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Section # B

Subject # Structure Analysis.

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Q#01

⇒ Finding reactions

$\circlearrowleft^{+} \sum M_A = 0$

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

$C_y = 25\ kip$

$\sum F_y = 0 \uparrow^{+}$

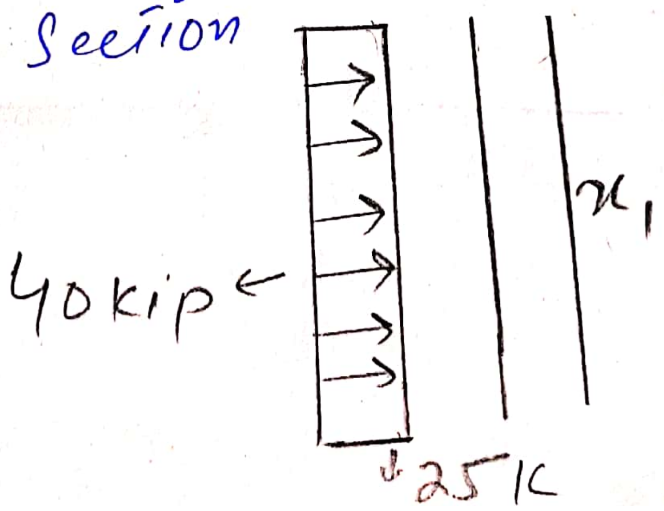
$= 25 + A_y = 0$

$A_y = -25\ kips$

$\sum F_x = 0 \longrightarrow$ Ⓐ

$= 40 - A_x = 0 \Rightarrow A_x = 40K$

Taking section

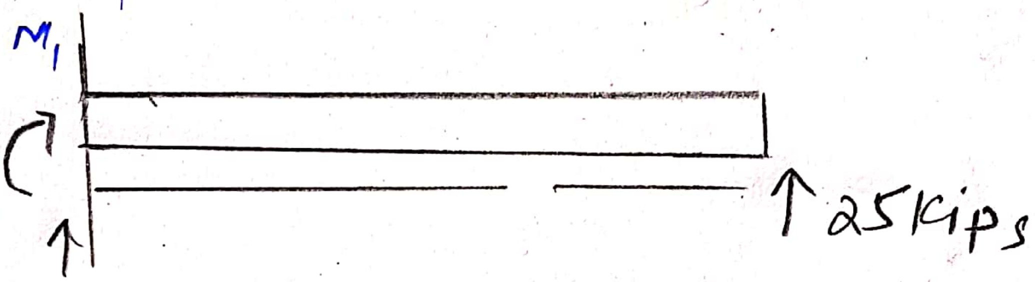


Real Moment

$\circlearrowright + \sum M_1 = 0$

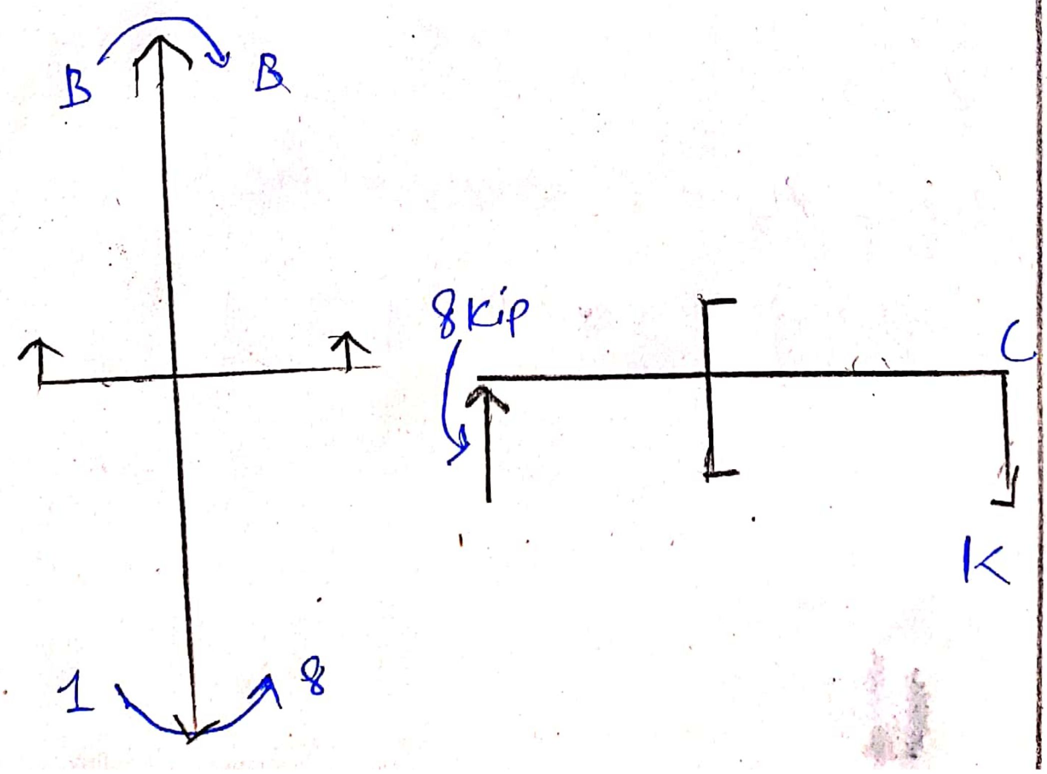
$-40(x_1) + 4x_1\left(\frac{x_1}{2}\right) + C_{x_1} = 0$

