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Name	Ashfaq Hussain
ID	7854
Section	B
Subject	Structural Analysis 1
Submitted To	Engr Sir-Saqib
Date	26.9.2020

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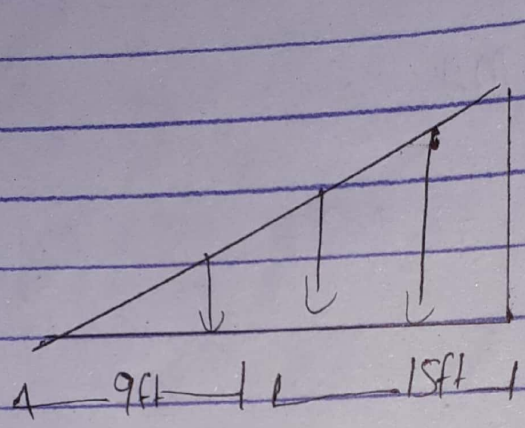
Q.No1 Draw the shear and bending moment diagrams for beam shown in figure 1 the value of the uniformly varying load is 54



Sol Converting UVL into point Load

$$= \frac{1}{2}(54 \times 24)$$

$$= 648 \text{ lb}$$

This point loads acts on $\frac{2}{3}$ of beam length

$$= \frac{2}{3} \times 24 = 16 \text{ ft}$$

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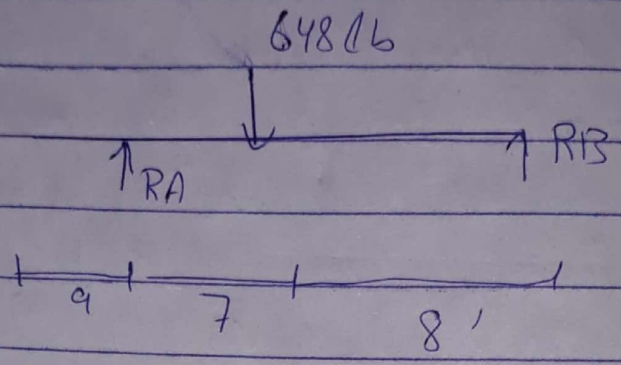

$\Sigma MA = 0 \curvearrowleft +$

$-15 RB + 648 \times 7$

$RB = \frac{648 \times 7}{15}$

$= 302.4$ lb

$\Sigma Fy = 0 \uparrow + \downarrow -$

$RA - 648 + 302.4 = 0$

$RA = 345.6$ lb

Finding Shear forces equation

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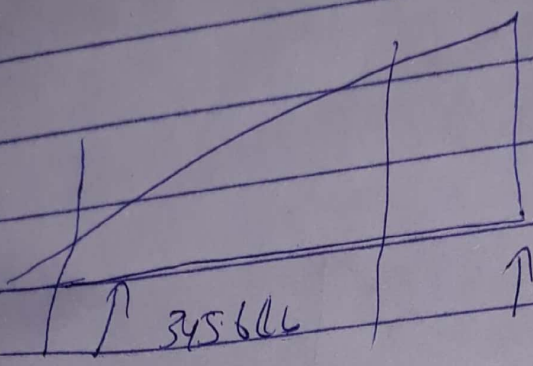
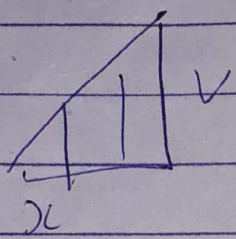


Section 1-1



$$V_{x=1} = -\frac{1}{2} \times x \times \frac{54}{24} x$$

$$= \frac{54}{48} x^2$$

$$V_{x=0} = \frac{54}{48} \times (0)^2 = 0$$

$$V_{x=9} = \frac{54}{48} (9)^2 = 91.125 \text{ kN}$$

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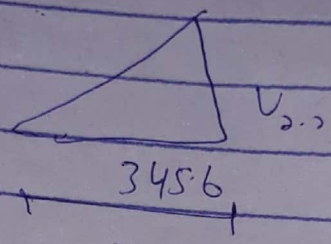
Section 2-2



