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PASCAL'S LAW

Pressure created at any point in the fluid distributed throughout the volume of the liquid without diminishing its magnitude.

$$\boxed{\frac{F_1}{A_1} = \frac{F_2}{A_2}}$$

$$\underline{F_2} = \left(\frac{A_2}{A_1}\right) F_1$$

Hydrolic lift.

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Hydrostatic force

$$dF = P_y (dA)$$

↳ Area of strip

$$\int_0^F dF = \int_0^H \rho g y (\omega\, dy)$$

$$F = \rho g \omega \int_0^H y\, dy$$

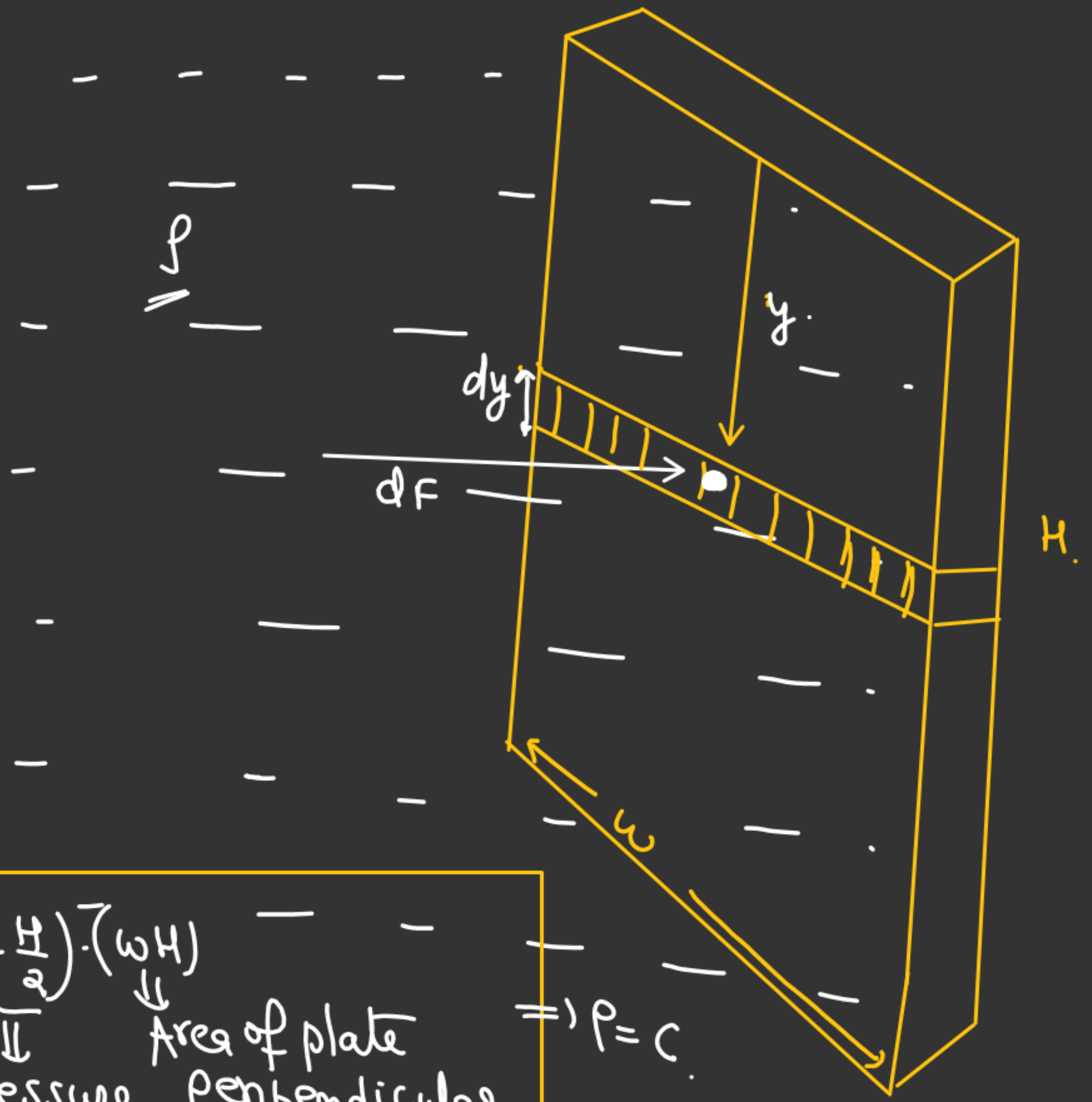
$$F = \rho g \omega \frac{H^2}{2}$$

$$F = \rho g (\omega H) \frac{H}{2}$$

$$\boxed{F = \underbrace{\left(\rho g \frac{H}{2}\right)}_{\text{Pressure at Mid-point}} \cdot \underbrace{(\omega H)}_{\text{Area of plate}}}$$

