"IQRA NATIONAL UNIVERSITY"

NAME : BASIT KHAN

ID : 7812

SEC : "A"

SUBJECT : STRUCTURE ANALYSIS – I

TEACHER : SIR, SAQIB KHAN

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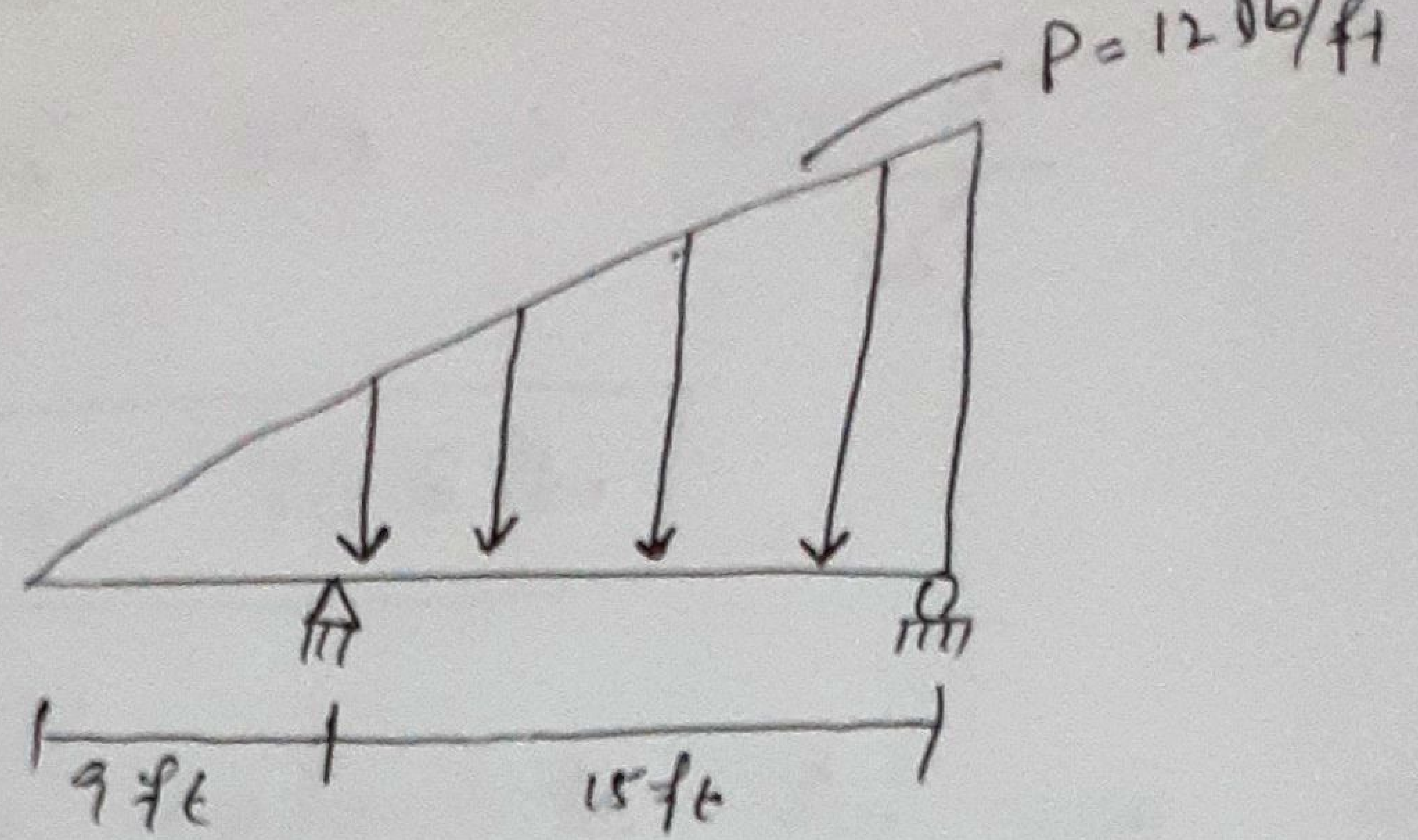
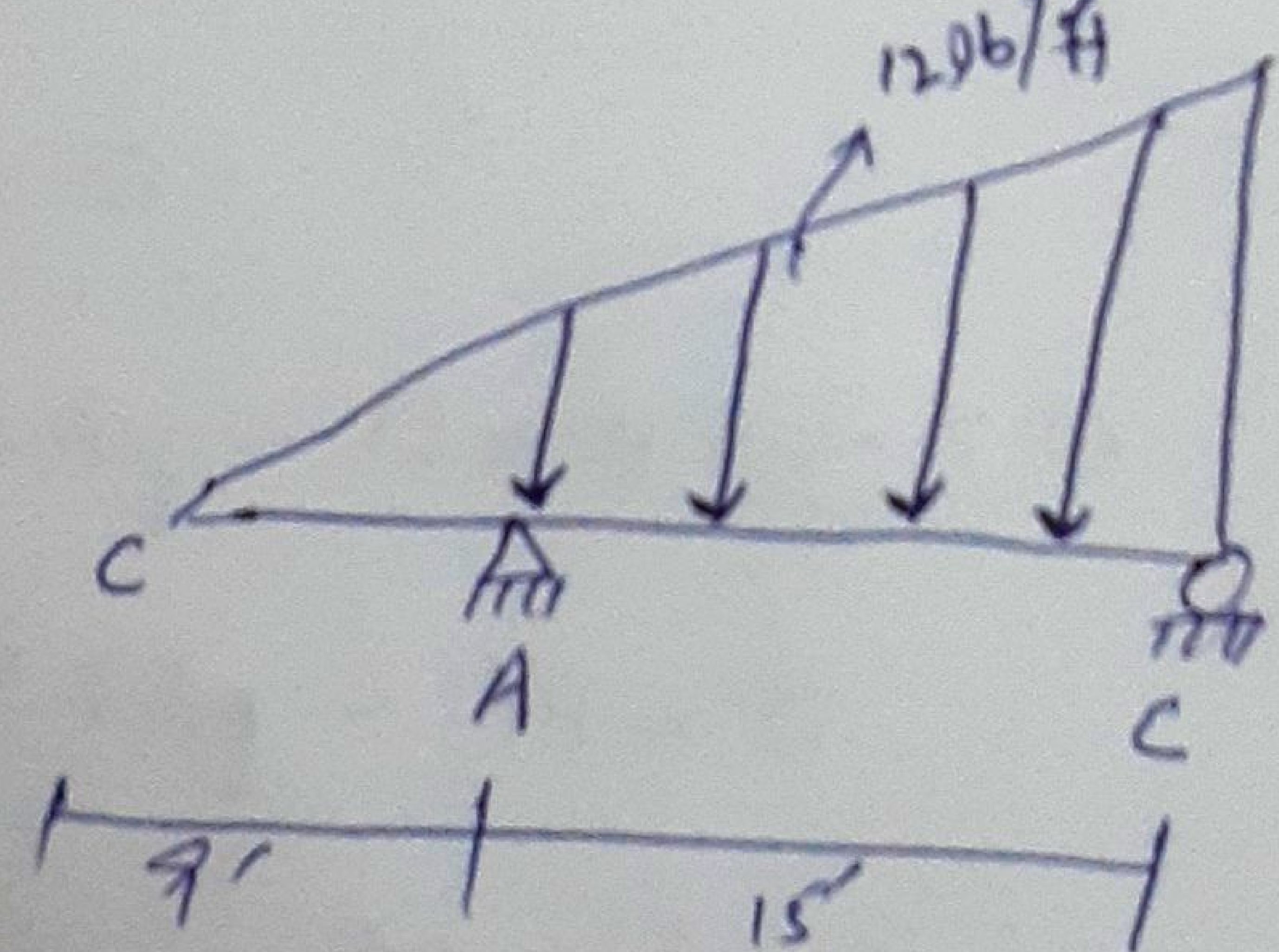
QNo: 1