$\Sigma F_y = 0$

$$-V + 345.6 - \frac{1}{2} \times \frac{54}{24} x_2 \cdot x_2 = 0$$

$$V_{2-2} = 345.6 - \frac{54}{48} x_2^2$$

$$V_{2-2}\Big|_{x=9} = 345.6 - \frac{54}{48}(9)^2$$

$$= 254.475 \text{ lb}$$

$$V_2\Big|_{x=24} = 345.6 - \frac{54}{48}(24)^2$$

$$= -302.4$$

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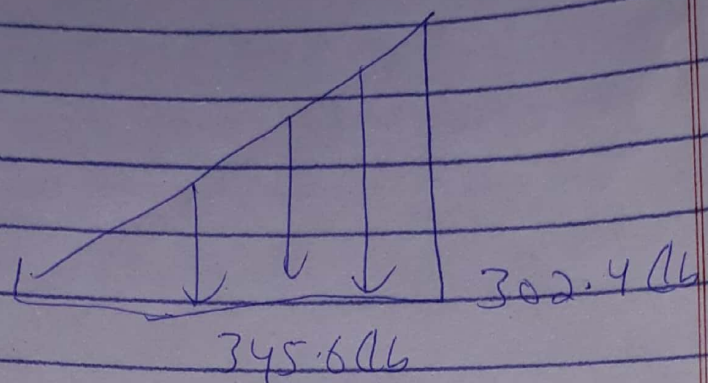
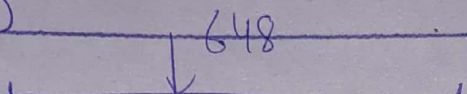
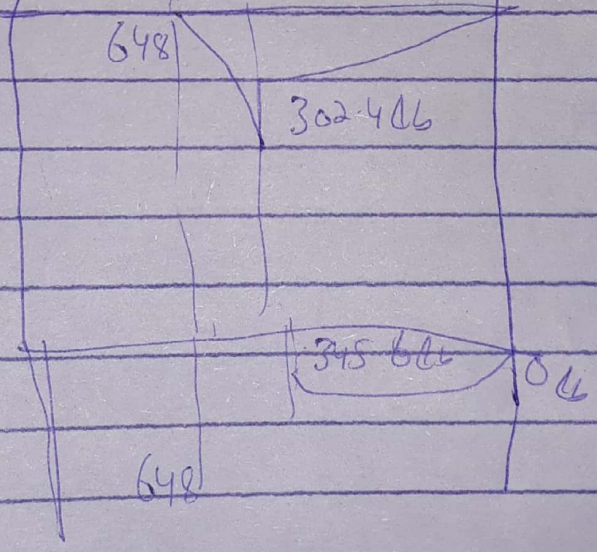


F.B.D



S.F.D



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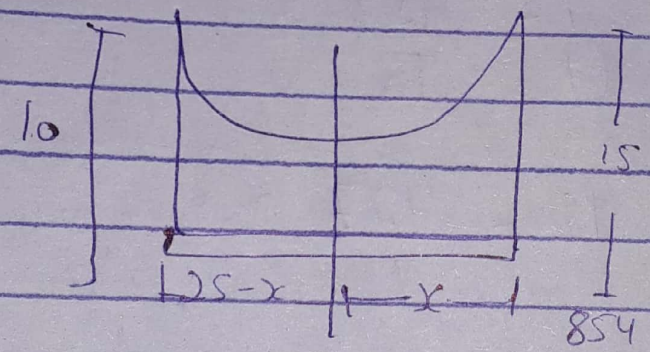
Q No2 The cable supports the uniform load 854. Determine the tension in cable at each support A and B

Sol: Let suppose we take a point "O" in the cable which is lowest point, where slope is zero



Using formula

$$y = \frac{wo\ x^2}{2T_o} = \frac{854\ x^2}{2T_o}$$

$$y = \frac{427\ x^2}{T_o}$$

Now,

Assume Point c is located at x distance from point "O" (Lowest point

So,

From Point "O" to Right

For distance 'x' $y = 15'$

$$\Rightarrow y = \frac{427}{T_o} x^2$$

$$15 = \frac{427}{T_o} x^2$$

$$T_o = \frac{427}{15} x^2 \rightarrow (1)$$

$$T_o = 28.46\, x^2 \rightarrow (2)$$

Again

From Point "O" to left

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

$$\Rightarrow y = \frac{427}{T_0} x^2$$

$$10 = \frac{427}{T_0} (-(25-x))^2$$

Again

From Point "O" to left

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

$$\Rightarrow y = \frac{427}{T_0} x^2$$

$$10 = \frac{427}{T_0} (-(25-x))^2$$

$$T_0 = \frac{427}{10} (-25-x)^2 \rightarrow (3)$$

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Comparing eq ① and ③

$$\frac{427}{15}x^2 = \frac{427}{10}(-(25-x))^2$$

Interchanging

$$\frac{427}{427}x^2 = \frac{15}{10}(625-50x+x^2)$$

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

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

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

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

By solving

using Quadratic Equation

$a = 0.5$, $b = -75$, $c = 937.50$

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(10)