$M_1 = 40m - 2x_1$



$= -25(x_2) + M_2 = 0$

$M_2 = 25x_2$ kips



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(3)

Member	BA	CB
origin	B	C
limit	0-10	0-8
M	$2x^2$	0
M	8	x

By Virtual Work Method

$$1 \cdot \Delta 1 = \int_0^{10} \frac{2x^2(8)\,dx}{EI} + \int_0^{8} \frac{(0)(x)}{EI}$$

$$'' = \left.\frac{16x^3}{3}\right|_0^{10} + 0$$

$$'' = \frac{16 \times 100}{3} \Big/ EI$$

$$'' = \frac{63333.33}{EI} = \frac{53333.33}{29 \times 10^3 \times 600}$$

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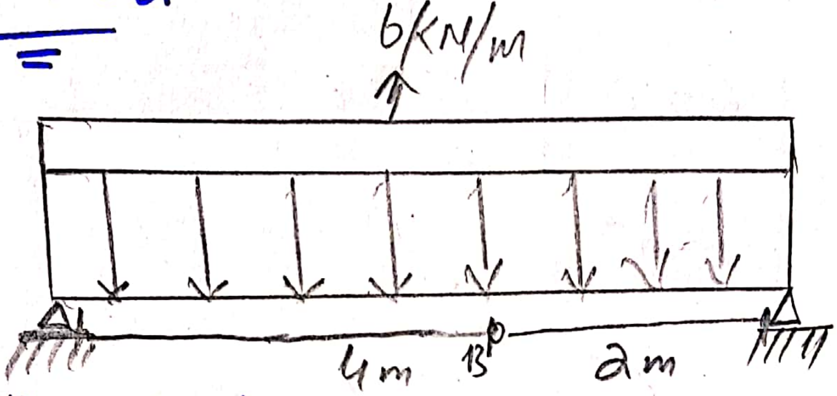
$$1 \cdot \Delta 1 = 3.06 \times 10^{-4}\ In$$

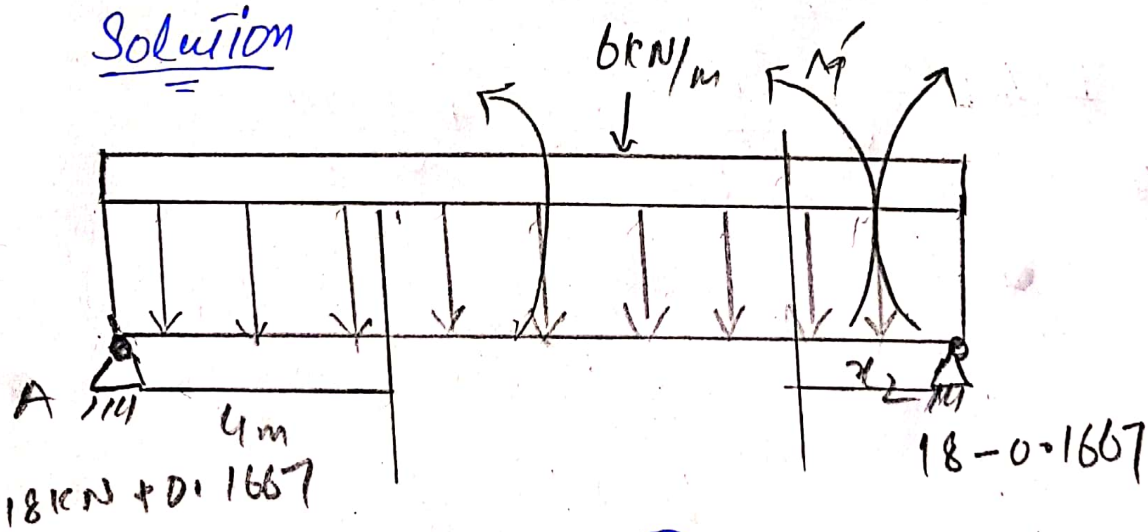
Q # 02



Required

Slope and displacement at Point "B"