perpendicular to F

$\Rightarrow P = C.$



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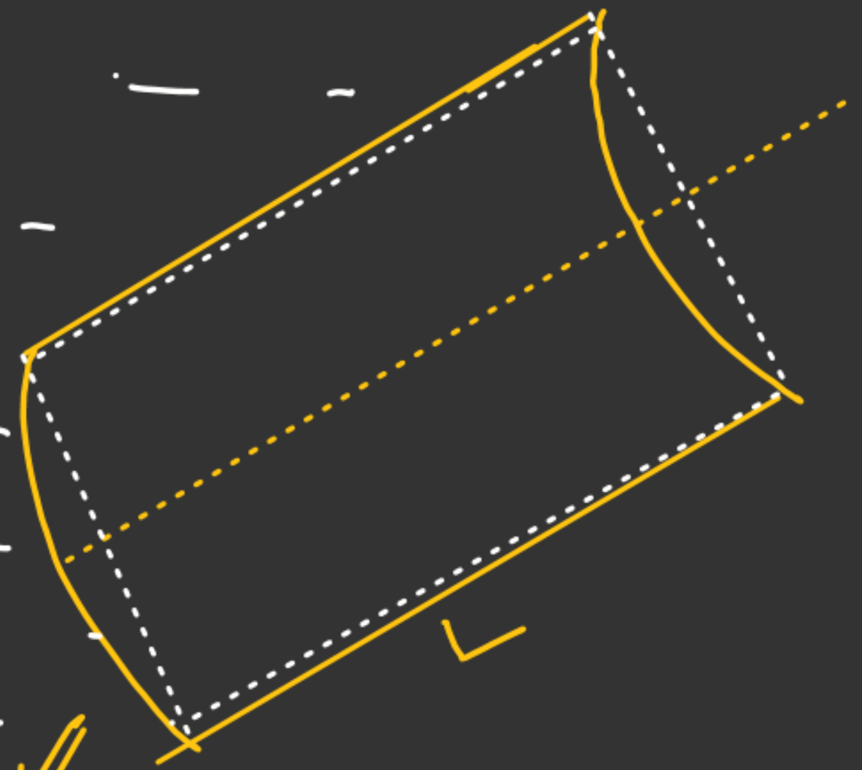
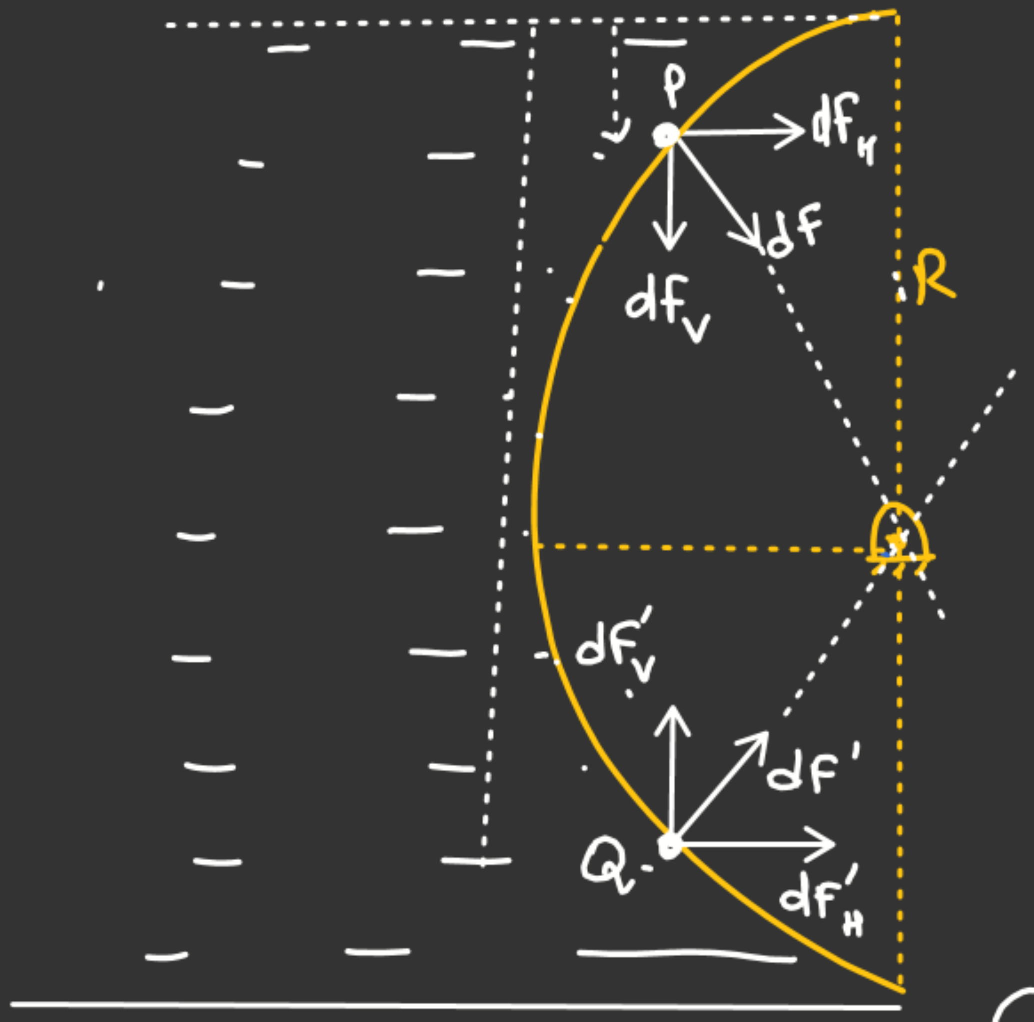
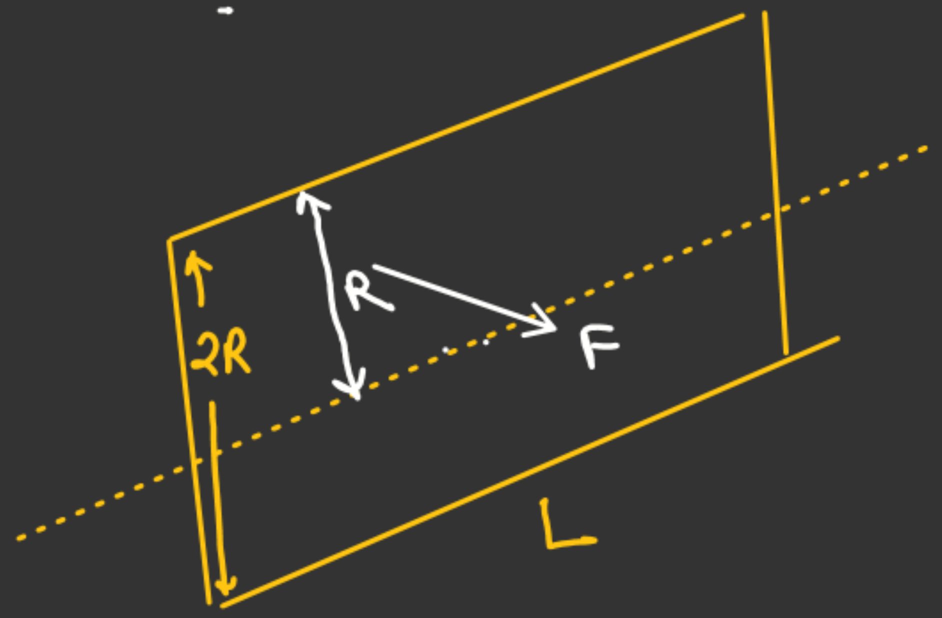