Registration is 7812 and udl becomes 12 lb/ft

First to determine reactions



$\Sigma M @ A = 0$

Consider Anticlockwise moment +ve

Clockwise " −ve

$$B_y \times 15 - \frac{1}{2} \times 12 \times 24 \times \Big(\underbrace{\frac{h}{3} \text{ or } \frac{24}{3}}_{\text{Centroidal distance}} \Big) = 0$$

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$$By \times 15 - \frac{1}{2} \times 12 \times 24 \times 8 = 0$$

$$By \times 15 - 1152 = 0$$

$$By \times 15 = 1152 \Rightarrow \frac{By \times \cancel{15}}{\cancel{15}} = \frac{1152}{15}$$

$$\boxed{By = 76.8 \text{ lbs}}$$

Now to calculate Ay we will take equilibrium vertical forces condition

upward forces +ve (consideration)

Downward forces -ve

$$\Sigma fy = 0$$

$$By + Ay - 12 \times 24 \times \frac{1}{2} = 0$$

$$76.8 Ay - 144 = 0$$

$$Ay = 144 - 76.8$$

$$\boxed{Ay = 67.2 \text{ lbs}}$$

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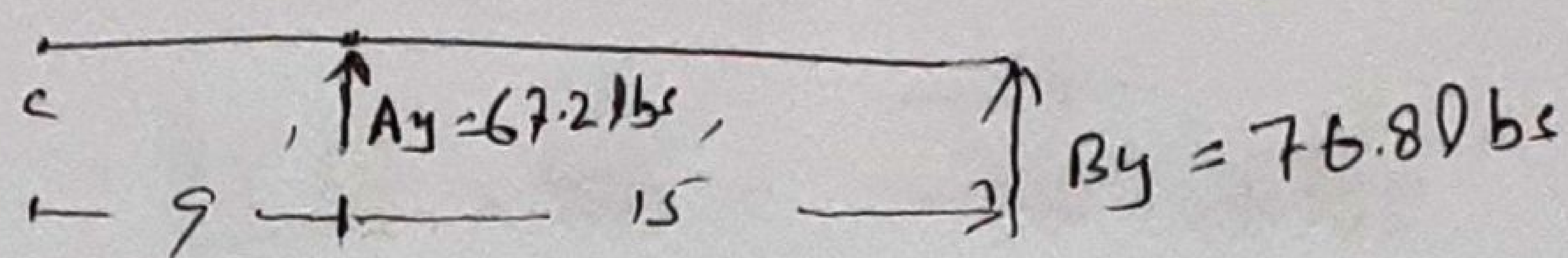
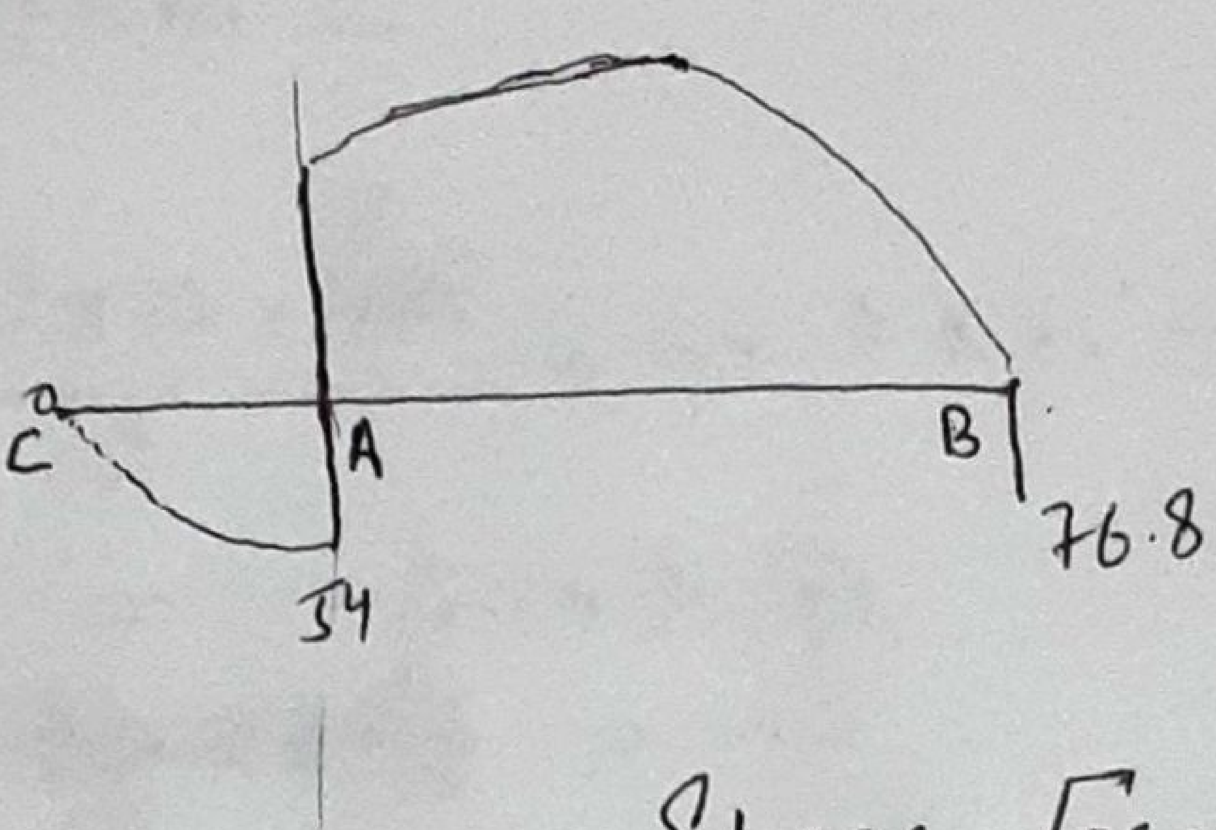
③





