P# 08

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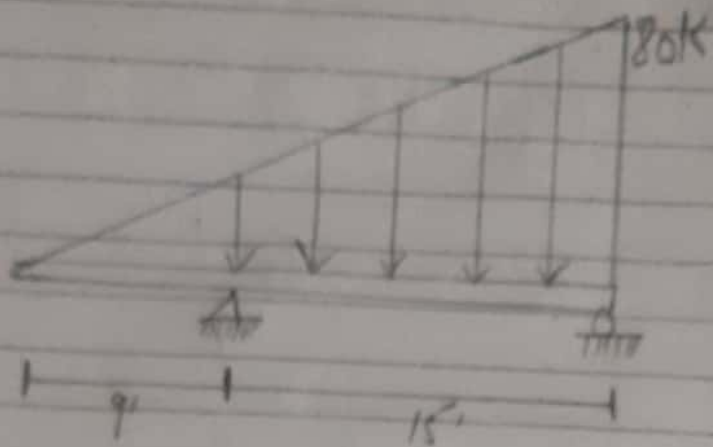
Subject : Structure analysis - I

Date : 26/9/2020

P#01

Q 1



Solution:.

$$\Sigma M_B = 0 \; (+\circlearrowright)$$

$$\frac{1}{2} \times 86 \times 24 \times \frac{1}{3} \times 24 = R_A \times 15$$

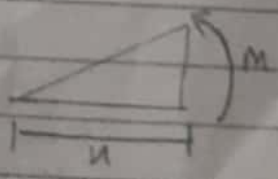
$$R_A = 550.4$$

$$\Sigma F_y = 0 \uparrow$$

$$R_A + R_B = \frac{1}{2} \times 86 \times 24$$

$$R_B = 481.6$$

Now, Section (i) - (i)



For x,

$$\frac{y}{x} = \frac{86}{24}$$

$$y = \left(\frac{86}{24}\right) x$$

P#02

$S_o = \Sigma F_y = 0 \uparrow +$

$-\frac{1}{2} \times x_c \left(\frac{86}{24}\right) x - V_C = 0$

$Y_C = \frac{-86x^2}{48}$

at, $x = 0$

$V_C = 0$

at, $x = 9$

$y_C = 13.5$

$M = -\frac{1}{2} \times x \times \frac{86}{24} x \times \frac{1}{3} x$

$M = -\frac{86}{144}$

at, $x = 0$

$M = 0$

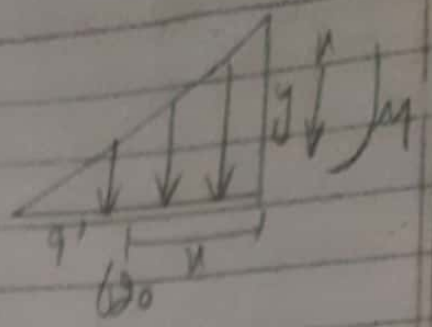
at, $x = 9$

$M = 40.5$

Now for Section ② - ②

P4+03

For y



$$\frac{y}{x+9} = \frac{86}{24}$$

$$y = \frac{86}{24}(x+9)$$

So, $\Sigma F_y = 0 \uparrow$

$$550.4 - \frac{1}{2}(x+9)\left(\frac{86}{24}\right)(x+9) - Vc = 0$$

$$V = 550.4 - \frac{97 \times (x+9)^2}{48}$$

at, $x = 0$

$Vc = 377$

at $x = 15$

$Vc = -481.613$

$$M + \frac{1}{2}(x+9)\left(\frac{86}{24}\right)(x+9)\frac{1}{3}(x+9) - 550.4x = 0$$