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

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

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

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

we got

$$\boxed{x = 13.76 \text{ ft}} \rightarrow (4)$$

Now put eq (4) in (2)

$$T_o = 28.46 x^2$$

$$= 28.46 (13.76)^2$$

$$T_o = 5388.548096 \text{ lbs}$$

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Now we have to find the tension at given points.

By using formula,

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

$$y = \frac{427}{T_0} \cdot x^2$$

Differentiate the above eq w.r.t "x"

$$\frac{dy}{dx} = \frac{d}{dx}\left(\frac{427}{T_0} \cdot x^2\right)$$

$$= \frac{427}{T_0} \cdot 2(x)$$

$$\frac{dy}{dx} = \frac{854}{T_0} x \rightarrow (a)$$

Also

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$$\frac{dy}{dx} = \tan\theta \rightarrow b$$

So $\tan\theta = \frac{854}{To}\ x$

As point is -11.24 away from "O"

So

$$\tan\theta_A = \frac{854}{5388.548096} \quad (-11.24)$$

$$\theta_A = \tan^{-1}(-1.78)$$

$$\theta_A = -60.67^\circ$$

Now, Tension at Point A is

$$T_A = \frac{To}{\cos\theta_A}$$

$$= \frac{5388.548096}{\cos(-60.67)} = 11000.6545$$

$$= 11.6 \text{ Kips}$$

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Now point 'B' where x = 13.76 ft

$$\tan \theta_B = \frac{427}{T_0} (13.76)$$

$$= \frac{427}{5388.548096} (13.76)$$

$$\theta_B = \tan^{-1} (1.090371635)$$

$$\theta_B = 47.48^\circ$$

Now tension

$$T_c = \frac{T_0}{\cos \theta_B}$$

$$T_c = \frac{5388.548096}{\cos (47.48)}$$

$$= 7.97 \text{ kips}$$

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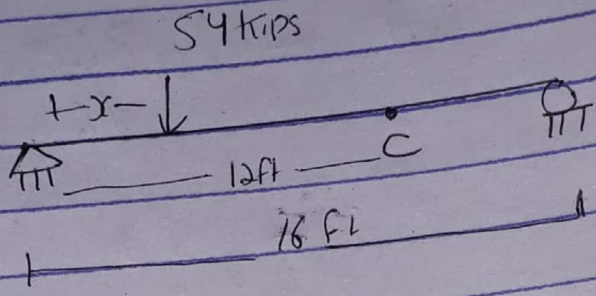
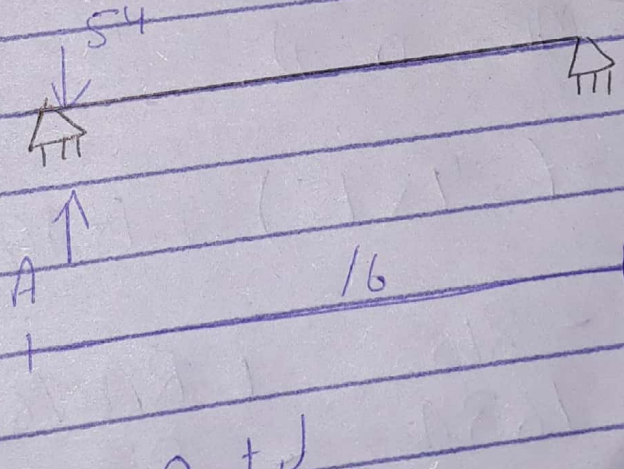
Q No 03 Draw the Shear force influence line for beam shown in figure 3 at point c also find the influence line for reaction A



P = 54

For x = 0 RA = ?



