

Mid Term Examination

Paper : structural Analysis-I

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Q: 03

P = 97 K



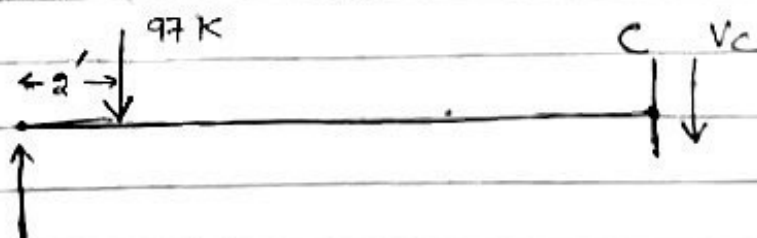
(a) Shear force influence for the beam

	(ft)	V_c (K)
at $x = 0$	0	0
	2	-12.125
	4	-24.5
	6	-36.375
	8	-48.5
	10	-60.625
	12	-72.75(L); 24.25(R)
	14	12.125
	16	0

$$-97 + R_A - V_c = 0$$

$$\Rightarrow V_c = 0$$

at $x = 2$

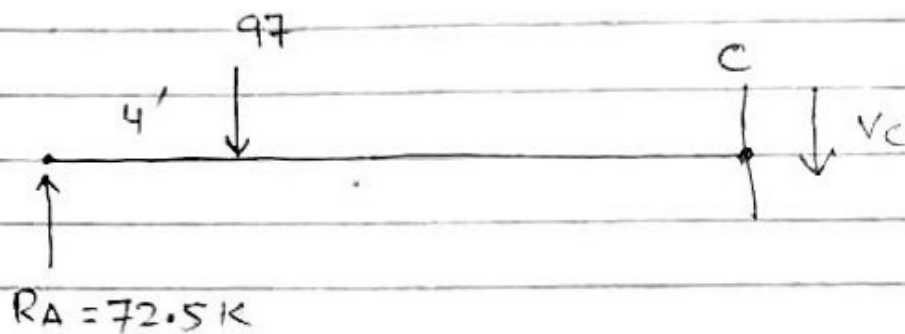


$$R_A = 84.875 K$$

$$\Rightarrow -97 + 84.875 - V_c = 0$$

$$\Rightarrow \boxed{V_c = -12.125 \text{ K}}$$