Shear force Diagram

Equation of Shear force

S.F from C to A

At $A = \frac{9 \times 12}{2} = 54$ lbs $\quad \uparrow^{+} \downarrow^{-}$

At $B = -54 + 67.2 - \frac{12 \times 15}{2} = 76.8$ lbs

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B.M at A from C

$$= -\frac{9\times 12}{2} \times \cancel{4}\,6 = \cancel{-648\ lb.ft}$$

$$= \boxed{-324\ lb\cdot ft}$$

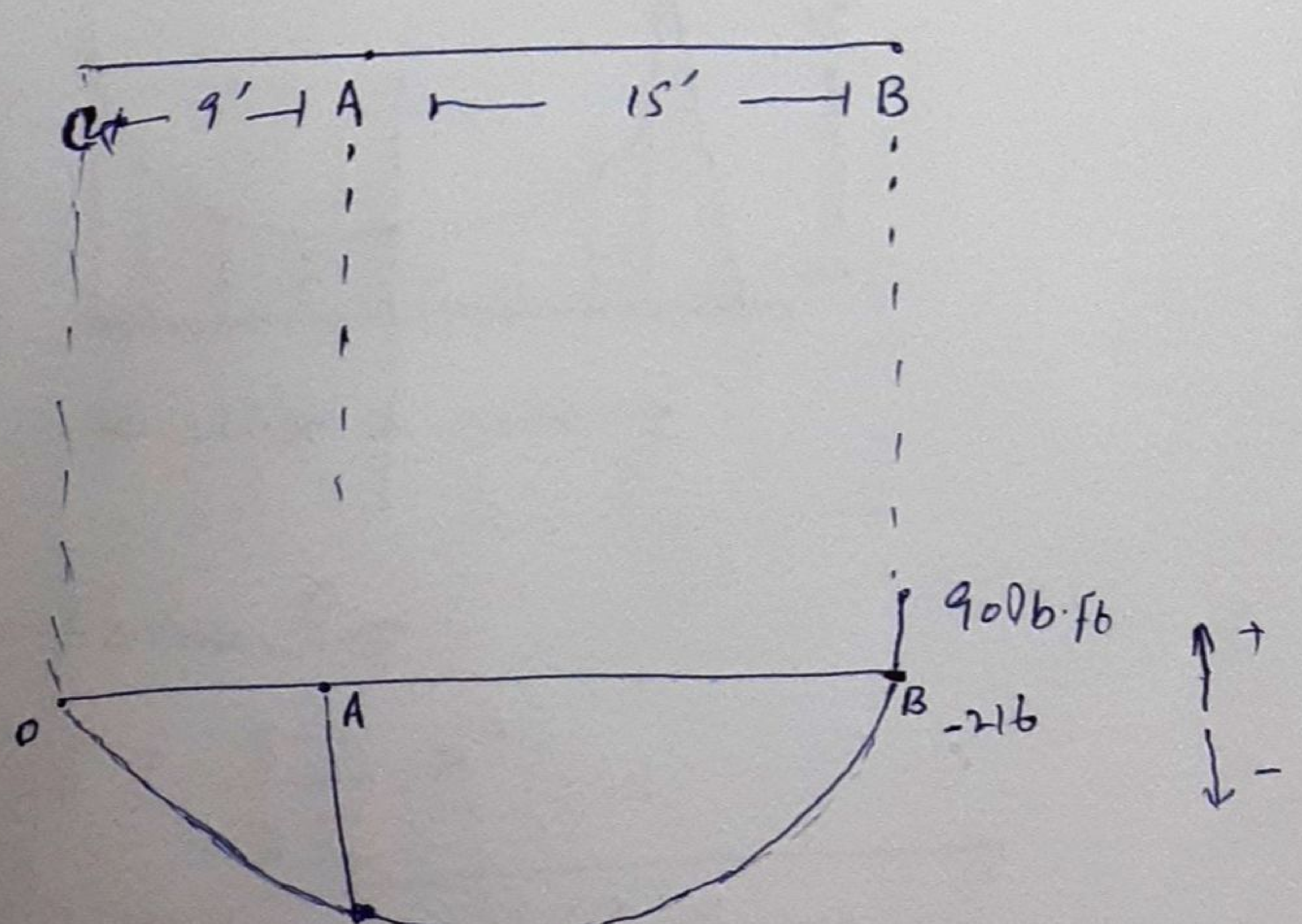
B.M at B from C

$$= \frac{-9\times 12\times \cancel{4}\,6}{2} + 67.2\times 15 - \frac{\cancel{9}\,15\times 12\times \cancel{7}\,10}{2}$$

$$= -216\ lb/ft$$

$$= \cancel{+90\ lb.ft} = \cancel{18}$$

"Bending Moment Diagram"



