exercício 8

1 - gravidade = 9,8 m/s

a)

P variada da água em (X)

Fx e Fy tem linha de ação no ponto "O", logo não geram momento.

Fy e Fx (reação das arestas)

P constante da agua e Y

FA e FB são perpendicular à superficie do Bloco

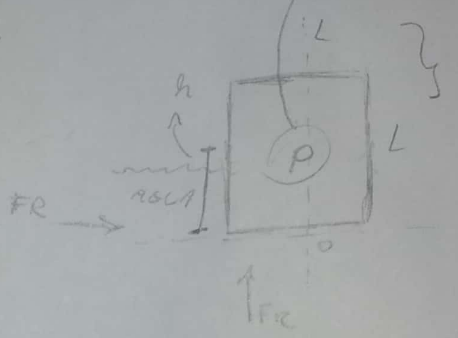
Força Hidroestatica é sempre radial e perpendicular

→ Força Hidroestatica é sempre radial e perpendicular

b) Força Hidroestatica resultante no bloco?

- é determinado por uma integração da força PdA
- que age em uma area diferencial dA

densidade = d } d.g
Gravidade = g }



$P(y) = d\,g\,y$

$dA = w \cdot dy$

- FORMULA → $F_R = \int_A P \, dA$

$$F_R = \int_0^h P \cdot w \, dy$$

$$= \int_0^h d g\, y \cdot w \, dy$$

$$= d g w \int_0^h y \, dy$$

$$= d g w \left[\frac{y^2}{2} \right]_0^h$$

$$= d g w \left[\frac{h^2}{2} - 0 \right]$$

$$\boxed{F_R = \frac{d g w h^2}{2}}$$

→ $F_R = \dfrac{d g w h^2}{2}$ //

$y' = \frac{h}{3}$ } centroide de um triangulo

c) calcular o valor de h:

Dados

• força resultante → $F_R' = \frac{d g w h^3}{2}$

→ $L^2 \cdot w \cdot d$

• Força peso → $P = m \cdot g$

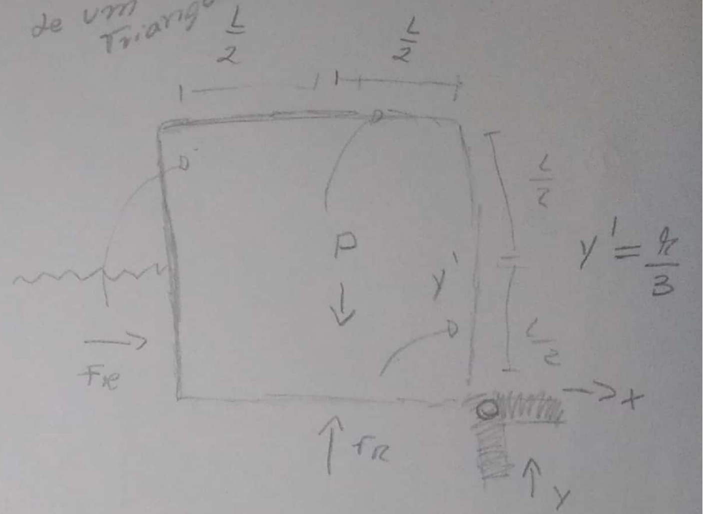
$P = L^2 \cdot w \cdot d \cdot g$

• Formula resultante $\int_A p \, dA = F''$

$= \int_0^{L} d h g w \, dx$

$= d h g w \int_0^{L} dx$

$= d h g w L$



$=$

$P \cdot \frac{L}{2} + F_R'' \cdot \frac{L}{2} + F_R' \cdot y$

$dgwL \cdot \frac{L}{2}$ $\quad$ $L d g w h \cdot \frac{L}{2}$

$d \frac{gwL^2}{2}$ $\quad$ $\frac{dgwh^2}{2} \cdot \frac{h}{3}$

→ Momento de equilibrio $\sum M_O = 0$

$= P \cdot \frac{L}{2} - F_R'' \cdot \frac{L}{2} - F_R' \cdot \frac{h}{3} = 0$

$dgwL^2 \cdot \frac{L}{2} - dghw \cdot \frac{L^2}{2} - wdgh^2$

→ Momento de equilibrio $\sum M_0 = 0$

$$= P \cdot \frac{L}{2} - F_R'' \cdot \frac{L}{2} - F_R' \cdot \frac{h}{3} = 0$$

$$d g w L^2 \cdot \frac{L}{2} - d g h w \cdot \frac{L^2}{2} - w d g \frac{h^2}{2} \cdot \frac{h}{3} = 0$$

