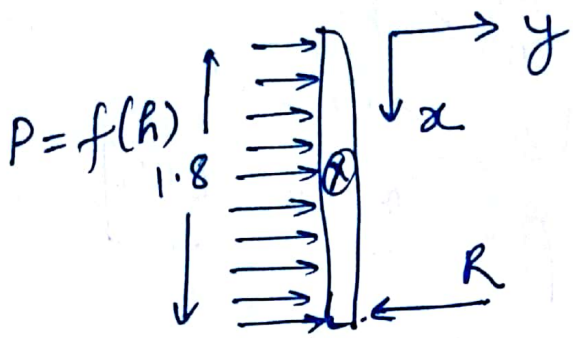
Quiz-5

Que-1 FBD of Wooden dam. (Height 1.8m).



Symmetric Section
Half of the total load will be shared by the each uprights (Vertical).

Take small element of force acting over the uprights.

$$dF = \rho g x\, dx \times W = V_x$$

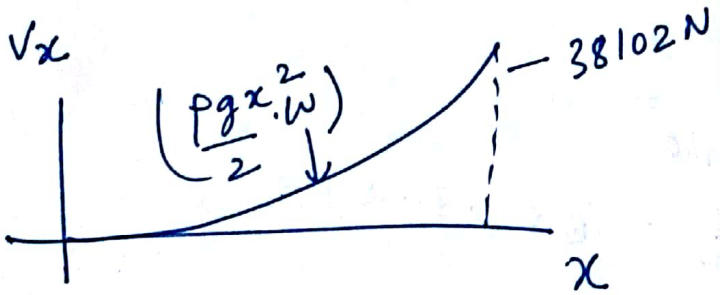
$$F = \frac{\rho g x^2}{2} \cdot W = V_x$$

Bending moment -

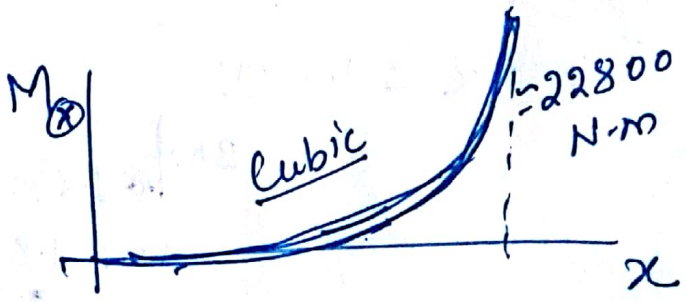
$$\int_0^M dM = \int dF.dx = \int \frac{\rho g \cdot x^2}{2} \cdot W\, dx$$

$$\boxed{M = \frac{\rho g x^3}{6} \cdot W}$$

Shear force Diagram.

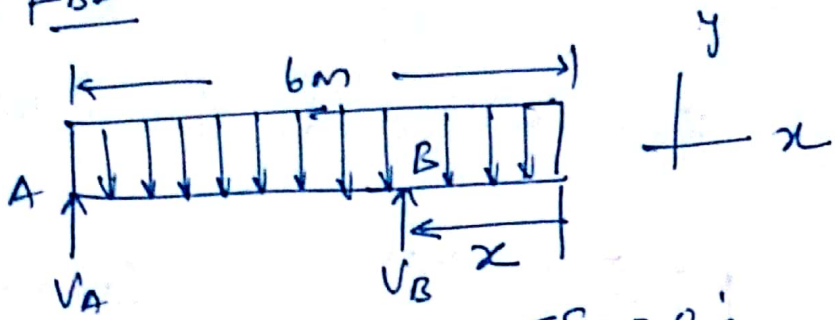


Bending moment Diagram



Que-2

FBD:



in 2D; $\Sigma F_x = 0$; $\Sigma F_y = 0$; $\Sigma M_{xy} = 0$;

$\Sigma F_x = 0$;

$$V_A + V_B = 6W_0$$

Take moment about point (A)

$$-V_B(6-x) + 6W_0 \times 3 = 0;$$

$$V_B = \frac{18W_0}{6-x}$$

$$V_A = 6W_0 - \frac{18W_0}{6-x} = \frac{36W_0 - 6W_0x - 18W_0}{6-x}$$

$$V_A = \frac{18W_0 - 6W_0x}{6-x} = \frac{6W_0(3-x)}{(6-x)}$$

Cutting @ the point, where the bending moment is zero;

Cross check put $x = 1$, $x = 2$, ..

Case I

if $x < 1.8$ m:

$$BM\big|_{@\ 1.8 \text{ from right}} = 0$$

$$W_0 \times \left(\frac{1.8}{2}\right) \times \frac{1}{2} - V_B \times (1.8 - x) = 0;$$

$$\frac{1}{2} \cdot W_0 (1.8)^2 - \frac{18W_0}{(6-x)}(1.8-x) = 0;$$

$$x = 1.3846 \text{ m}$$

Case-II if $x > 1.8$ m.

BM | @ 1.8 from right $= 0$;

$$W_0 \times \frac{(1.8)^2}{2} - V_B(x - 1.8) = 0;$$

$$W_0 \times 1.8 \times 0.9 + -18W_0\left(\frac{x-1.8}{6-x}\right) = 0$$

$$1.8 \times 0.9(6-x) = +18(x-1.8)$$

$$\boxed{x = 11.37 \text{ m}}.$$

Case I is feasible

So BM will be zero @ only when V_B is placed @ 1.5846 m apart from right side.