Homework 3 – Due September 30

3.1. (20 pt.) Two infinitely long filaments are placed parallel to the *x*-axis as shown in Figure 1.

a) Find *H* at the origin;

a) Find *H* at (-1,2,2);

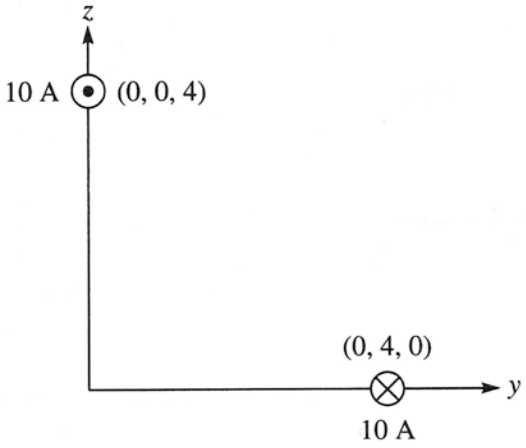

Figure 1

3.2. (20 pt.) A long, straight wire of radius *a* has current density $J = J_0 e^{-\beta(\alpha-\rho)} u_z$ where β is a constant and $\rho < \alpha$. Determine *B* inside and outside the wire.

3.3. (25 pt.) A conductor that is 2 m long and is caring a current of 3 A is placed parallel to the *z*-axis at a distance ρ_0 = 10 cm as shown in Figure 2.

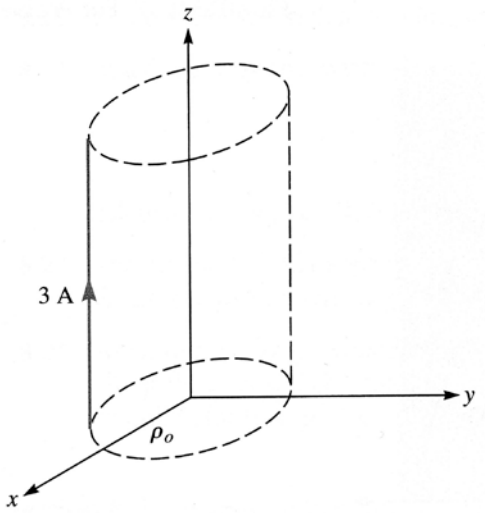

Figure 2

If the magnetic field in the region is $\cos\frac{\varphi}{3}u_\rho \frac{Wb}{m^2}$, how much work is required to rotate the conductor one revolution about the *z*-axis?

3.4. (25 pt.) Consider the magnetic circuit shown in Figure 3.

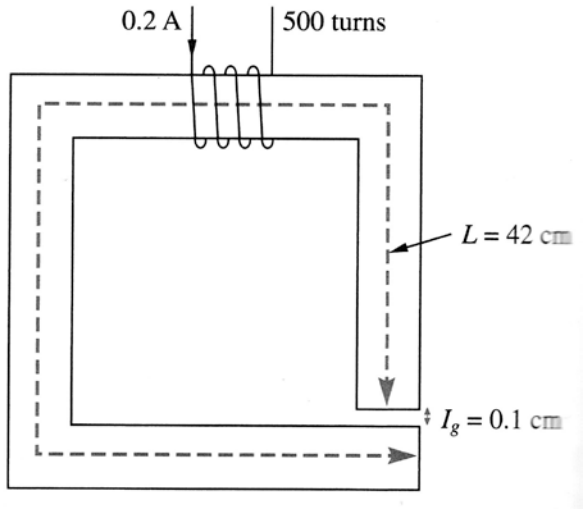

Figure 3

Assuming that the core (μ_r = 1000) has a uniform cross section of 4 cm^2, determine the flux density in the air gap.

3.5. (10 pt.) The current density in a cylindrical conductor of radius *a* placed along the *z*-axis is

$$J = 10e^{-\left(1-\frac{\rho}{a}\right)}u_z \ \frac{A}{m^2}$$

Find the current through the cross-section of the conductor.