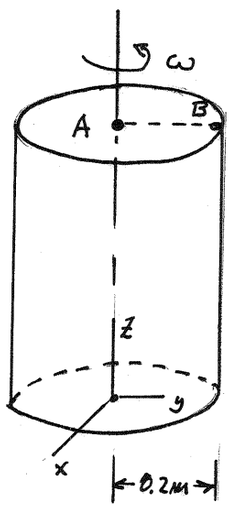
2.101

2.101 A closed, 0.4-m-diameter cylindrical tank is completely filled with oil ($SG = 0.9$) and rotates about its vertical longitudinal axis with an angular velocity of 40 rad/s. Determine the difference in pressure just under the vessel cover between a point on the circumference and a point on the axis.



Pressure in a rotating fluid varies in accordance with the equation,

$$p = \frac{\rho\omega^2 r^2}{2} - \gamma z + \text{constant} \qquad \text{(Eq. 2.33)}$$

Since $z_A = z_B$,

$$p_B - p_A = \frac{\rho\omega^2}{2}\left(r_B^2 - r_A^2\right)$$

$$= \frac{(0.9)(10^3 \frac{kg}{m^3})(40 \frac{rad}{s})^2}{2}\left[(0.2m)^2 - 0\right]$$

$$= \underline{\underline{28.8\ kPa}}$$