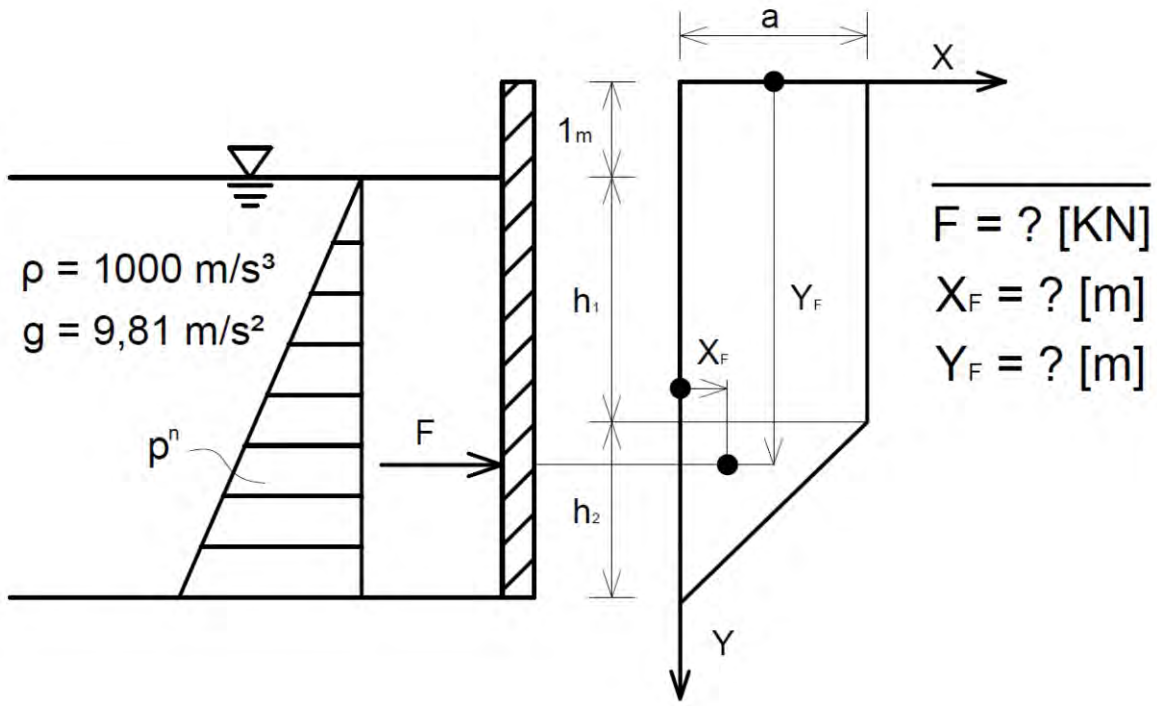
Naloga 1. Določi silo in položaj (koordinate) prijemališča sile v koordinatnem sistemu, podanem v definiciji naloge.



Podatki:

$\rho = 1000 \frac{kg}{m^3}$ $h_1 = 4m$ $a = 3m$

$g = 9,81 \frac{m}{s^2}$ $h_2 = 2,3m$ $b = 1m$

$F = ?$ $x_F = ?$ $M_F = ?$

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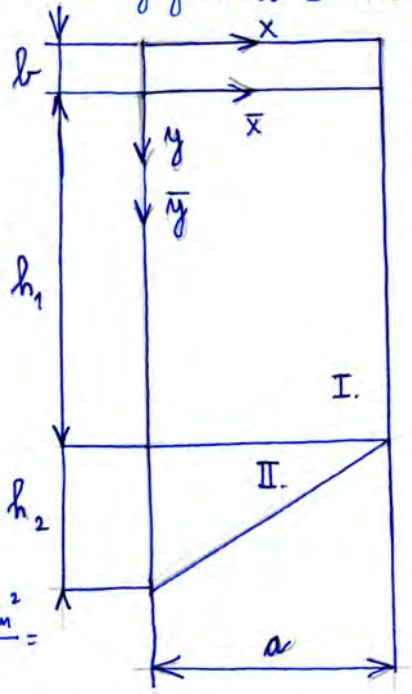
$F = ?$ $\quad x_F = ?$ $\quad M_F = ?$

$$F = \rho g \bar{y}_T A, \quad \bar{x}_p = \bar{x}_T + \frac{I_{\bar{x}\bar{y}_T}}{\bar{y}_T A}$$

$$\bar{y}_p = \bar{y}_T + \frac{I_{\bar{x}_T}}{\bar{y}_T A}$$

→ Cglej sliko za razlago oznak:



