Name :- M. Hasnain

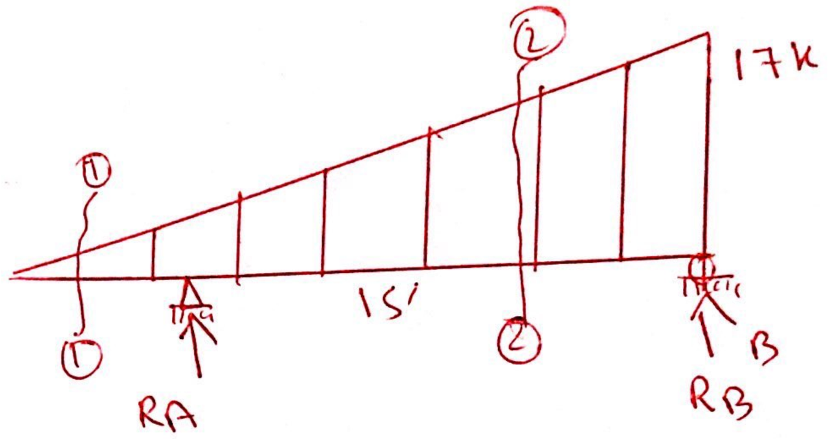
ID :- 7817

SEC :- A

Subject :- Structure Analysis-1

Instructor :- Engr. Muhammad Saqib

Q no (1)



$\Sigma MB = 0$ ↻+

$\frac{1}{2} \times 17 \times 24 \times \frac{1}{3} \times 24 = RA \times 15$

$RA = 108.8 Lb$

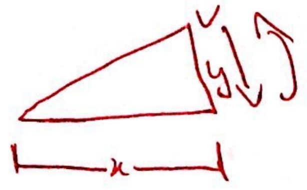
$\Sigma Fy = 0$ ↑

$RA + RB = \frac{1}{2} \times 17 \times 24$

$RB = 204 - 108.8$

$RB = 95.2$ lbs.

Now section 1—1



For y

$\frac{y}{x} = \frac{17}{24}$

$y = \left(\frac{17}{24}\right)x$

So $\Sigma F_y = 0 \uparrow +$

$$\Rightarrow -\frac{1}{2} \times x\left(\frac{17}{24}\right)x - V_C = 0$$

$$V_C = -\frac{17}{48}x^2$$

at $x = 0$

$V_C = 0$

at $x = 9$

$V_C = -28.6875$ lb

$$M = \frac{1}{2} \times x \times \left(\frac{17}{24}x\right) \times \frac{1}{3}x$$

$$M = -\frac{17x^3}{144}$$

$x = 0$

$M = 0$

at $x = 9$

$M = -86.0625$ lbs-ft

Now for section 2—2

For y

$$\frac{y}{(x+9)} = \frac{17}{24}$$

$$y = \frac{17}{24}(x+9)$$

So

$\Sigma F_y = 0 \uparrow$

$$108.8 - \frac{1}{2} \times (x+9)\left(\frac{17}{24}(x+9)\right) - V_C = 0$$

$$V_C = 108.8 - \frac{17 \times (x+9)^2}{48}$$

at $x = 0$

$V_C = 80.1125$

at $x = 15$

$V_C = -95.2\,k$

$$M + \frac{1}{2} \times (x+9)\left(\frac{17}{24}(x+9)\right) \times \frac{1}{3} \times (x+9) - 108.8 = 0$$

