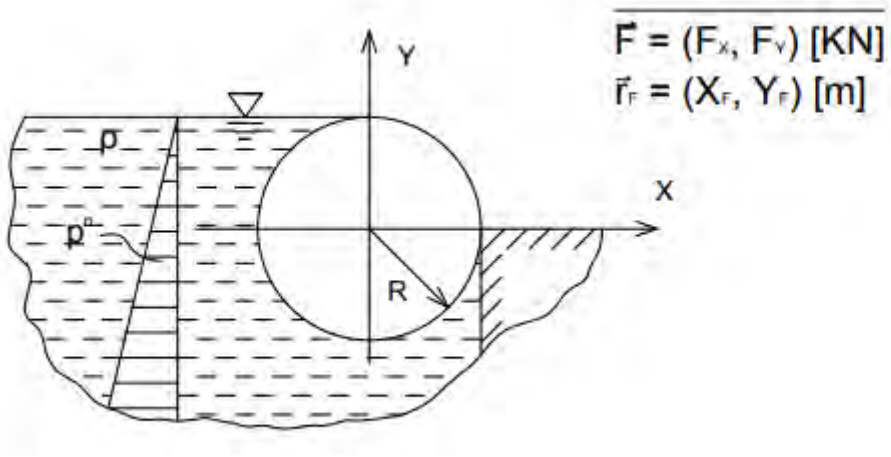
Naloga 1. Določi silo in prijemališče sile, s katero fluid deluje na valj. Stik med valjem in podporo je zatesnjen.



Podatki: $\rho = 1000 \frac{kg}{m^3}$, $g = 9.807 \frac{m}{s^2}$, $R = 1{,}5\ m$, $B = 10\ m$

$\vec{F} = ?$, $\vec{r}_P = (x_F, y_F) = ?$

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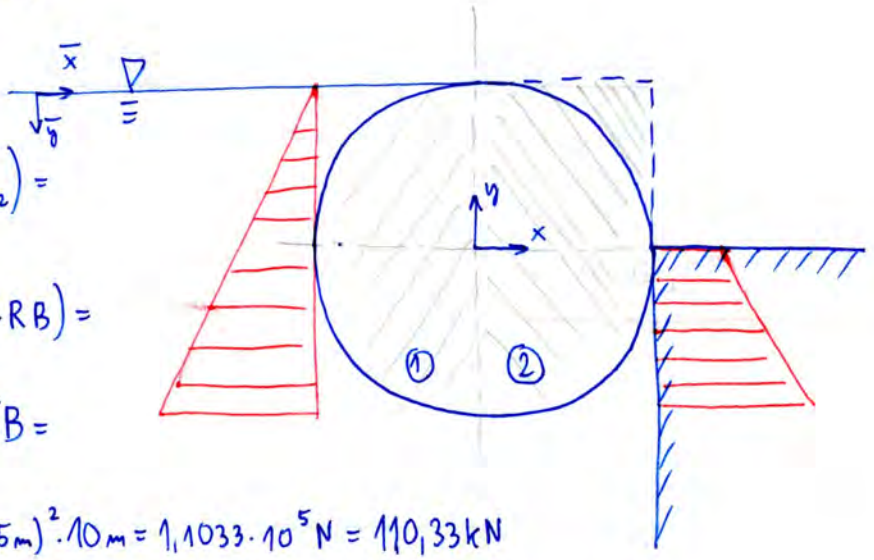


$$F_x = \rho g \left(\bar{y}_{T,1} A_1 + \bar{y}_{T,2} A_2 \right) =$$

$$= \rho g \left(R \cdot (2RB) - \left(R + \tfrac{1}{2}R\right) \cdot RB \right) =$$

$$= \rho g RB \left(2 - \tfrac{3}{2}\right) = \tfrac{1}{2} \rho g R^2 B =$$

$$= \tfrac{1}{2} \cdot 1000 \frac{kg}{m^3} \cdot 9,807 \frac{m}{s^2} \cdot (1,5m)^2 \cdot 10m = 1,1033 \cdot 10^5 N = \underline{110,33 kN}$$