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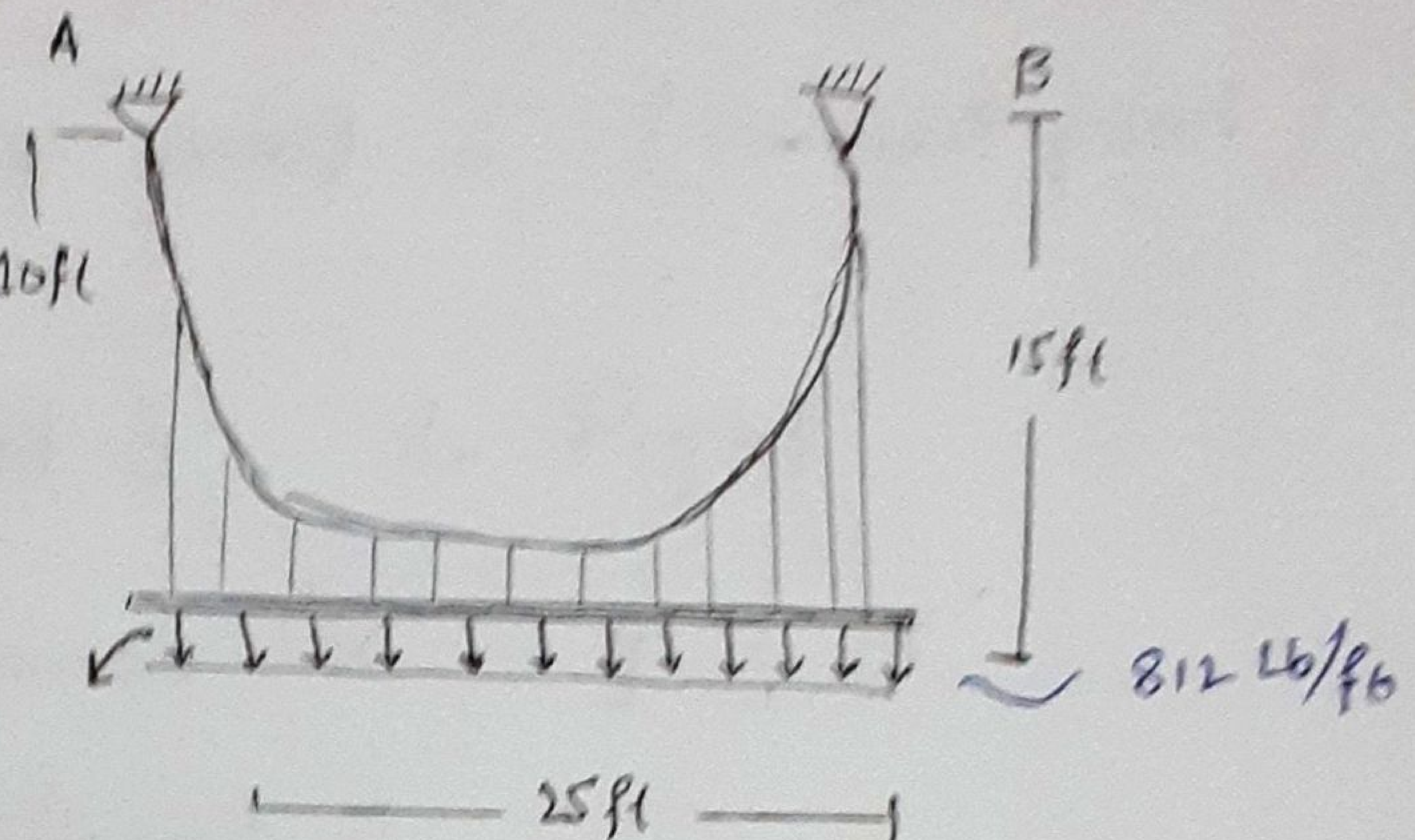
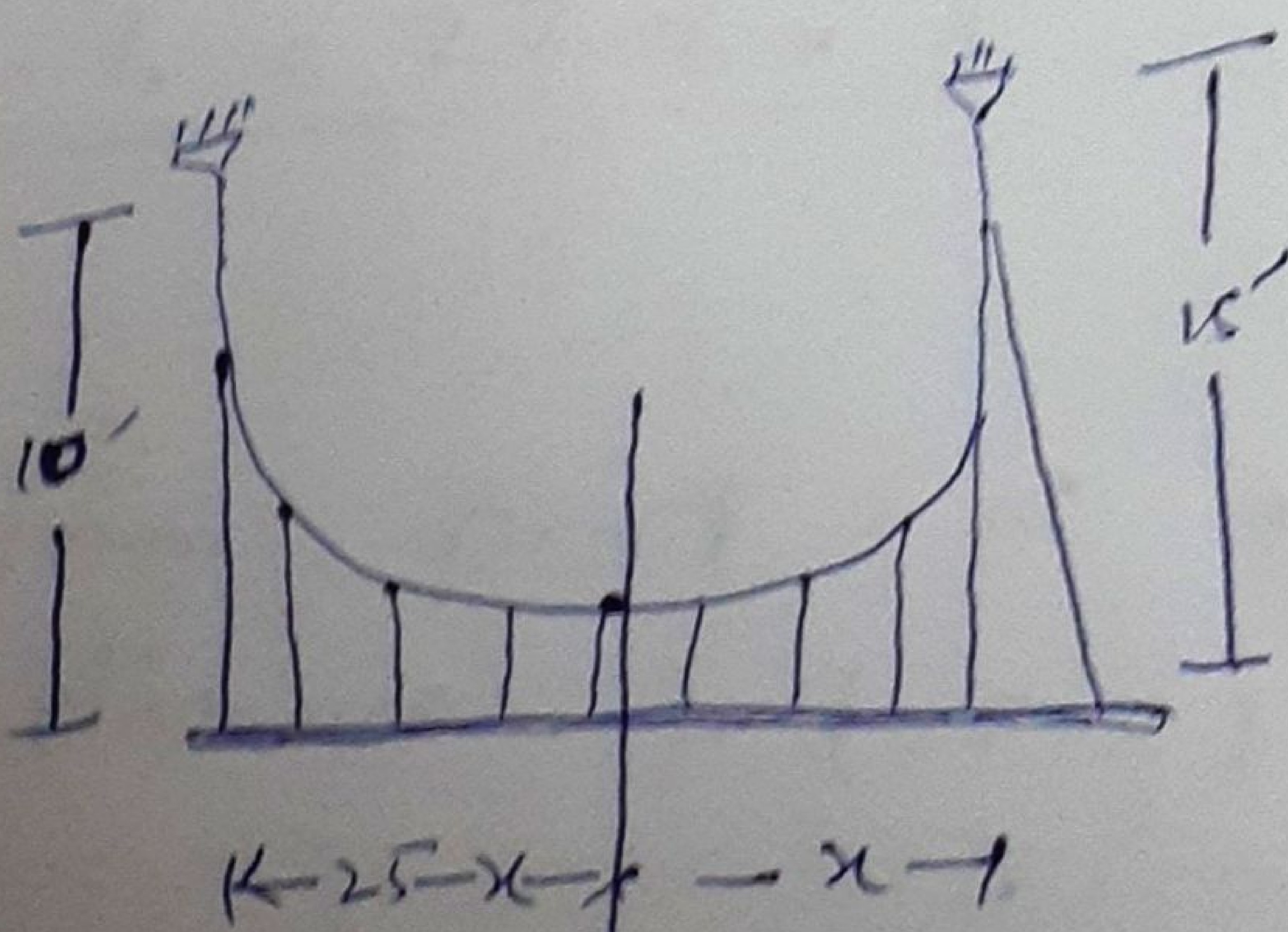
Q No: 02



Sol: Let Suppose we take a point "O" in the Cable which is the Lowest point, where Slope is zero.



Using Formula

$$y = \frac{812}{2T_0} x^2$$

$$\boxed{y = \frac{406}{T_0} x^2}$$

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Now Assume point C is Located at x distance from point "O" (Lowest point)

So,

From point "O" to Right

For distance "x" $y = 15'$

$$= y = \frac{406}{T_0} x^2 \quad \text{(1)}$$

$$15 = \frac{406}{T_0} x^2 \Rightarrow \boxed{T_0 = \frac{406}{15} x^2}$$

$$\boxed{T_0 = 27.06 x^2} \quad \text{— (2)}$$

Again

From point "O" to Left

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

$$\Rightarrow y = \frac{406}{T_0} x^2$$

$$10 = \frac{406}{T_0} - (25-x)^2$$

$$10 = \frac{406}{T_0} [-(25-x)]^2 \quad \text{— (3)}$$

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Comparing eq 1 & 3

$$\frac{406}{15}x^2 = \frac{406}{10}\left[-(25-x)\right]^2$$

Interchanging,

$$\frac{406}{406}x^2 = \frac{15}{10}(625 - 50x + x^2)$$

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

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

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

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

By solving

Using Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad a = 0.5, \quad b = -75 \quad c = 937.50$$

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

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

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

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$x = 75 \pm 61.24$

$= 75 - 61.24$

$$\boxed{x = 13.76\ 76} \quad \text{—} \ (4)$$

Now put the value of x in eq (2)

$T_0 = 27.06 \times (13.76)^2$

$$\boxed{T_0 = 5123.47 \text{ Lbs}}$$

Now we have to find the tension at given point by using Formula,

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

$y = \frac{406}{T_0} x^2$

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

$\frac{dy}{dx} = \frac{d}{dx}\left(\frac{406}{T_0} x^2\right)$

$= \frac{406}{T_0} . 2(x)$

$\frac{dy}{dx} = \frac{812}{T_0} x$ — (a)

Also $\frac{dy}{dx} = \tan\theta$ — (b)

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so

$$\boxed{\tan\theta = \frac{812}{T_0} x}$$

As point (A) is -11.24 away from "O"

So

$$\tan\theta_A = \frac{812}{5123.47}(-11.24)$$

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

$$\boxed{\theta_A = -60.67^\circ}$$

Now, Tension at point A is,

$$T_A = \frac{T_0}{\cos\theta_A} \qquad \text{As } \left(\cos\theta = \frac{T_0}{T_A}\right)$$

$$T_A = \frac{5123.47}{\cos(-60.67^\circ)} = 10673.89 \text{ lbs}$$

$$= 10.67 \text{ kips}$$

⟹ Now point "B" where $x = 13.76$ ft

$$\tan\theta_B = \frac{812}{T_0}(13.76)$$

$$= \frac{812}{5123.47}(13.76)$$

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

$$\boxed{\theta_B = ~~2.18~~ \; 65.35^\circ}$$

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Now Tension at "c"

