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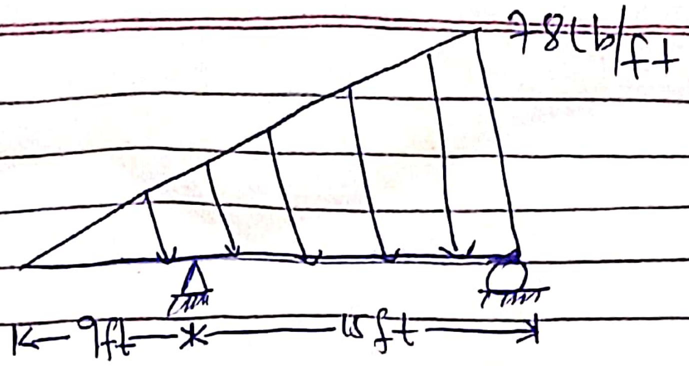
Paper:- Structural Analysis - I

Submitted to :- Engr. Muhammad Saqib

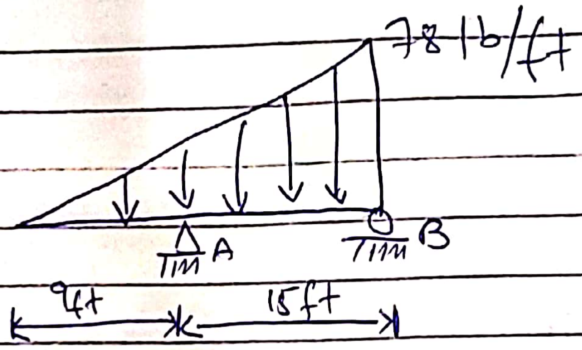
Dated :- 26-09-2020

Q1)

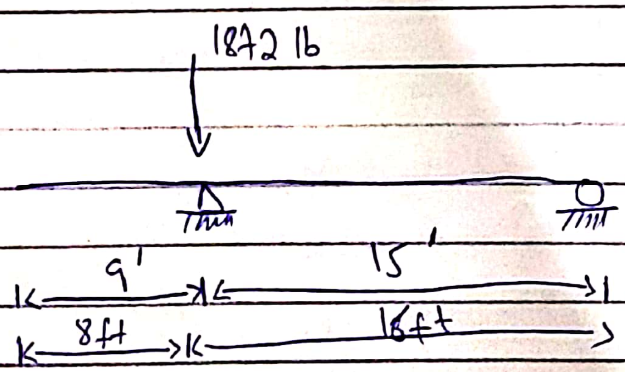


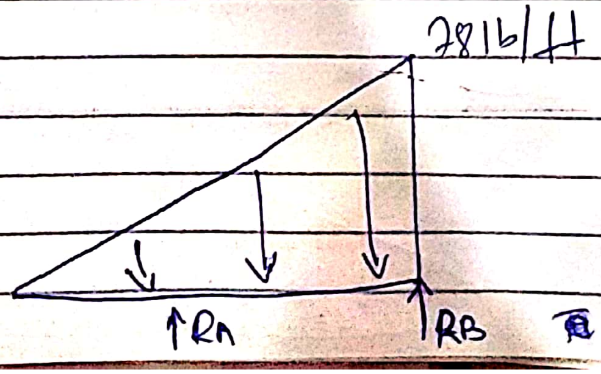
Sol:-
To find shear force & Bending moment Diagram

F.B.D



To find out the point load at uniform varying load.





To find out the support location

(-ive +ive) $\sum M_B = 0$

$$-15R_A + 1872(16) = 0$$

$$R_A = \frac{(1872)(16)}{15}$$

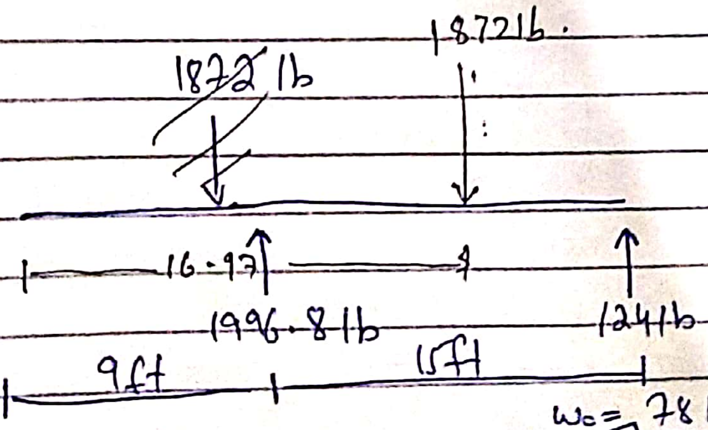
$$\boxed{R_A = 1996.8\,lb}$$

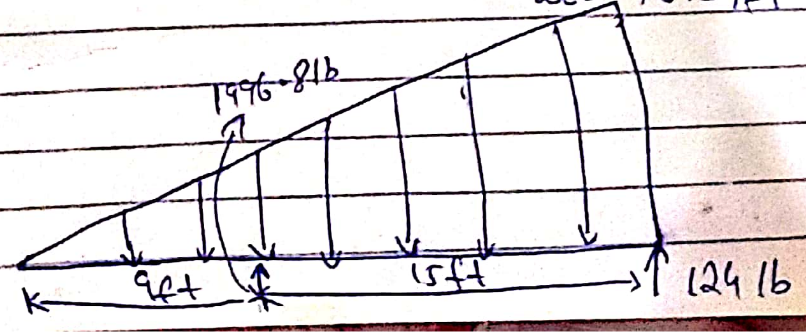
$-\downarrow \overset{+}{\uparrow}\ \sum f_y = 0$

