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).

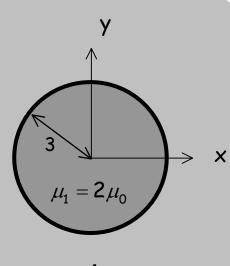
The center region (region 1) is a **cylinder** of material with $\mu_r = 2$ and a **radius** of **3 meters**. The magnetic flux density in region 1 is known to be (note it's a function of ρ !):

$$\mathbf{B}_{1}(\rho) = 8\mu_{0} \rho \hat{a}_{\phi} \left[\frac{\mathbf{W}}{\mathbf{m}^{2}} \right]$$

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 !):

$$\mathbf{B}_{2}(\rho) = \frac{\alpha \,\mu_{0}}{\rho} \,\hat{\mathbf{a}}_{\phi} \quad \left[\mathbf{W} / \mathbf{m}^{2} \right]$$

where the value α is an unknown constant.



$$\mu_{2} = 4\mu_{0}$$

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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.