$$\Delta I = \frac{1}{EI}\left| \frac{40x^3}{3} - \frac{2x^3}{4} \right|_0^{10} + \left(\frac{31.25}{3}x_2^3\right)\Big|_0^8$$

$$\Delta I = \frac{1}{EI}(2.3333 + 10666.66)$$

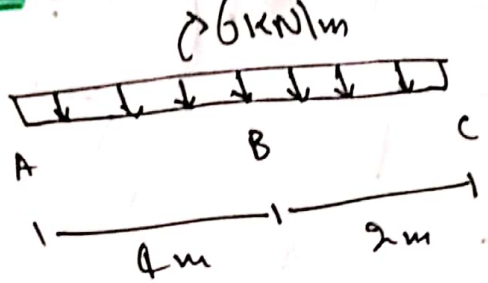
$$\Delta I = \frac{33999.99}{(200)(60\times10^6)}$$

$$\boxed{\Delta I = 2.833 \times 10^{-6}\ \text{in}}$$

x ——————— x .

Q No #2:→

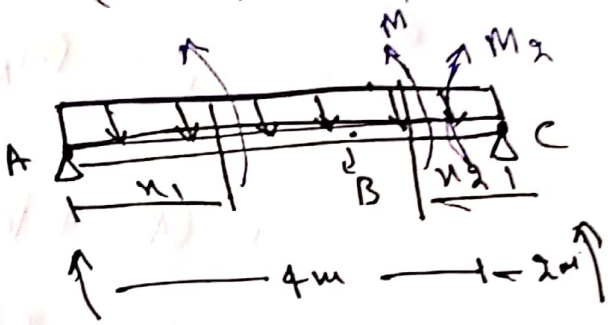
Answer:→



Required:→

Slope & displacement at Point "B".

⇒ Solution:→



18KN ↑ 0.1667 18 ↓ -0.1667

(a)

(a')

$$R_1 + R_2 = 0 \quad \text{---} (1)$$

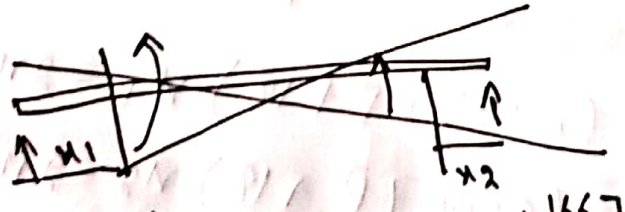
$$\Sigma M_A = 0 \; \circlearrowleft +$$

$$1 + R_2 (6) = 0$$

$$\Rightarrow -0.16667 \text{ Put in } (1)$$

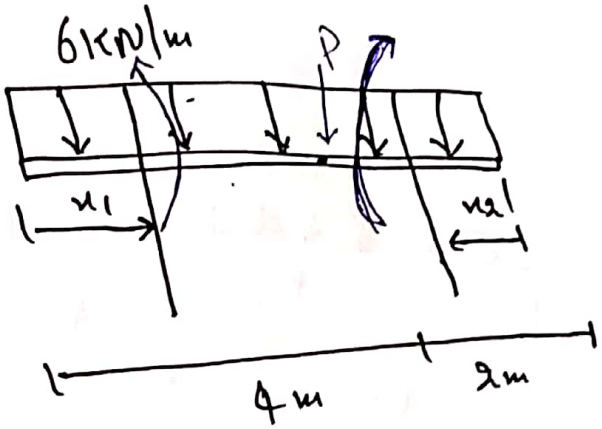
$$R_1 + (-0.1667) = 0$$

$$R_1 = 0.16667 \text{ KN}$$



18 ↑ 0.1667 18 ↓ 0.1667.

(b)



(b)

(4)

$R_1 + R_2 = 1$

$\circlearrowleft + \Sigma M_A = 0$

$-(1)(4) + R_2(6) = 0$

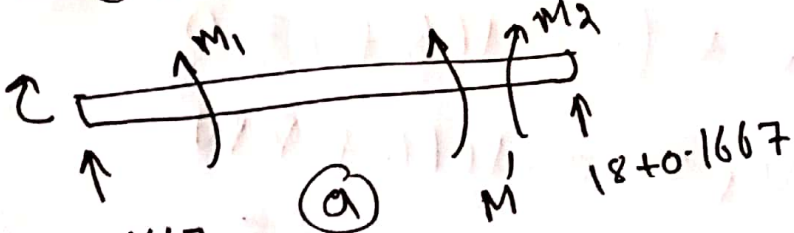
$R_1 = 0.6667\ KN$

$R_2 = 1 - 0.6667\ KN$

$R_2 = 0.333\ KN$

$M_1 = (18 + 0.16667M')x_1 - 2x_1^2$

$M_2 = (18 - 0.6667M')x_2 - 2x_2^2$

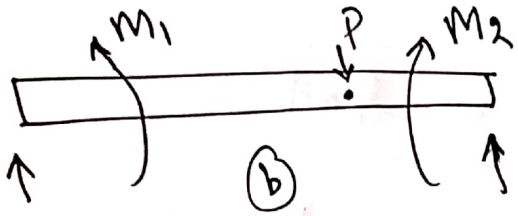


(a)

