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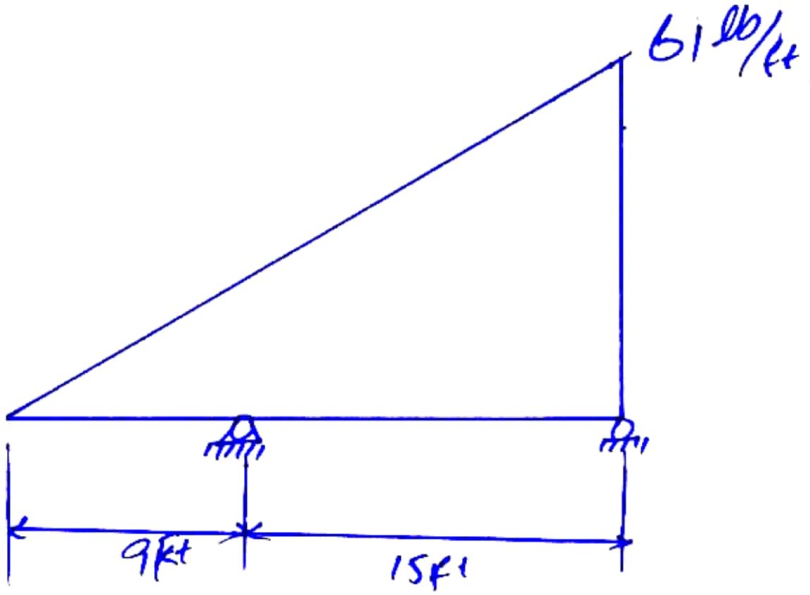
Roll ID# ____ 7861

Submitted to ____ Sir - Saqib

Subject ____ Structural Analysis - I

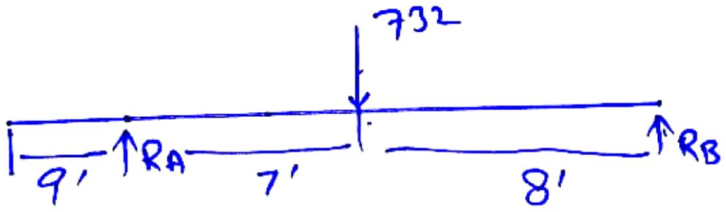
QNO1:- Draw the Shear and Bending Moment:-



Solution:-

Converting UVL into point load $= \frac{1}{2}(61 \times 24) = 732$ lb

Thus the point load acts 07 Beam length from Left Side $= \frac{2}{3} \times 24 = 16$ ft



So

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

$\Rightarrow -\frac{1}{2} \times x \times \left(\frac{61}{24}\right)x - V_C = 0$

$\Rightarrow V_C = -\left(\frac{61}{48}\right)x^2$

at $x = 0$

$V_C = 0$

and at $x = 9$

$V_C = -\left(\frac{61}{48}\right)9^2 = -103.94 \text{ kN}$

$\Rightarrow M = \frac{1}{2} \times x \times \left(\frac{61}{24}\right) \times \frac{1}{3}x$

$\Rightarrow M = \frac{61x^3}{1424}$

at $x = 0$

$M = 0$

$\Sigma M_B = 0 \quad \circlearrowleft +$

$\Rightarrow 732 \times \frac{1}{3}(24) = R_A \times 15$

$\boxed{R_A = 390.4 \text{ lb}}$

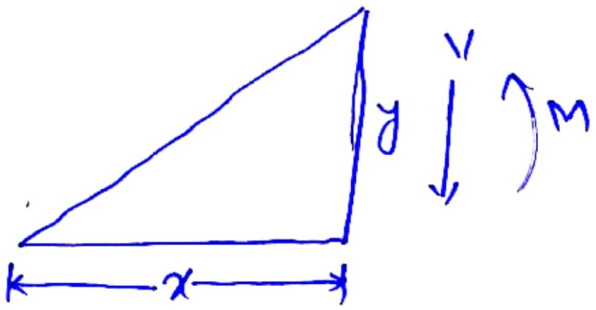
$\Sigma F_y = 0 \quad \uparrow$

$R_A + R_B = 732 \text{ lb}$

$R_B = 732 - 390.4$

$R_B = 341.6 \text{ lb}$

Now Section (1)