$$-1872 + R_A + R_B = 0$$

$$-1872 + 1996.8 + R_B = 0$$

$$\Rightarrow \boxed{R_B = +124\,lb}$$





Now the Applicable loads is be

$$\frac{w_o l}{4} - \frac{1}{2}\left(\frac{w_o x}{l}\right)(x) = 0$$

$$468 - \frac{1}{2}\,\frac{78x^2}{l}$$

$$\frac{39x^2}{l} - 468 = 0$$

$$1.625x^2 - 468 = 0$$

$$\sqrt{x^2} = \sqrt{288}$$

$$\Rightarrow \boxed{x = 16.97}$$

(-ive +ive) $\Sigma M = 0$;

$$M + \frac{1}{2}\left(\frac{w_o x}{l}\right) x\left(\frac{x}{3}\right) - \frac{w_o l}{4}\left(x - \frac{l}{3}\right) = 0$$

$$m = -\frac{1}{2}\left(\frac{78(16.97)}{24}\right)(16.97)\left(\frac{16.97}{3}\right) +$$

$$\frac{78(24)}{4}\left(\frac{(16.97)}{x} - \frac{l}{3}\right) = 0$$

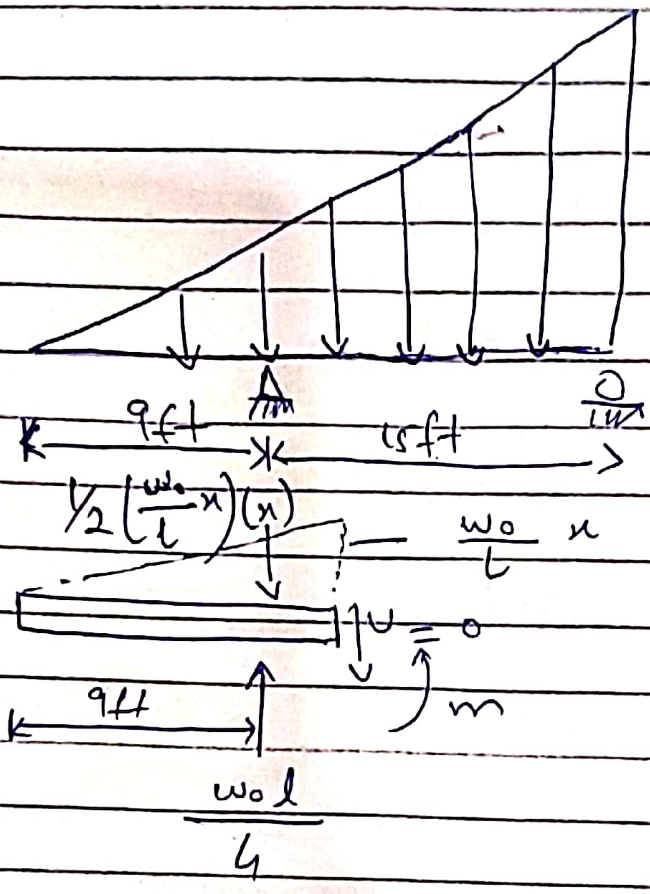
$$m = -7941.4 + 4197.96$$

$$m = -3743.44 \text{ lb-ft}$$

The -ive sign shown that

The moment reaction is in clock-wise direction

Now a section



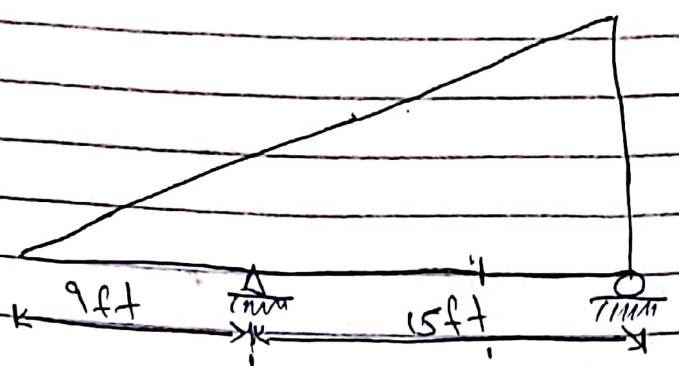
$$\frac{1}{2}\left(\frac{78\,(16.97)}{24}\right)(16.97)$$

