9. Spacecraft pressure (6 points) — *Johan Runeson.* Consider a spacecraft shaped as a homogeneous pipe, which is closed at both ends. The spacecraft is rotating around its center of mass with angular velocity ω, around an axis perpendicular to the pipe, in order to simulate gravity. The spacecraft is filled with air of molar mass μ, which has pressure p_0 at the rotation axis. The diameter of the spacecraft is much smaller than its length. *Added during the competition: the temperature is T.*

i) *(4 points)* Calculate the pressure p as a function of the distance r from the rotation axis.

ii) *(2 points)* As a comparison, consider a (non-rotating) tower in a constant gravitational field of strength g, filled with the same gas. If the ground level pressure is p_0, what is the pressure p as a function of height h above the ground in such a tower?