ID : 7964

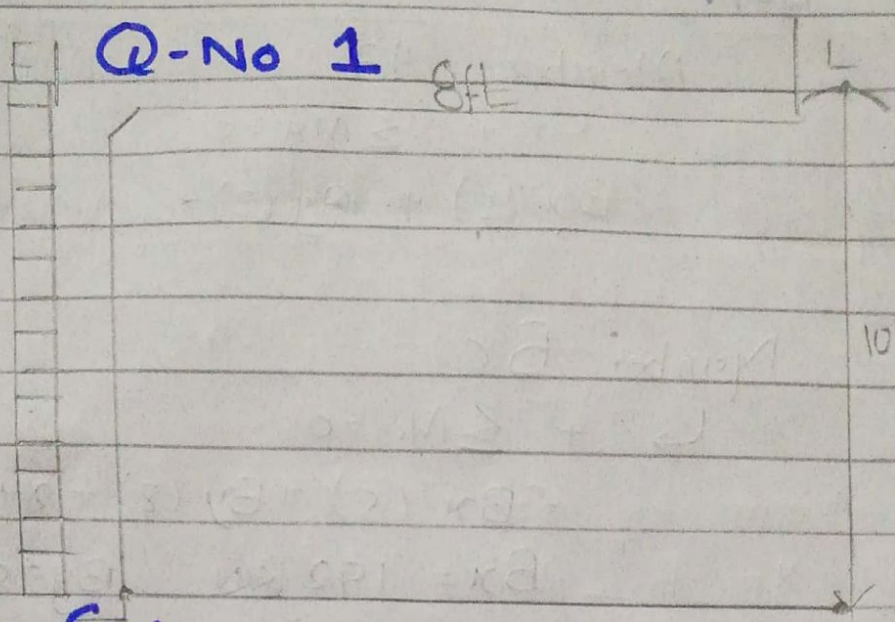
SECTION: B

PAPER : Structure analysis

Instructor : Engr: Amjad - Islam

Date : 26/6/20

Q-No 1



Sol :-

Find reaction.

$$\curvearrowleft + \quad \Sigma M_A = 0$$

$$-4(10)(5) + C_y(8) = 0$$

$$C_y = 25 \text{ kip}$$

$$\Sigma F_y = 0 \quad \uparrow +$$

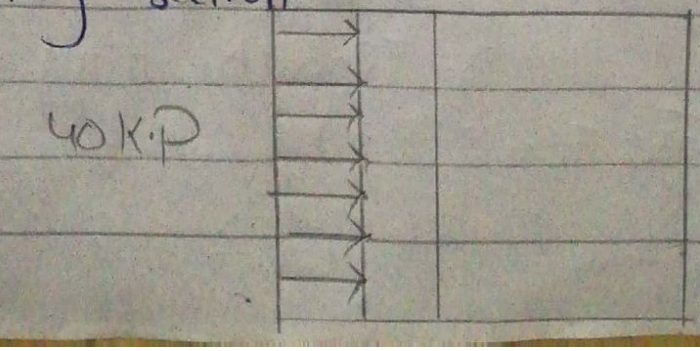
$$25 + A_y = 0$$

$$A_y = -25 \text{ kips}$$

$$\Sigma F_x = 0 \quad \rightarrow +$$

$$40 - A_x = 0 \quad \Rightarrow A_x = 40 \text{ K}$$

Taking section.

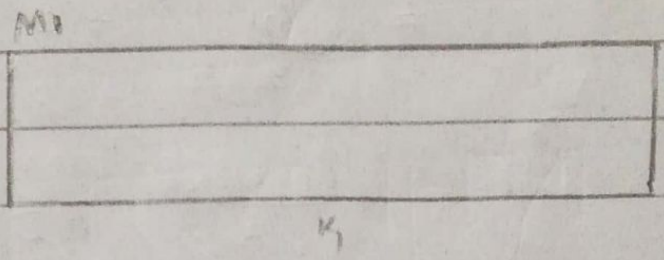


Real moment:

$\circlearrowleft + \Sigma m_1 = 0$

$-40(x_1) + 4x_1\left(\frac{x_1}{2}\right) + cx_1 = 0$

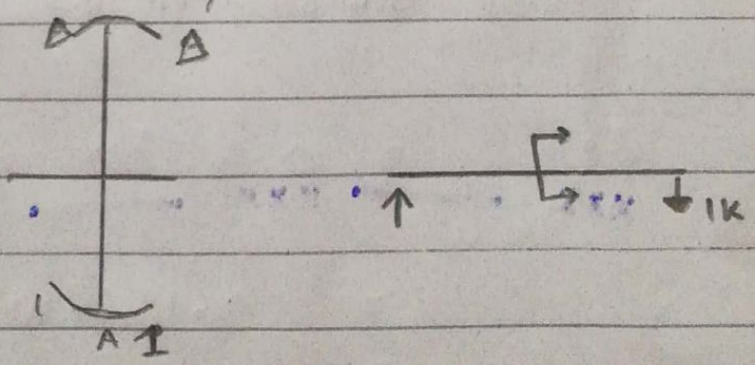
$M_1 = 40x_1 - 2x_1$



$-25(x_2) + M_2 = 0$

$M_2 = 25x_2$ kips

Now.



M_{em}	BA	CB
origin	B	C
limit	0-10	0-1
M	$2x^2$	0
M	8	x

By virtual work Method.

$$1.\quad \Delta_1 = \int_0^{10} \frac{2x_2\,(8)}{E*I}\,dx + \int_0^{8} \frac{(0)(x_2)}{E_i}$$

$$= \frac{16x^3}{3}\Big|_0^{10} + 0$$

$$\frac{16 \times 1000}{3} \Big/ EI$$

$$= \frac{6333.33}{E_i} = \frac{5333.33}{29 \times 10^3 \times 600}$$

$$\Delta_1 = 3.06 \times 10^{-4}\ in$$

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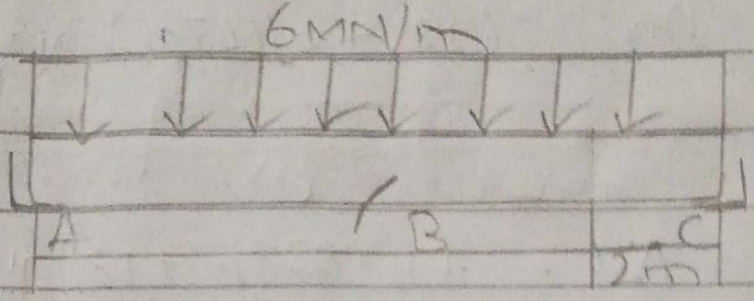
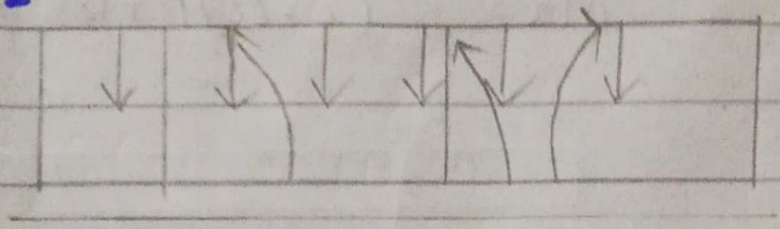
Q- no 2



Sol :-



$R_1 + R_2 = 0$ --- ①

$\Sigma M_A = 0$ ↳+

$1 + R_2(6) = 0$

-0.16667 Put in eq ①

$R_1 + (-0.1667) = 0$

$R_1 = 0.1667$ kN

→ $R_1 + R_2 = 1$

↳+ $\Sigma M_A = 0$

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

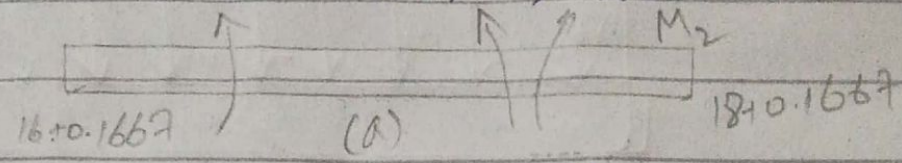
$R_1 = 0.667$ kN

$R_2 = 1 - 0.6667$ kN

$R_2 = 0.333\,KN$

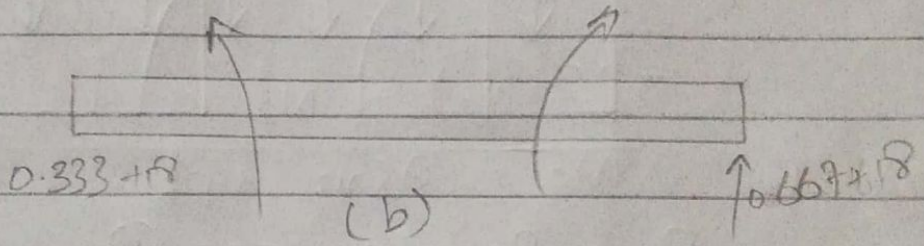
$M_1 = (18 + 0.1667m)\,x_1 - 2x_1^2$

$m_2 \quad (18 - 0.1667m)\,x_2 - 2x_2^2$



$M_1 = (0.333p + 18)\,x_1 - 2x_1^2$

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



The displacement function shown in the figure (a)

$$\frac{\partial M_1}{\partial M_1'} = 0.1667x_1 \quad \& \quad \frac{\partial M_2}{\partial M'} = 0.1667x_2$$