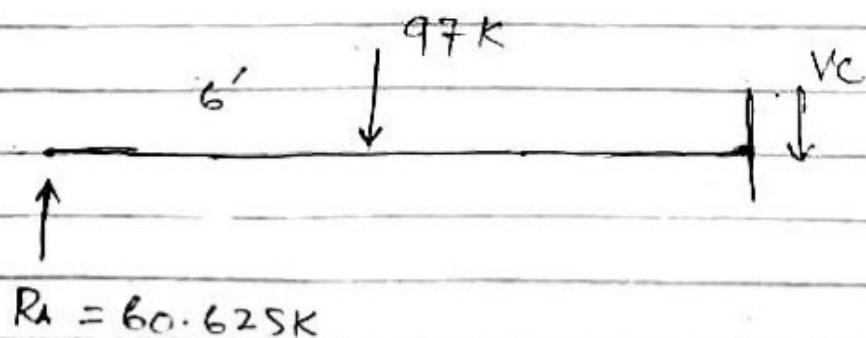
at $x = 4$



$$-97 + 72.5 - V_c = 0$$

$$\Rightarrow \boxed{V_c = -24.5 \text{ K}}$$

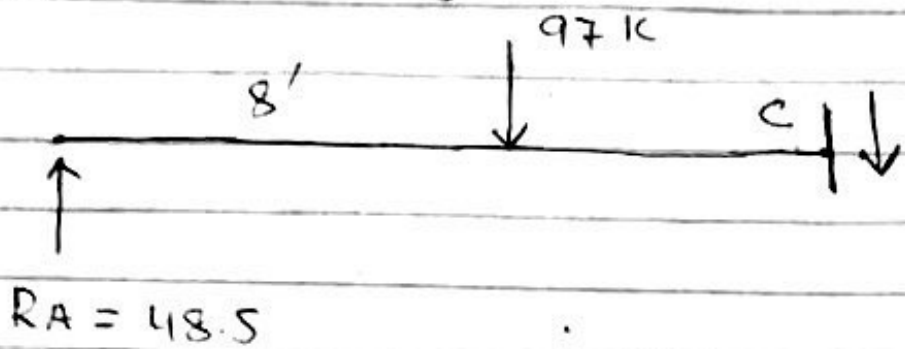
at $x = 6'$



$$\Rightarrow -97 + 60.625 - V_c = 0$$

$$\Rightarrow \boxed{V_c = -36.375 \text{ K}}$$

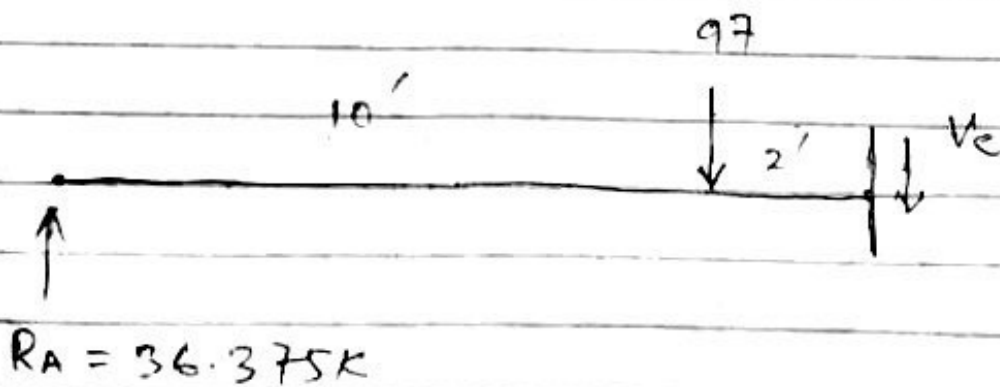
at $x = 8'$



$$\Rightarrow -97 + 48.5 - V_c = 0$$

$$\Rightarrow \boxed{V_c = -48.5\text{ k}}$$

at $x = 10'$

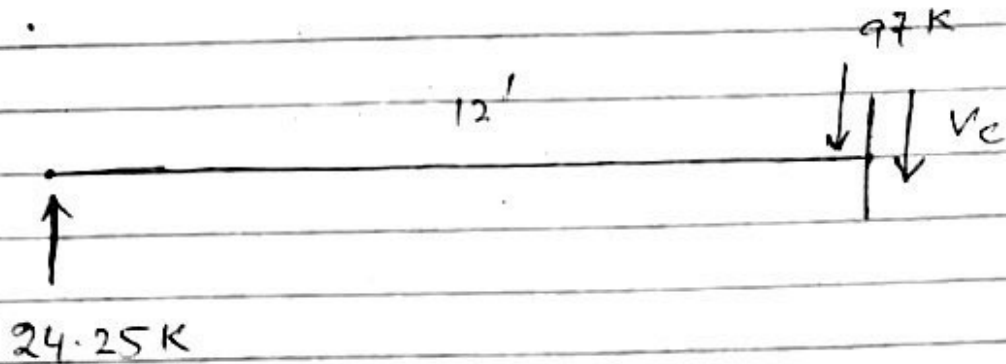


$$\Rightarrow -97 + 36.375 - V_c = 0$$

$$\Rightarrow \boxed{V_c = -60.625\text{ k}}$$

(4)