Cylindrical dam of length L & Radius R.

⇒ Find hydrostatic force in horizontal direction.

⇒ Find hydrostatic torque about axis.





$$F_H = (\rho g R)(L \cdot 2R)$$

$$F_H = 2\rho g R^2 L$$

$$F_{net} = \sqrt{F_H^2 + F_V^2}$$

$$\int (dF_V)_{net} = \int \left[(dF_V') - (dF_V)\right]$$

$\Downarrow$

F_B = weight of displaced liquid.

$$(F_V) = F_B = \left(\frac{\pi R^2 L}{2}\right)\rho g$$

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M-1:

$$dF = \rho g y (dA)$$

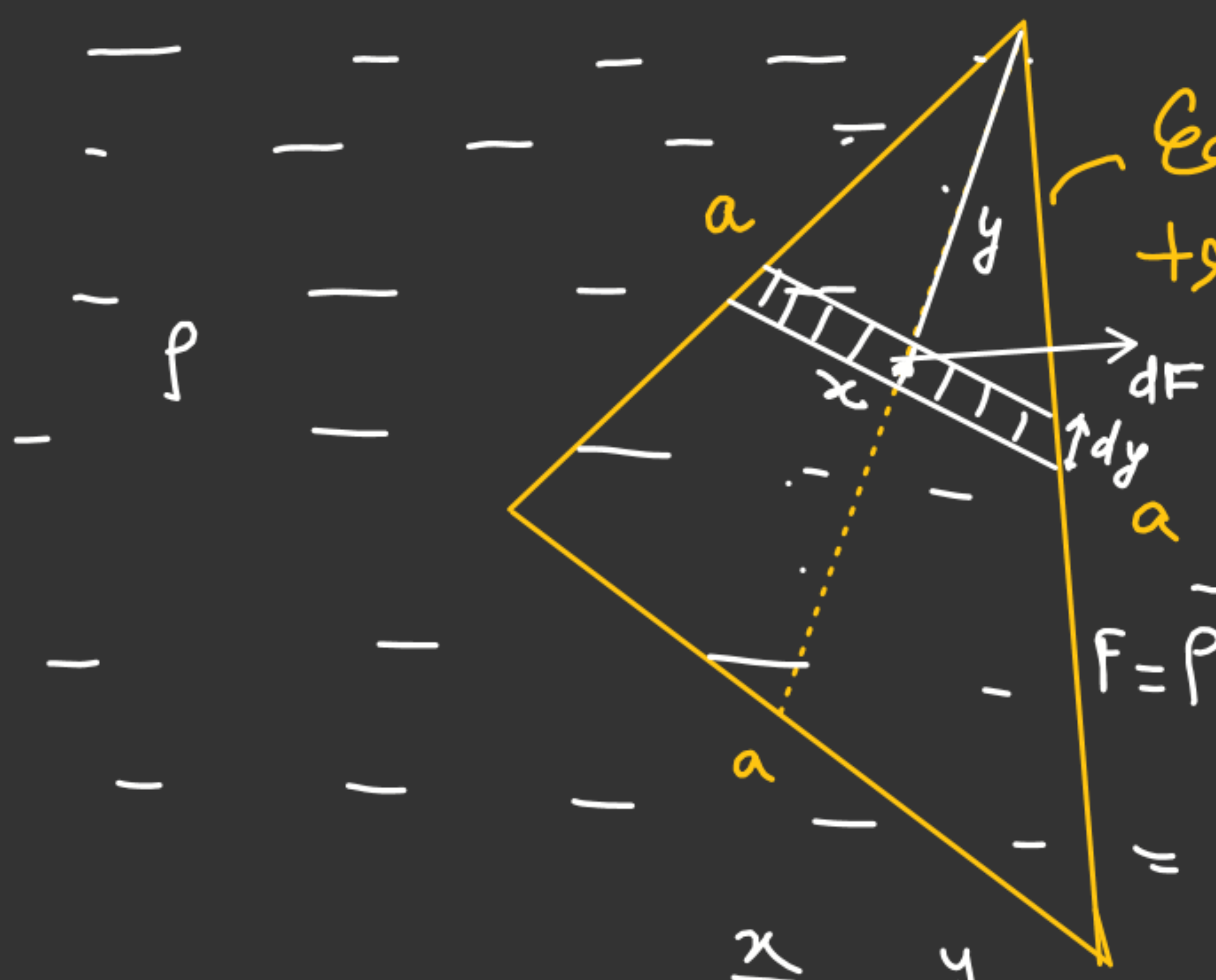
$$dA = x\,dy$$

$$= \left(\frac{2}{\sqrt{3}} y\,dy\right)$$

$$dF = \rho g\, y\left(\frac{2}{\sqrt{3}} y\,dy\right)$$