$$\cancel{dgw} L^2 \cdot \frac{L}{\cancel{2}} = \cancel{dg} h \cancel{w} \cdot \frac{L^2}{\cancel{2}} + \cancel{wdg} \frac{h^2}{\cancel{2}} \cdot \frac{h}{3}$$

$$L^3 = L^2 \cdot h + \frac{h^3}{3}$$

$$\Updownarrow$$

$$L^3 - hL^2 - \frac{h^3}{3} = 0$$ resolvendo o polinomio poderemos encontrar o valor de h

Isolando H

$$\frac{h^3}{3} = L^3 - hL^2$$

$$h^3 = 3L^2(L-h)$$

$$h = \sqrt[3]{3L^2(L-h)}$$

Questão 2

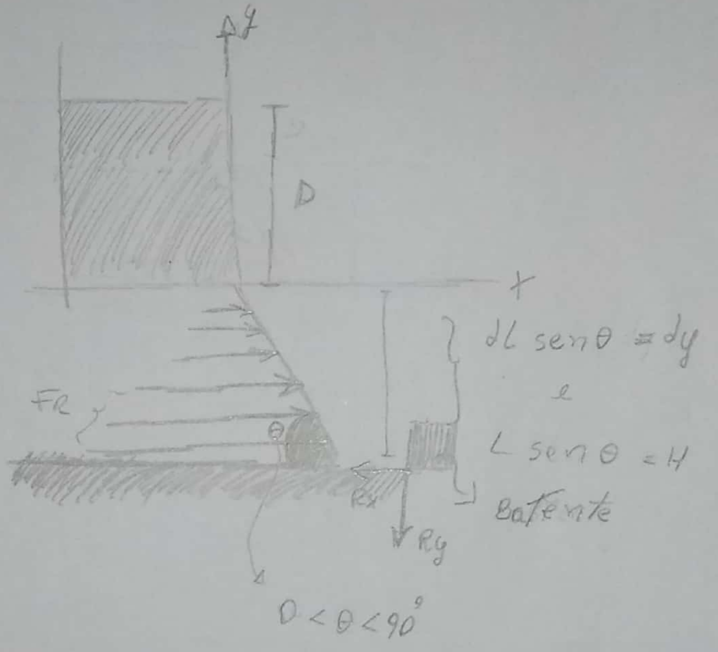
* Peso da comporta = P ↗ Largura $\underline{w}$

a) * água = comporta retangular → comprimento $\underline{L}$

* inclinação = ângulo θ $(0<\theta<90°)$

nível de água está a uma distância D, do limite superior da comporta

base inferior = batente fechado



b)

DADOS

$dL = \frac{dy}{sen\theta}$

$dL\,sen\theta = dy$

$L\,sen\theta = H \rightarrow L = \frac{H}{sen\theta}$

$P_0 = \rho g D$

$dA = w \cdot dL$

$P = \rho g y$

$H =$

• Força resultante → $\int_A P.\,dA = F_{R_x}$

$F_R = \int P\,dA_x$

$$F_R = \int_0^H (P_0 + P)\,dA$$

$$= \int_0^H (\rho g D + \rho g y) \cdot w \cdot \frac{dy}{sen\theta}$$

$$= \int_0^H \left(\frac{\rho g D w}{sen\theta}\right) dy + \int_0^H \left(\frac{\rho g y w}{sen\theta}\right) dy$$

$$= \left(\frac{\rho g D w}{sen\theta}\right) \underbrace{\int_0^H dy}_{[y]} + \frac{\rho g w}{sen\theta} \underbrace{\int_0^H y\,dy}_{\left[\frac{y^2}{2}\right]}$$

$$\frac{\rho g D w}{sen\theta} \cdot H + \frac{\rho g w}{sen\theta} \cdot \frac{H^2}{2}$$

$$\frac{\rho g w}{sen\theta}\left(DH + \frac{H^2}{2}\right)$$

$$\frac{\rho g w}{\cancel{sen\theta}}\left(D.L\,\cancel{sen\theta} + \frac{L^2 sen^2\theta}{2}\right)$$