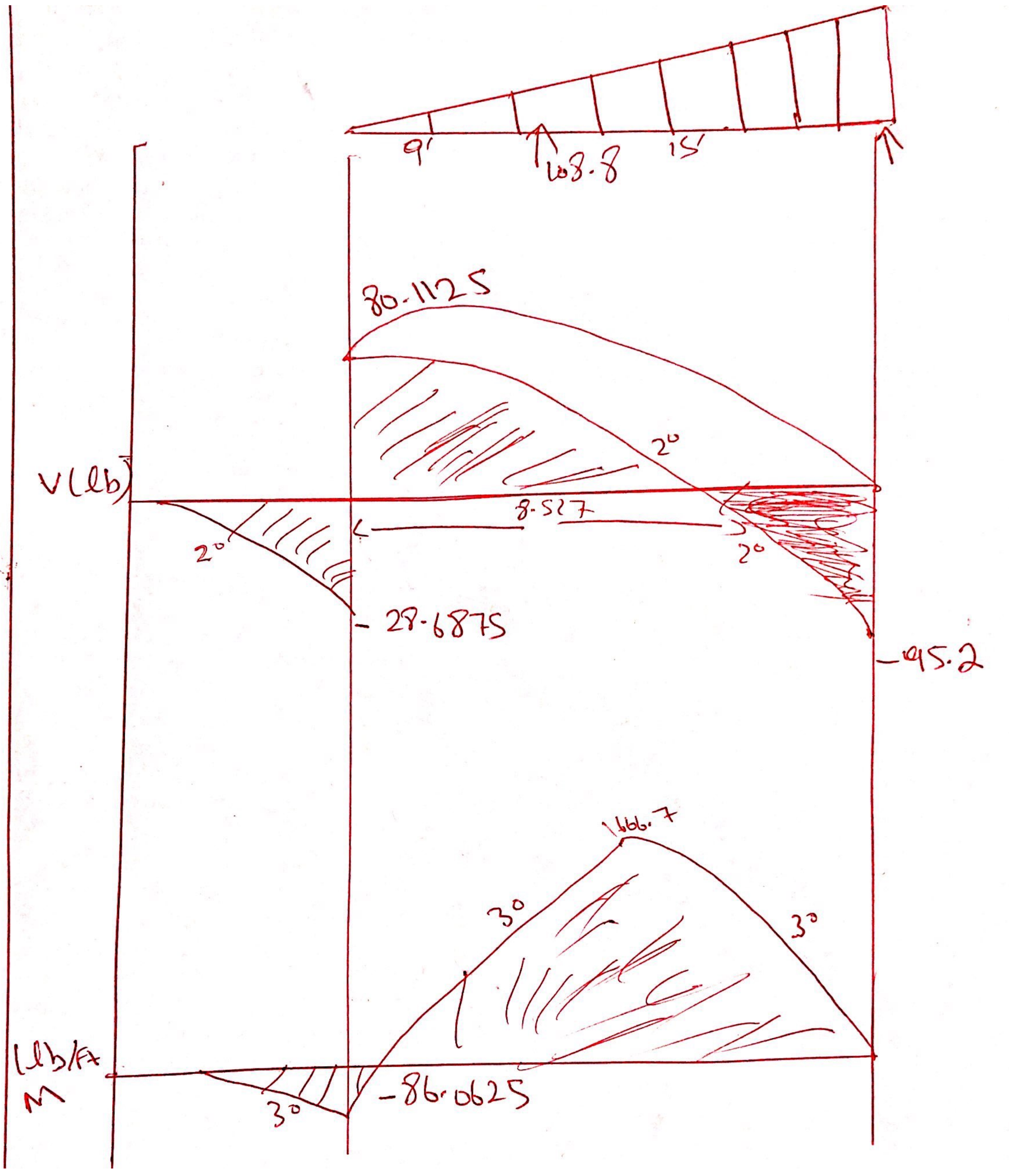
$$M = 108.8 - \frac{17(x+9)^3}{144}$$

at $x = 0$

$M = 22.7375$ lb.ft

at $x = 15$

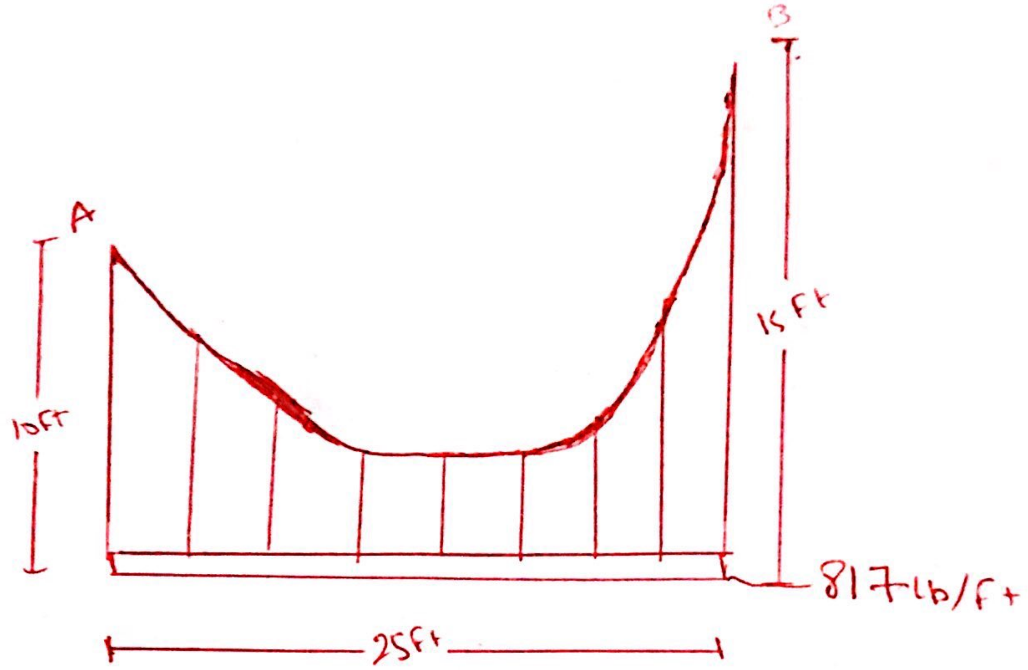
$M = -1523.2$



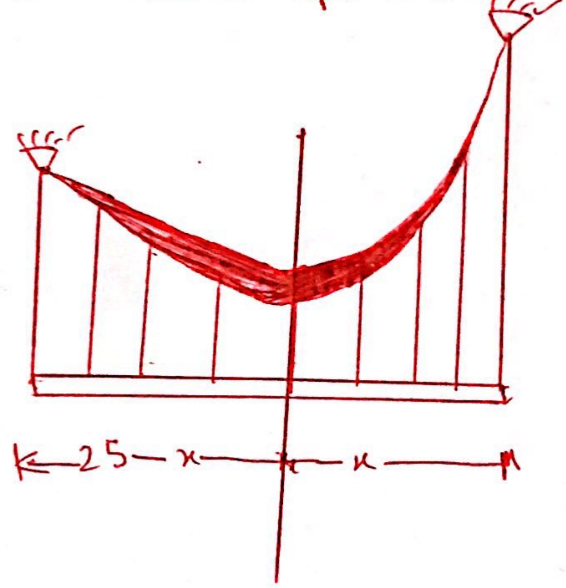
9'
108.8
15'
80.1125
2°
V(lb)
8.527
2°
2°
-28.6875
-95.2
166.7
3°
3°
lb/ft
M
3°
-86.0625

Qno 12)

Solution:-



let suppose we take a point "o" in the cable which is the lowest point, where slop is zero



using Formula

$$y = \frac{W_o}{2T_o} \cdot x^2 = \frac{817}{2T_o} x^2$$

$$y = \frac{408.5}{T_o} x^2$$

Now

Assume point C is located at x distance from Point "O" (lowest point).

So

From point "O" to Right

For distance "x" $y = 15'$

$$\Rightarrow y = \frac{408.5}{T_0} x^2$$

$$15 = \frac{408.5}{T_0} x^2 \Rightarrow T_0 = \frac{408.5}{15} x^2 \rightarrow ①$$

$$T_0 = 27.23 x^2 \longrightarrow ②$$

Again

From point "O" to left

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

$$\Rightarrow y = \frac{408.5}{T_0} x^2$$

$$10 = \frac{408.5}{T_0} (-(25-x))^2 \longrightarrow ②$$

Again

$\Rightarrow$ From point "O" to left

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

$$y = \frac{408.5}{T_0} x^2$$

$$10 = \frac{408.5}{T_0} \left[-(25-x)\right]^2$$

$$T_0 = \frac{408.5}{10} \left[-(25-x)\right]^2 \longrightarrow ③$$

Comparing eq ① and ③

$$\frac{408.5}{15}x^2 = \frac{408.5}{10}\left[-(25-x)\right]^2$$

Interchanging

$$\frac{\cancel{408.5}}{\cancel{408.5}}x^2 = \frac{15}{10}\left(625 - 50x + x^2\right)$$

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

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

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

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

By solving Quadratic Equation.

