Physics 322   Homework Set #2   Winter 2009

Due in class Fri. 1/23/09

1.   Problem 5.9 in your textbook.

2.   A long cylindrical wire of radius, R, carries a constant current, I. Find the magnetic field inside and outside of the wire ($s < R$, $s > R$) where s is the distance from the axis.

a.)   The current is uniformly distributed within the wire.

b.)   The current all flows on the surface of the wire.

c.)   The current density within the wire is proportional to s^2.

3.   Three infinitely long, parallel, thin straight wires each carry current, I, in the same direction. The wires lie in the $x - y$ plane and run parallel to the $\hat{y}$ axis, with their centers at $x = 0, x = -d$, and $x = d$.

a.)   Calculate two positions where the net magnetic field vanishes.

b.)   If the center wire is displaced a small distance ϵ along the $\hat{x}$ axis ($x \to \epsilon, \epsilon << d$), what is the force per unit length acting on the center wire.

4.   Problem 5.14 in your textbook.

5.   An infinitely long solenoid with a square cross section (side length a) has n_1 turns of wire per unit length each carrying current, I.   A smaller infinite solenoid with square cross section (side length b) is centered within the large solenoid. The smaller solenoid has n_2 turns per unit length, each with current, I, but the current flows in the opposite direction than the current in the large solenoid. Find the magnetic field a.) within the small solenoid, b.) between the two solenoids, and c.) outside of the large solenoid.

6.   Problem 5.16 in your textbook.