$$\int_0^F dF = \frac{2\rho g}{\sqrt{3}} \int_0^{\left(\frac{\sqrt{3}a}{2}\right)} y^2\,dy$$

$$F = \frac{2\rho g}{\sqrt{3}} \times \left[\frac{y^3}{3}\right]_0^{\frac{\sqrt{3}a}{2}} = \frac{2\rho g}{3\sqrt{3}}\left(\frac{\sqrt{3}a}{2}\right)^3 = \left(\frac{\rho g a^3}{4}\right)$$



Equilaterial triangular plate.

$$\frac{x}{a} = \frac{y}{\frac{\sqrt{3}a}{2}}$$

$$x = \frac{2}{\sqrt{3}} y.$$

Pressure at COM. M-2

$$F = \rho g\left(\frac{a}{\sqrt{3}}\right) \times \frac{1}{2} \times a \times \frac{\sqrt{3}a}{2}$$

$$= \left(\frac{\rho g a^3}{4}\right)$$

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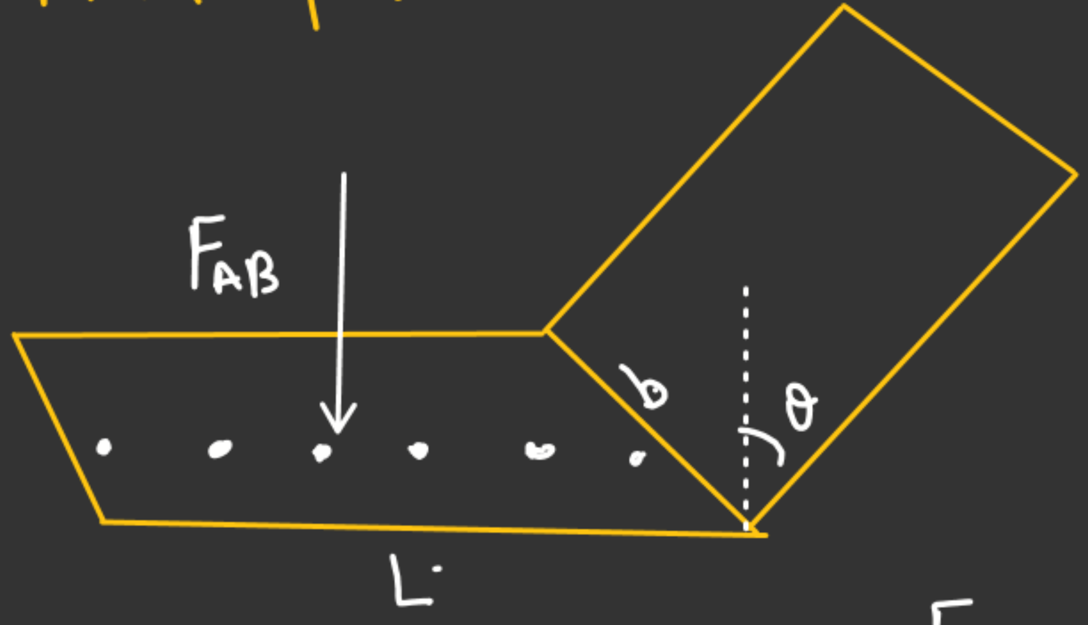
#

