Assignment 5
PHGN361

Homework due Feb. 16

1. Before the Friday (Feb. 11) class go to http://www.falstad.com/mathphysics.html. Under Electricity and Magnetism: Statics choose 2-D Electrostatic **Fields** Applet. From the pulldown menu at the top

   - Setup: conducting plate
   - Color: field magnitude
   - Floor: equipotentials
   - Display: Field Vectors
   - Mouse: Surface Integral

   Play and have fun with the applet.

2. Two charges in 1-D, four in 2-D, and six in 3-D are symmetrically placed about the origin (put them on the axes). All are positive charges. Using the potential energy for a positive test charge near the origin demonstrate that this test charge can or cannot be trapped in 1, 2, or 3 dimensions. In 3-D find the $\vec{\nabla} \cdot \vec{E}$ near the origin.

3. For this problem you might want to look at the following two web pages. Griffiths doesn't discuss transformation of vector fields between cartesian, cylindrical, and spherical coordinate systems and I could not find this material on wikipedia.

   http://emtmadeeasy.blogspot.com/2009/11/circular-cylindrical-coordinate-system.html

   http://emtmadeeasy.blogspot.com/2009/11/spherical-coordinate-system.html

   Given point P(-2,6,3) and the vector function $\overrightarrow{\mathbf{A}} = y\hat{x} + (x+z)\hat{y}$,

   (a) express P and $\overrightarrow{\mathbf{A}}$ in cylindrical and spherical coordinates and

   (b) evaluate $\overrightarrow{\mathbf{A}}$ at P in the Cartesian, cylindrical and spherical systems.

4. Something seems wrong with the trig function solutions to Laplace's equation using separation of variables. Explain in words only how you can have extremum only at the boundaries in the example used in lecture (remember that at the boundaries $y = 0$ and $y = b$ the trig function vanished yet the voltage was non-zero in the region between these points).

5. 3.13(PMC), 3.14(PMC), 3.15(PMC).