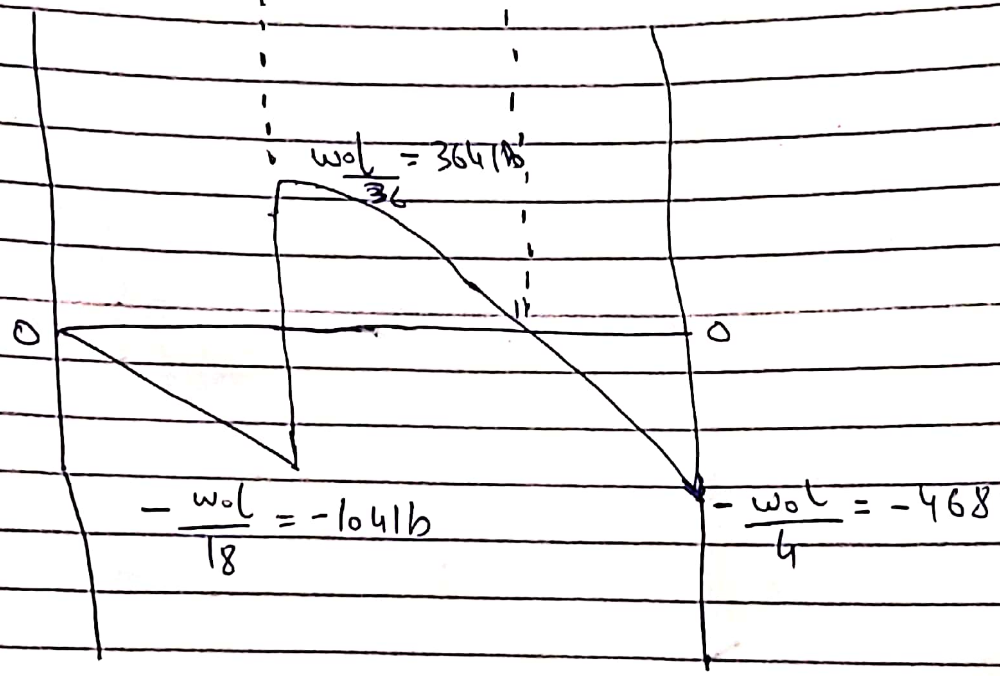
$$= 467.96 \text{ lb}$$

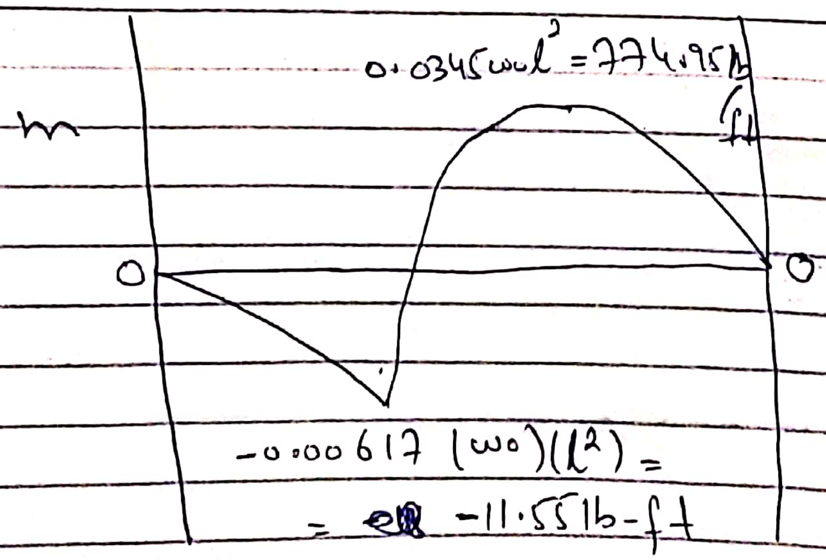
$$\frac{w_o}{l}\,x = \frac{78}{24}\,(16.97)$$

$$= 55.15 \text{ lb/ft}$$

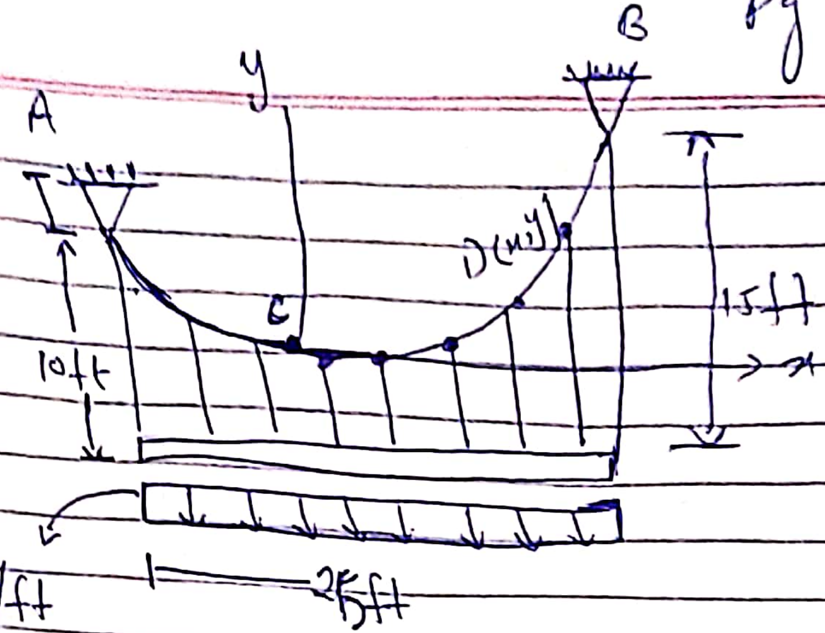
Now shear force & bending moment







Q2:→



Solⁿ:→

Consider the cable supporting a uniform, horizontally distributed load e.g. support cable for a suspension bridge.