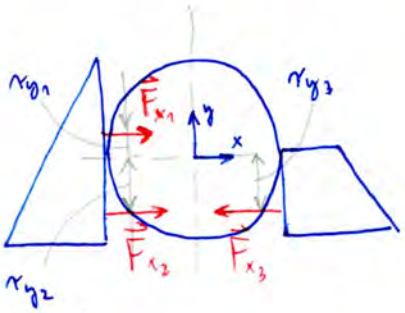
$$F_y = \rho g (V_1 + V_2) = \rho g \left(\tfrac{1}{2}\pi R^2 B + \left(\tfrac{1}{4}\pi R^2 B + R^2 B \right) \right) = \rho g R^2 B \left(\tfrac{3\pi}{4} + 1 \right) =$$

$$= 1000 \frac{kg}{m^3} \cdot 9,807 \frac{m}{s^2} \cdot (1,5m)^2 \cdot 10m \cdot \left(\tfrac{3\pi}{4} + 1 \right) = 7,406 \cdot 10^5 N =$$

$$= \underline{740,60 kN}$$

$\rightarrow \vec{F} = (F_x, F_y) = \underline{(110.33, 740.60)\,kN}$

→ Prijemališče sile: ↳ Določamo oddaljenost prijemališča K.S.



$$y: \quad y_F = \frac{\sum_{i=1}^{N} r_{yi} F_{xi}}{\sum_{i=1}^{N} F_{xi}} = \frac{r_{y_1} F_{x_1} + r_{y_2} F_{x_2} - r_{y_3} F_{x_3}}{F_{x_1} + F_{x_2} - F_{x_3}} =$$

($r_{y_1} F_{x_1} + r_{y_2} F_{x_2} - r_{y_3} F_{x_3} = 0$; $F_{x_2} - F_{x_3} = 0$)

$$= r_{y_1} = \tfrac{1}{3} R = \tfrac{1}{3} \cdot 1,5m = \underline{0,5m}$$

↳ Ker je pri $y \in [0, -R]$ tlačno polje na obeh stranah valja enako: $\vec{F}_{x_2} = -\vec{F}_{x_3}$

$r_{y_2} = r_{y_3}$

$$x: \quad x_F = \frac{\sum_{i=1}^{N} r_{xi} F_{yi}}{\sum_{i=1}^{N} F_{yi}} = \frac{r_{x_1} F_{y_1} + r_{x_2} F_{y_2}}{F_{y_1} + F_{y_2}}$$

$$r_{x_1} = -\frac{4R}{3\pi}, \quad r_{x_2} = \frac{r_{x_{2,1}} A_{2,1} + r_{x_{2,2}} A_{2,2}}{A_{2,1} + A_{2,2}} =$$

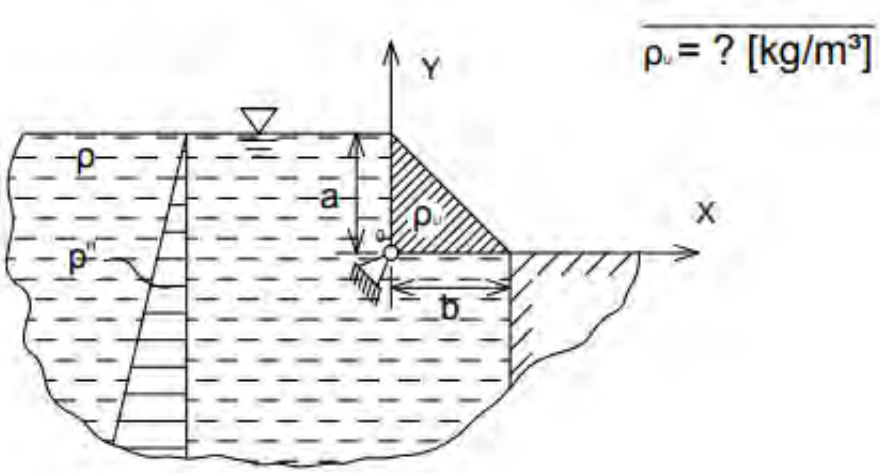
$$= \frac{\frac{4R}{3\pi} \cdot \frac{\pi R^2}{4} + \frac{1}{2} R \cdot R^2}{\frac{\pi R^2}{4} + R^2} = \frac{5R}{6\left(1 + \frac{\pi}{4}\right)}$$