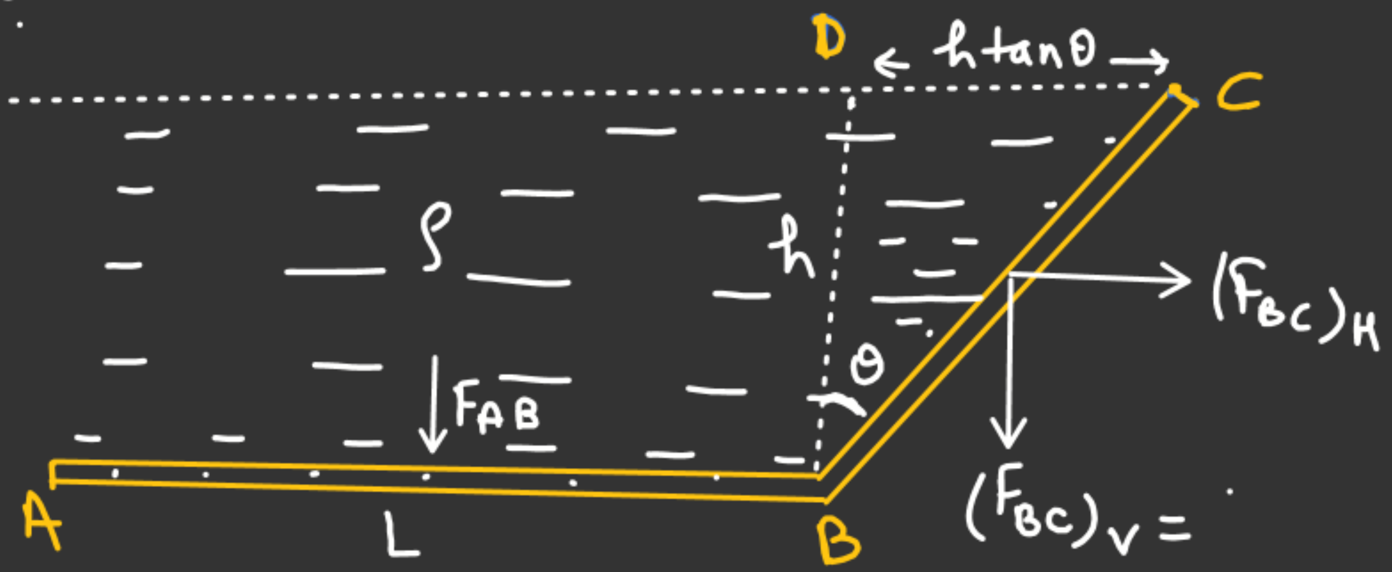
Width of dam is b.

Find force on AB and BC.



$\Longrightarrow$

Front View



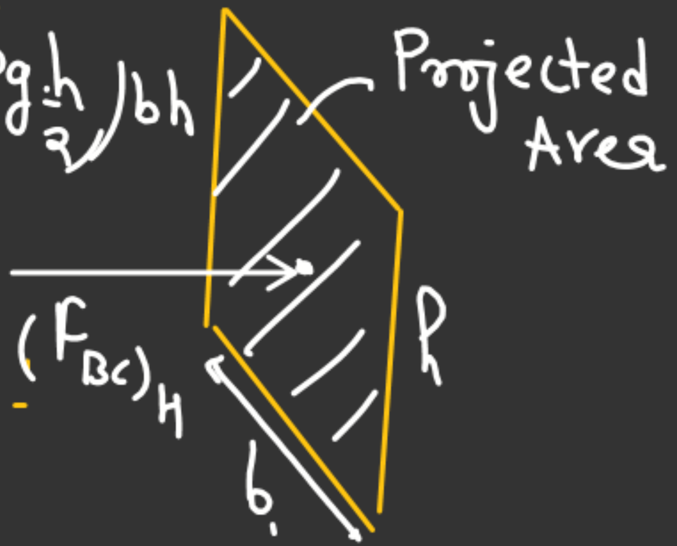
$$F_{AB} = (\rho g h) L b.$$

$F_{BC} = ??$

$$L_{BC}\cos\theta = h \rightarrow \text{given}$$

$$(F_{BC})_H = \left(\rho g \frac{h}{2}\right) bh$$

$$(F_{BC})_H = \left(\frac{\rho g h^2 b}{2}\right)$$



$(F_{BC})_V$ = Weight of liquid above BC.

$$= \left[\frac{1}{2}(h\tan\theta) \times h\right] b \rho g \qquad \tan\theta = \frac{CD}{h}$$