Consider the lowest point C on cable

Consider an other point D on diagram of parabolic arch

D point is given By $w = wx$

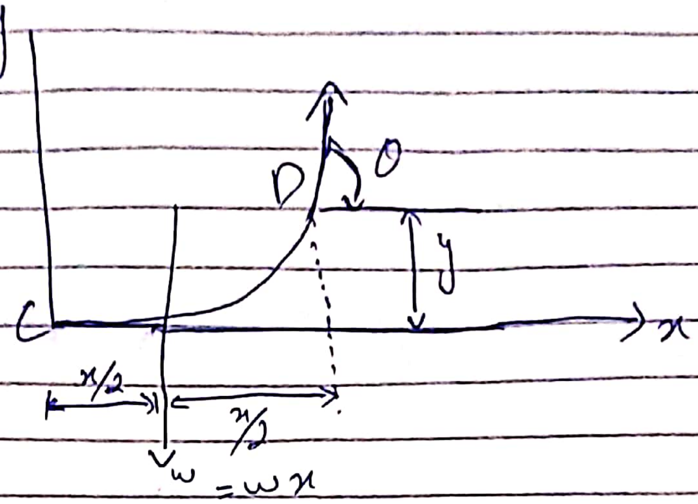
The Internal force magnitude & direction are

$$T = \sqrt{T_0^2 + w^2 x^2}$$

$$\frac{dy}{dx} = \frac{wx}{T_0}$$

Summing moment about point D.

· Take a section C, D



w = last two digit at st, ID

$w = 78 lb/ft$

$\Sigma M_D = 0$

$\Rightarrow w x \frac{x}{2} - T_0 y = 0$

$\frac{78 x^2}{2} - T_0 y = 0$

$\Rightarrow y = \frac{78 x^2}{2T_0}$

So the able from a barabolve curve

at point C,

$x = \frac{3}{4} l, \quad y = h_2 - h_1$

Applying the generall able Theorem yields the following.

$$A_{xy} = \left(\frac{x}{l}\right)\left(\frac{wl^2}{2}\right) - \left(\frac{wx^2}{2}\right)$$

$$= \frac{w}{2}(x)(l-x)$$

$$\left(\frac{wL^2}{8h}\right)y = \frac{w}{2}(x)(l-x)$$

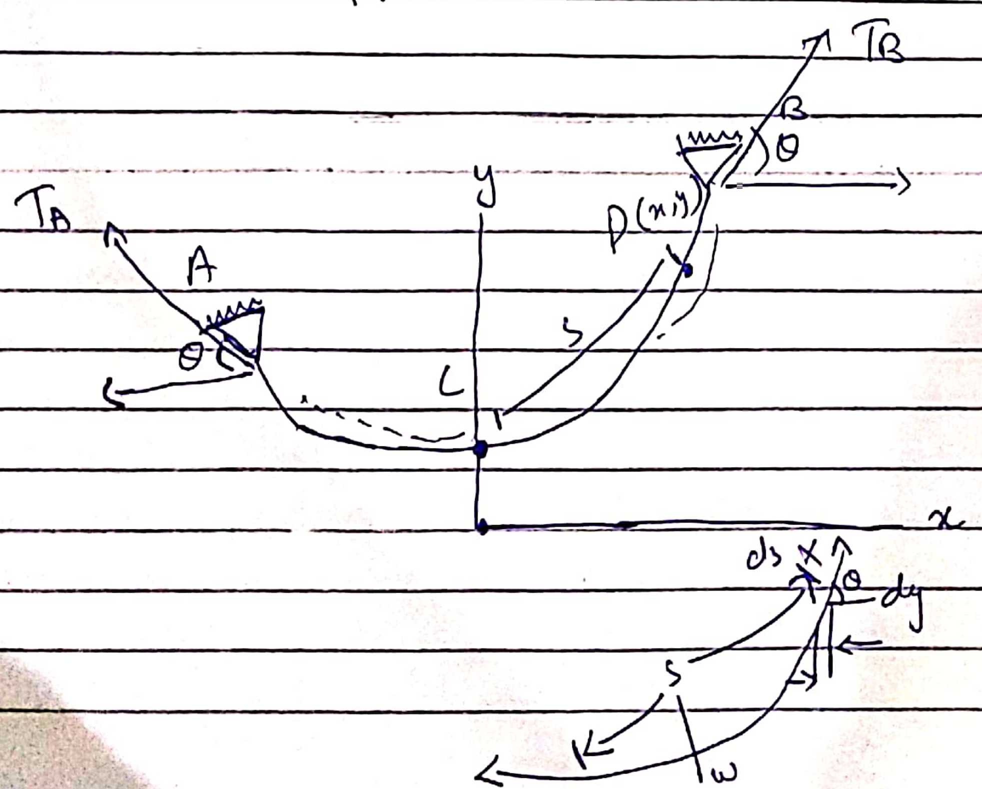
$$\Rightarrow y = \frac{4h}{l^2}x\,(l-x)$$