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

$$T_c = \frac{5123.47}{\cos(65.35)} = 12284.316 \text{ lbs}$$

$$\boxed{T_c = 12.28 \text{kips}}$$

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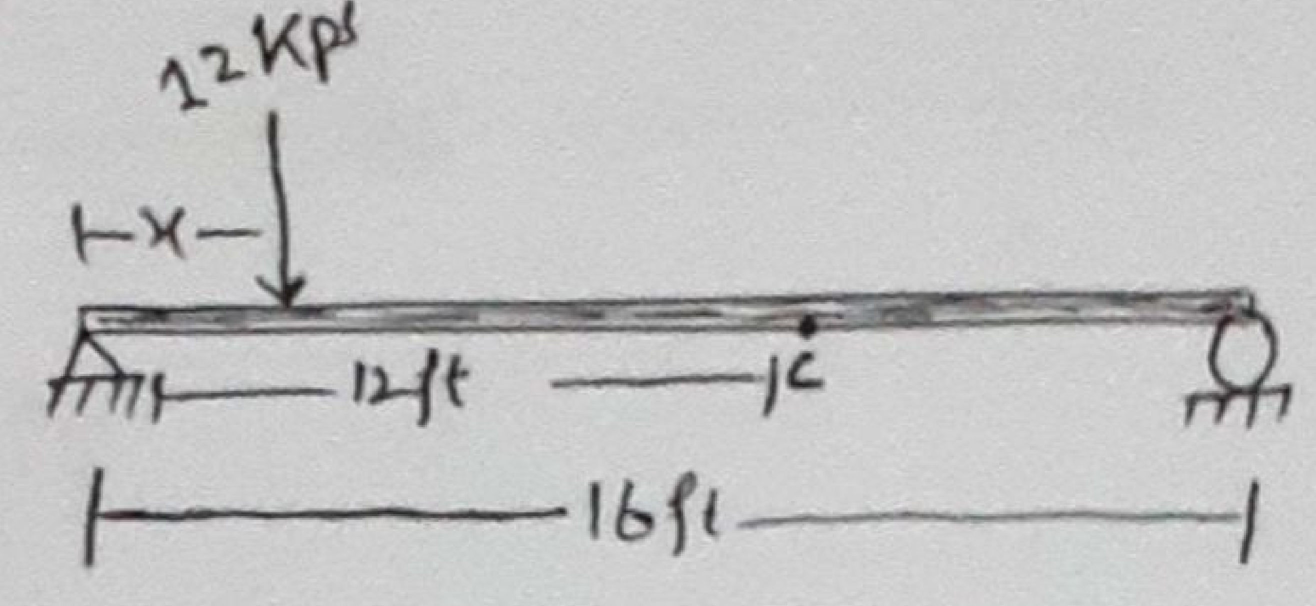
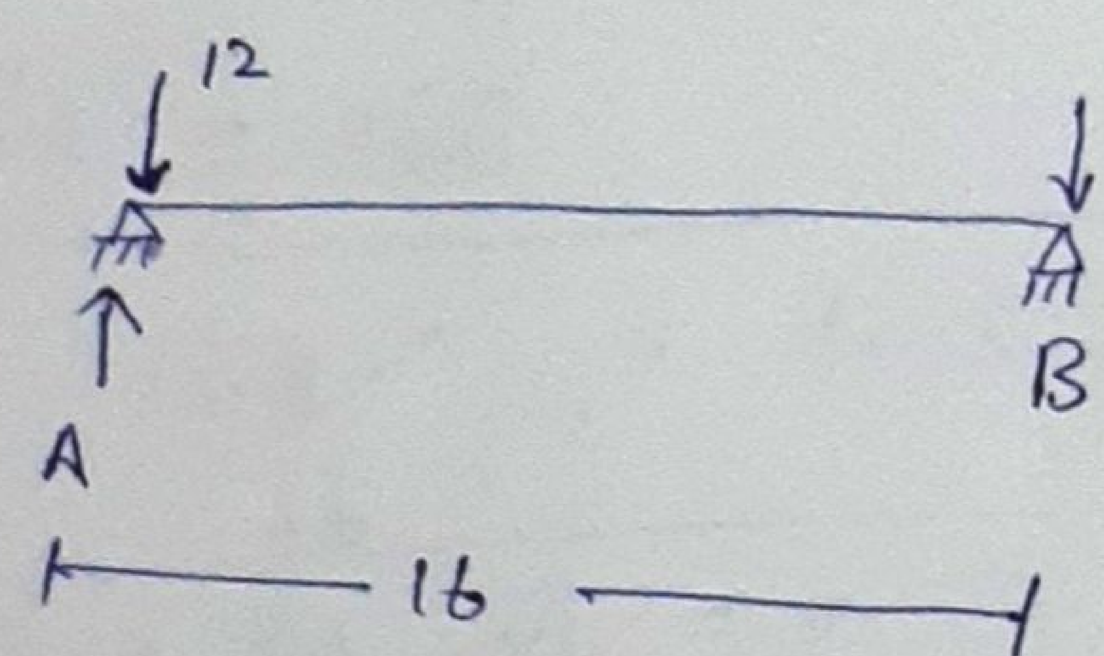
Q NO: 03

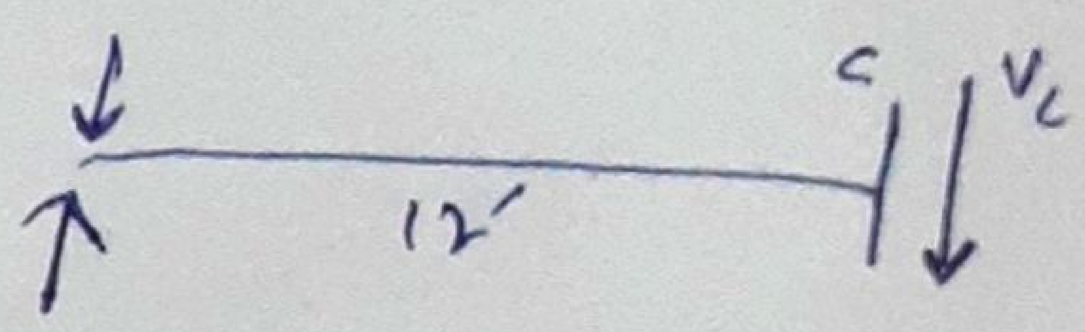


Infulance at "C" and "A"

$P = 12$

For $x = 0$ $R_A = ?$





$\Sigma M_B = 0$ (+)

$-(12 \times 16) + P_A(16) = 0$

$-192 + 16R_A = 0$

$16RA = 192$

$RA = \frac{192}{16} = 12\,K$

$\boxed{-12 + RA - Vc = 0}$

$-12 + 12 - Vc = 0$

$Vc = 0$

For $x = 2ft$ $RA = ?$

(1)