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

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

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

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

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

we get

$$x = 13.76 \text{ Ft} \longrightarrow ④$$

Now put eq ④ in ②

$$T_0 = 27.23x^2$$

$$= 27.23(13.76)^2$$

Now we have to find the tension at given points.

By using Formula.

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

$$y = \frac{408.5 . x^2}{T_o}$$

Differentiate the above eq w.r.t x

$$\frac{dy}{dx} = \frac{d}{dx}\left(\frac{408.5}{T_o} . x^2\right)$$

$$= \frac{408.5}{T_o} . 2(x)$$

$$\frac{dy}{dx} = \frac{817}{T_o} x \text{ --- (a)}$$

Also

$$\frac{dy}{dx} = \tan\theta \text{ --- (b)}$$

$$\boxed{\tan\theta = \frac{817}{T_o} x}$$

As point A is -11.24 away from "O"

So $$\tan\theta_A = \frac{817}{5155.66}(-11.24)$$

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

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

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Now, Tension at point A is $\therefore \left(\cos\theta = \frac{T_0}{T_A}\right)$

$$T_A = \frac{T_0}{\cos\theta_A}$$

$$= \frac{5155.66}{\cos(-60.67)} = 10525.21 \text{Lbs}$$

$$= 10.5 \text{ kips}$$

Now point "B" where $x = 13.76$ ft

$$\tan\theta_B = \frac{817}{T_0}(13.76$$

$$= \frac{817}{5155.66}(13.76)$$

$$\theta_B = \tan^{-1}(2.18)$$

$$\theta_B = 65.3^\circ$$

Now Tension

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

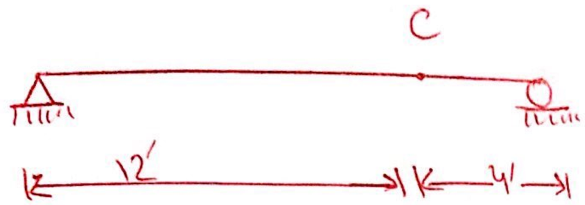
$$T_C = \frac{5155.66}{\cos(65.3} = 12338 \text{ Lbs}$$

$$= 12.3 \text{ kips.}$$

Q.no 37

ID= 1814

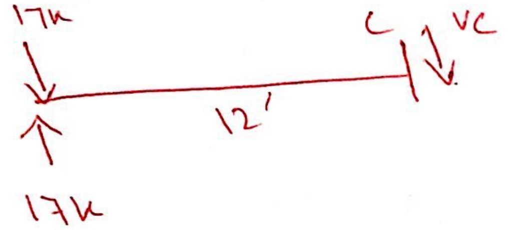
P= 17



(a) shear force influence for the beam.

x	V_C(k)
0	0
2	-2.125
4	-4.25
6	-6.375
8	-8.5
10	-10.625
12	-12.75, 24.25
14	2.25
16	0