$$x_F = \frac{-\frac{4R}{3\pi}\cdot\frac{1}{2}\pi R^2 B\rho_g + \frac{5R}{6\left(1+\frac{\pi}{4}\right)}\left(\frac{\pi R^2}{4}+R^2\right)B\rho_g}{\rho_g\left(\frac{1}{2}\pi R^2 B + \left(\frac{\pi}{4}R^2+R^2\right)B\right)} = \frac{-\frac{2}{3}R^3 B + \frac{5R}{6\left(1+\frac{\pi}{4}\right)}\left(\frac{\pi}{4}+1\right)R^2 B}{\left(\frac{\pi}{2}+\left(\frac{\pi}{4}+1\right)\right)R^2 B} =$$

$$= \frac{R}{6\left(\frac{3\pi}{4}+1\right)} = \frac{1{,}5\,m}{6\left(\frac{3\pi}{4}+1\right)} = \underline{0{,}0745\,m}$$

$$r_F = (0{,}0745\,m,\ 0.5\,m)$$

Naloga 2. Zapornica v obliki prizme je vrtljivo vpeta v točki 0. Določite gostoto zapornice, da bo le ta obstala v narisani legi. Stik med zapornico in robom je zatesnjen.



Podatki: $\rho_0 = 910 \frac{kg}{m^3}$ $a = 0{,}4\,m$ $b = 2{,}1\,m$

$\rho_p = ?$

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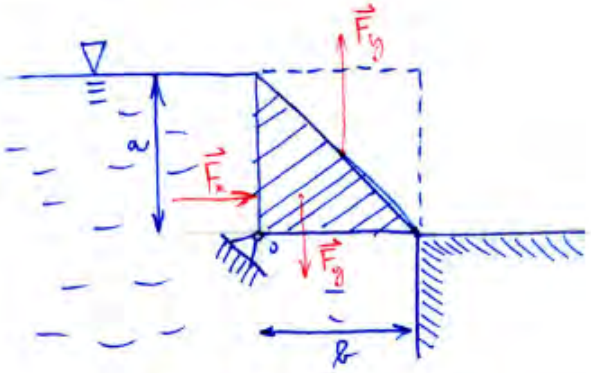


Vrstu momentov skoli stičišče:

$$\sum_{i=1}^{3} M_i = 0 \rightarrow \frac{1}{2} b F_y - \frac{1}{3} a F_x - \frac{1}{3} b F_g = 0$$

$$\frac{1}{3} b F_g = \frac{1}{2} b F_y - \frac{1}{3} a F_x \;/ \cdot \frac{3}{b}$$

$$F_g = \frac{3}{2} F_y - \frac{a}{b} F_x$$

$$F_g = \rho_p \cdot V \cdot g = \frac{1}{2} \rho_p a b L \cdot g$$

$$F_x = \rho_0 g A_{yT} = \frac{1}{2} \rho_0 g a^2 L \left(= \rho_0 g \cdot \frac{a}{2} \cdot a \cdot L \right)$$