$$(ds)^2 = (dx)^2 + (dy)^2$$

$$(ds)^2 = (dx)^2\left[1 + \left(\frac{dy}{dx}\right)^2\right]$$

$$S = 2(25)\left[1 + \frac{2}{3}\left(\frac{4}{25}\right)^2 - \frac{2}{5}\left(\frac{4}{25}\right)^4\right]$$

$$S = 18.67\ ft$$



So by x, & y co-ordinate

$$y = (c)\cosh\left(\frac{x}{c}\right)$$

$$y = (4)\cos(5)\left(\frac{18.76}{4}\right)$$

$$\boxed{y = 71.05ft}$$

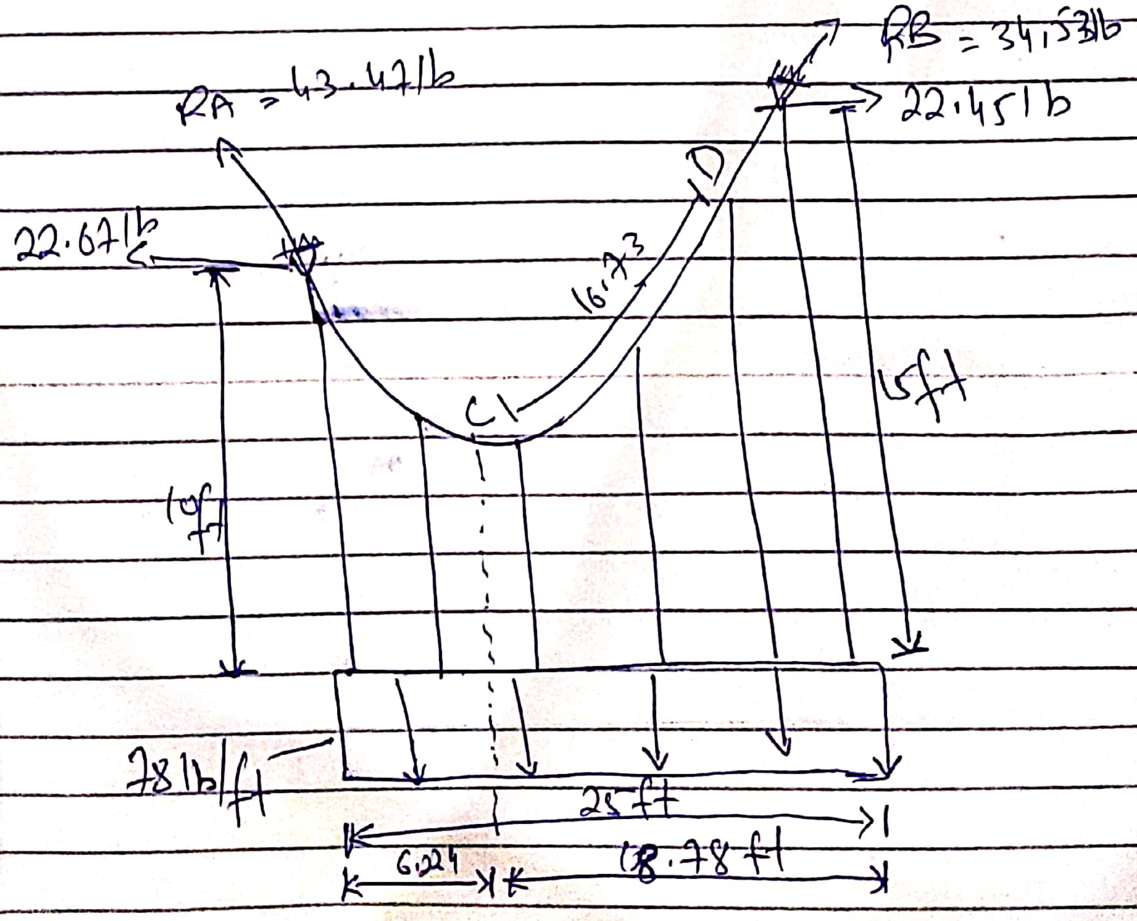
$\Sigma M_B = 0$

$0.6\,T_0\,(25) - T_0\,(5) = 0$

$\Rightarrow 10T_0 = 71$

$\Rightarrow T_0 = 7.32$ kip

so the point reaction one



The Influencey line of reaction is at point C.

which is 6.22 ft from point A & 7.22 ft from reaction B.