Solution



$$R_1 + R_2 = 0 \rightarrow (1)$$

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

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

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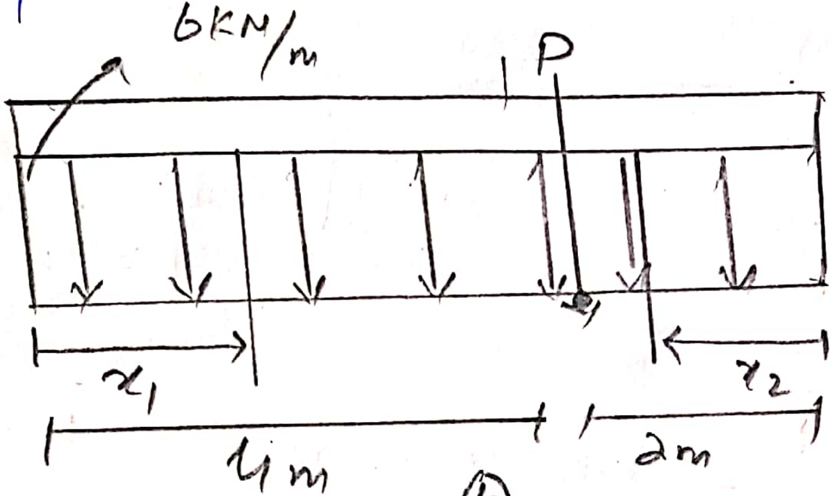
⑤

$R_1 + (-0.1667) = 0$

$R_1 = 0.16667 \text{ K.N}$



ⓑ

$= R_1 + R_2 = 1$

$= \circlearrowleft + \sum M_A = 0$

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

$R_1 = 0.6667 \text{ KN}$

$R_2 = 1 - 0.6667 \text{ KN}$

$R_2 = 0.333 \text{ KN}$

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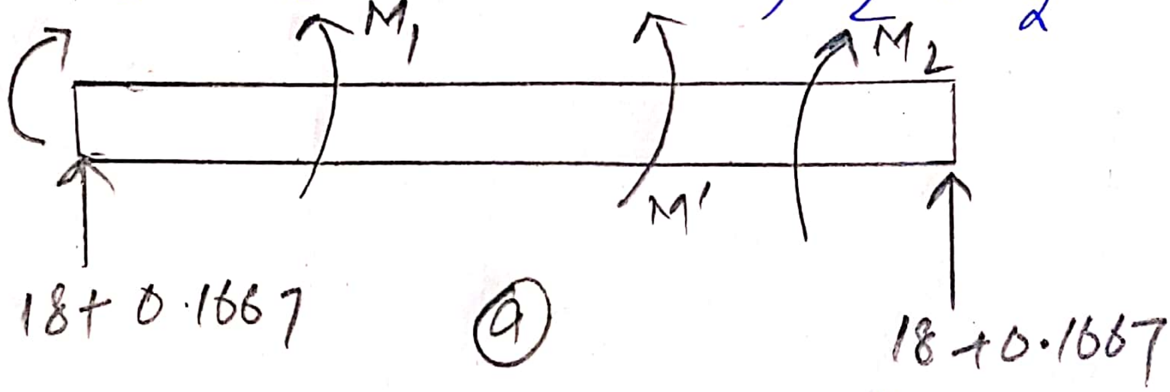
(b)

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

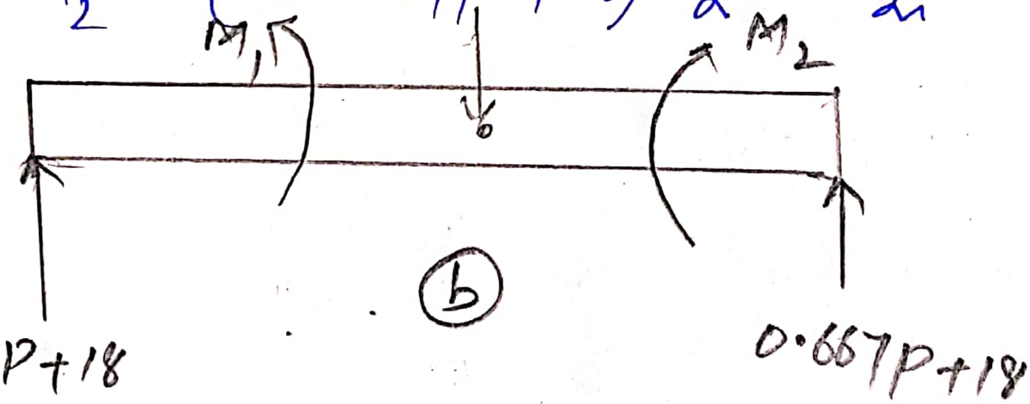
$$M_2 = (18 - 0.1667M')x_2 - 2x_2^2$$



(a)

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

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



(b)

