Homework 6
Due at the beginning of class Feb. 26

1. Find the magnetic vector potential of a finite segment of straight wirre carrying current I. Put the wire on the z axis from z_1 to z_2. Do the integral.

2. Find the magnetic field for your previous answer using the curl in the cylindrical system.

3. Find the vector potential above and below a sheet of current moving in the x-y plane along the x axis.

4. For an infinite straight wire carrying constant current I along the z axis, $\vec{A} = A(s)\hat{z}$ where s is the radial coordinate in the cylindrical coordinate system. (a) Find $A(s)$ and show that (b) $\nabla \cdot \vec{A} = 0$ and (c) $\nabla \times \vec{A} = \vec{B}$ using the cylindrical coordinate system.

5. Assume water acts as a Ohmic material. You suspend a small metal object 1000 meters below the bow of a ship and set its potential to 100 V (a wire runs from the ship to the object). In a similar way you suspend another small metal object 1000 meters below the stearn of the ship at potential 0V. The ship is of length 20 meters. Using the relaxation method find the voltage in the water enclosing the two metal objects. What extra assumptions did you make to solve this problem? Print out your spreadsheet with numerical values. Sketch on this printout lines of constant voltage. Also sketch lines of current density between the objects.

6. A parallel plate capacitor is charged to voltage V_0. A rectangular wire loop, which obeys Ohm's law, is placed so that one segment is well inside this capacitor and aligned parallel to the electric field of the capacitor. The opposite end of this loop is well outside the capacitor. Explain what current flows in the loop and why.

7. Shadowitz chapter 9 problem 17.

8. Shadowitz chapter 9 problem 18.