$$= \frac{h^2 b \rho g \tan\theta}{2}.$$

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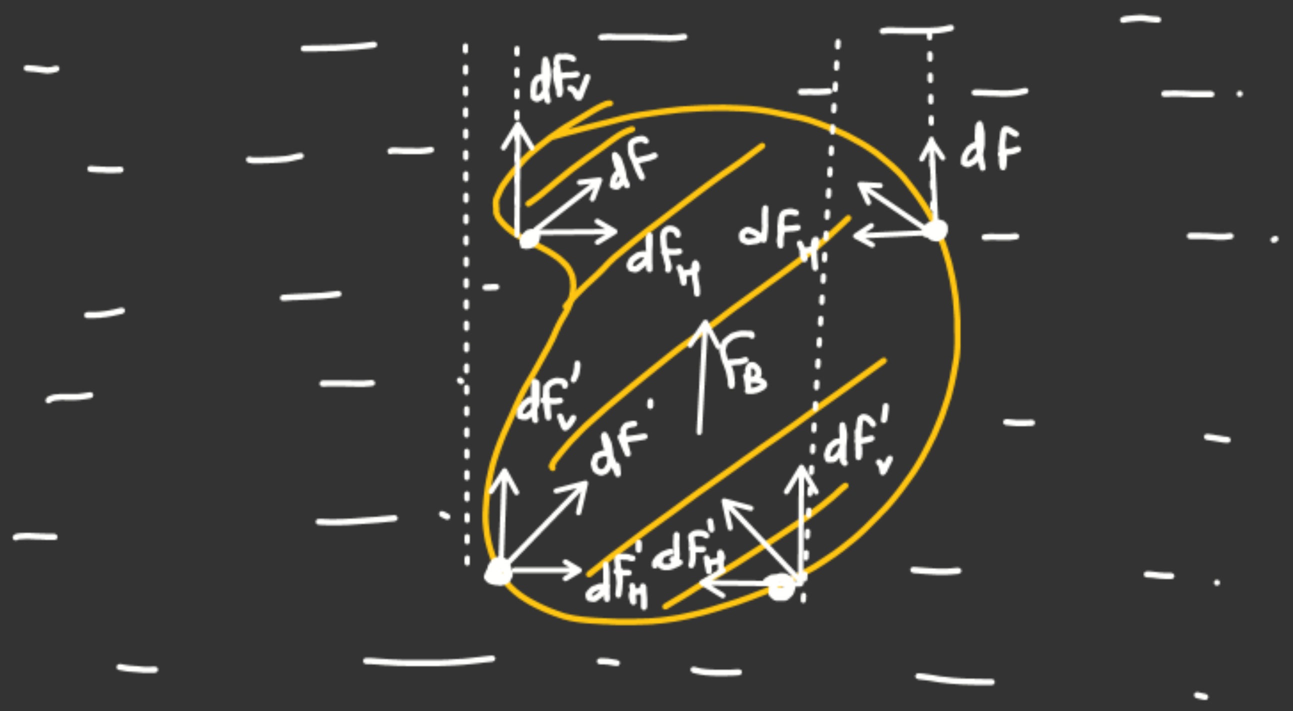

F_B = (Net Vertical upthrust)

= Weight of displaced liquid.

$= V_s \rho_L g = V_L \rho_L g$

$V_L = V_s$ = submerged Volume of body.

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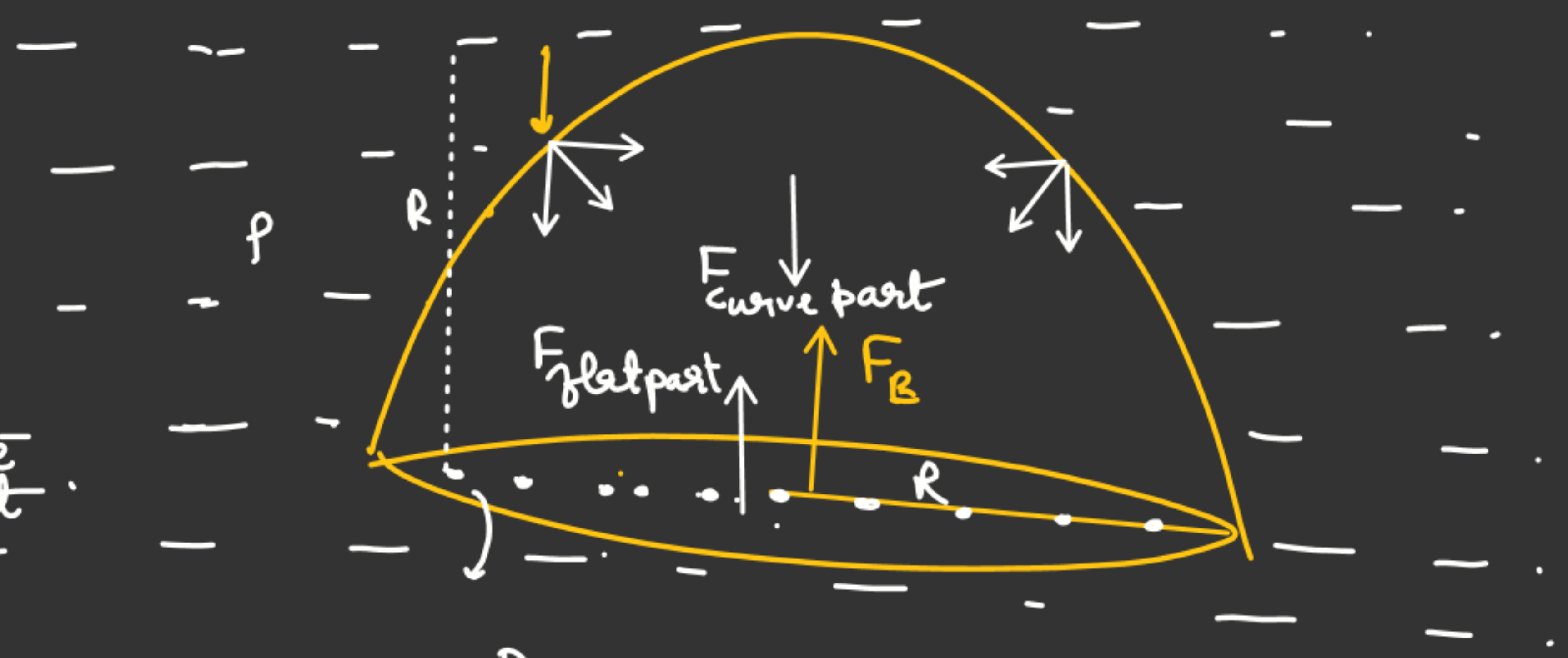
Find force on the Curve part.

