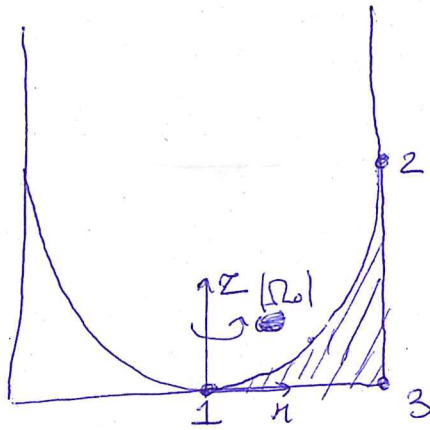


Problem ~~1~~ Task 3
Spinning Fluid



Using Bernoulli's Theorem for the rotating reference frame with a fluid at rest

$$\frac{P_1}{\rho} - \frac{|\Omega_0|^2 r_1^2}{2} + g z_1 = \frac{P_2}{\rho} + \frac{|\Omega_0|^2 r^2}{2} + g z$$

~~$z(r) = \frac{|\Omega_0|^2 r^2}{2g}$~~

$$z(r) = \frac{|\Omega_0|^2 r^2}{2g}$$

The volume of the fluid when stationary $V_0 =$
The volume of the fluid when rotating

$$\begin{aligned} V_0 = \pi R^2 H &= \int_0^R \int_0^{z(r)} \int_0^{2\pi} r d\theta dz dr \\ &= \int_0^R \int_0^{z(r)} 2\pi r dz dr \\ &= \int_0^R 2\pi r z dr = \int_0^R \frac{2\pi |\Omega_0|^2 r^3}{2g} dr \\ &= \int_0^R \frac{\pi |\Omega_0|^2 r^3}{g} dr \end{aligned}$$

$$\Rightarrow \pi R^2 H = \frac{\pi |\Omega_0|^2 R^4}{4g} \Rightarrow |\Omega_0| = \sqrt{\frac{4gH}{R^2}}$$