Special Problem 8-3.4

Shown below is the **cross-section** of a cylindrical structure that is centered along the z-axis (the z-axis is pointing out of the page).

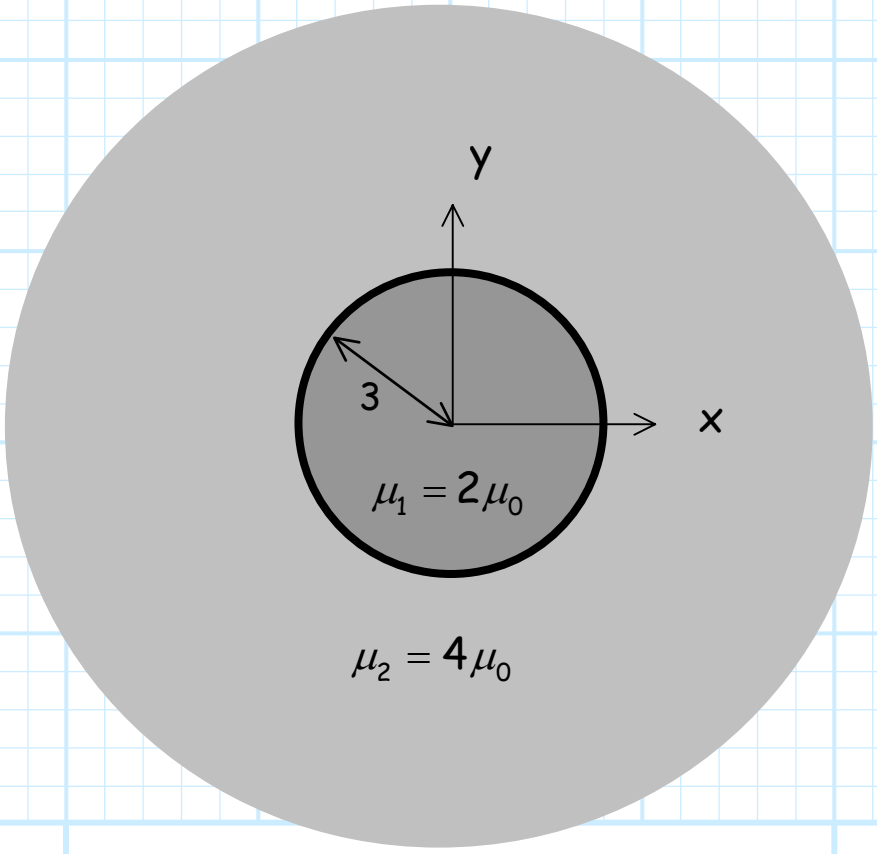
The center region (region 1) is a **cylinder** of material with $\mu_r = 2$ and a **radius** of **3 meters**. The magnetic flux density in region 1 is known to be (note it's a function of ρ !):

$$\mathbf{B}_1(\rho) = 8\mu_0\ \rho\,\hat{a}_\phi \quad \left[W/m^2\right]$$

Surrounding the cylinder of region 1 is material with $\mu_r = 4$. The magnetic flux density within this region is known to have the form (note it's also a function of ρ !):

$$\mathbf{B}_2(\rho) = \frac{\alpha\,\mu_0}{\rho}\,\hat{a}_\phi \quad \left[W/m^2\right]$$

where the value α is an unknown **constant**.



In **region 1**, determine:

1) the **magnetization** currents flowing on the cylinder surface and within the cylinder volume.

In **region 2**, apply the magnetic **boundary conditions** to the material interface (i.e., ρ=3) to determine:

2) the **magnetic flux density** (i.e., find constant α).
3) the **magnetic field**.