

(1)

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ID # : 7734

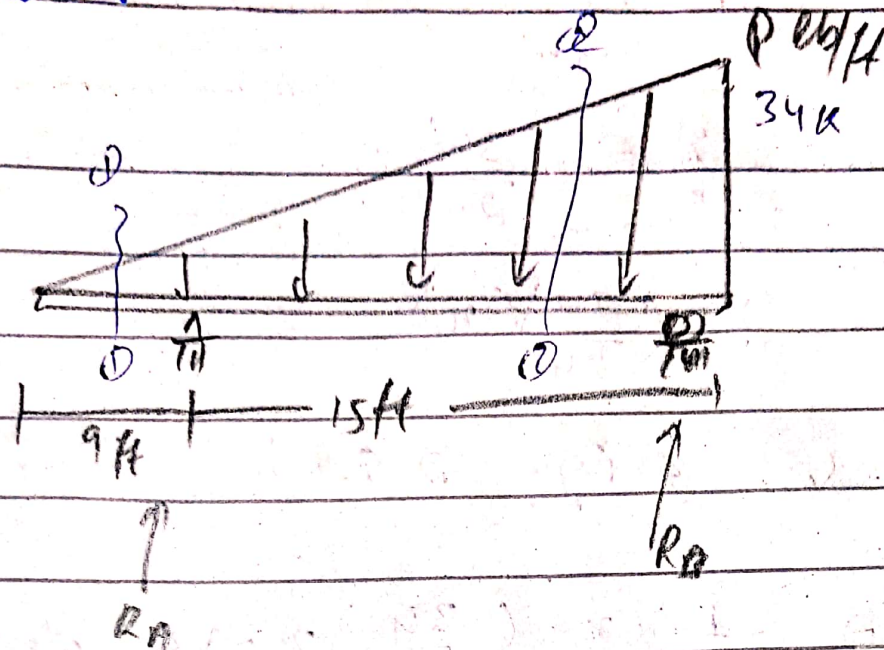
Subject : structure
Analysis - I

Instructor : Engr. M. Saqib

Department : Civil
Engineering

Date : 26 Sept 2020

(2)
Q No 1.



Sol:

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

$$\Rightarrow \frac{1}{2} \times 34 \times 24 + \frac{1}{3} \times 24 = R_A \times 15$$

$$\Rightarrow 3264 = R_A \times 15$$

$$\Rightarrow \boxed{R_A = 217.6}$$

$$\sum F_y = 0 \uparrow$$

$$R_A + R_B = \frac{1}{2} \times 34 \times 24$$

$$R_B = 408 - 217.6$$

$$\boxed{R_B = 190.4}$$

(2) (3)

for y

$$\frac{y}{x} = \frac{34}{24}$$

$$y = \left(\frac{34}{24} \right) (x)$$

$$\text{So } \Sigma Fy = 0 \uparrow +$$

$$\Rightarrow -\frac{1}{2} \times x \times \left(\frac{34}{24} \right) x - V_c = 0$$

$$\Rightarrow V_c = \frac{-34 x^2}{48}$$

at $x=0$

$$V_c = 0$$

at $x=9$

$$V_c = 57.375 \text{ lb}$$

$$M = -\frac{1}{2} \times x \times \left(\frac{34x}{24} \right) \times \frac{1}{3} x$$

$$M = -\frac{34 x^3}{144}$$

at $x=0$

$$M = 0$$

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at $x = 9$

$$M = 172.125 \text{ lbs. ft}$$

Now for section ②-②

for y .

$$\frac{y}{x+9} = \frac{34}{24}$$

$$y = \frac{34}{24} (x+9)$$

so

$$\sum F_y = 0 \uparrow$$

$$217.6 - \frac{1}{2} \times (x+9) \frac{34}{24} (x+9) - V_c = 0$$

$$\Rightarrow V_c = 217.6 - \frac{34(x+9)^2}{48}$$

at $x = 0$

$$V_c = 563.425$$

at ~~$x = 15$~~ $x = 15$

$$V_c = 219.8$$

(5)

$$M + \frac{1}{2}x(x+9) \left(\frac{34}{24} \right) (x+9) \times \frac{1}{3}x(x+9)$$