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



$$-97 + 24.25 + V_c = 0$$

$$\Rightarrow V_c = -72.75K$$

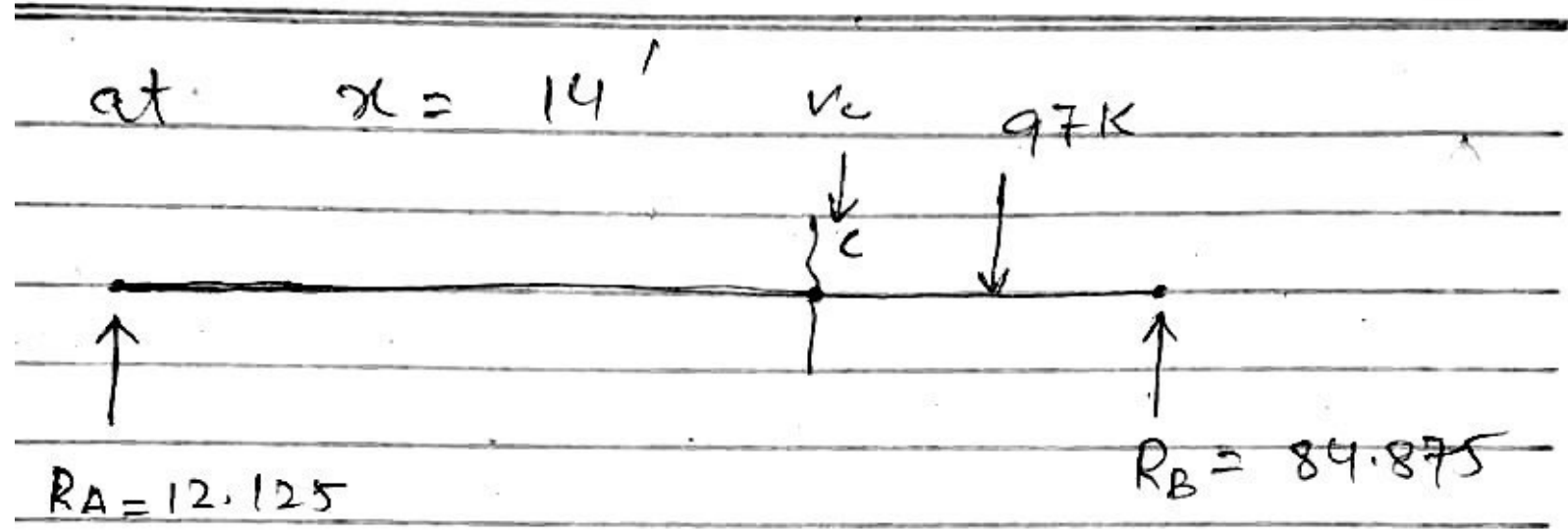
at $x = 12$ just to the Right



$$\Rightarrow +24.25 - V_c = 0$$

$$\Rightarrow \boxed{V_c = 24.25K}$$

