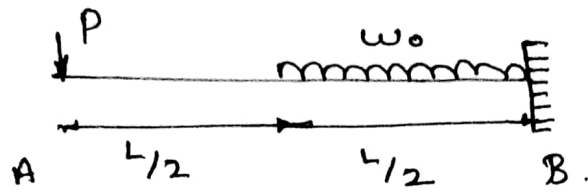
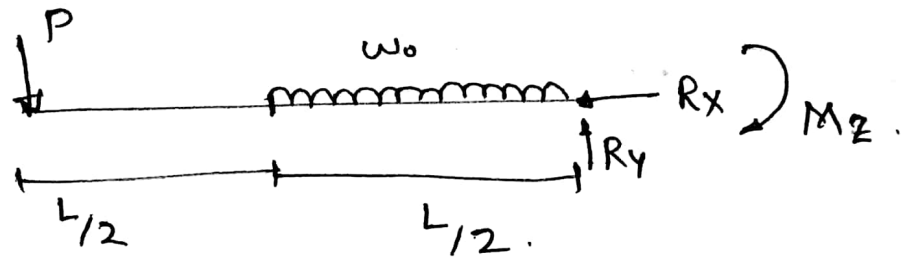


# ASSIGNMENT 8.

Q. 1, 2



FBD.



$$\sum F_y = 0 \text{ gives.}$$

$$P + \frac{w_0 L}{2} - R_y = 0$$

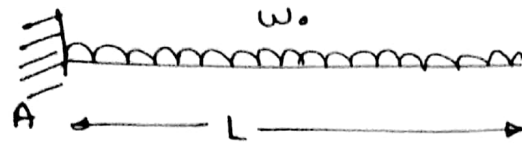
$$\therefore R_y = P + \frac{w_0 L}{2}$$

$$\sum M_B = 0$$

$$P + w_0 \times \frac{L}{2} \times \frac{1}{2} \times \frac{L}{2} = M_z$$

$$\therefore M_z = P + \frac{w_0 L^2}{8} \quad [\text{Hogging}]$$

Q. 3.



$$R_A = wL$$

$$M_A = \frac{wL^2}{2} \text{ [Hogging]}.$$

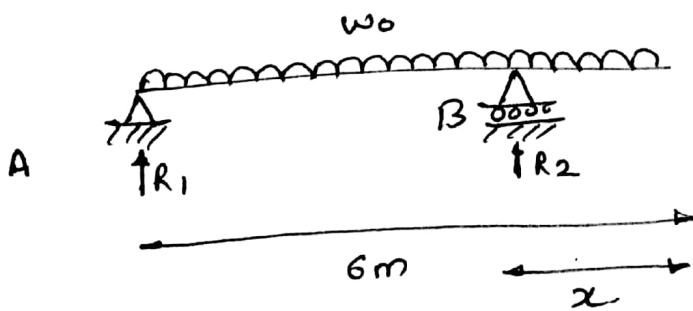
$$S.F._{L/2} = R_A - wx$$

$$x = L/2$$

$$= R_A - \frac{wL}{2} = wL - \frac{wL}{2} = \frac{wL}{2}$$

$$M_{L/2} = w \times \frac{L}{2} \times \frac{1}{2} \times \frac{L}{2} = \frac{wL^2}{8}$$

Q. 4



Let  $x$  be the distance where the other support is to be fixed.

$$\sum M_A$$

$$R_2 \times (6-x) - \frac{w \times 6^2}{2} = 0$$

$$R_2 = \frac{18w_0}{6-x}$$

$$\sum F_y$$

$$R_1 + R_2 = 6w_0$$

$$\therefore R_1 = 6\omega_0 - \frac{18\omega_0}{6-x}$$

$$R_1 = \frac{18\omega_0 - 6\omega_0 x}{6-x}$$

Now moment at 1.8m from other end of plank is zero

$$\sum M_{A.2} = 0$$

$$\therefore R_1 \times 4.2 - \frac{\omega_0 \times 4.2^2}{2} = 0$$

$$\therefore \frac{18\omega_0 - 6\omega_0 x}{6-x} - \frac{\omega_0 \times 4.2^2}{2} = 0$$

Solving we get

$$\underline{\underline{x = 1.385m}}$$

5, 6, 7, 8.

$\sum M_A = 0$  gives.

$$400 \times 0.15 - R_{BY} \times 0.4 = 0$$

$$R_{BY} = 150N \text{ [Upward]}$$

$\sum F_y = 0$  gives.

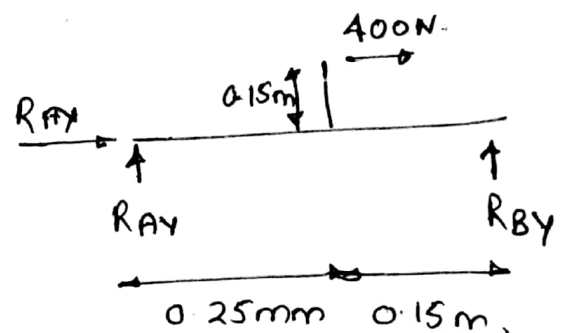
$$R_{AY} + R_{BY} = 0$$

$$R_{AY} = -150N. = 150N \text{ [Downward]}$$

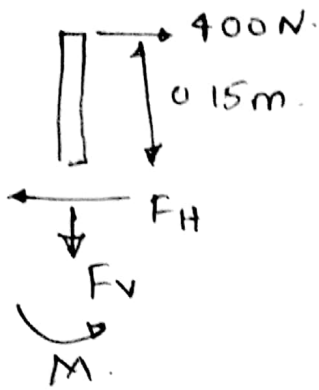
$$\sum F_x = 0$$

$$R_{AX} + 400 = 0 \quad ; \quad R_{AX} = -400N$$

$$R_{AX} = 400N \text{ [Left]}.$$



At Section 1.