$H = L.sen\theta$

$$F_R = \rho g w\left(DL + \frac{L^2 sen\theta}{2}\right)$$

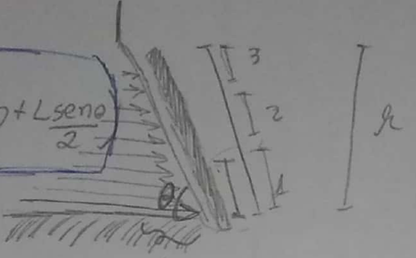
Digitalizado com CamScanner

c) ponto de aplicação da força Hidroestática

da Letra B

área correspondente aos vetores

$$\frac{1}{F_R} = \frac{1}{\rho g w L\left(D + \frac{L\,sen\theta}{2}\right)}$$



$$F_R \cdot y' = \int_A y\, dF \quad ; \quad dF = P \cdot dA, \quad P = \rho g y$$

$$h' = \frac{1}{F_R}\int_A y \cdot P \cdot dA$$

$$h' = \frac{1}{F_R}\int_0^w\int_0^L y \cdot \rho \cdot g y \, dy\, dw$$

$$h' = \frac{1}{F_R}\cdot \rho g \int_0^w\int_0^L y^2\, dy\, dw$$

$$= \frac{1}{F_R}\cdot \rho g \int_0^w \left[\frac{y^3}{3}\right]_0^L dw$$

$$= \frac{1}{F_R}\,\rho g \cdot \frac{L^3}{3}\underbrace{\int_0^w dw}_{w}$$

$$= \frac{\rho g L^3 w}{3 F_R}$$

DA LETRA B

$$= \frac{\cancel{\rho g} L^{\cancel{3}} \cancel{w}}{3\, \cancel{\rho g w L}\left(D + \frac{L\,sen\theta}{2}\right)} = \frac{L^2}{3\left(D + \frac{L\,sen\theta}{2}\right)}$$

d) componente perpendicular à comporta

$$\circlearrowleft + \sum M_O$$

$$-\frac{P}{\cos\theta}\cdot\frac{L}{2} - F_B \cdot L + F_R \cdot h' = 0$$

$$F_B = \frac{\left(\frac{-P}{\cos\theta}\right)\left(\frac{L}{2}\right) + F_R h'}{L}$$

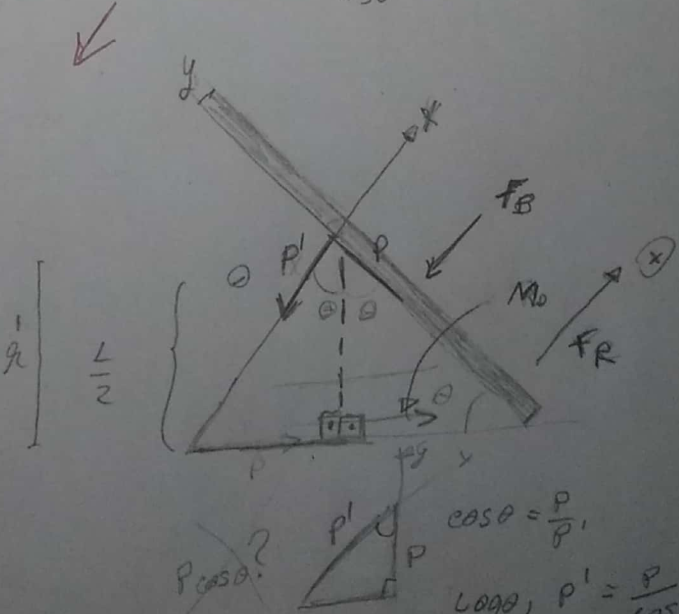
$$\boxed{F_B = F_R \cdot h' - \frac{PL}{2\cos\theta}}$$

DADOS

$$F_R = \rho g w\left(DL + \frac{L^2 sen\theta}{2}\right)$$

$$F_B = ?$$

$$P_x = -P\cos\theta$$



$$\cos\theta = \frac{P}{P'}$$

$$\text{Logo, } P' = \frac{P}{\cos\theta}$$

$P\cos\theta$?