

Special Problem 9-3.1

A **solenoid** with $N=1000$ turns and length $d=1.0$ m and is filled with a magnetic material with permeability:

$$\mu(\rho) = \mu_0(8 - 60\rho)$$

Note this permeability is **not** a constant, but instead is a **function** of coordinate ρ .

The **magnetic field** within the solenoid is:

$$\mathbf{H}(\bar{r}) = \frac{iN}{d} \hat{a}_z \quad \left[\frac{A}{m} \right]$$

where i is the current within the wire.

Each loop forms a **circle** with radius $a=0.1$ m .

Determine the **inductance** of this solenoid in terms of μ_0 (Hint: the answer is **not** a function of ρ !).