$$- 217.6x = 0$$

$$\Rightarrow M = 217.6x - \frac{34(x+9)^3}{144}$$

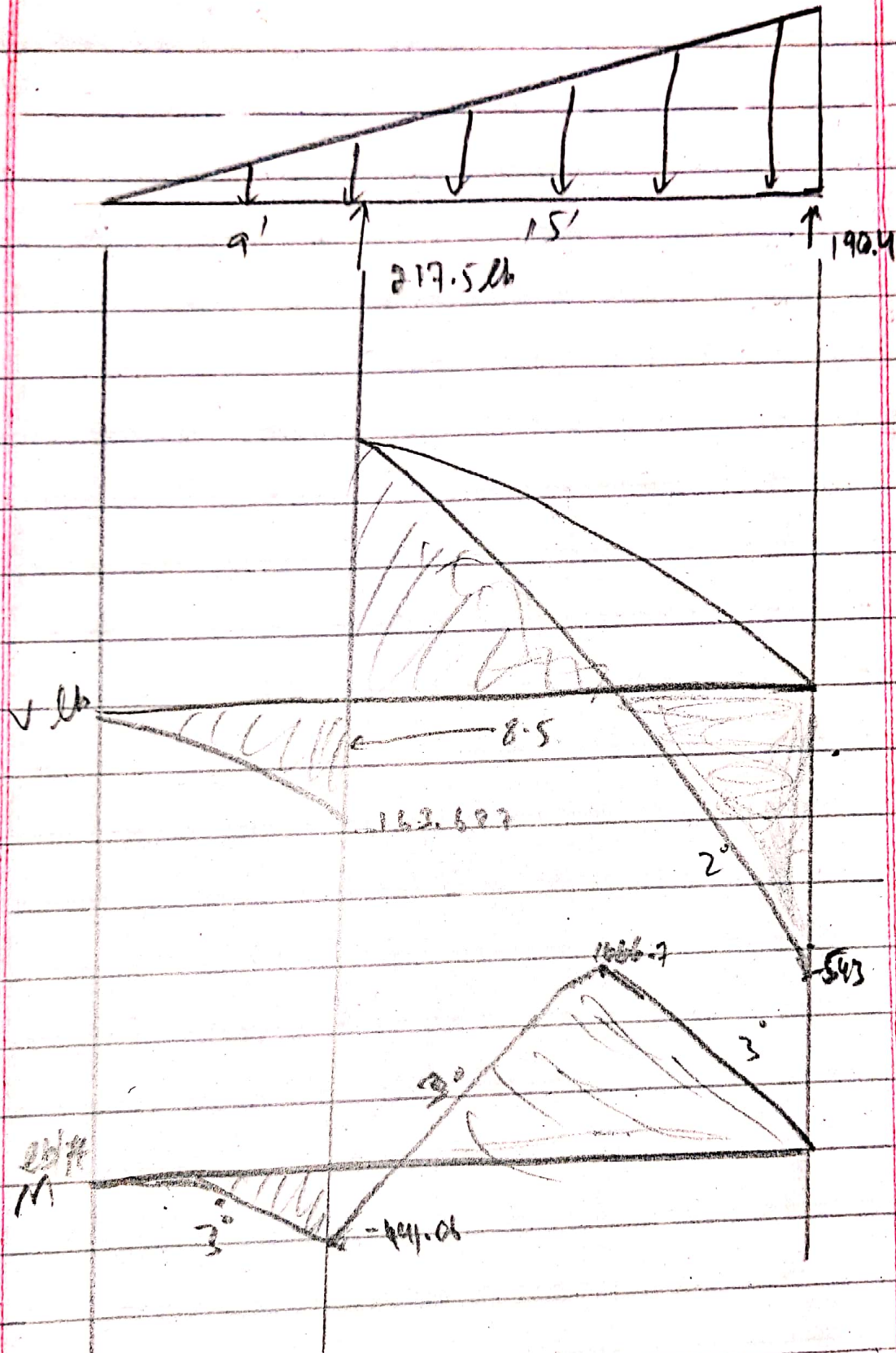
at $x = 0$

$$M = -172.125$$

at $x = 15$

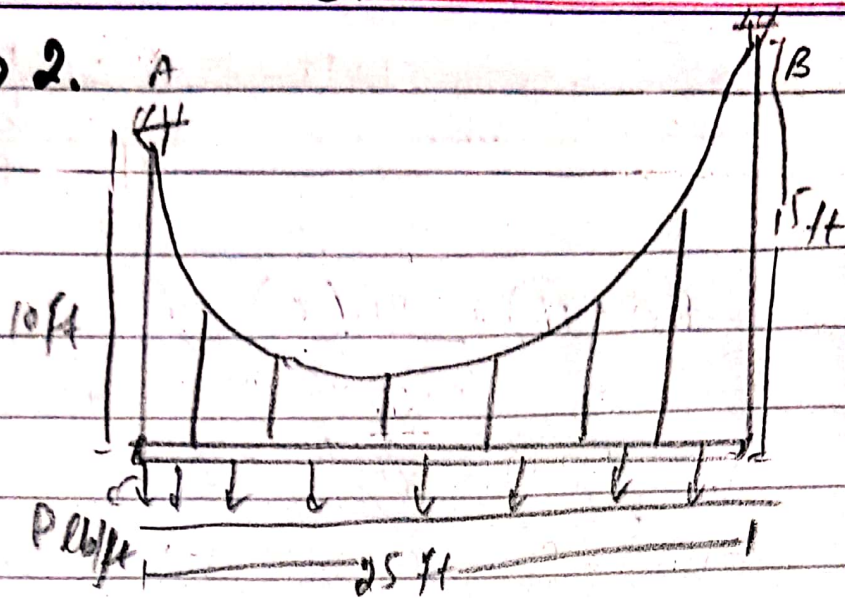
$$M = 6048 \text{ lb-ft}$$

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(7)

Q No 2.



$$F_{HL} = \frac{wL^2}{2h}$$

$$F_{HL} = \frac{734 \cdot (25-x)^2}{2 \times 10}$$

$$F_{HR} = \frac{734 \cdot (x)^2}{2 \times 15}$$

$$\Rightarrow \frac{734(25-x)^2}{2 \times 10} = \frac{734(x)^2}{2 \times 15}$$

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

$$25-x = x(0.8165)$$

$$x = \frac{25}{1.08165} \Rightarrow x = 13.76 \text{ ft}$$

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→ ~~FH = 734x~~

Now

$$25 - 13.76 = \boxed{11.25 \text{ ft}}$$

As;

$$FH = \frac{734 x^2}{2(15)} = \frac{734 (13.76)^2}{2(15)}$$

$$\boxed{4632.46}$$

$$\Rightarrow FH = \frac{734 (25 - x^2)}{2(10)} \Rightarrow \frac{734 (11.25)^2}{20}$$