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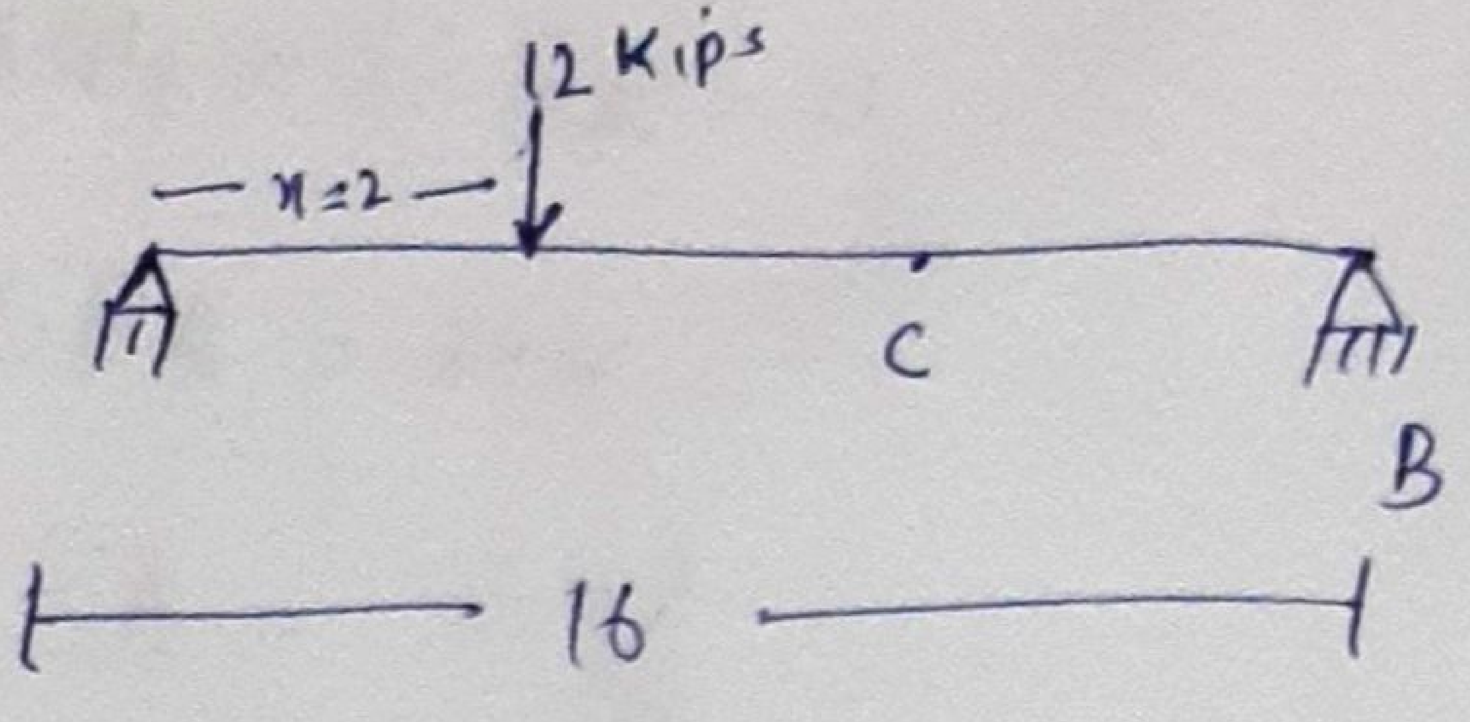


$16-2=14$

$\Sigma M_B = 0$ +)

$(12\times14) + R_A\times16 = 0$

$-168 + 16R_A = 0$

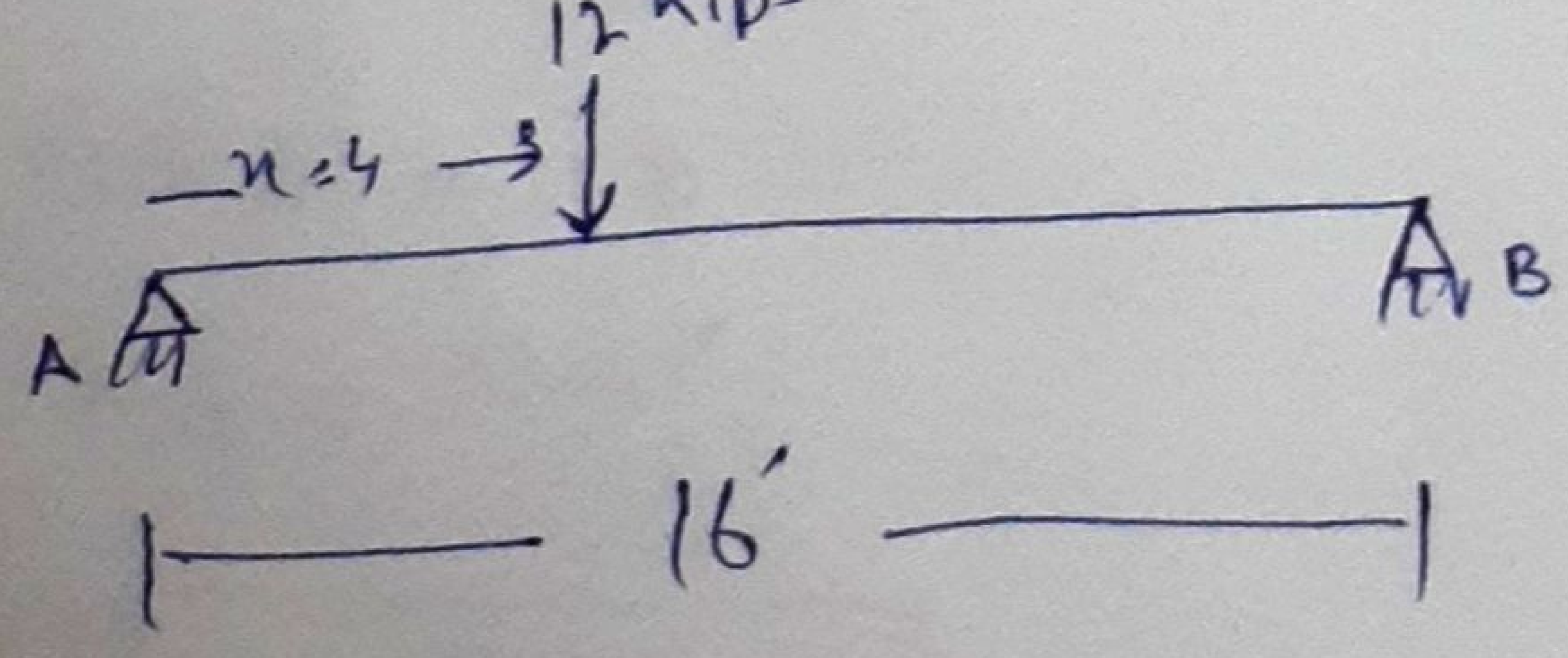
$16R_A = 168$

$$\boxed{R_A = \frac{168}{16} = 10.5\ K}$$

$-12 + R_A - V_C = 0$

$V_C = -12 + 10.5 = -1.5\ K$

Now $x = 4$



$16-4=12$

$\Sigma M_B = 0$ +)