$$F_B = F_{\text{flat part}} - F_{\text{curve part}}$$

$$\left(\frac{2}{3}\pi R^3\right)\rho g = (\rho g R)\pi R^2 - F_{\text{curve part}}$$

$$F_{\text{curve part}} = \rho g \pi R^3 - \frac{2}{3}\pi \rho g R^3$$

$$= \frac{1}{3}\rho g \pi R^3$$



$P = (\rho g R)$

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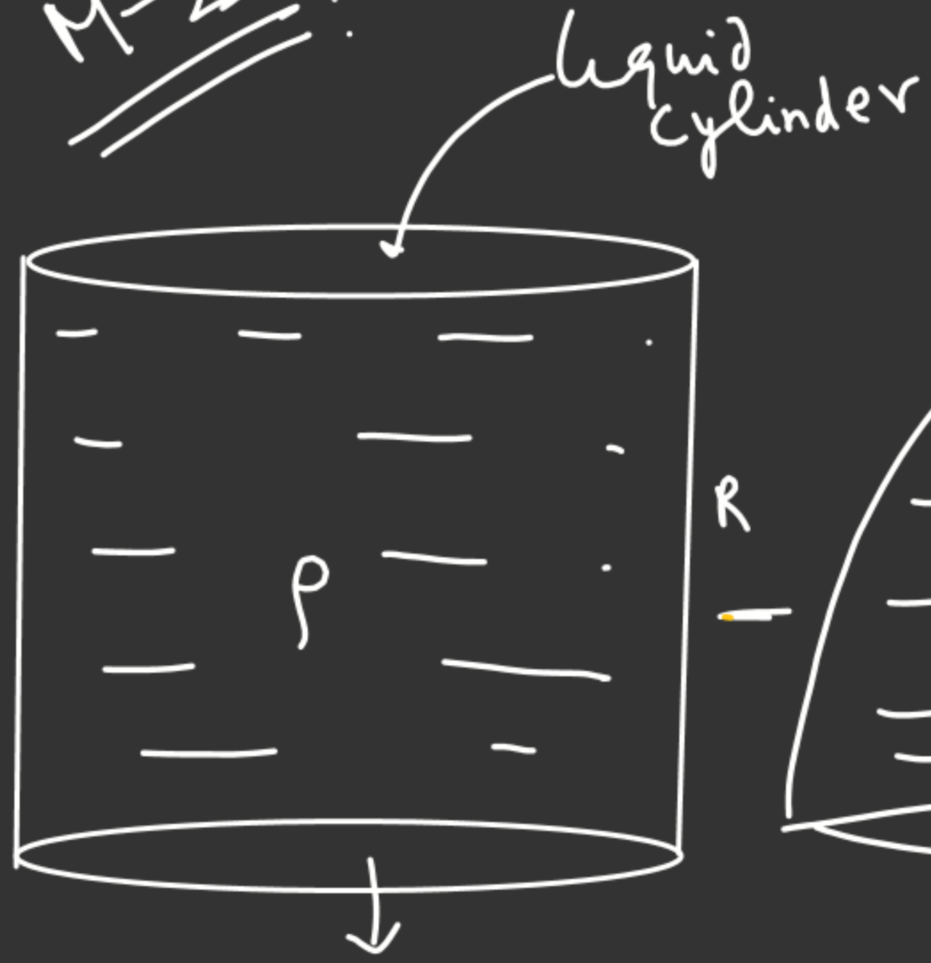
