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Section = A

Subject = Structural Analysis - 1

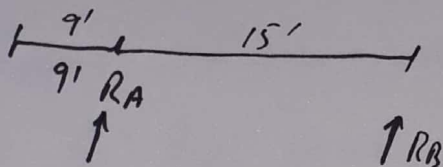
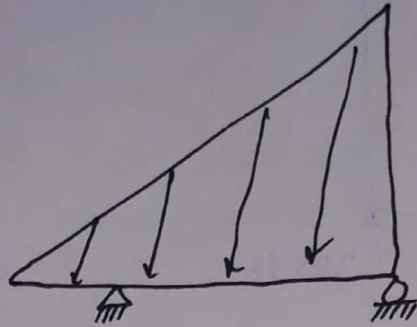
Submitted To = Engr. Muhammad Saqib

Exam = Final Term

Date = 26/09/2020

(1)

Q No 1 \Rightarrow Draw the Shear and bending moment equation and diagram for the beam shown in Figure 1. The value of the uniformly load is 77.



Sol

$$\sum F_y = 0 \quad \uparrow + \downarrow -$$

$$R_A + R_B - \frac{1}{2}(77)(24) = 0$$

$$R_A + R_B = 924 \rightarrow \textcircled{1}$$

$$\sum M_A = 0 \quad \uparrow + \downarrow -$$

$$-(R_B)(15) + \left(\frac{1}{2}(77)(15)\right)\left(\frac{2}{3} \times 15\right) = 0$$

$$-15R_B + 5775$$

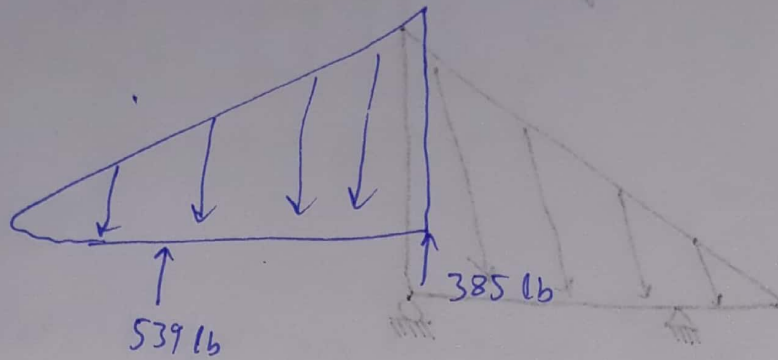
$$-R_B = \frac{5775}{15}$$

$$R_B = 385 \text{ lb}$$

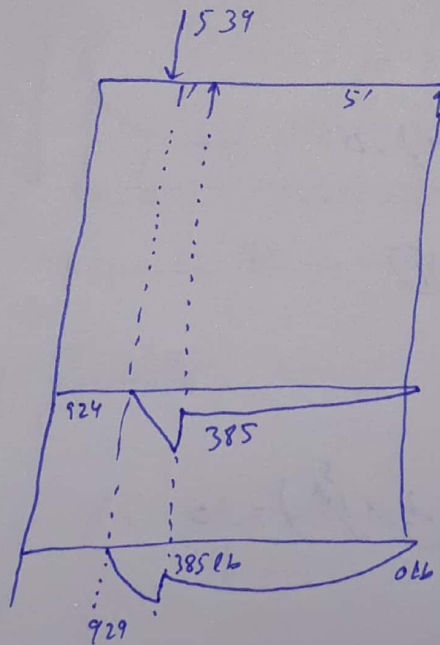
(2)

Put in eq ① we get

$$R_A = 539 \text{ lb}$$



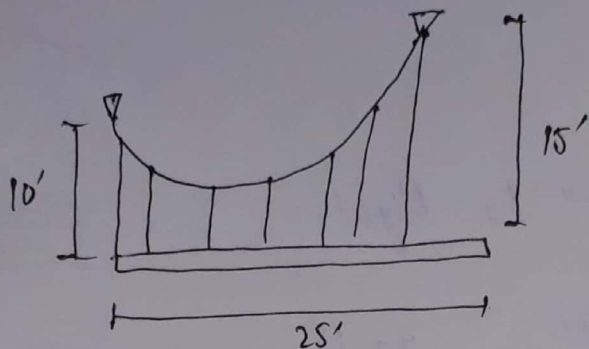
F.B.D



S.F.D

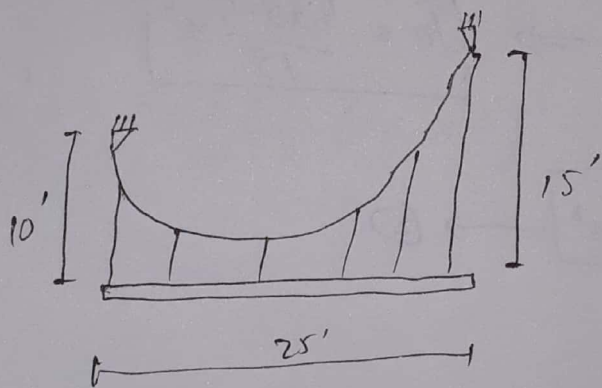
(3)