$(-12\times12) + (R_A\times16) = 0$

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$$-144 + 16RA = 0$$

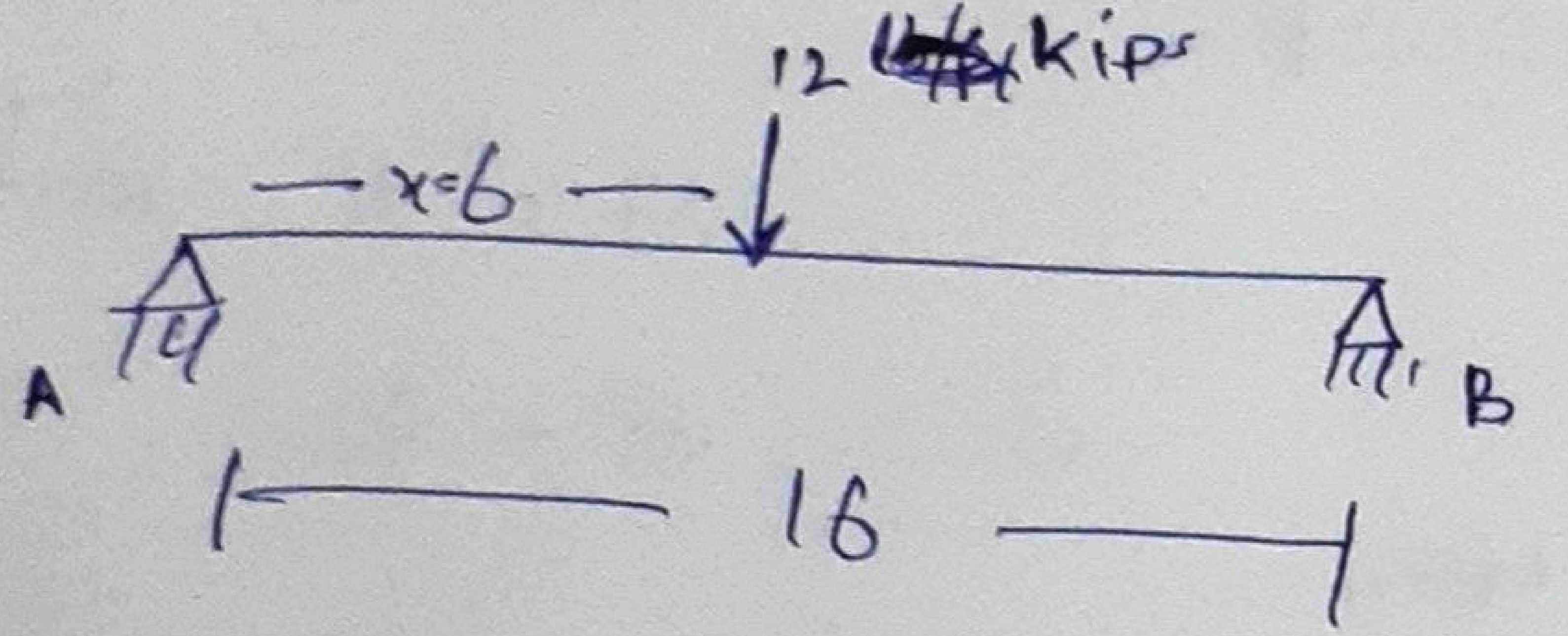
$$16RA = 144$$

$$RA = 144/16$$

$$\boxed{R_A = 9k}$$

$-12 + RA - Vc = 0$ $\quad Vc = -3K$

$x = 6$



$\Sigma M_B = 0$ +) $\quad 16 - 6 = 10'$

$$-(12 \times 10) + RA \times 16 = 0$$

$$-120 + 16RA = 0$$

$$16RA = 120$$

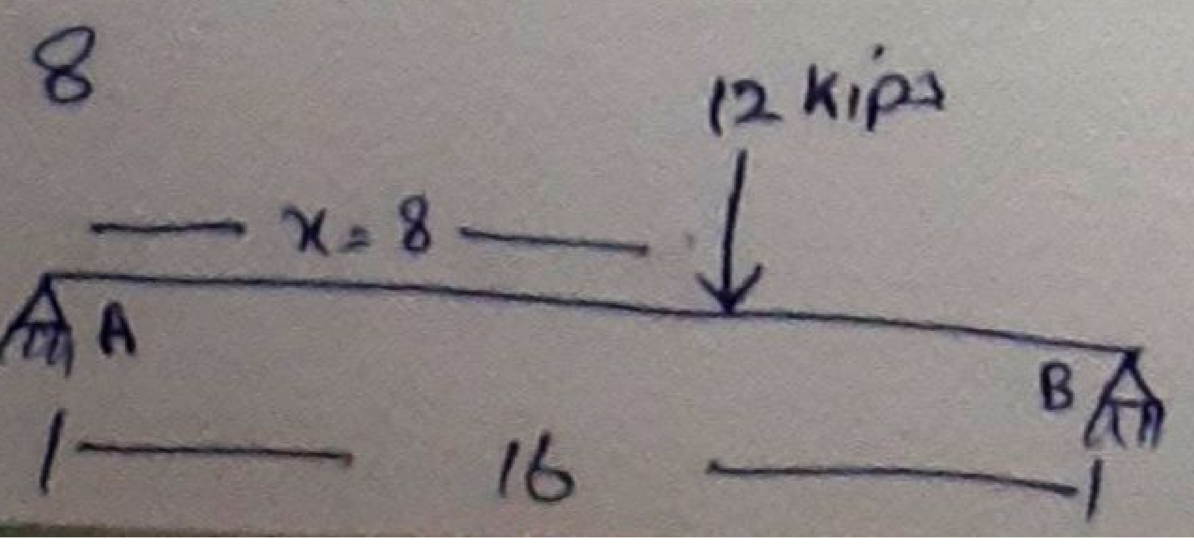
$$RA = 120/16$$

$$\boxed{R_A = 7.5k}$$

$-12 + RA - Vc = 0$ $\quad Vc = -12 + 7.5 \Rightarrow -4.5$

For, $x = 8$

$16 - 8 = 8$



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$\Sigma M_B = 0$ ↻+

$(-12 \times 8) + 16 RA = 0$

$-96 + 16 RA = 0$