at $x = 0$



$$-17 + R_A - V_C = 0$$

$$V_C = 0$$

at $x = 2$

$$-(17 \times 14) + R_A 16 = 0$$

$$-238 - R_A 16 = 0$$

$$R_A = \frac{238}{16} = 14.875$$

$$-17 + 14.875 - V_C = 0$$

$$V_C = -2.125$$

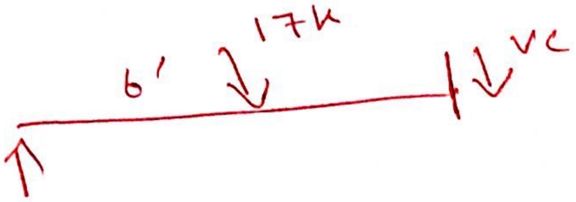
at $x = 4$

$R_A = 12.75$

$-17 + 12.75 - V_C = 0$

$V_C = -4.25\,k$

at $x = 6'$

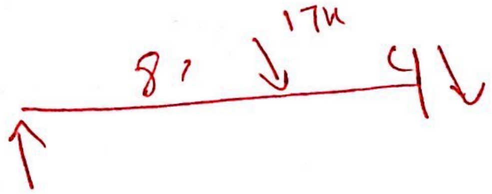


$R_A = 10.625$

$-17 + 10.625 - V = 0$

$V_C = -6.375$

at $x = 8$

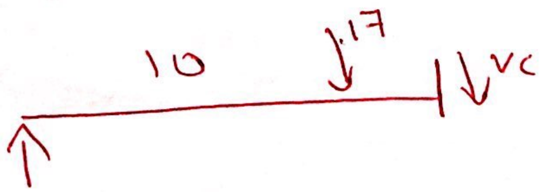


$R_A = 8.5$

$-17 + 8.5 - V_C = 0$

$V_C = -8.5\,k$

at $x = 10'$

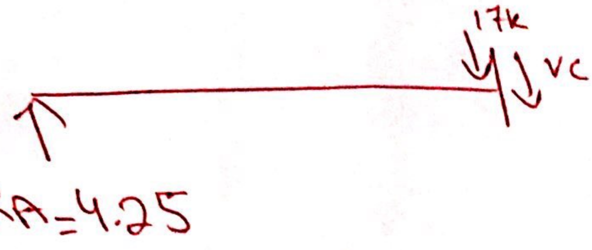


$R_A = 6.375$

$-17 + 6.375 - V_C = 0$

$V_C = -10.625$

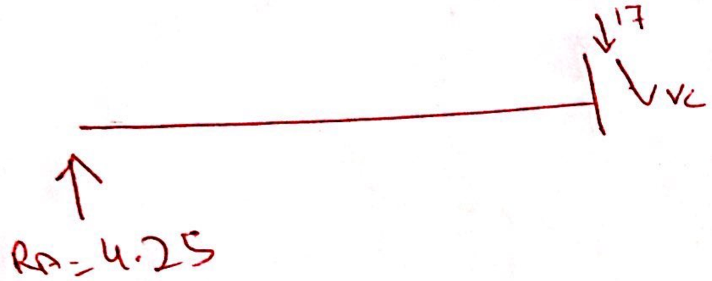
at $x = 12'$ (Just to the left)



$-17 + 4.25 - V_C = 0$

$V_C = -12.75k$

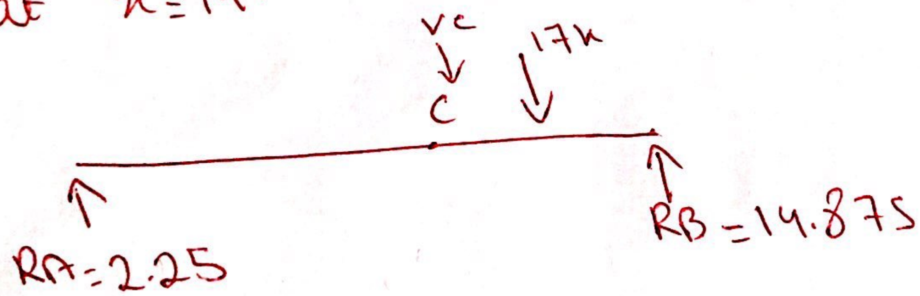
at $x = 12$ just to the Right.