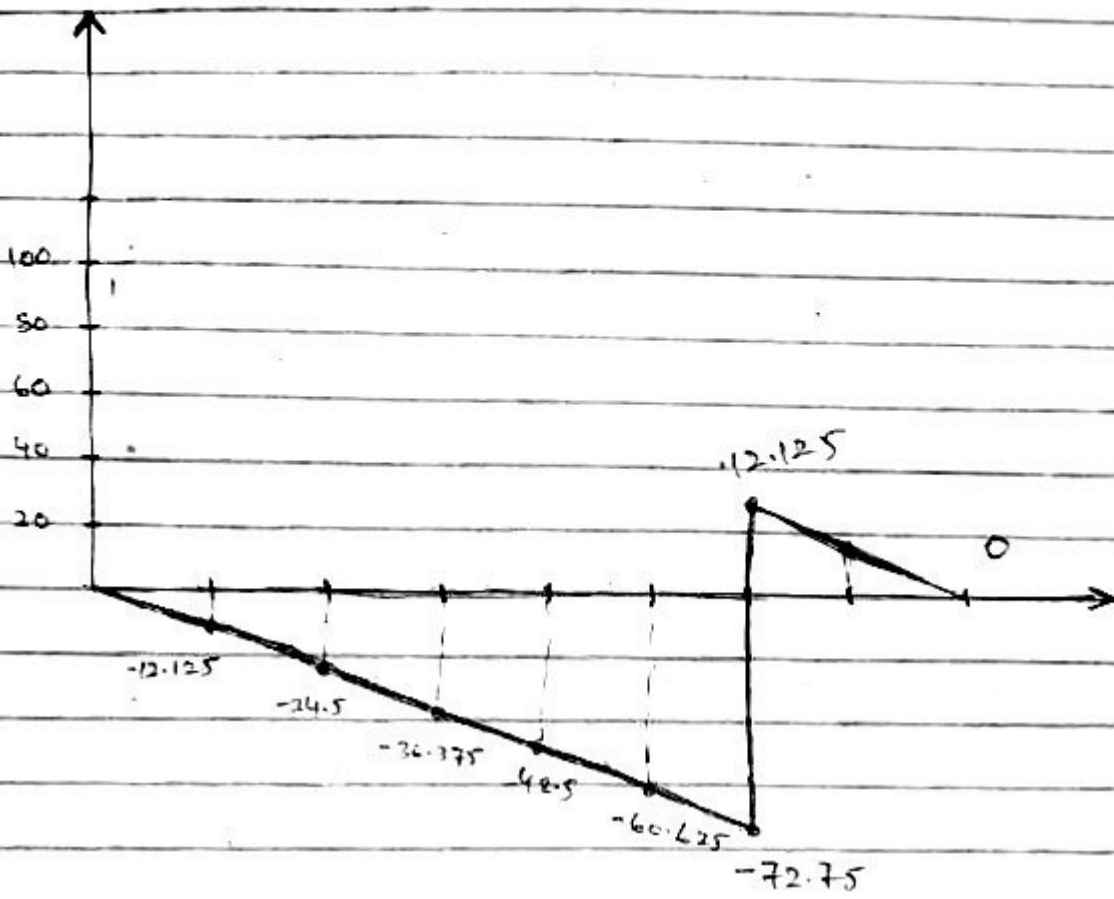
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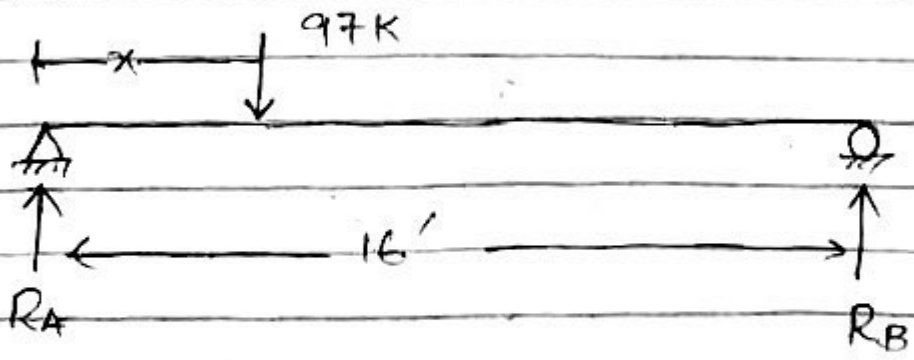
$\Rightarrow V_c = 12.125$

at $x = 16$

$V_c = 0$



(b) Now influence line for Reaction at A.