$M_1 = (0.333P + 18)x_1 - 2x_1^2$

$M_2 = (0.667P + 18)x_2 - 2x_1^2$

$(P - T - O) \Rightarrow$



(5)

The displacement function shows in the figure "a" above

$$\frac{\partial M_1}{\partial M'} = 0.1667x_1 \text{ and } \frac{\partial M_2}{\partial M'} = 0.1667x_2$$

– set $M' = 0$ then

$$M_1 = (18 + 0.1667(0))x_1 - 2x_1^2$$

$$\rightarrow M_1 = (18x_2 - 2x_2^2)$$

$$\rightarrow M_2 = (18x_2 - 2x_2^2)$$

$$\theta_B = \int_0^2 M\left(\frac{\partial M}{\partial M'}\right)\frac{dx}{EI} = \int_0^4 \frac{(18x_1 - 2x_1^2)(0.1667x_1)}{EI} dx + \int_0^2 \frac{(18x_2 - 2x_2^2)(0.1667x_2)dx_2}{EI}$$

$$\theta_B = \frac{42.65}{EI} + \frac{6.66}{EI}$$

$$\theta_B = \frac{49.31}{EI}$$

$$\theta_B = \frac{49.31}{200 \times 10^6 \, KPa(0.00006)}$$

$(P - T - 0) \Rightarrow$

$\theta_B = 0.4411$ rad

→ For the displacement functions are shown in figure "b"

$\frac{\partial M_1}{\partial M_P} = 0.333 x_1$ and $\frac{\partial M_2}{\partial P} = 0.6667 x_2$ also

set $P = 0$

then $M_1 = (18x_1 - 2x_1^2)$ KN·m

$M_2 = (18x_2 - 2x_2^2)$ KN·m

Thus

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

~~$\Delta_B = \int_0^4 30x x_1 - 2x_1^2)(0.333x_1) \int_0^2 (\cdot$~~

$$\Delta_B = \int_0^4 \frac{(30x x_1 - 2x_1^2)(0.33x_1)\,dx}{EI} + \int_0^2 \frac{(30x_2 - 2x_2^2)(0.6667x_2)\,dx}{EP}$$

$$\Delta_B = \frac{218.5}{EI} \Rightarrow \frac{218.5}{(200 \times 10^6)(0.00006)}$$

$= 0.018$ m (or) 18 mm

Ans

X ——— X

Q No #3 :->

Answer :->

(7)

⇒ **Given Data :->**

Uniform Load "wo" = 400 lb/ft

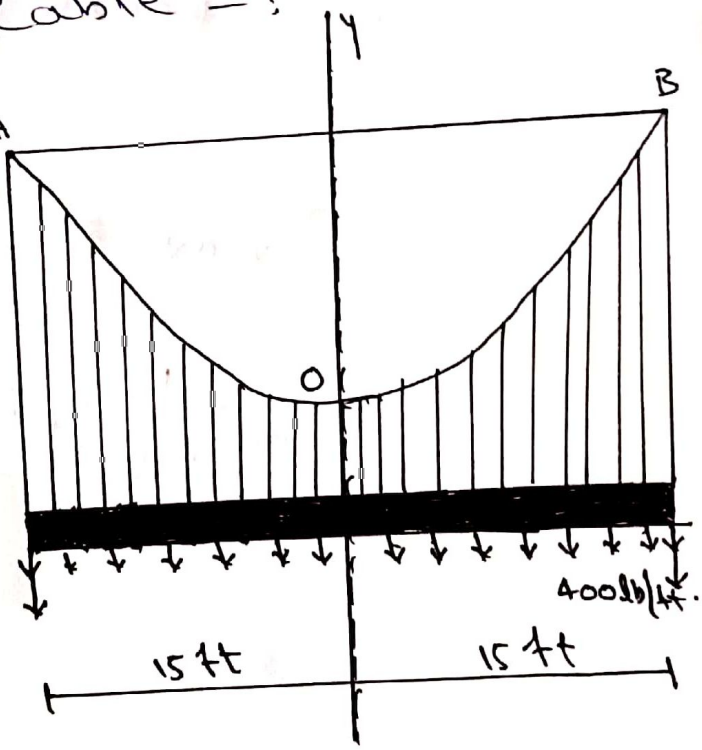
h = 10 ft

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

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

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

$$T_O = FH = \frac{wL^2}{2h} \Rightarrow \frac{400 \times (15)^2}{2 \times 10}$$

$$T_O = 4500 \text{ lb}$$

$$= 4.5 \text{ K}$$

$$T_B = T_{max} = \sqrt{(FH)^2 + (wL)^2}$$

(P - T - O) ⇒

(8)

$$T_B = T_{max} = \sqrt{(FH)^2 + (W/2L)^2}$$

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

Now "T_{max}" By another equation

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

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

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

$$\Rightarrow \boxed{= 7.5 \text{ k}}$$

Q no # 4 :->

Answer :->

⇒ **Given Data :->**

Uniform load = 30 KN/m

⇒ **Required :->**

Internal moment at D = ?