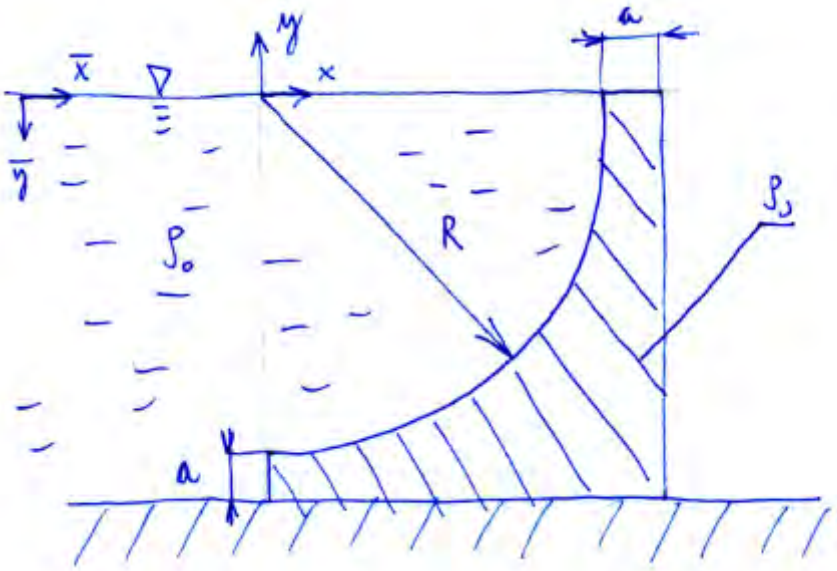
$$F_y = \rho_0 g V = \rho_0 g a b L$$

$$\frac{1}{2} \rho_p g a b L = \frac{3}{2} \rho_0 g a b L - \frac{a}{b} \cdot \frac{1}{2} \rho_0 g a^2 L$$

$$\frac{1}{2} \rho_p a b = \frac{3}{2} \rho_0 a b - \frac{1}{2} \rho_0 \frac{a^3}{b} \rightarrow \rho_p = \rho_0 \left(3 - \frac{a^2}{b^2} \right) = 910 \frac{kg}{m^3} \cdot \left(3 - \frac{(0{,}4\,m)^2}{(2{,}1\,m)^2} \right) =$$