(Z $\bar{x}, \bar{y}$ označimo koordinate v K.S, ki ima izhodišče na gladini vode)

$A_I = a h_1 = 3m \cdot 4m = 12m^2$

$A_{II} = \frac{1}{2} a h_2 = \frac{1}{2} \cdot 3m \cdot 2{,}3m = 3{,}45m^2$

$\bar{x}_{T,I} = \frac{1}{2} a = \frac{1}{2} \cdot 3m = 1{,}5m$

$\bar{y}_{T,I} = \frac{1}{2} h_1 = \frac{1}{2} \cdot 4m = 2m$

$\bar{x}_{T,II} = \frac{1}{3} h_1 = \frac{1}{3} \cdot 3m = 1m$

$\bar{y}_{T,II} = \frac{1}{3} h_2 + h_1 = \frac{1}{3} \cdot 2{,}3m + 4m = 4{,}7667m$

$$\bar{y}_T = \frac{\bar{y}_{T,I} A_I + \bar{y}_{T,II} A_{II}}{A_I + A_{II}} = \frac{2m \cdot 12m^2 + 4{,}7667m \cdot 3{,}45m^2}{12m^2 + 3{,}45m^2} =$$

$$= \underline{2{,}6178m}$$

$$x_T = \frac{\bar{x}_{T,I} A_I + \bar{x}_{T,II} A_{II}}{A_I + A_{II}} = \frac{1{,}5m \cdot 12m^2 + 1m \cdot 3{,}45m^2}{12m^2 + 3{,}45m^2} = \underline{1{,}3883m}$$

$$F = \rho g \bar{y}_T (A_I + A_{II}) = 1000 \frac{kg}{m^3} \cdot 9{,}81 \frac{m}{s^2} \cdot 2{,}6178m \cdot (12m^2 + 3{,}45m^2) = \boxed{396770N = \underline{396{,}77kN}}$$

$$I_{\bar{x}_T,I} = \frac{a h_1^3}{12} = \frac{3m \cdot (4m)^3}{12} = 16m^4, \quad I_{\bar{x}_T,II} = \frac{a h_2^3}{36} = \frac{3m \cdot (2{,}3m)^3}{36} = 1{,}0139m^4, \quad I_{\bar{x}\bar{y}_T,I} = 0\,m^4$$

$$I_{\bar{x}\bar{y}_T,II} = -\frac{a^2 h_2^2}{72} = \frac{-(3m)^2 \cdot (2{,}3m)^2}{72} = -0{,}6612m^4$$

$$I_{\bar{x}_T} = I_{\bar{x}_{T,I}} + (\bar{y}_{T,I} - \bar{y}_T)^2 A_I + I_{\bar{x}_{T,II}} + (\bar{y}_{T,II} - \bar{y}_T)^2 A_{II} =$$

$$= 16m^4 + (2m - 2{,}6718m)^2 \cdot 12m + 1{,}0139m^4 + (4{,}7667m - 2{,}6718m)^2 \cdot 3{,}45m^2 = \underline{38{,}3610m^4}$$

$$I_{\bar{x}\bar{y}_T} = I_{\bar{x}\bar{y}_T,I} + (\bar{x}_{T,I} - \bar{x}_T)(\bar{y}_{T,I} - \bar{y}_T) A_I + I_{\bar{x}\bar{y}_T,II} + (\bar{x}_{T,II} - \bar{x}_T)(\bar{y}_{T,II} - \bar{y}_T) A_{II} =$$

$$= 0\,m^4 + (1{,}5m - 1{,}3883m)(2m - 2{,}6178m) \cdot 12m^2 - 0{,}6612m^4 + (1m - 1{,}3883m)(4{,}7667m - 2{,}6178m) \cdot 3{,}45m^2$$