For y

$$\frac{y}{x} = \frac{61}{24} \Rightarrow y = \left(\frac{61}{24}\right)x$$

at $x = 9$

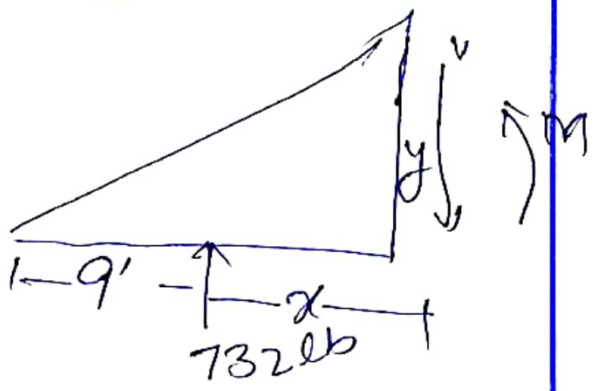
$M = -\cancel{4961.25} - \frac{61x^3}{144}$

$= -\frac{61(9)^3}{144} \Rightarrow -308.8125 \text{ lb·ft}$

Now for Section (2)

For y

$\frac{y}{(x+9)} = \frac{61}{24}$



$= y = \frac{61(x+9)}{24}$

So $\Sigma F_y = 0 \uparrow +$

$732 - \frac{1}{2} x(x+9)\left(\frac{61}{24}\right)(x+9) - V_c = 0$

$V_c = 732 - \frac{61}{48}(x+9)^2$

at $x = 0$

$V_c = 629.06$

at $x = 15$

$$V_C = 732 - \frac{61}{48}(15+9)^2$$

$$V_L = 732 - 732 = 0$$

$$M_1 = 732x + \frac{1}{2}(x+9)\left(\frac{61}{24}(x+9) \times \frac{1}{3} \times (x+9)\right) - 732x$$

$$M_1 = 732x - \frac{61}{1244}(x-9)^3$$

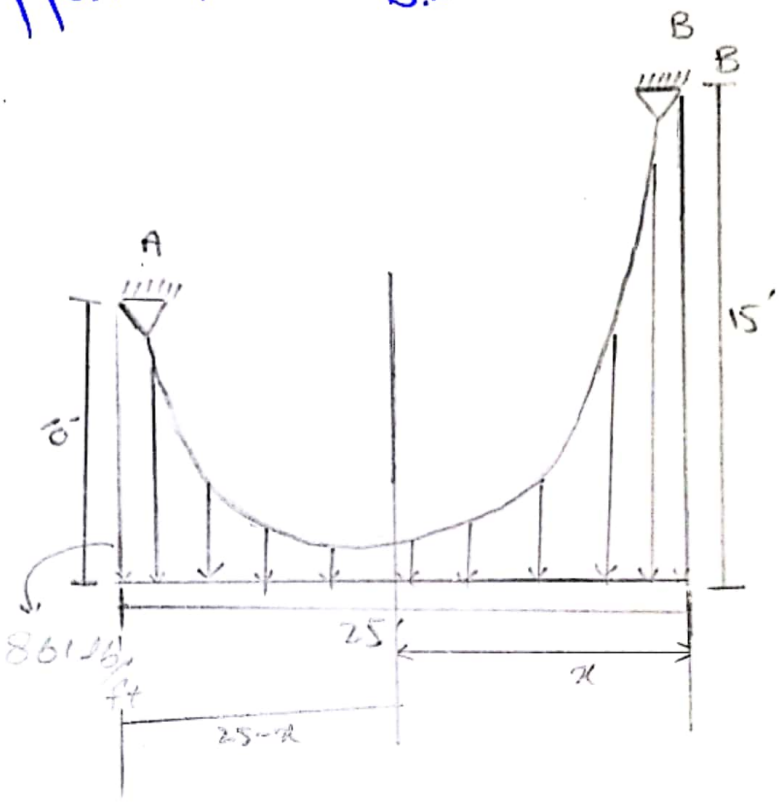
at $x = 0$

$M_1 = 308.8125$ lb-ft

at $x = 15$

$M_1 = 640.5$ lb-Ft

QNO2:- The Cable having uniform load p = 861 lb/ft Determine the Tension in the Cable at each Support A and B:-



$$F_H = \frac{wL^2}{2h}$$

$$F_{H_1} \Rightarrow \frac{861 \times (25-x)^2}{2 \times 10} \Rightarrow \frac{861(25-x)^2}{20}$$