$$\sum M_B = 0$$

$$\Rightarrow R_A \times 16 - 97(16 - x) = 0$$

$$\Rightarrow R_A = 97(16 - x) \rightarrow \textcircled{A}$$

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at $x = 0$

$$\text{eq. (A)} \Rightarrow R_A = \frac{97(16-0)}{16}$$

$$R_A = 97 \text{ k}$$

at $x = 2$

$$\text{(A)} \Rightarrow R_A = 84.875 \text{ k}$$

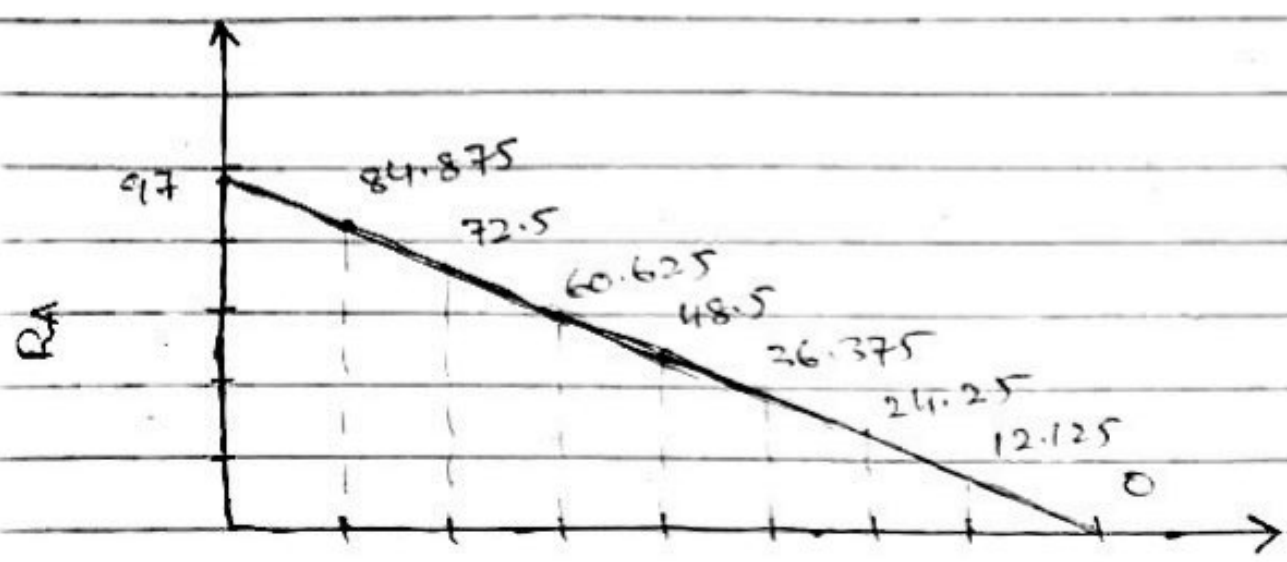
at $x = 4$

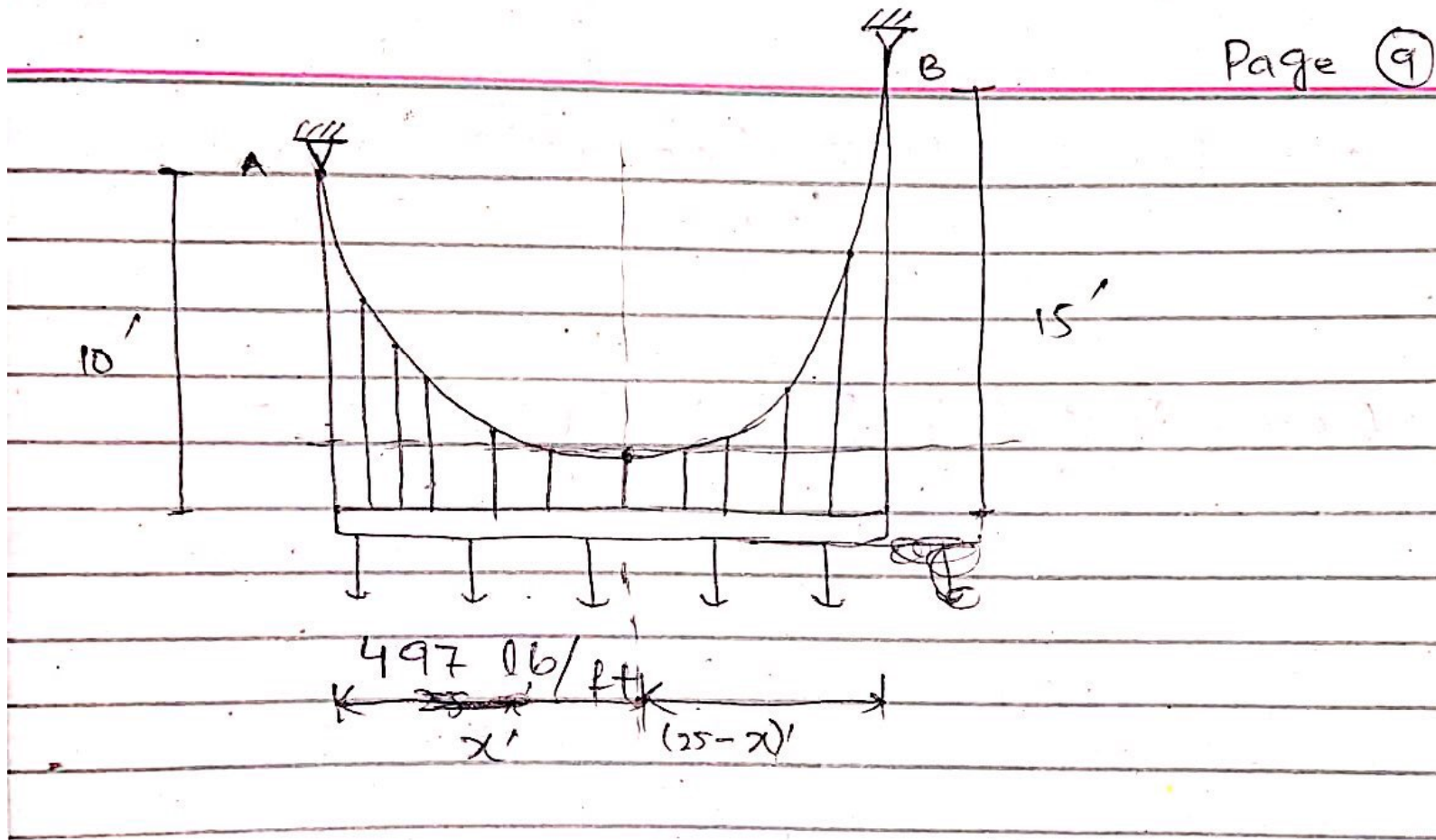
$$\text{(A)} \Rightarrow R_A = 72.5 \text{ k}$$