Q No 2 ⇒ The cable support the uniform load is 877 lb/ft
Determine the tensions in the cable at each
Support A and B.



Sol

Let support we take a point "O" in the cable
which is the least point, where slope is zero.

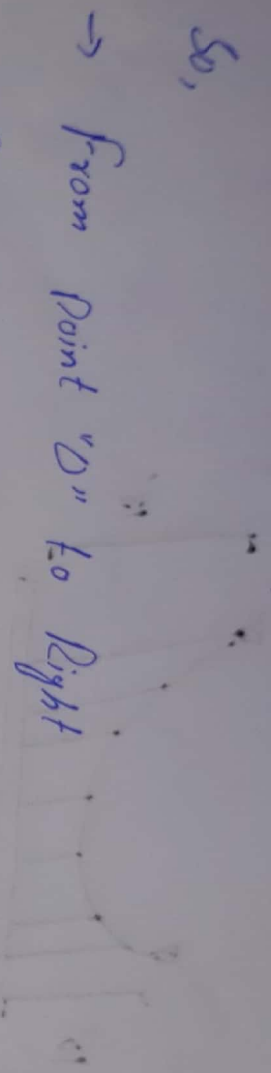


Using Formula

$$y = \frac{w_0}{2T_0} x^2 = \frac{877}{2T_0} x^2$$

$$y = \frac{438.5}{T_0} x^2$$

(4) Now, Assume Point C is located at a distance from Point 'O' (lowest point)



→ From Point "O" to Right

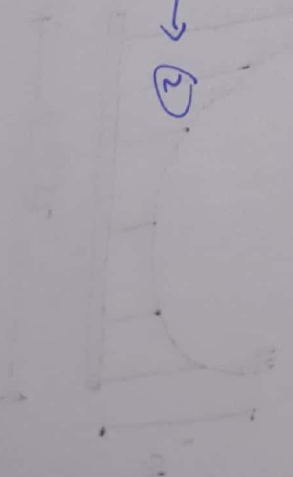
For distance 'x'

$$y = 15$$

$$\Rightarrow y = \frac{438.5}{T_0} x^2$$

$$15 = \frac{438.5}{T_0} x^2 \Rightarrow T_0 = \frac{438.5}{15} x^2$$

$$T_0 = 29.23 x^2 \rightarrow \textcircled{2}$$



Again

→ From Point "O" to Left

For distance - (25-x) $y = 10$

$$\Rightarrow y = \frac{438.5}{T_0} - (25-x)^2$$

$$10 = \frac{438.5}{T_0} [- (25-x)^2] \rightarrow \textcircled{3}$$

Again

(5)

→ From point 'D' to left

∴ distance $-(25-x)$ $y=10$

$$\Rightarrow y = \frac{438.5}{10} x^2$$

$$\Rightarrow 10 = \frac{438.5}{10} [-(25-x)]^2$$

$$\Rightarrow \boxed{T_0 = \frac{438.5}{10} [-(25-x)]^2} \rightarrow (3)$$

Comparing eq (1) and (3)

$$\frac{438.5}{15} x^2 = \frac{438.5}{10} [-(25-x)]^2$$

Interchanging

$$\frac{438.5}{438.5} x^2 = \frac{15}{10} (625 - 50x + x^2)$$

$$x^2 = 1.5(625 - 50x + x^2)$$

$$x^2 = 937.50 - 75x + 1.5x^2$$

$$\Rightarrow 937.50 - 75x + 1.5x^2 - x^2 = 0$$

$$\Rightarrow 0.5x^2 - 75x + 937.50 = 0$$

By solving

(6)