$$F_{H_2} = \frac{861 \times (x)^2}{2 \times 15} = \frac{861 x^2}{30}$$

Therefore we know that Right Support F_{H_2} will be equal F_{H_1}

$$\frac{861(25-x)^2}{2\cancel{0}10} = \frac{861x^2}{15\cancel{8}0}$$

$$\Rightarrow \frac{(25-x)^2}{10} = \frac{x^2}{15}$$

further Simplifying

$$\sqrt{(25-x)^2} = \sqrt{x^2\left(\frac{10}{15}\right)}$$

$$25-x = x(0.8167)$$

$$\frac{25}{1.8167} = \frac{1.8167x}{1.8167}$$

$$\boxed{x = 13.761'}$$

$$FM = \frac{861(11.24)^2}{2\times 10}$$

$$\boxed{FM = Ax = Bx = 5438.84 \text{ lb}}$$

$$\frac{861(25-x)^2}{2010} = \frac{861x^2}{1530}$$

$$\Rightarrow \frac{(25-x)^2}{10} = \frac{x^2}{15}$$

further Simplifying

$$\sqrt{(25-x)^2} = \sqrt{x^2\left(\frac{10}{15}\right)}$$

$$25 - x = x(0.8167)$$

$$\frac{25}{1.8167} = \frac{1.8167x}{1.8167}$$

$$\boxed{x = 13.761'}$$

$$FH = \frac{861(11.24)^2}{2 \times 10}$$

$$\boxed{FH = Ax = Bx = 5438.84 \text{ lb}}$$

⇒ At point B:-

$$y = \frac{w_o}{2f_H} x^2 = \frac{861}{2(5438.84)} x^2$$

$$\frac{dy}{dx} = \tan\theta_B = 0.15838x \Big|_{x=13.76}$$

$$= 2.179$$

$$\theta_B = 65.35^\circ$$

$$T_B = \frac{f_H}{\cos\theta_B} = \frac{5438.84}{\cos 65.36^\circ}$$

$$= 13045.43 lb = 13.045 kip$$

⇒ At point A:-

$$y = \frac{w_o}{2f_H} x^2 = \frac{861}{2(5438.84)} x^2$$

$$\frac{dy}{dx} = \tan\theta_A = 0.15838x$$

$$x = 25 - 13.76 = 11.24$$

$$= 1.780$$

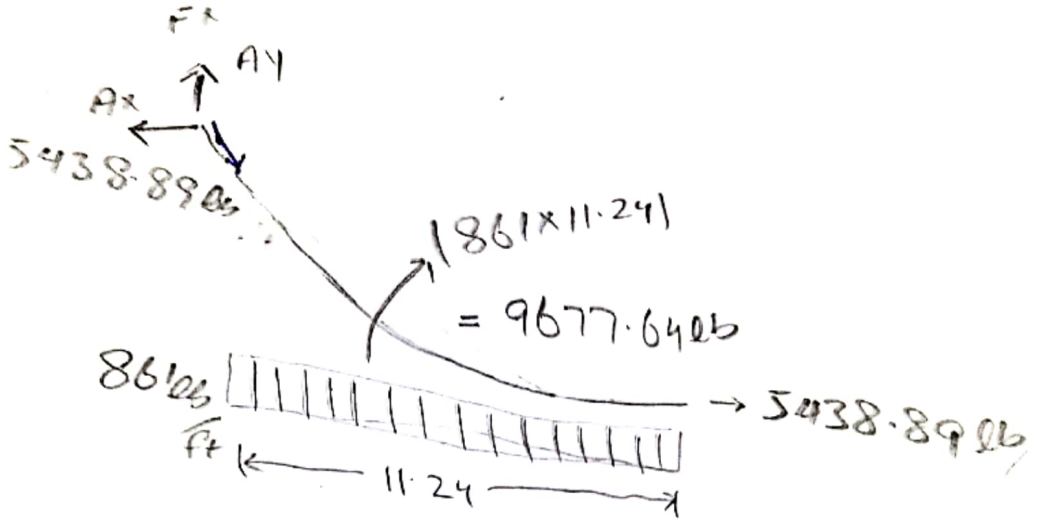
$$\theta_A = 60.675^\circ$$