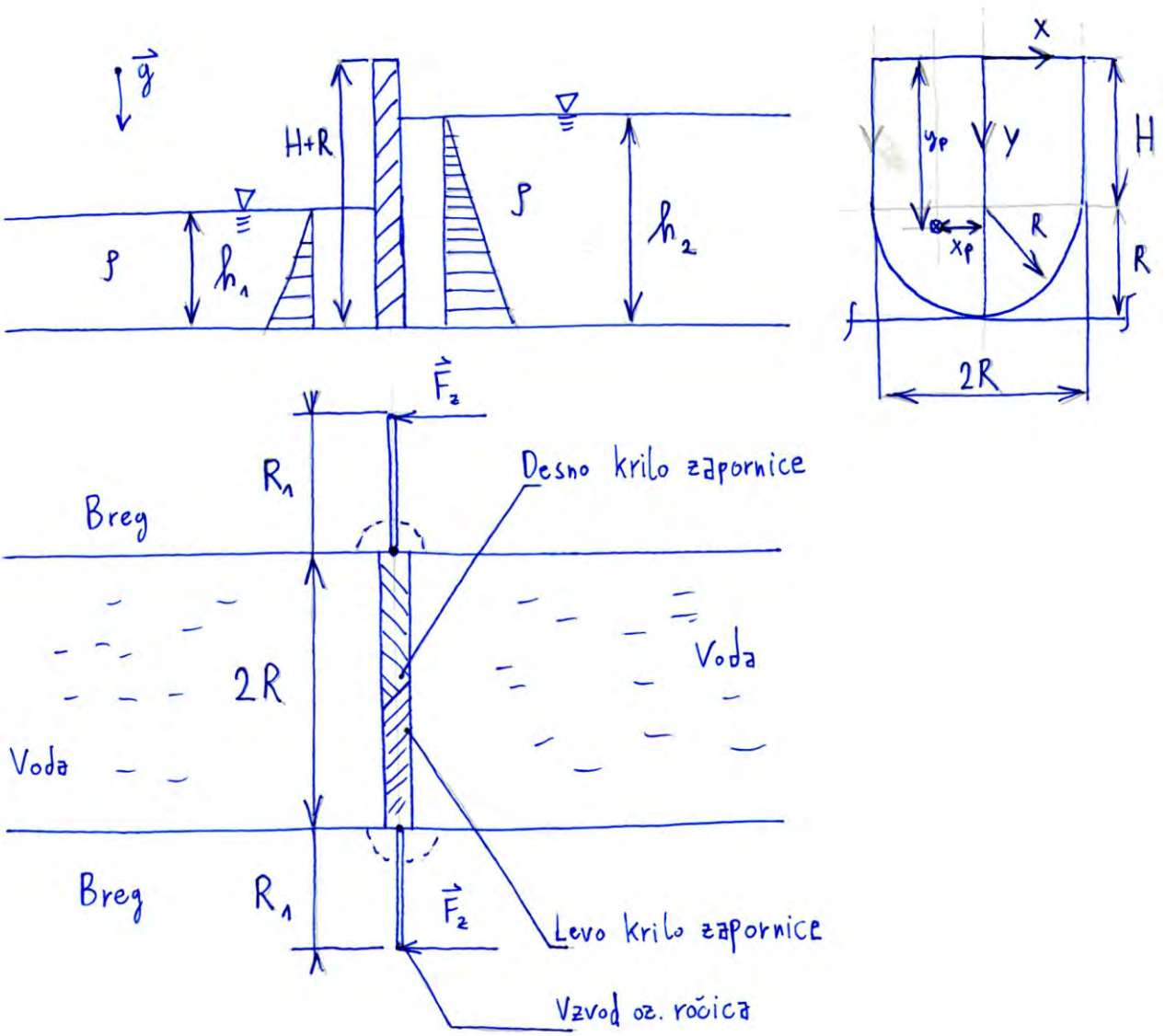
$$= -7{,}6708m^4$$

$$\bar{x}_p = \bar{x}_T + \frac{I_{\bar{x}\bar{y}_T}}{\bar{y}_T A} = 1{,}3883\,m + \frac{-7{,}6708\,m^4}{2{,}6178\,m \cdot 15{,}45\,m^2} = \underline{1{,}1986\,m}$$

$$\bar{y}_p = \bar{y}_T + \frac{I_{\bar{x}_T}}{\bar{y}_T A} = 2{,}6178\,m + \frac{38{,}3610\,m^4}{2{,}6178\,m \cdot 15{,}45\,m^2} = \underline{3{,}5663\,m}$$

→ $x_p = \bar{x}_p = 1{,}1986\,m$, $y_p = \bar{y}_p + f = 4{,}5663\,m$

Naloga 2. Zapornica, ki zapira prekat na kanalu, je sestavljena iz dveh kril. Spoj med kriloma je zatesnjen. Kolikšni morata biti sili na ročici oz. vzvoda (Fz), če prek njih držimo zapornico zaprto? Določi tudi položaja prijemališča sile na posamezno krilo zapornice (upoštevaj koordinatni sistem, definiran na risbi).



Podatki:

$\rho = 1000 \frac{kg}{m^3}$ $h_{v_1} = 2{,}5\,m$ $H = 3\,m$ $R_1 = 2\,m$

$g = 9{,}807 \frac{m}{s^2}$ $h_{v_2} = 3{,}8\,m$ $R = 1{,}5\,m$

$F_z = ?$, $x_p = ?$, $y_p = ?$

(x_p, y_p ... enakovredno x_F, y_F - prijemališče sile)