⇒ **Solution :->**

Dividing into two members AB and BC.

AB :->

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

BC :->

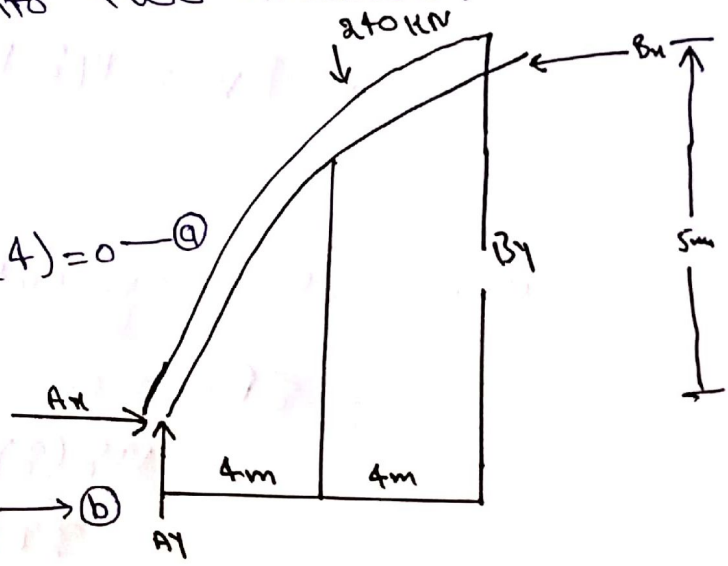
$\circlearrowleft + \Sigma M_C = 0 \quad -B_x(5) + B_y(8) + 240(4) = 0$ → ⓑ

Adding eq ⓐ and ⓑ

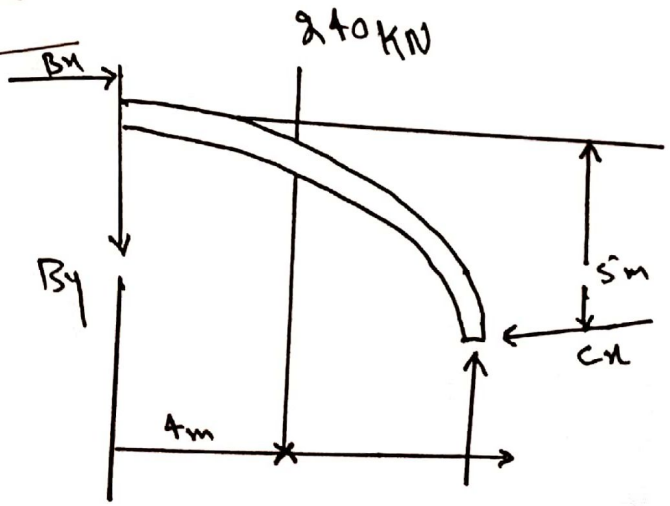
$B_x(5) + B_y(8) - 240(4) = 0$

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

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



Member AB



Member BC

$(P - T - O) \Rightarrow$

$$\Sigma B_y(8) = 0$$

$$\Rightarrow \quad B_y = 0 \cdot KN$$

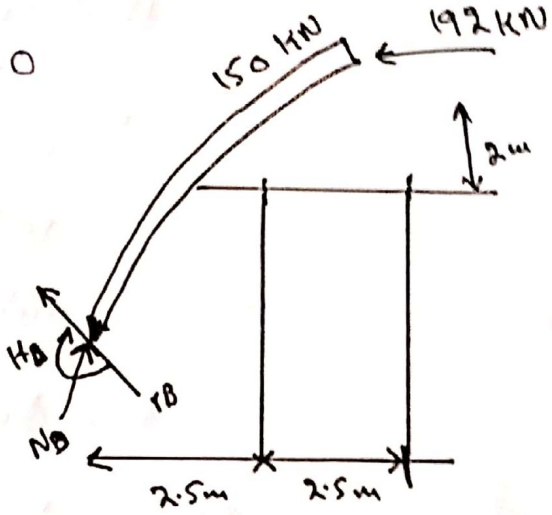
Putting the value of "B_y" in eq (1)

eq (1) $\Rightarrow$ $-B_x(5) + 0(8) + 960 = 0$

$$B_x(5) = 960$$

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

$$B_x = 192\ KN$$



Member DB

"Now at segment DB"

$$\circlearrowleft + \Sigma M_D = 0$$

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

$$384 - 375 - M_D = 0$$

$$9 - M_D = 0$$

$$\Rightarrow \quad M_D = 9\ KN \cdot m$$

The End.