Using Quadratic Equation

$$a = 0.5$$

$$b = -75$$

$$c = 937.50$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

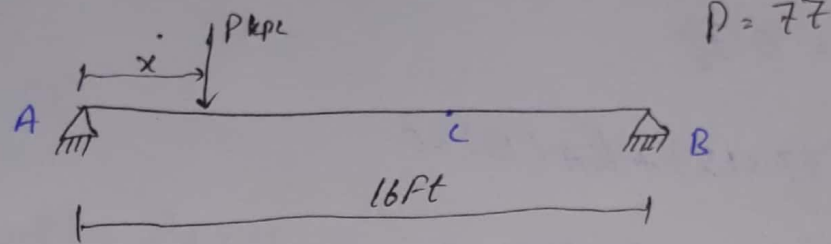
$$= \frac{-(-75) \pm \sqrt{(-75)^2 - 4(0.5)(937.50)}}{2(0.5)}$$

$$x = \frac{75 \pm \sqrt{5625 - 1875}}{1}$$

$$x = 75 \pm \sqrt{3750}$$

(7)

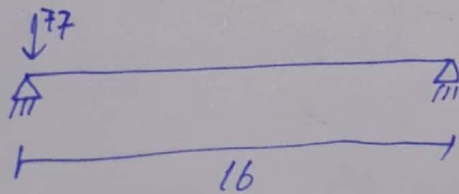
QNO3 ⇒ Draw the Shear force Influence line for the beam show in figures 3 at point C. also the influence line for reaction A.



Sol ⇒

$$P = 77$$

For $x = 0$ $R_A = ?$



$$\sum M_B = 0 \quad (+\curvearrowright)$$

$$-(77 \times 16) + R_A(16) = 0$$

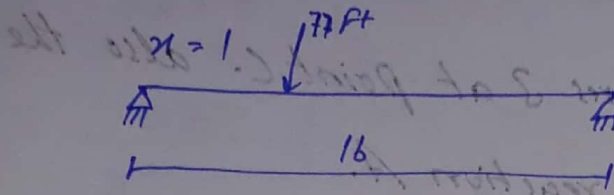
$$-1232 + 16R_A = 0$$

$$16R_A = 1232$$

$$R_A = \frac{1232}{16} = 77$$

(8)

For $x = 15$ $R_A = ?$



$$\sum M_B = 0 \text{ (+)}$$

$$-(77 \times 15) + R_A(16) = 0$$

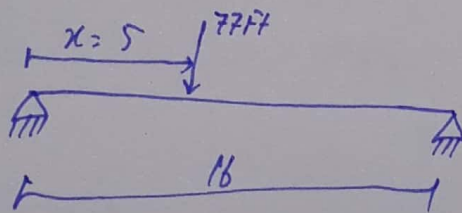
$$-1155 + R_A(16) = 0$$

$$16R_A = 1155$$

$$R_A = \frac{1155}{16} = 72.18$$

$$x = 5$$

→ For $x = 5$



$$\sum M_B = 0 \text{ (+)}$$

$$-(77 \times 5) + 16R_A = 0$$

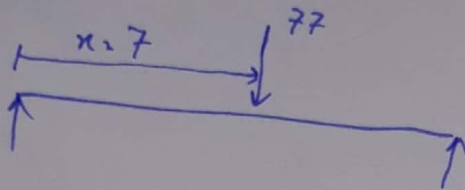
$$-385 + 16R_A = 0$$

$$16R_A = \frac{385}{16} = 24.06$$

(9)

$$R_A = 24.06 \Rightarrow 24.1$$

$$x = 7 \quad R_A = ?$$



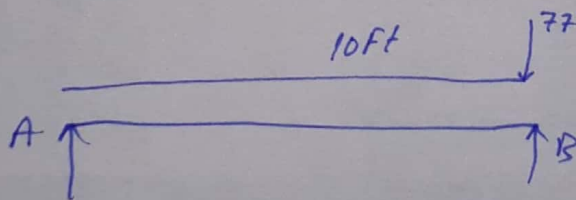
$$\sum M_B = 0 \quad (+\curvearrowright)$$

$$-(77 \times 7) + R_A \times 16 = 0$$

$$-539 + 16R_A = 0$$

$$16R_A = 539$$

$$R_A = \frac{539}{16} = 28.36$$



$$\sum M_B = 0 \quad (+\curvearrowright)$$

$$+R_A(16) - 62(0) = 0$$

$$16R_A = 0$$

$$R_A = 0$$

(10)

$$RA_1 = 77$$

$$RA_2 = 72.18$$

$$RA_3 = 24.1$$

$$RA_4 = 28.36$$

$$RA_5 = 0$$

