Homework 3

Due Friday 2/7/2014 - at beginning of class

Reading Assignment - Chapter 2.4-2.5

Griffiths Problems, 4th Edition

Each problem should be started on its own piece of paper. Points will be removed from solutions that are difficult to read.

When the problem numbering is different between the 3rd and 4th edition of Griffiths, the third edition number is in parenthesis.

2.23

2.41 (Griffiths 3rd Edition problem 2.37)

2.42 (Griffiths 3rd Edition problem 2.38)

2.43 (Griffiths 3rd Edition problem 2.39)

Problem 1.1 A spherical system has a NON-UNIFORM volume charge density $\rho = \gamma/r$ for $r < a$ and $\rho = 0$ for $r > a$ where γ is a constant. Compute either the electric potential everywhere or the total energy of the system.

Problem 1.2 Calculate the electric potential at a point $(0, 0, z)$ of a finite cylinder ($s < a$, $0 < z < \ell$) containing a uniform volume charge density ρ. Work on the problem until you have a single one-dimensional integral to do.

Problem 1.3 An infinite cylinder of radius a contains a uniform volume charge density ρ. Compute the potential difference between a point on the axis and a point on the outside surface.

Problem 1.4 Calculate the field and potential at the origin of a NON-UNIFORM spherical volume charge of radius a and charge density $\rho = \gamma \sin(2\theta)$ where γ is constant.

Problem E.3.5 Two spherical shells of radius a and b, $a < b$, have uniformly distributed charges $Q_a = Q$ and $Q_b = -Q$. Compute the energy between the shells.

Problem 1.6 The electric potential in some region of space is $V = V_0 x^2 - V_0 y^2$. Compute the electric field in cylindrical coordinates. What is the charge density in the region containing the field?