THE displacement functions shown in the figure "a" above

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

set $M' = 0$ Then

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

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(7)

$$M_1 = (18x_1 - 2x_1^2)$$

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

$$\theta_B = \int_0^2 M\left(\frac{\partial M}{\partial M_1}\right)\frac{dx}{EI} = \int_0^4 \frac{(18x_1 - 2x_1^2)(0.1667x_1)dx_1}{EI}$$

$$+ \int_0^2 \frac{(18x_2 - 2x_2^2)(0.1667x_2)\,dx}{EI}$$

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

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

$$\theta_B = \frac{49.31}{(200 \times 10^6 \, Kpa)(0.0006)}$$

$$\boxed{\theta_B = 0.4411 \text{ radians}}$$

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

$$\frac{\partial M_1}{\partial M_p} = 0.333x_1 \quad \text{and} \quad \frac{\partial M_2}{\partial P} = 0.6667x_2$$

also set $p = 0$ then $M_1 = (18x_1 - 2x_1^2)$ kN·m

Thus

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

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

$$\Delta_B = \frac{218.5}{EI} \Rightarrow \frac{218.5}{(200\times10^6)(0.00006)}$$

$$\boxed{\Delta_B = 0.018\,m \text{ or } 18\,mm}$$

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Q #03

Solution

⇒ We know That

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

$$y = \frac{10}{225}x^2$$

$$y = 0.444x^2$$

⇒ We know That

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

$T_0 = 4500lb$ dividing by 1000

$T_0 = 4.5K$

⇒ As we know That

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

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

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

$T_{Max} = 7500 lb$

:- Dividing by 1000

$$= \quad T_B = T_{Max} = 7.5K$$

⇒ As we know that

$$T_B = T_{Max} = w_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

$$T_B = T_{Max} = 400(15)\sqrt{1 + \left(\frac{15}{20}\right)^2}$$

$$T_B = T_{Max} = 6000(1.25)$$

$T_B = T_{Max} = 7500 lb$

Dividing by 1000

$$T_B = T_{Max} = 7.5K$$ Ans

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Q#4

Member AB;

$\circlearrowright + \sum M_A = 0$

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

⇒ Member BC :-

$\circlearrowright + \sum M_C = 0$

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

Slowing

$B_x = 192 \text{ KN}$, $B_y = 0$

Segment BD :-

$\circlearrowright + \sum M_D = 0$

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

$M_D = 9 \text{ KN·m}$ Ans

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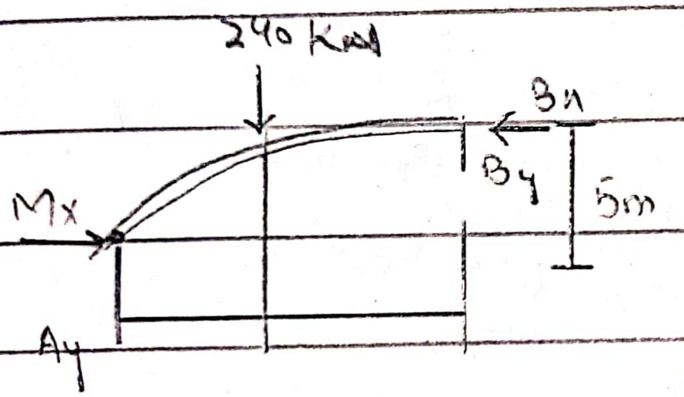

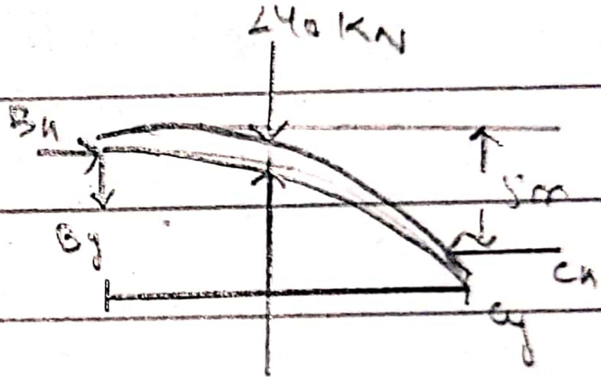

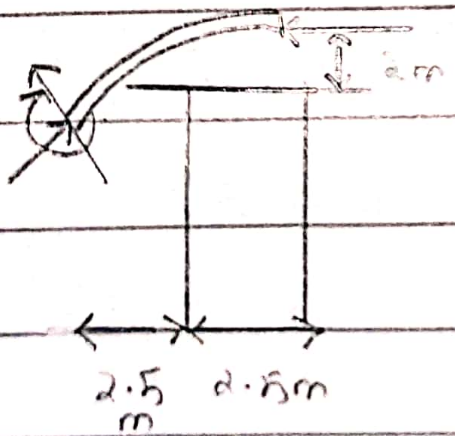

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