Set $M' = 0$ then

$m_1 = (18 + 0.1667(0))\,x_1 - 2x_1^2$

$m_1 = (18x_1 - 2x_1^2)$

$m_2 = (18x_2 - 2x_2^2)$

$$\phi B = \int_0^2 m \left(\frac{\partial m}{\partial m_1}\right) \frac{dx}{EI}$$

$$= \int_0^4 \frac{(18x_1 - 2x_1^2)(0.1667x_1)}{EI} dx_1 + \int_0^2 \frac{(18x_2 - 2x_1^2)(0.1667x_2)}{EI} dx_2$$

$$\phi B = \frac{42.65}{EI} + \frac{6.66}{EI}$$

$$\phi B = \frac{49.31}{(200 \times 10^6 kPa)\ 0.00006}$$

For the displacement function are shown in figure (b)

$$\frac{\partial m_1}{\partial m_p} = 0.333x_1 \quad \& \quad \frac{\partial m_2}{\partial p} = 0.6667x_2$$

also Set $P = 0$

then $M_1 = (18x_1 - 2x_1)$ KN-m

$M_2 = (18x_2 - 2x_2^2)$ KN-m

Thus $\Delta B = \int_0^2 m \left(\frac{\partial m}{\partial P}\right) \frac{dx}{EI}$

$$\Delta_B = \int_0^4 \frac{(30kx_1 - 2x_1^2)(0.333x_1)dx}{EI}$$

$$\Delta B = \frac{218.5}{Ei} \Rightarrow \frac{218.5}{(200\times10^6)(0.000006)}$$

$$= 0.018m$$

$$\Delta_B = 18mm \downarrow$$

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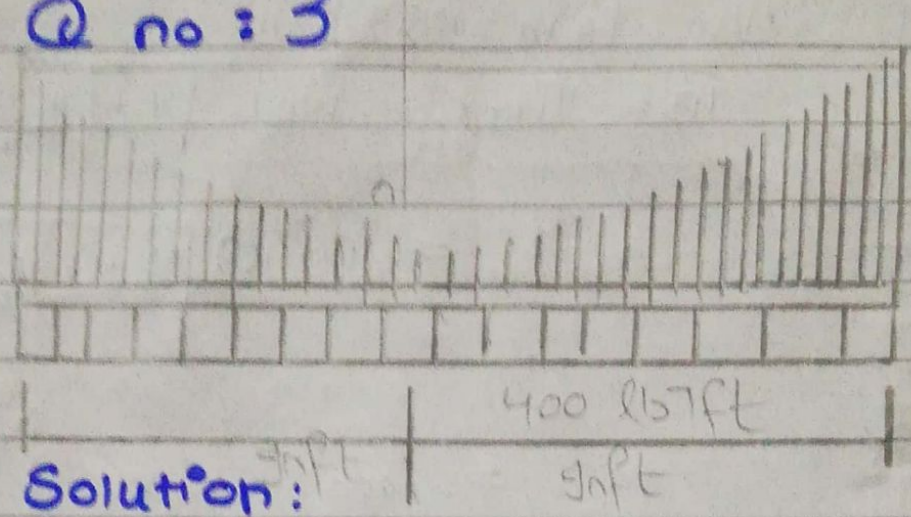
Q no : 3



Solution:

From eq 5.9

$$y = \frac{h}{L^2} x^2 = 10/15^2 \, x^2$$

$$y = 0.0444 \, x^2$$

From Eq 5.8

$$T_0 = F_4 = \frac{w_0 L^2}{2h} = \frac{400 \, (15^2)}{2(10)}$$

$T_0 = 4500$ lb ÷ing by 1000

$T_0 = 4.5$ K

From Eq 5-10.