Point C ~~(6.22)~~ (6.22, 7.22)

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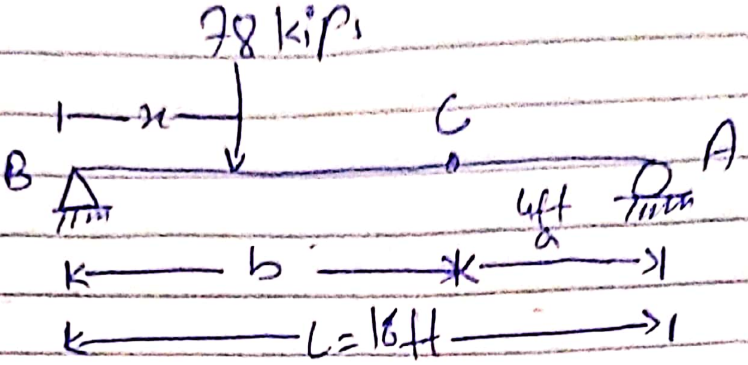
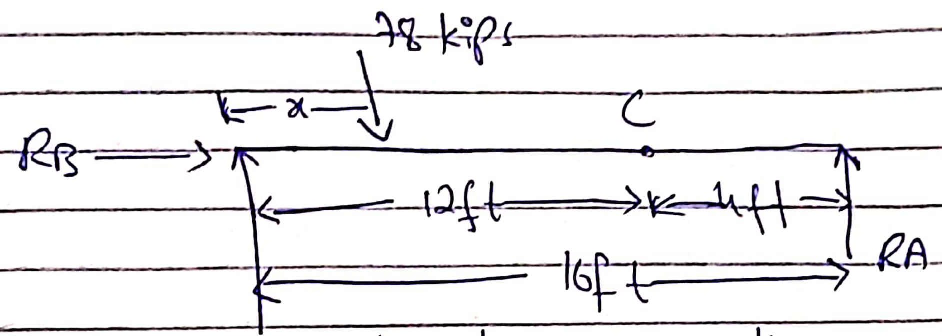


Sol:

F.B.D



To find beam reaction

+ive $\curvearrowright$ $\Sigma M_B = 0$

$$x\,78 + 16\,RA = 0$$

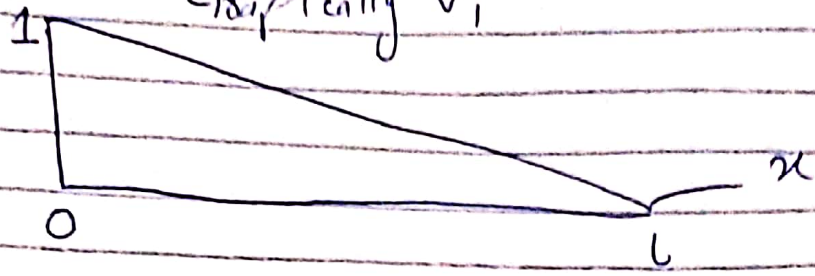
$$\Rightarrow RA = \frac{78x}{16}$$

$$RA = 4.875\, x \longrightarrow (1)$$

where $x = 0$, $RA = 0$

$x = 1$ $RA = 4.875$ kips

Graphically V_1



Similarly R_B is founded by taking the moment at point A

$$+\text{ive}\circlearrowleft \; \Sigma M_A = 0$$

$$+78(16-x) + R_B(16) = 0$$

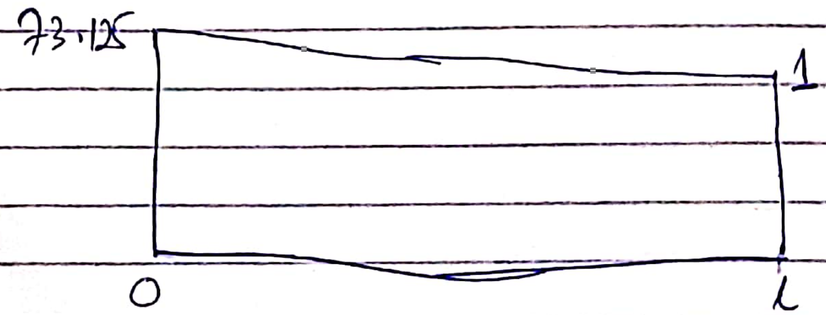
$$R_B = \frac{78(16-x)}{16} \Rightarrow (11)$$