$\Sigma M_B = 0$ +↺

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$$-(54 \times 16) + PA(16) = 0$$

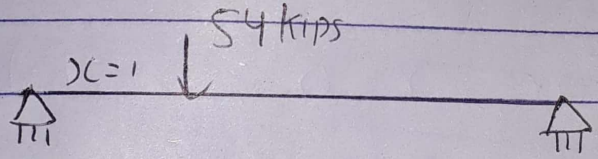
$$-864 + 16PA = 0$$

$$16PA = 864$$

$$RA = \frac{864}{16}$$

$$= 54$$

For $x = 1$ ft RA = ?



$$\Sigma M_B = 0 \text{ ↻}$$

$$-(54 \times 15) + RA(16) = 0$$

$$-810 + RA(16) = 0$$

$$16RA = 810$$

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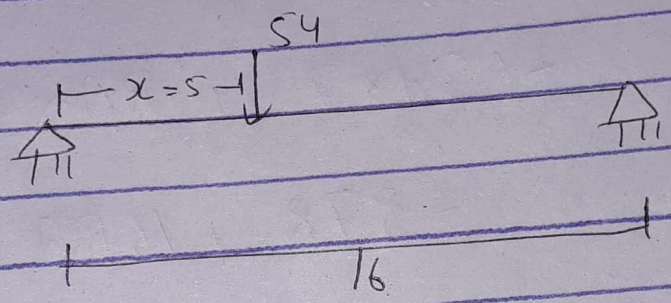
$$RA = \frac{810}{16}$$

$$= 50.625$$

$x = 5$

For $x = 5$



$\Sigma M_B \; +\circlearrowleft$

$$-(54 \times 5) + 16RA = 0$$

$$-270 + 16AA = 0$$

$$16RA = \frac{270}{16}$$

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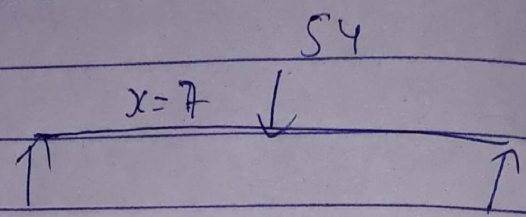
RA = 16.875

x = 7 RA = ?



$\Sigma MB = 0$

$-(54 \times 7) + RA \times 16 = 0$

$-378 + 16RA = 0$

$16RA = \frac{378}{16}$

$= 23.625$

$\Sigma MB = 0$ ✓

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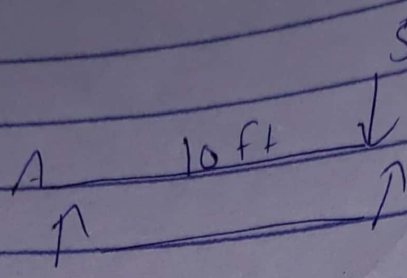

$+ RA(16) - 54(0) = 0$

$16RA = 0$

$RA = 0$

$RA_1 = 54$

$RA_2 = 50.625$

$RA_3 = 16.875$

$RA_4 = 23.625$

$RA_5 = 0$

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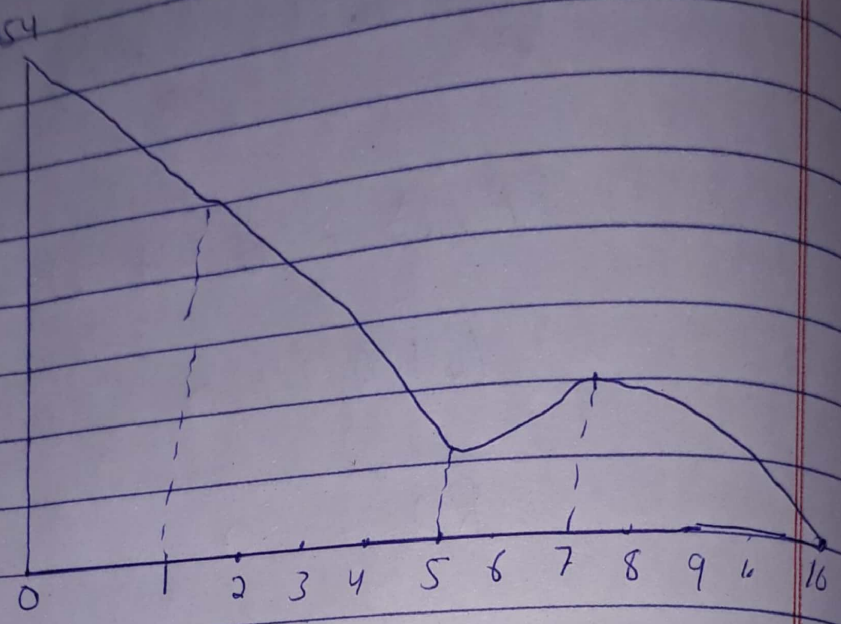

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