$$T_B = T_{max} = \sqrt{F_4^2 + (w_0 L)^2}$$

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

$$= \sqrt{\text{[illegible]}}$$

$$= \sqrt{20250000 + (400 \times 15)^2}$$

$= 7500$ lb ÷ing by 1000

$T_B = T_{max} = 7.5$ K

Also from eq 5-11

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

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

$$= 6000\sqrt{1 + \frac{225}{400}}$$

$$= 6000\,(1.25)$$

$$= 7500\ lb \div ing\ by\ 1000$$

$$T_B = T_{max} = 7.5k$$

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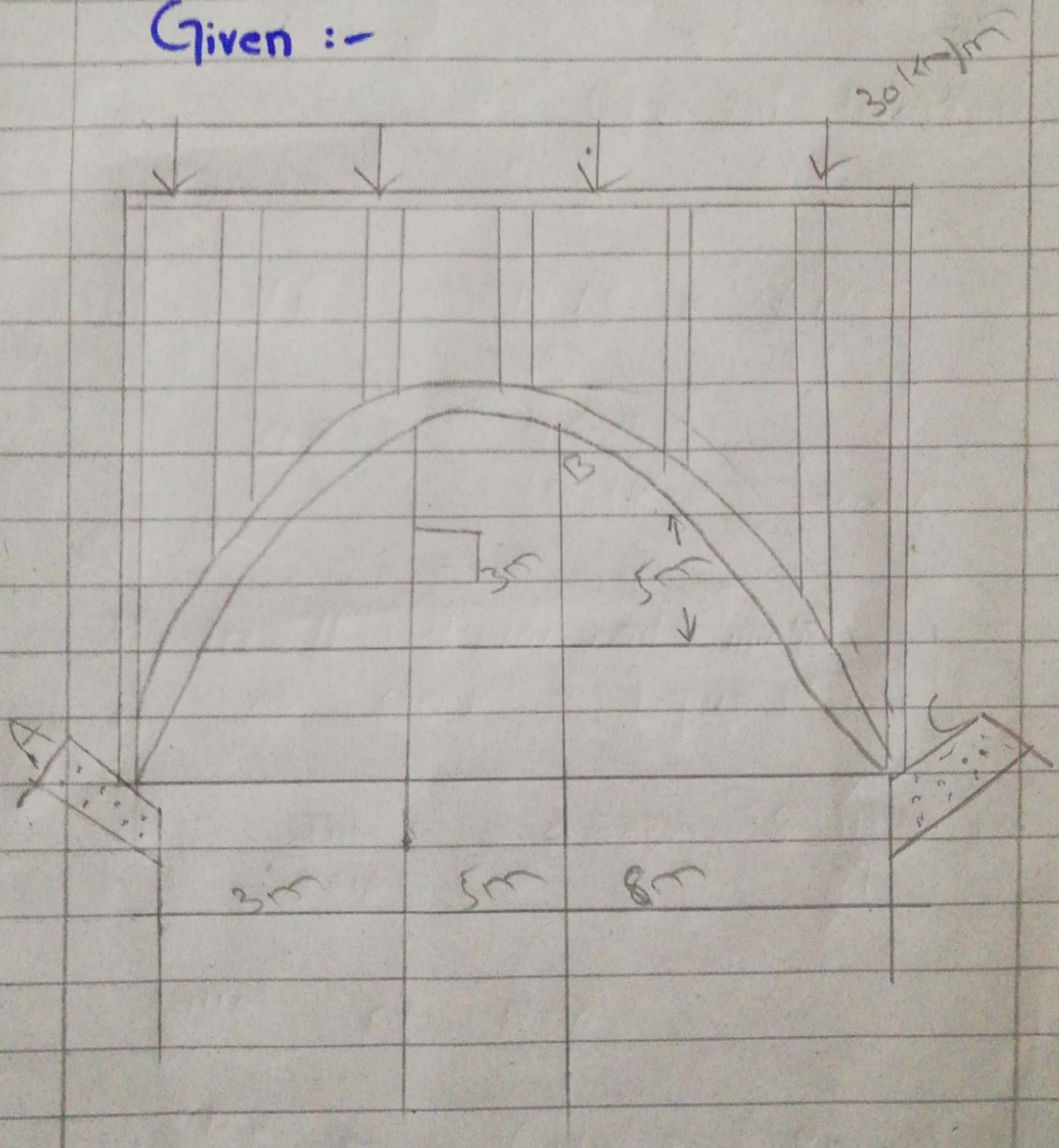
Q- no 4

Given :-



Sol:

Member AB

$\curvearrowright + \quad \Sigma M_A = 0$

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

Member BC:

$\curvearrowright + \quad \Sigma M_C = 0$

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

$B_x = 192\,kN \qquad B_y = 0$

Segment BD:

$\curvearrowright + \quad \Sigma M_D = 0$

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

$M_D = 9\,kN \cdot m$

xxx ——— xxx ———