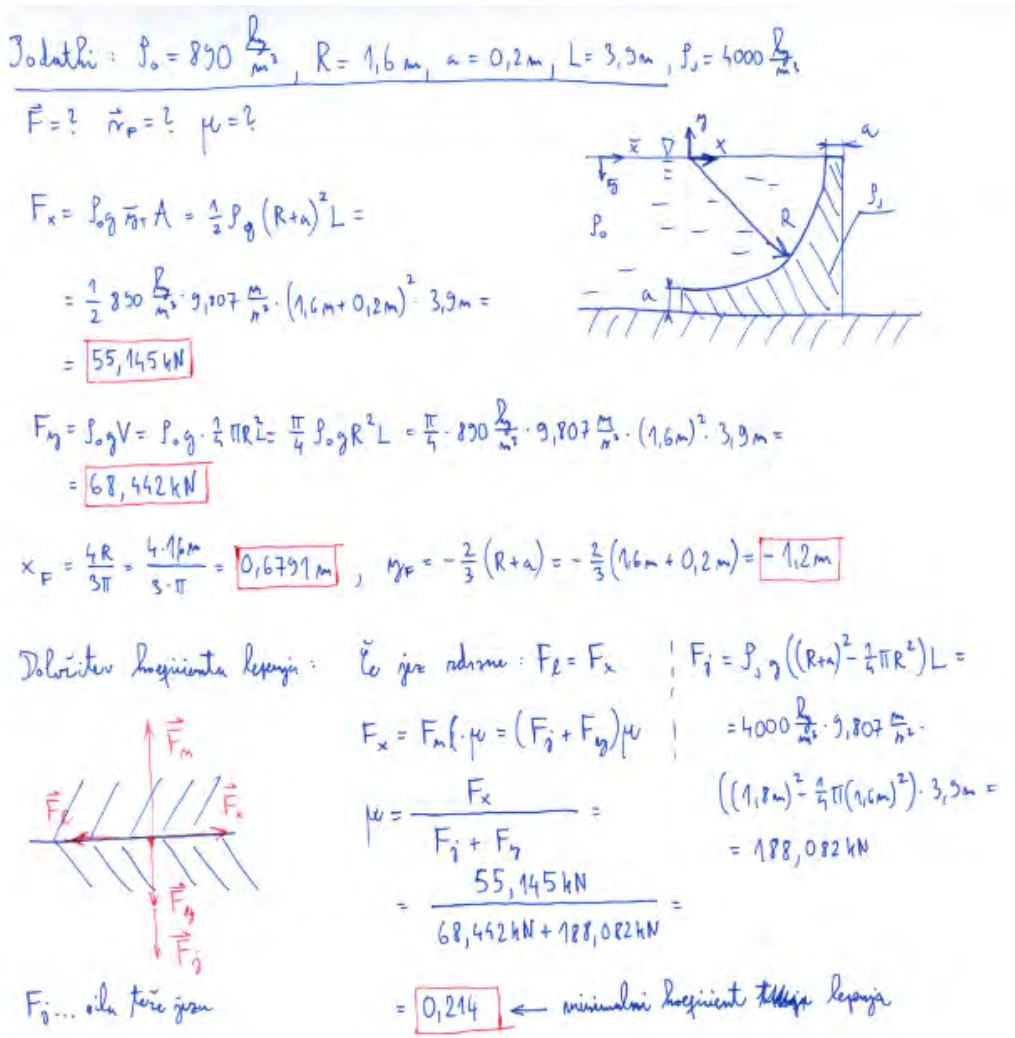
$$= 2696{,}98 \frac{kg}{m^3}$$

Naloga 3. Obravnavamo jez, ki ga na mestu zadržuje sila statičnega trenja oz. lepenja. Stik med jezom in tlemi je popolnoma zatesnjen. Določi silo fluida na jez, prijemališče sile in minimalni koeficient lepenja, pri katerem ostane jez v mirovanju.

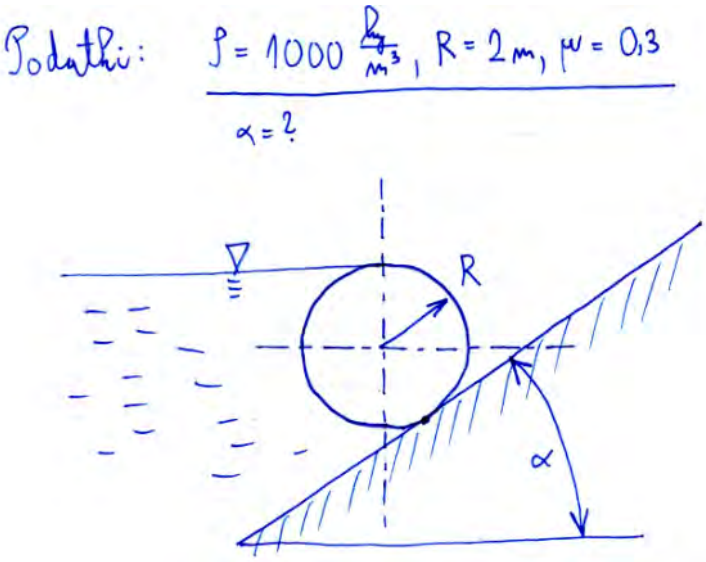


Podatki: $\rho_0 = 890 \frac{kg}{m^3}$, $R = 1{,}6\,m$, $L = 3{,}9\,m$, $a = 0{,}2\,m$