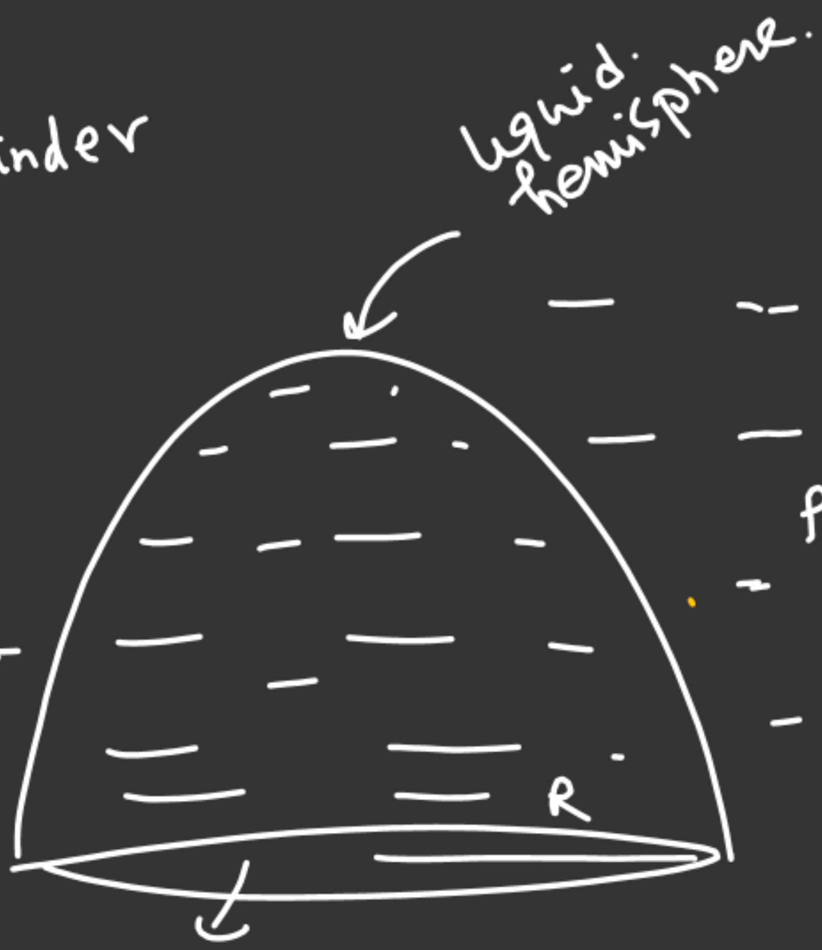
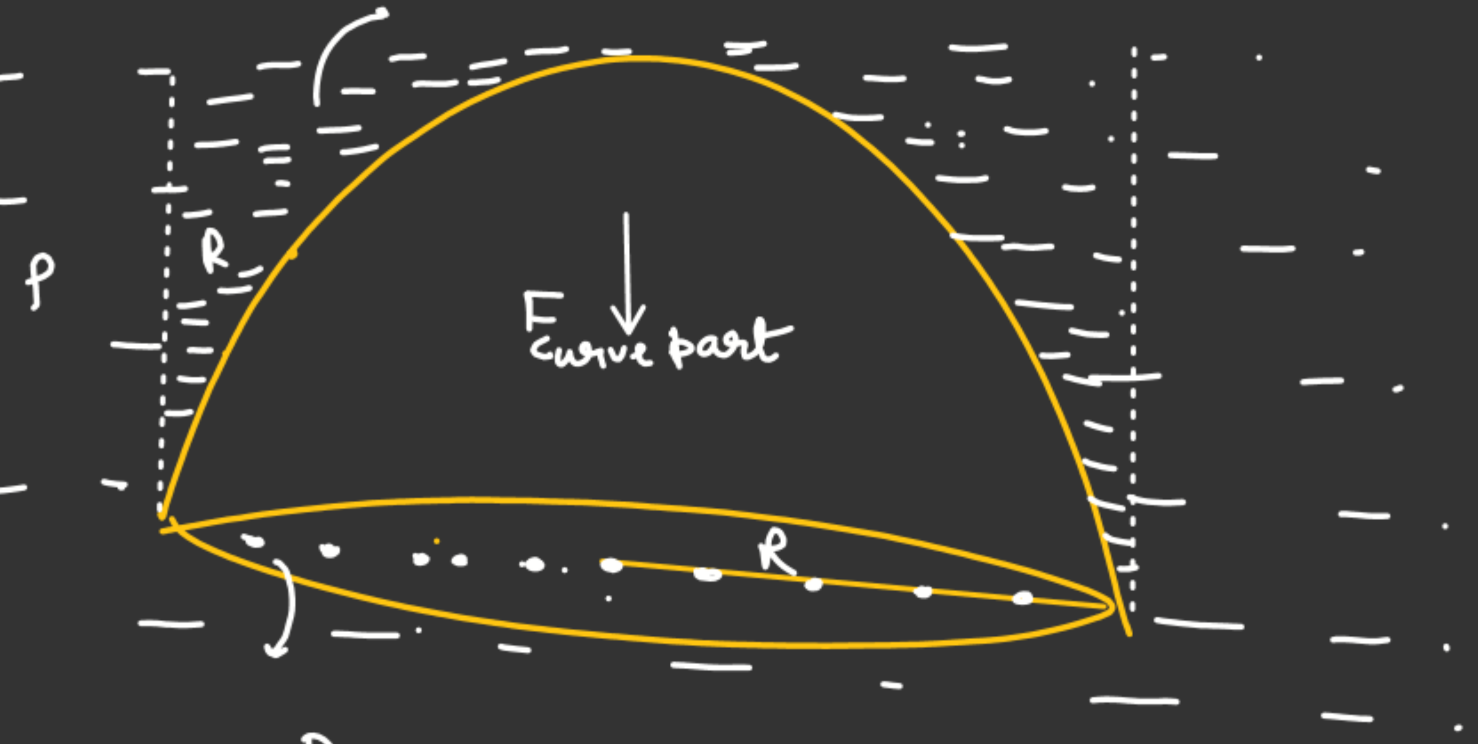
M-2 :



$$V_1 = \pi R^2 (R) = \pi R^3$$



$$V_2 = \frac{2}{3}\pi R^3$$



$$P = (\rho g R)$$

Weight of liquid just above hemisphere = Force on the curve part

$$\left(\pi R^3 - \frac{2}{3}\pi R^3\right)\rho g =$$