$$\sum F_y = 0 \text{ gives}$$

$$F_V = 0$$

$$\sum F_x = 0$$

$$F_H - 400 = 0$$

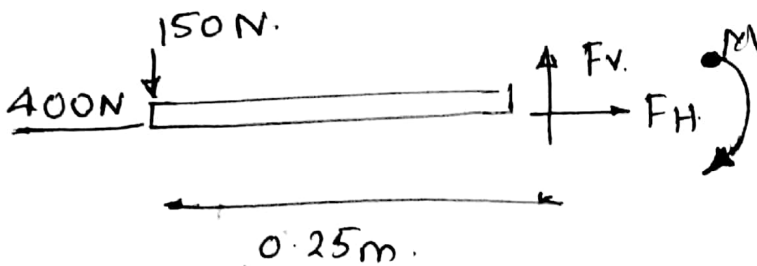
$$\therefore F_H = 400 \text{ N}$$

$$\sum M = 0$$

$$M - 400 \times 0.15 = 0$$

$$M = 60 \text{ Nm [counterclockwise]}$$

At Section 2



$$\sum F_y = 0$$

$$F_V = 150 \text{ N}$$

$$\sum F_x = 0$$

$$F_H = 400 \text{ N}$$

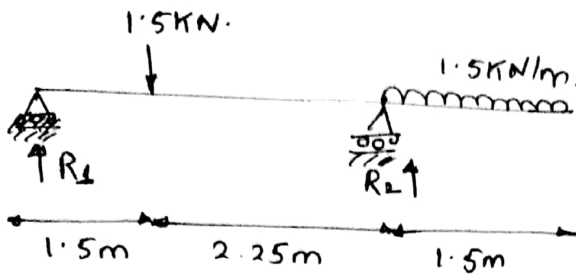
$$\sum M = 0$$

$$150 \times 0.25 - M = 0$$

$$M = 150 \times 0.25$$

$$= 37.5 \text{ [clockwise]}$$

Q. 9, 10, 11



$\sum M_1 = 0$  gives.

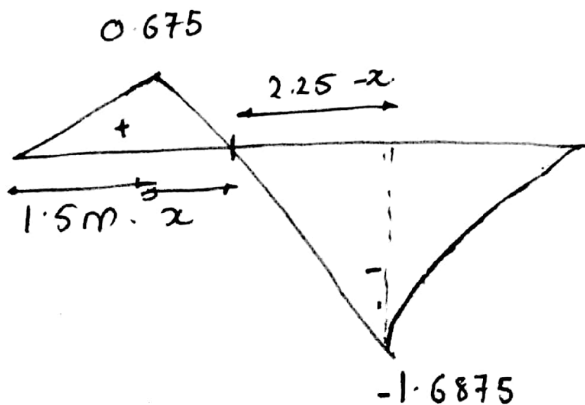
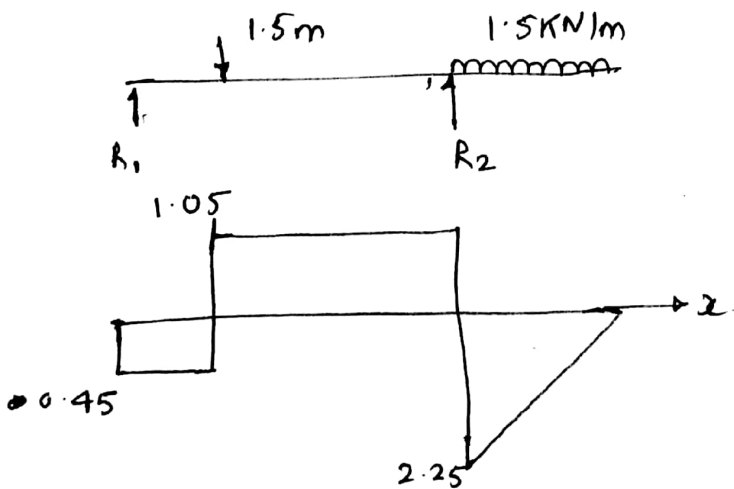
$$1.5 \times 1.5 + 1.5 \times 1.5 \times \left(1.5 + 2.25 + \frac{1.5}{2}\right) - R_2 \times (1.5 + 2.25) = 0$$

$$R_2 = 3.3 \uparrow \text{ kN}$$

$\sum F_y = 0$

$$R_1 + R_2 - 1.5 - 1.5^2 = 0$$

$$R_1 = 0.45 \text{ kN}$$



Max Sagging Moment =

$$0.45 \times 1.5 = 0.675 \text{ kN-m}$$

Max Hogging Moment =

$$1.5 \times \frac{1.5^2}{2} = 1.6875 \text{ kN-m}$$

$$\frac{0.675}{x} = \frac{1.6875}{2.25 - x}$$

$$\frac{2.25 - 1}{x} = \frac{1.6875}{0.675}$$

$$x = 0.643$$

Distance from hinged end.

$$= 1.5 + 0.643$$

$$= \underline{\underline{2.143 \text{ m}}}$$