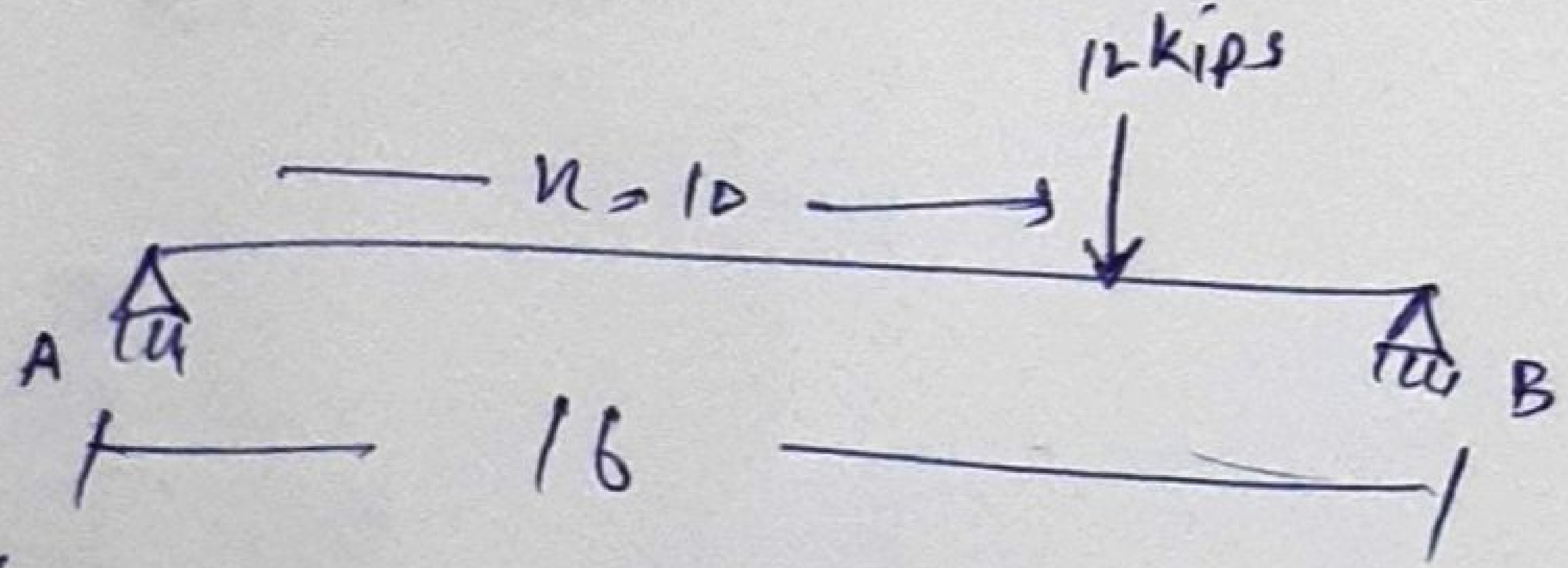
$RA = \frac{96}{16}$

$\boxed{RA = 6k}$

$-12 + RA - V_C = 0$ $\boxed{V_C = -6}$

For $x = 10$

$16 - 10 = 6$



$\Sigma M_B = 0$

$(-12 \times 6) + RA \times 16 = 0$

$-72 + 16 RA = 0$

$RA = 72/16$

$\boxed{RA = 4.5k}$

$-12 + RA - V_C = 0$ $\boxed{V_C = -7.5k}$

For $x = 16$

$16 - 6 = 0$

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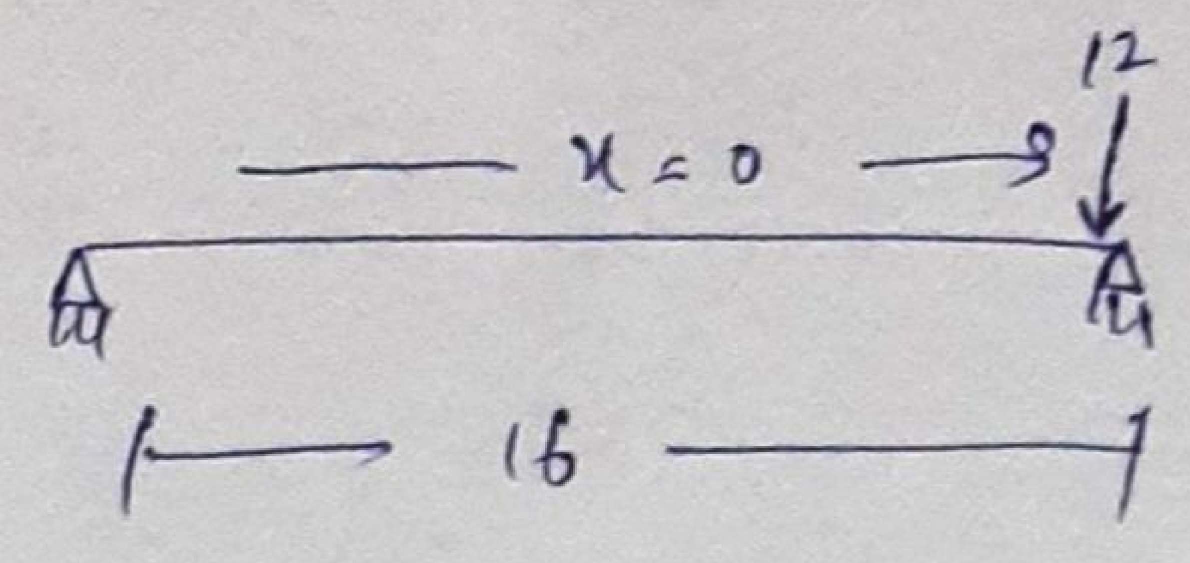


$\Sigma M_B = 0$

$(-12 \times 0) + (16 \times R_A) = 0$

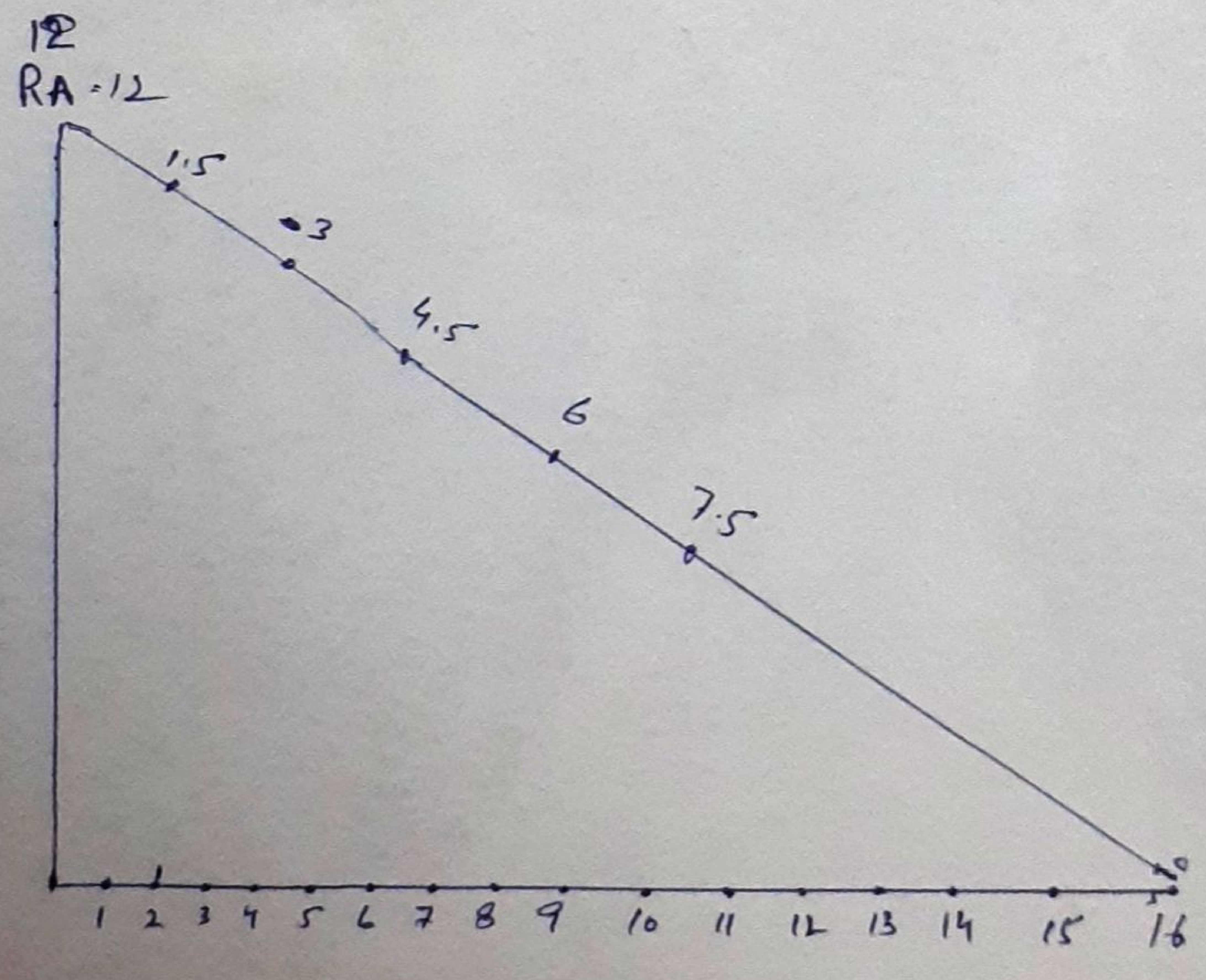
$0 + 16 R_A = 0$

$16 R_A = 0$

$\boxed{R_A = 0k}$

$-12 + R_A - V_C = 0$

$\boxed{V_C = 0}$



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