$$\Rightarrow \boxed{4644.84}$$

Support B:-

$$y = \frac{w_0 x^2}{2FH} \Rightarrow \frac{734 (x)^2}{2(4644.84)}$$

$$\frac{dy}{dx} = 0.07901 (x^2)^{1/2}$$

$$\Rightarrow 14.959$$

Now $\frac{dy}{dx} = \tan \theta_B = 14.957$

$$\theta_B = \tan^{-1} (14.957)$$

$$\boxed{\theta_B = 86.17}$$

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Tension at B :-

$$T_B = \frac{F_H}{\cos \theta_B} = \frac{4644.84}{\cos(86.17)}$$

$$\Rightarrow 69,537.34 \Rightarrow \boxed{69.537 \text{ Kips}}$$

Support : A :-

$$y = \frac{w_0}{2FH} x^2 = \frac{734}{2(4644.84)} (25-x)^2$$

$$= \frac{734}{2(4644.84)} (11.25)^2$$

$$\Rightarrow \boxed{y = 10.00}$$

$$\frac{dy}{dx} = \tan \theta_A = 10.00$$

$$\theta_A = \tan^{-1}(10.0)$$

$$\theta_A = 84.289^\circ$$

Now,

$$T_A = \frac{F_H}{\cos \theta_A} = \frac{4644.84}{\cos(84.289)}$$

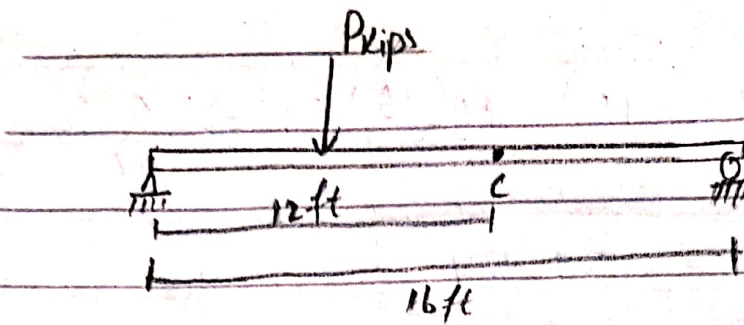
$$46603.55 \text{ lb}$$

$$\Rightarrow \boxed{46.603 \text{ Kips}}$$

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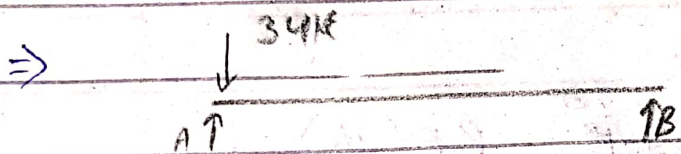
QNO. 3

$P = 34$



Influence line for R_A :

For $x = 0$ $R_A = ?$



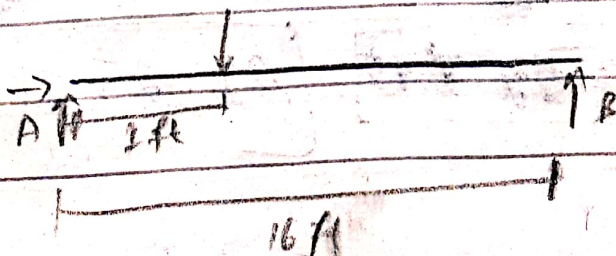
$$\sum M_B = 0$$

$$(34 \times 16) - R_A(16) = 0$$

$$\Rightarrow R_A = \frac{544}{16}$$

$$R_A = 34$$

For $x = 1$ ft $R_A = ?$



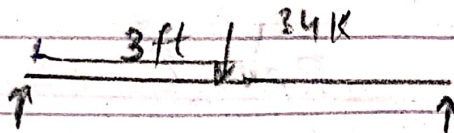
(01 (11))

$$\Rightarrow \sum M_B = 0$$

$$(34 \times 15) - R_A(16) = 0 \Rightarrow \frac{510}{16}$$

$$R_A = 31.875$$

for $x = 3 \text{ ft}$ $R_A = ?$



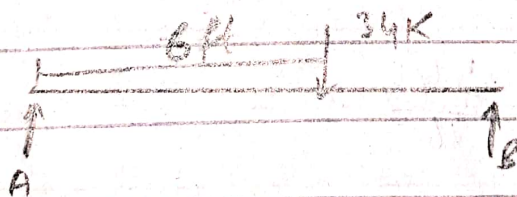
$$\sum M_B =$$

$$(34 \times \frac{13}{16}) - R_A(16) = 0$$

$$\Rightarrow \frac{170}{16}$$

$$R_A = 27.625$$

Put $x = 6$ $R_A = ?$



$$\sum M_B =$$

$$(34 \times \frac{10}{16}) - R_A(16) = 0 \Rightarrow$$

$$R_A = 21.25$$

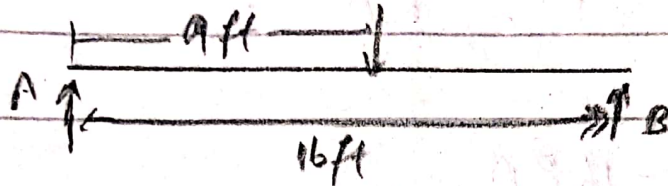
$$21.25$$

(12)