$$R_B = 4.875(16-x)$$

$$R_B = 78 - 4.875x \Rightarrow (11)$$

$x = 0$; $R_B = 78$

$x = 1$; $R_B = 73.125$ kips



Shearing force

$$V = R_A = x/l$$

$$v = x/l$$

where $x = 0 \Rightarrow v = 0$

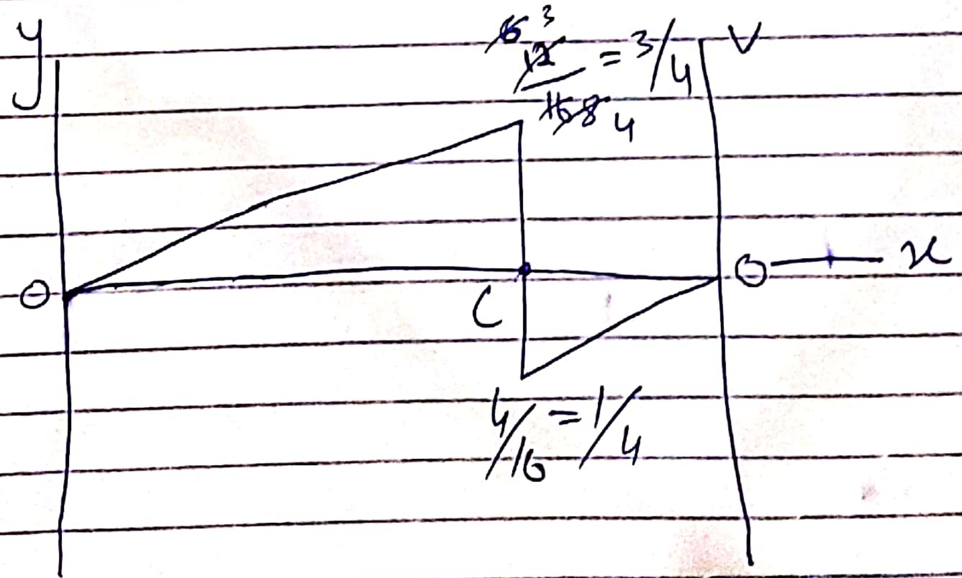
$$x = b \Rightarrow v = b/l$$

$$x = 4 \Rightarrow v = 4/l \Rightarrow v = 1/4 = 0.25 \text{ kip}$$

$$V = -R_B = -\frac{L-x}{L} = \frac{16-x}{16} = -1 + 1/16$$

where $x = 16 = \frac{-16+16}{16}$

then $x = 0 \Rightarrow v = 0$



$$m = R_A\,(16 - x) = x/16\,(16 - x)$$

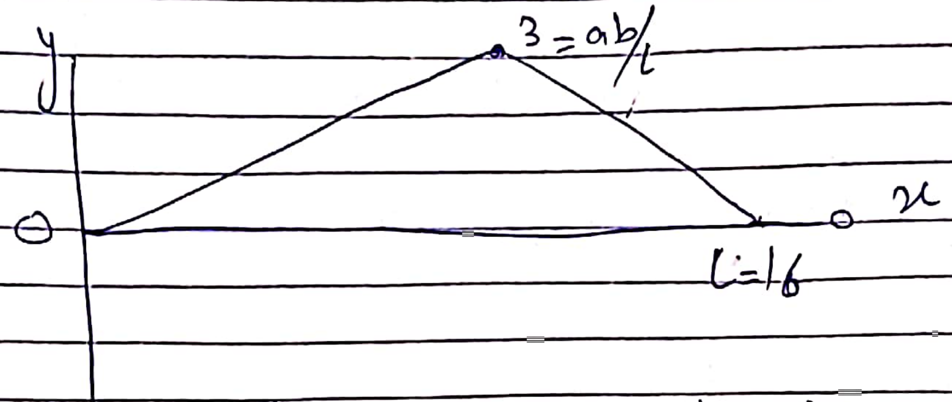
$x = 0 \quad m = R_A(0) = 0$

$x = 12 \quad m = R_A - (4)$

$$m = R_B x = \frac{(L-x)}{L} x$$

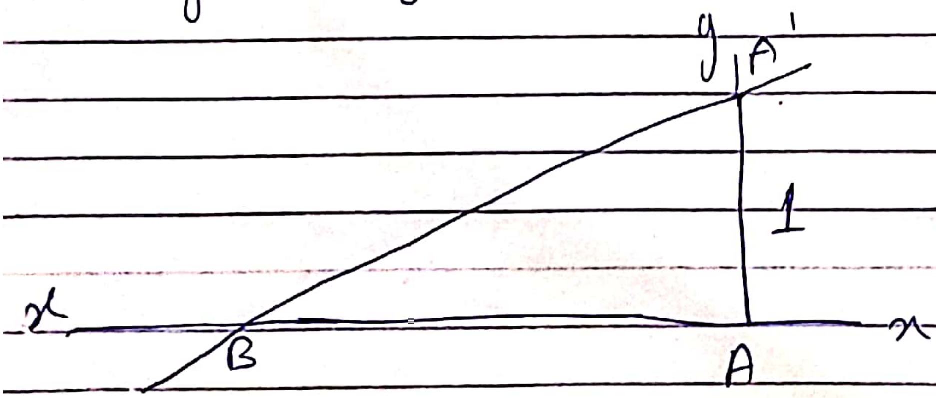
where $x = 0$, $m = 0$

$x = 12$ $m = 12$

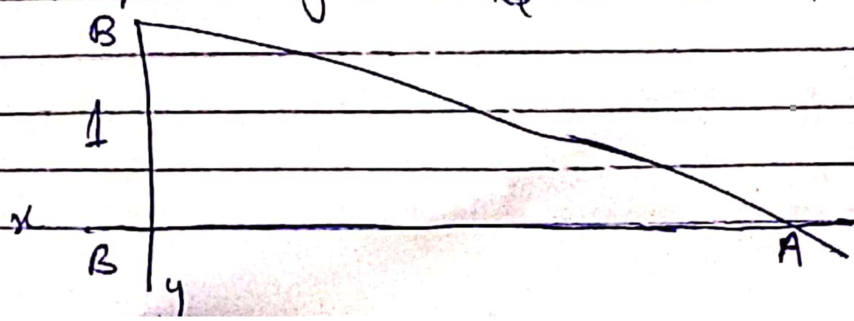


Influencing line fore moment at section h

