An infinitely long, cylindrical container of radius $R$ rotates at the angular speed $\Omega$. It contains water which is also in solid-body rotation with angular speed $\Omega$. At time $t = 0$, the container suddenly stops rotating, and the contained water gradually comes to rest.

In all that follows, the possible effects of turbulence and other instabilities are to be considered absent.

• (a) Sketch curves of $V_\theta$ versus $r$, showing how the circumferential velocity varies with radius for several successive times, $t > 0$.

• (b) What is the order of magnitude of the time, $t_R$, up to which the Rayleigh’s solution for impulsive start of a flat plate would describe the motion near the wall?

• (c) Suppose that $\Omega = 33 \, \frac{-1}{3} \, [rpm]$, $R = 10\, [cm]$, and that the fluid is water at 20 degrees celcius.

Make a very rough estimate of the time, in seconds required for most of the motion to disappear.