$$T_A = \frac{F_H}{\cos\theta_A} = \frac{5438.84}{\cos(60.675)}$$

$$= 11105.047 \text{ lb} = 11.105 \text{ kip.}$$

P.T.O

For another Method-



$$\Sigma F_y = 0$$

$$A_y = 9677.64 \text{ lb}$$

$$T_A = \sqrt{A_x^2 + A_y^2}$$

$$T_A = \sqrt{(5438.89)^2 + (9677.64)^2}$$

$$T_A = 11101.27 \text{ lb}$$

$$B_y + 9677.64 - 25 \times 861 = 0$$

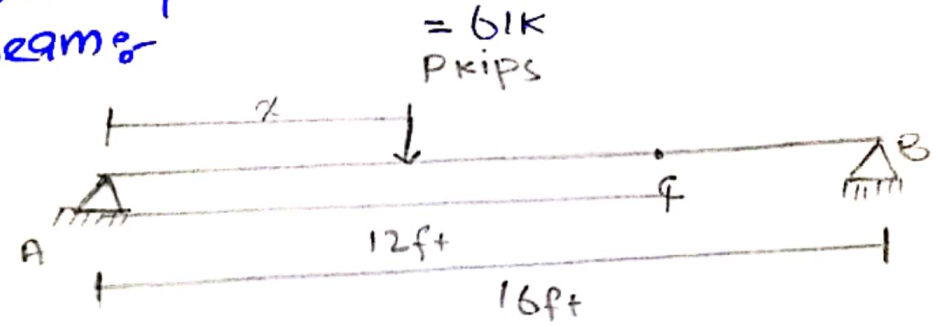
$$B_y = 11847.36$$

$$T_B = \sqrt{B_x^2 + B_y^2}$$

$$T_B = \sqrt{(5438.89)^2 + (11847.36)^2}$$

$$T_B = 13036.1598 \text{ lb}$$

QNO3:- Shear force influence line for the Beam:-



$x = 0$ $\quad V_c = ?$

$\Sigma M_B = 0$

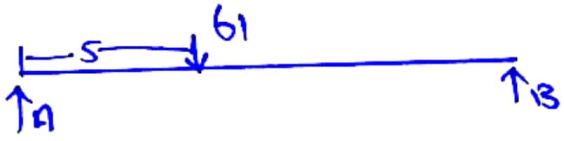
$$-R_A(16) + 61(16) = 0$$

$$R_A = 61$$

$$61 - 61 - V_c = 0$$

$$V_c = 0$$

$x = 5$



$\oplus \circlearrowright M_B = 0$

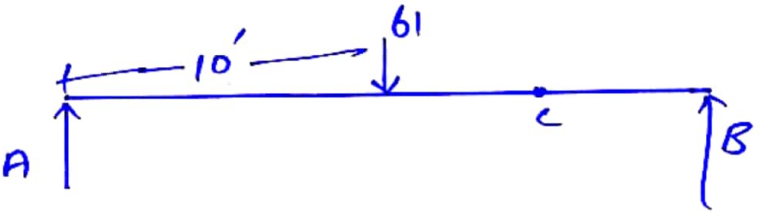
$$-R_A(16) + 61(11) = 0$$

$$R_A = 41.9375$$

$41.9375 - 61 - Vc = 0$

$Vc = -19.063$

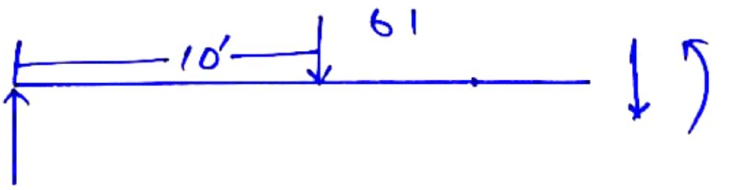
$x = 10$



$\circlearrowleft_{+} \Sigma M_b = 0$

$-RA(16) + 61 \times 6 = 0$

$RA = 22.875K$



$22.875 - 61 - Vc = 0$

$Vc = 38.125$

$x = 12$

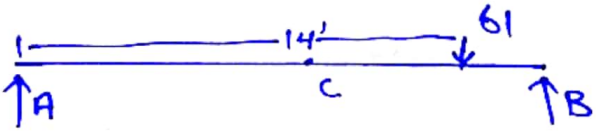
$$61(4) - RA(16) = 0$$

$$RA = 15.25$$

$$15.25 - 61 - VC = 0$$

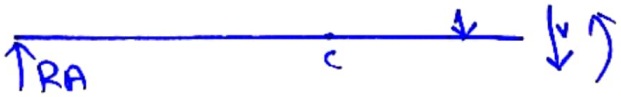
$$VC = -45.75$$

$x = 14$



$$-16(RA) + 61(2) = 0$$

$$RA = 7.625$$



$$7.625 - VC = 0$$

$$VC = 7.625$$

$x = 16$

$$-R_A(16) + 61(0) = 0$$

$$R_A = 0$$

$$0 - V_c = 0$$

$$V_c = 0$$

x	Vc
0	0
5	-19.063
10	-38.125
12	-45.75
14	7.625
16	0