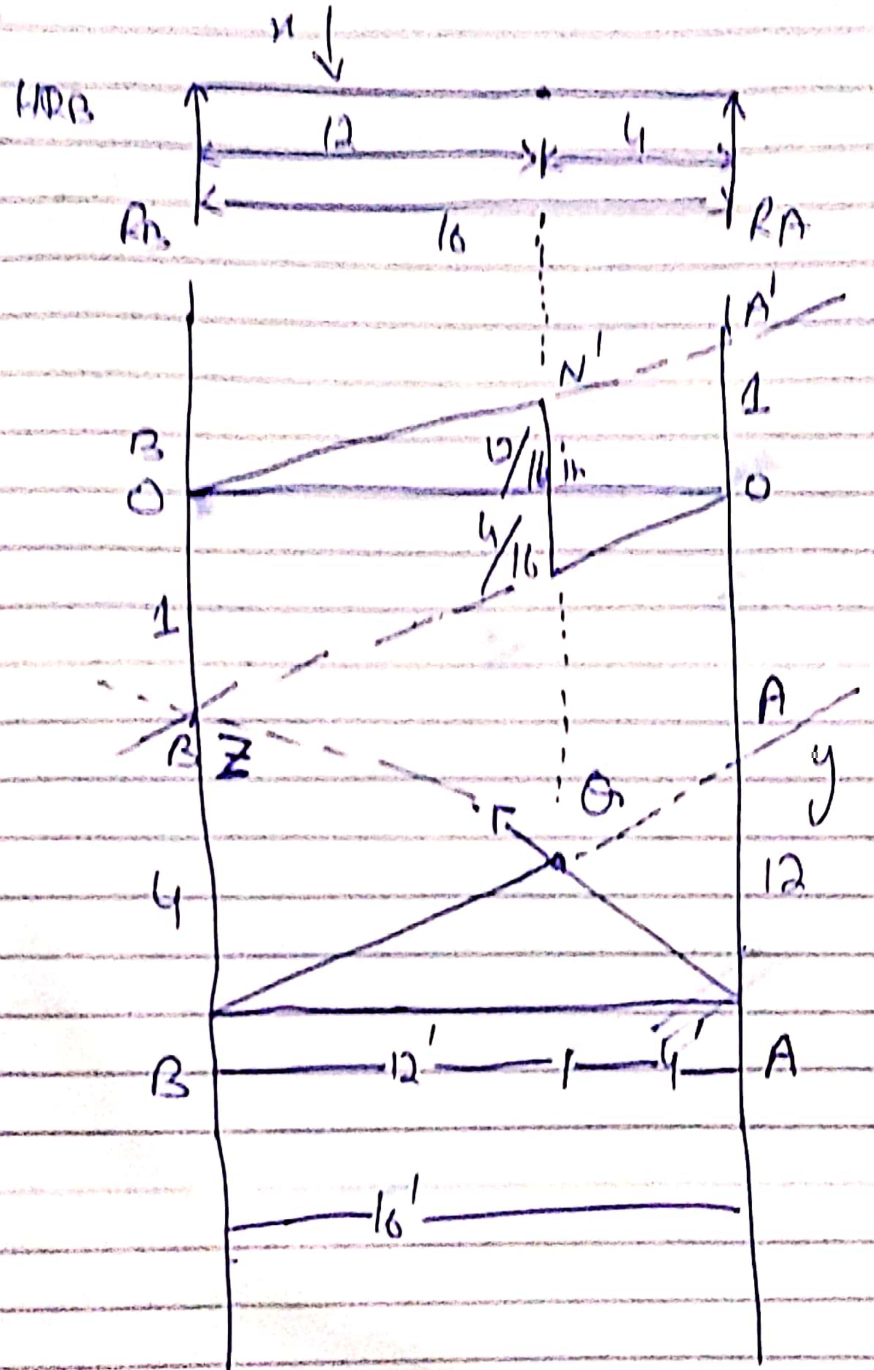
The Position of left support at Point A along the y-axis, Plot a value 1 point A



Draw a line joining Point B & A, Triangle A B' A is formed



$\frac{1}{16} = x = \frac{N''}{4}$ —— $N'' = -\frac{1}{16}$



Line AZ & BY intersect at Φ

The triangle BΦA is the influencing line for the moment at section n, if accurately drawn with the right sense of proportional

The intersection ϕ should line directly on a vertical line passing through the section n

The value of $n\phi$ can be obtain as follow

$$\frac{\cancel{4}^{1}}{\cancel{16}_{4}} = \frac{n\phi}{12} \Rightarrow n\phi = \frac{\cancel{12}^{3}}{\cancel{4}_{1}}$$

$$\boxed{n\phi = 3}$$

or

$$\frac{12}{16} = \frac{n\phi}{4} \Rightarrow \boxed{n\phi = 3}$$

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