at $x = 6$

$$\text{(A)} \Rightarrow R_A = 60.625$$

x	R_A (k)
0	97
2	84.875
4	72.5
6	60.625
8	48.5
10	36.375
12	24.25
14	12.125
16	0





(10)

at A ,

$$x = -x' \quad , \quad y = 10$$

$$\Rightarrow y = \frac{w_0 x^2}{2FH}$$

$$\Rightarrow 10 = \frac{497(x)^2}{2FH}$$

$$\Rightarrow FH = \frac{497 x'^2}{30} \rightarrow \text{A}$$

at B

$$x = 25 - x \quad , \quad y = 15$$

$$\Rightarrow 15 = \frac{497 x (25 - x)^2}{2 \times FH}$$

$$\Rightarrow FH = \frac{497 x (25 - x)^2}{30} \rightarrow \text{B}$$

Equating A & B , we get

$$\boxed{x' = 11.24'}$$

(11)

$$\Rightarrow FH = \frac{497 \times (11.24)^2}{20}$$

$$FH = 3138 \text{ lb}$$

$$\tan \theta = \frac{w_0 x}{FH}$$

$$\text{at } x = 11.24', y = 10$$

$$\Rightarrow \tan \theta = \frac{497 \times 11.24}{3138}$$

$$\Rightarrow \theta_A = 60.67^\circ$$

Now

$$T_A \sin \theta = w_0 x$$

$$\Rightarrow T_A = \frac{w_0 x}{\sin \theta}$$

$$= \frac{497 \times 11.24}{\sin 60.67^\circ}$$

$$T_A = 6407.66 \text{ lb}$$

(12)