For $x = 9 \text{ ft.}$

$R_A = ?$

$$\hookrightarrow \sum M_B = 0$$

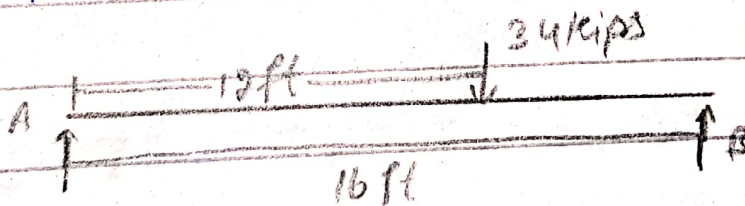


$$(34 \times 7) - R_A(16) = 0$$

$$238 - R_A(16) = 0$$

$$R_A = 14.875$$

\Rightarrow (For $x = 12 \text{ ft}$) :-



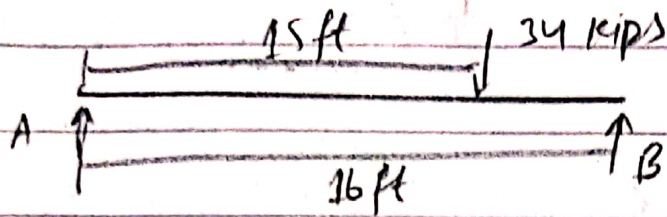
$$(34 \times 4) - R_A(16) = 0$$

$$136 - R_A(16) = 0$$

$$\frac{136}{16} \Rightarrow R_A = 8.5$$

(13)

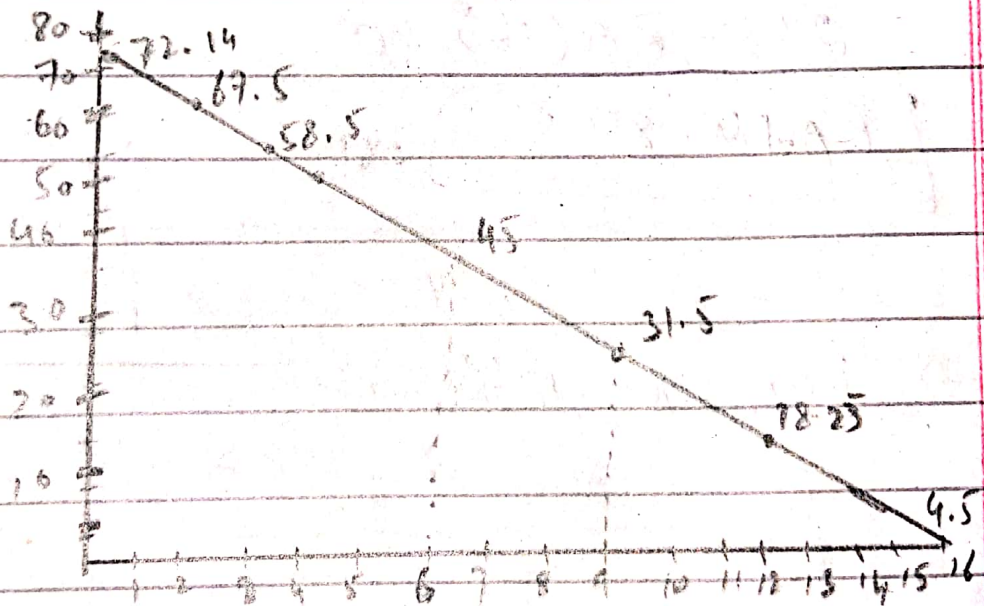
⇒ For $x = 15$ ft.



$$(34 \times 1) - R_A(16)$$

$$34 - 16R_A$$

$$R_A = 2.125$$

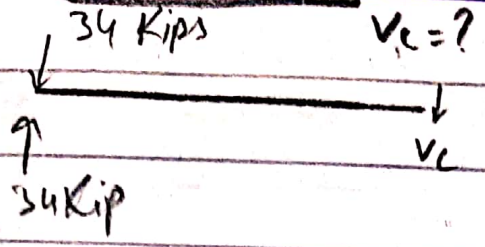


Influence line of R_A :

Now shear influence line
of point "C";

(14)