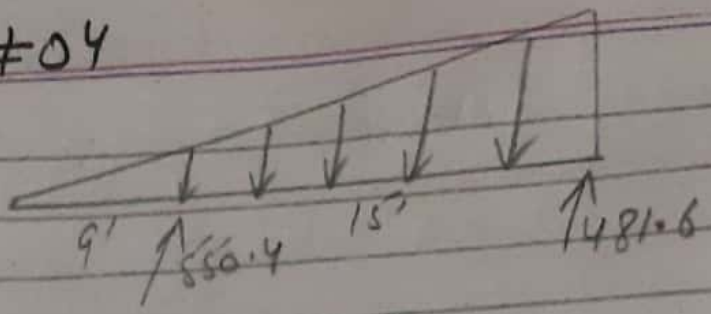
$$M = 550.4 - \frac{86(x+9)^3}{144}$$

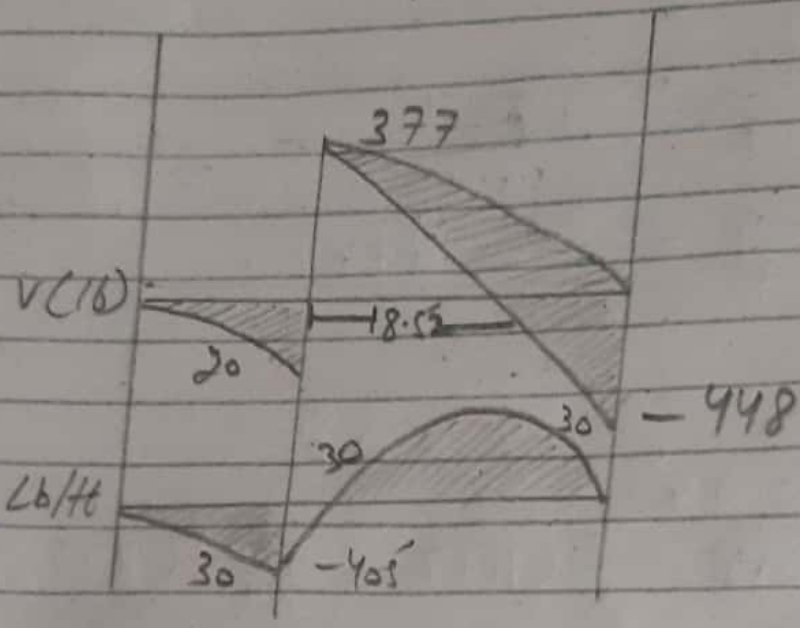
at $x = 0$

$M = -405$

at, $x = 15 \Rightarrow M = 0$

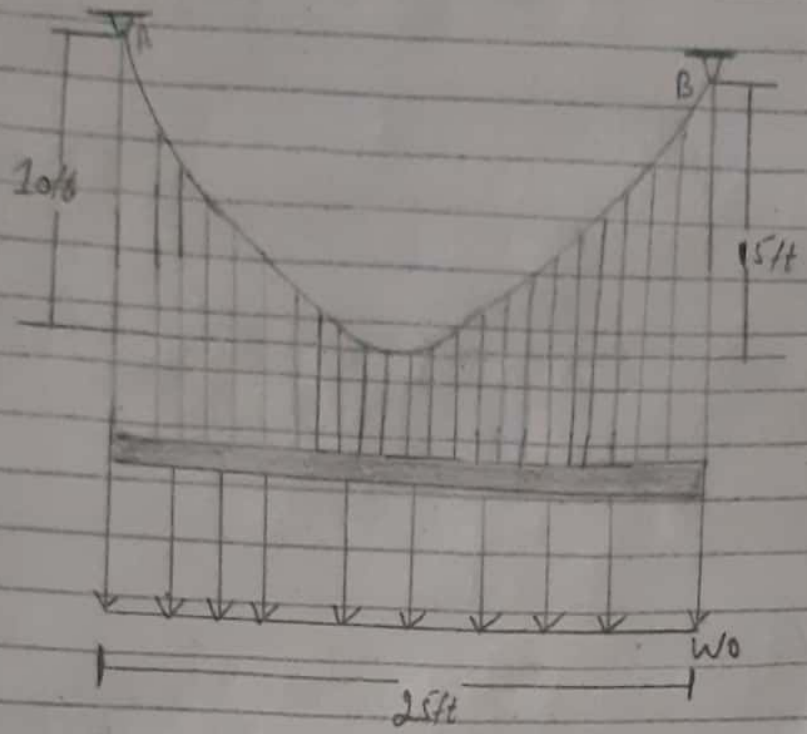
P#04



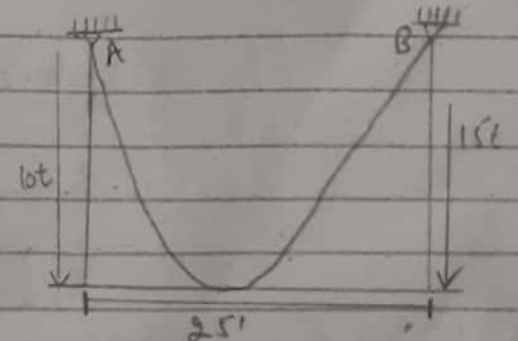


P#05

Q 2



Solution:-



$W_o = 886$

$$y = \frac{W_o}{2FH} x^2$$

$$15 = \frac{886}{2FH} (25 - x)^2$$

$$\frac{886}{2(15)} x^2 = \frac{886}{2(10)} (20 - x)^2$$

$$\frac{886}{30} x^2 = \frac{886}{20} \left[(25)^2 + x^2 - 2(25)(x) \right]$$

$$\frac{x^2}{30} = \frac{1}{20} (625 + x^2 - 50x)$$

P#06

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

$0.5x^2 - 75x + 937 - 50 = 0$

Choose root < 25 ft

$x = 13.76$ ft

∴ By Quadratic formula we get ($x = 13.76$ ft)

$F_H = \frac{W_o}{2y} x^2 = \frac{886}{2(15)} (13.76)^2 =$

$F_H = 5591.770$

At (B):.