Now at $x = (25 - x) = 13.76'$

$$\tan \theta = \frac{497 \times 13.76}{3138} \quad (\text{ignore -ve sign})$$

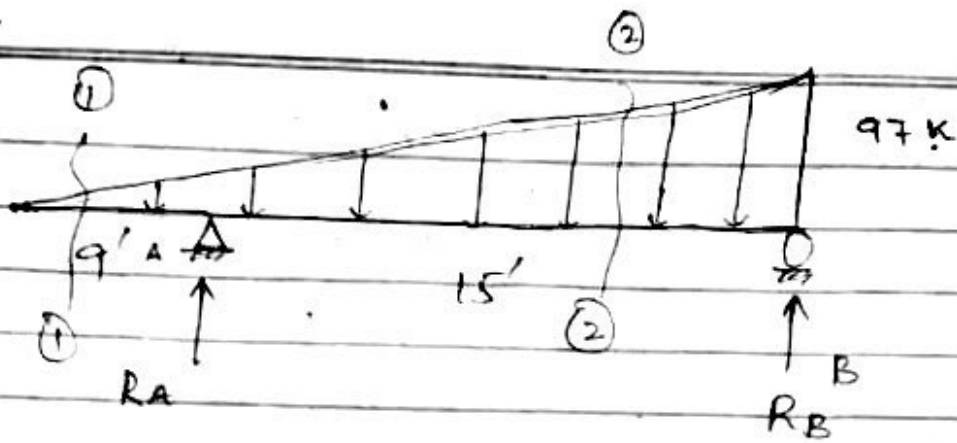
$$\Rightarrow \theta_B = 65.35^\circ$$

$$T_B \times \sin \theta_B = \text{work}$$

$$\Rightarrow T_B = \frac{497 \times 13.76}{\sin 65.35}$$

$$T_B = 7524.4 \text{ lb}$$

Q41



$$\sum M_B = 0 \quad \curvearrow +$$

$$\Rightarrow \frac{1}{2} \times 97 \times 24 \times \frac{1}{3} \times 24 = R_A \times 15$$

$$\Rightarrow \boxed{R_A = 620.8 \text{ lb}}$$

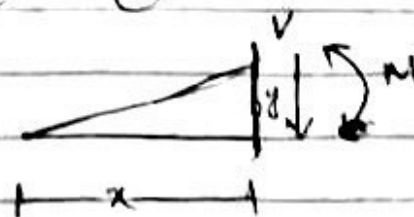
$$\sum F_y = 0 \quad \uparrow$$

$$R_A + R_B = \frac{1}{2} \times 97 \times 24$$

$$\Rightarrow R_B = 1164 - 620.8$$

$$\boxed{R_B = 543.2 \text{ lbs}}$$

Now Section ①-①



(14)

for y

$$\frac{y}{x} = \frac{97}{24}$$

$$\Rightarrow y = \left(\frac{97}{24}\right)x$$

$$\text{So } \Sigma Py = 0 \quad \uparrow +$$

$$\Rightarrow -\frac{1}{2}xx \times \left(\frac{97}{24}\right)x - V_c = 0$$

$$\Rightarrow V_c = -\frac{97x^2}{48}$$

$$\text{at } x = 0$$

$$V_c = 0$$

$$\text{8 at } x = 9$$

$$V_c = -163.6875 \text{ lb}$$

$$\Rightarrow M = -\frac{1}{2}xx \times \left(\frac{97x}{24}\right) \times \frac{1}{3}x$$

$$\Rightarrow M = -\frac{97x^3}{144}$$

$$\text{at } x = 0$$

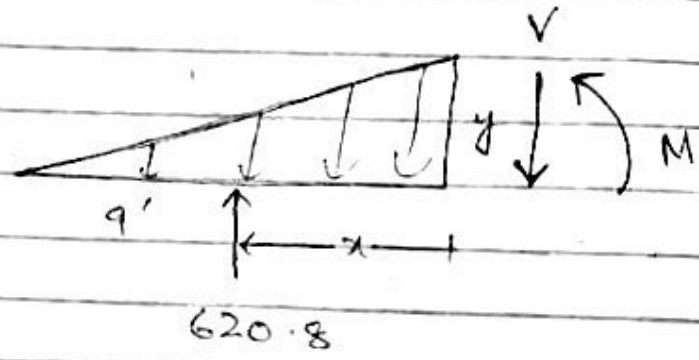
$$M = 0$$

at $x = 9$

$$M = -491.0625 \text{ lbs-ft}$$

Now for section ②-②

for y



$$\frac{y}{(x+9)} = \frac{97}{24}$$

$$\Rightarrow y = \frac{97}{24}(x+9)$$

So

$$\sum F_y = 0 \quad \uparrow$$

$$620.8 - \frac{1}{2}x(x+9)\left(\frac{97}{24}(x+9)\right) - V_c = 0$$

$$\Rightarrow V_c = 620.8 - \frac{97}{48}x(x+9)^2$$

at $x = 0$

$$V_c = 457.1125$$

~~$V_c = 457.1125$~~

(16)

at $x = 15$

$$V_c = -543.2 \text{ k}$$

$$M + \frac{1}{2}x(x+9)\left(\frac{97(x+9)}{24}\right) \times \frac{1}{3}x(x+9) - 620x = 0$$

$$\Rightarrow M = 620x - \frac{97(x+9)^3}{144}$$

at $x = 0$

$$M = -491.0625 \text{ lb-ft}$$

at $x = 15$

$$M = 0$$