For $x = 0$



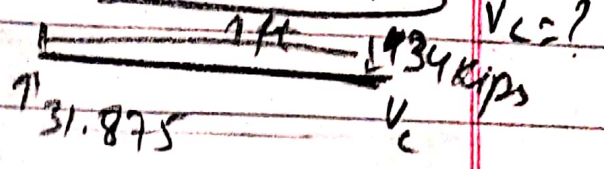
$$+\uparrow \sum F_y = 0$$

$$R_A - 34 - V_c = 0$$

$$34 - 34 - V_c = 0$$

$$V_c = 0$$

For $x = 1 \text{ ft}$



$$+\uparrow \sum F_y = 0$$

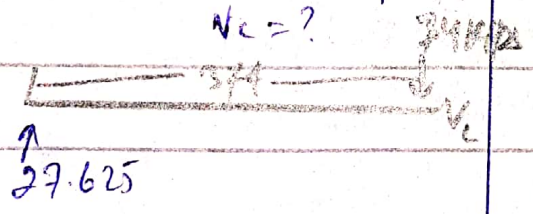
$$R_A - P - V_c = 0$$

~~$$31.675 - V_c = 0$$~~

$$31.675 - 34 - V_c = 0$$

$$V_c = -2.325$$

For $x = 3 \text{ ft}$



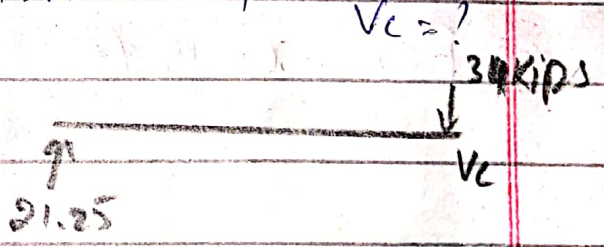
$$+\uparrow \sum F_y = 0$$

$$R_A - P - V_c = 0$$

$$27.625 - 34 - V_c = 0$$

$$V_c = -6.375$$

For $x = 6 \text{ ft}$



$$+\uparrow \sum F_y = 0$$

$$R_A - P - V_c = 0$$

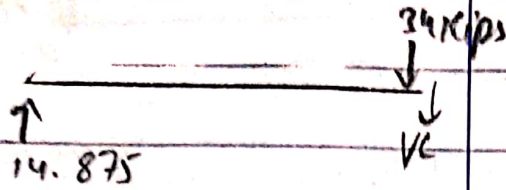
$$R_A - P - V_c = 0$$

$$21.25 - 34 - V_c = 0$$

$$-12.75$$

(21) (15)

For $x = 9 \text{ ft}$



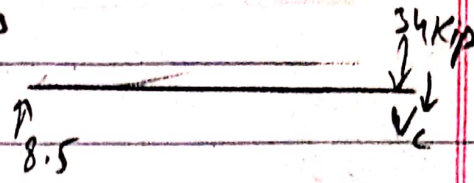
$$+\uparrow \sum F_y = 0$$

$$R_A - P - V_C = 0$$

$$14.875 - 34 - V_C = 0$$

$$V_C = -19.125$$

For $x = 12 \text{ ft}$



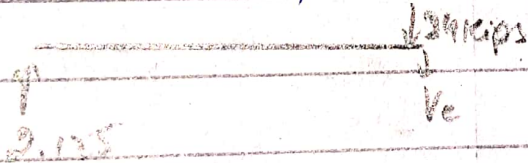
$$+\uparrow \sum F_y = 0$$

$$R_A - P - V_C = 0$$

$$8.5 - 34 - V_C = 0$$

$$V_C = +25.5$$

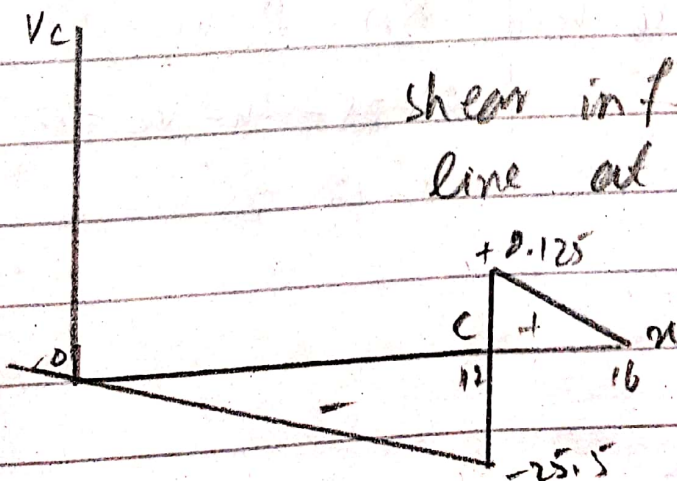
For $x = 15 \text{ ft}$ $V_C = ?$



$$+\uparrow \sum F_y = 0$$

$$R_A - P \Rightarrow R_A - V_C = 0 \Rightarrow 2.125 - V_C = 0$$

$$V_C = 2.125$$



shear influence
line at point "C"