$Y = \frac{W_o}{2y} x^2 = \frac{886}{2(5591.770)} x^2$

$\frac{dy}{dx} = \tan\theta_B = 0.0792(x^2)$

$= 0.0792(13.76\text{ft})$

$= \boxed{1.089}$

We have;

$\tan\theta_B = 1.089$

$\theta_B = \tan^{-1}(1.089)$

$\boxed{\theta_B = 47.439^\circ}$

P#07

Tension at B;

$$T_B = \frac{F_H}{\cos \theta_B} = \frac{5591.770}{\cos(47.439°)}$$

$$T_B = 8267.26 \text{ lb} = \boxed{8.26726 \text{ kip}}$$

At (A):-

$$y = \frac{w_0}{2F_H} x^2 = \frac{886}{2(5591.770)} x^2$$

$$= \frac{886}{2(5591.770)} (25 - x)^2$$

$$= \frac{886}{2(5591.770)} (25 - 13.76)^2$$

$$\boxed{x = 10.0089}$$

$$dy/dx = \tan \theta_B = 10.0089$$

$$\theta_A = \tan^{-1}(10.0089) \Rightarrow \theta_A = 89.294$$

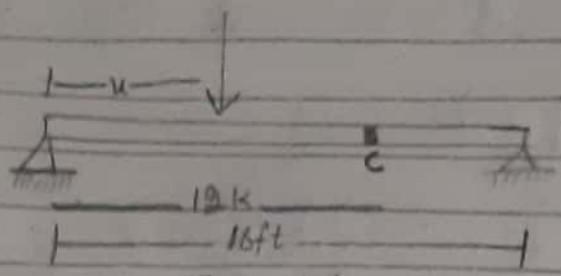
Now,

$$T_A = \frac{F_H}{\cos \theta_A} = \frac{5591.770}{\cos(89.294)} = 453814.34 \text{ lb}$$

$$\boxed{T_A = 453.81434}$$

P#09

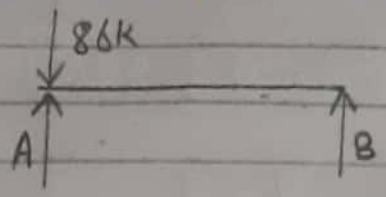
Q 3



P = 86

Solution:-

For, x = 0 RA = ?



$+\circlearrowright \Sigma MB = 0$

$(86 \times 16) - RA(16) = 0$

$1376 - RA(16) = 0$

$\frac{RA(16)}{16} = \frac{1376}{16}$

$\boxed{RA = 86}$

For, x = 1ft RA = ?

$+\circlearrowright \Sigma MB = 0$

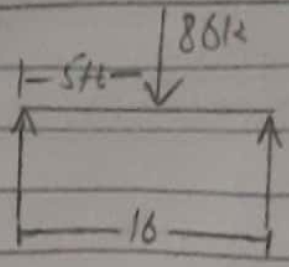
$(86 \times 15) - RA(16) = 0$

$1290 - RA(16) = 0$

$\frac{RA(16)}{16} = \frac{1290}{16} \Rightarrow \boxed{RA = 80.625}$

P#10

For, x = 5 RA = ?



$+\circlearrowright \sum MB = 0$

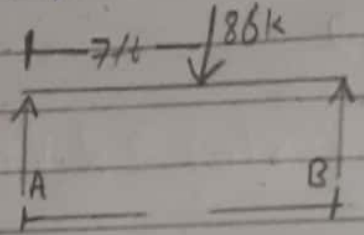
$(86 \times 5) - RA(16) = 0$

$430 - RA(16) = 0$

$\frac{RA(16)}{16} = \frac{430}{16}$

$\boxed{RA = 26.875}$

Pub, x = 7 RA = ?



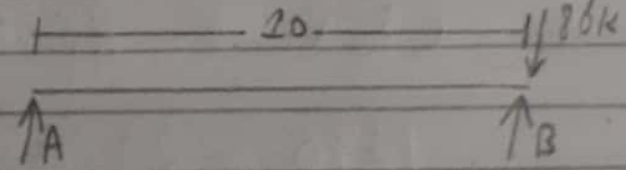
$+\circlearrowright \sum MB = 0$

$(86 \times 7) - RA(16) = 0$

$602 - RA(16) = 0$

$\frac{RA(16)}{16} = \frac{602}{16}$

$\boxed{RA = 37.625}$



P#11

$-RA(16) + 86(0) = 0$

$\boxed{RA = 0}$

$RA_1 = 86$

$RA_2 = 80.625$

$RA_3 = 26.875$

$RA_4 = 37.625$

$RA_5 = 0$