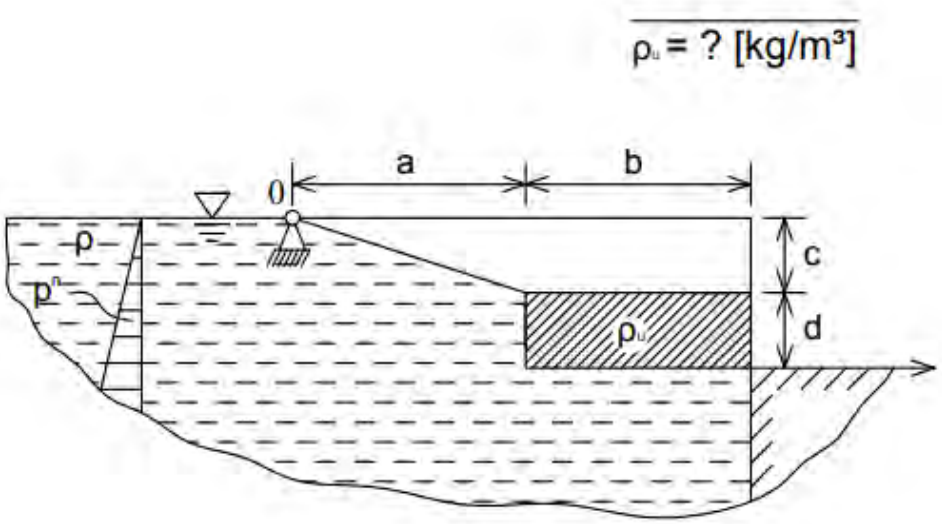
$\vec{F} = ?$ $\vec{r}_F = ?$ $\mu = ?$ | $\rho_J = 4000 \frac{kg}{m^3}$



Naloga 4. Stik med valjem in klančino je zatesnjen. Določi kot klančine, pri katerem valj obmiruje (težo valja zanemarimo).



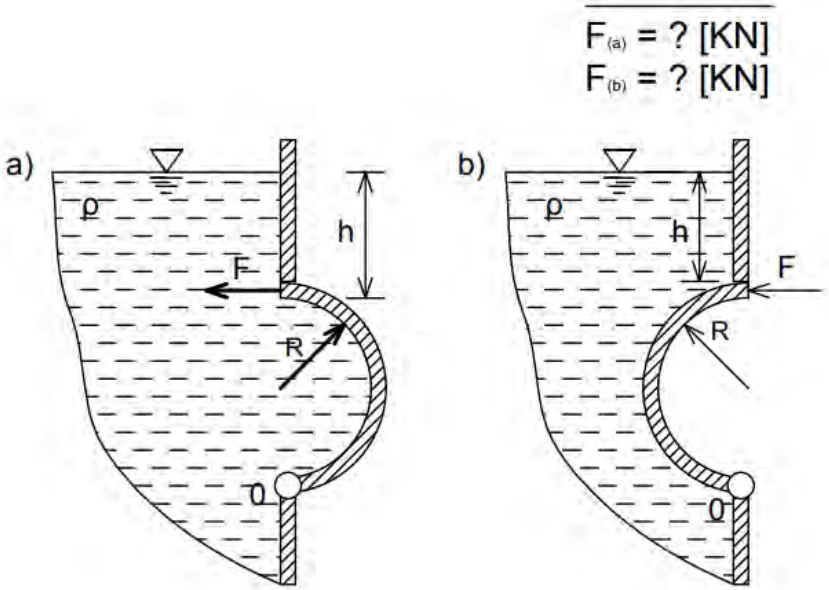
Naloga 5. Zapornica je vrtljivo vpeta v točki 0. Stik med zapornico in robom je zatesnjen. Določite gostoto uteži, da bo zapornica obstala v narisani legi, in prijemališče sile vode na zapornico.



Podatki: $\rho_0 = 1000 \frac{kg}{m^3}$, $a = 3{,}8\,m$, $b = 2{,}7\,m$, $c = 2{,}6\,m$, $d = 2{,}5\,m$

$\rho_p = ?$ $\vec{r}_F = ?$

Naloga 6. Zapornica v obliki lupine polvalja je vrtljivo vpeta v točki 0. Stik med zapornico in jezom je zatesnjen. Določite velikost sile F, da bo zapornica obstala v narisani legi.



Podatki: $\rho_0 = 1000 \frac{kg}{m^3}$, $R = 1{,}3\,m$, $h = 2{,}5\,m$, $l = 3{,}2\,m$

$\vec{F}_a = ?$ $\vec{F}_R = ?$