$+4.25 - V_C = 0$

$V_C = 4.25$

at $x = 14'$



$V_C = 2.25$

at $x = 16$

$V_C = 0$

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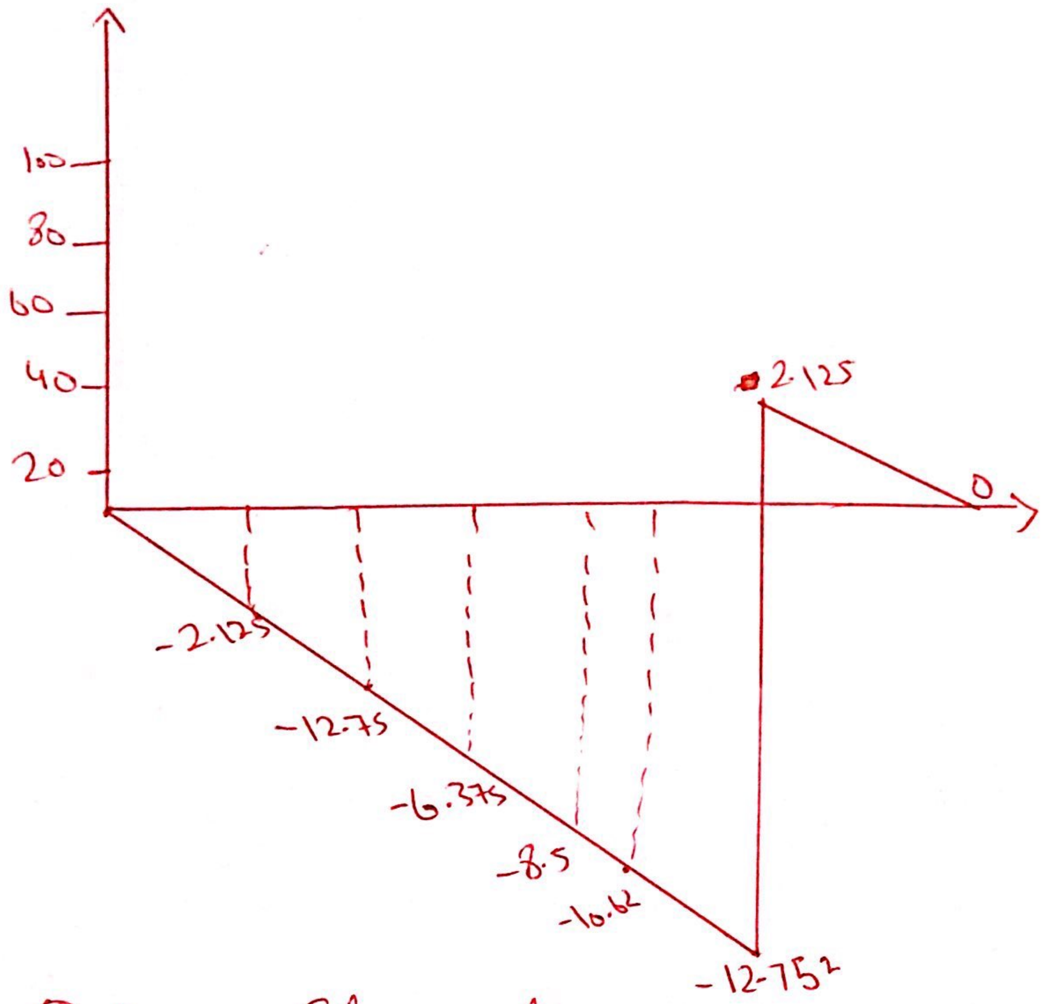
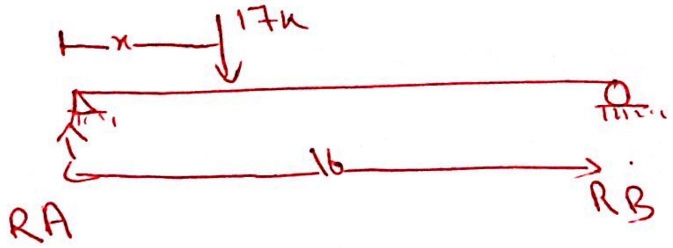


Ⓑ Now influence line for Reaction at A



$\Sigma MB = 0$

$RA \times 16 - 17(16 - x) = 0$

$RA = \dfrac{17(16-x)}{16}$ —— Ⓐ

at $x = 0$

$\Rightarrow RA = \dfrac{17(16-0)}{16}$

$RA = 17K$

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at $x = 2$

$RA = 14.87k$

at $x = 4.25k$

at $x = 6$

$RA = 6.375$

x	$RA(k)$
0	17
2	14.25
4	12.75
6	10.625
8	8.5
10	6.375
12	4.25
14	2.25
16	0