Homework 6: Due TUESDAY 10/4

(Actual Previous Midterm Problems! Should take 10 min. each.)

1) Find the capacitance of a solid conducting sphere of radius R near a large conducting plane of area A. The distance between the edge of the sphere and the plane is "d". ASSUME that the details of the distribution of the charge on the sphere is not affected by the charge on the plane, and the details of the distribution of the charge on the plane is not affected by the charge on the sphere.

2) (Note, I used "r" instead of "s" in this problem.) A long, hollow, non-conducting cylinder with thick walls has an inner radius of "a" and an outer radius of "b", as shown. (It is hollow in the middle, where the picture is black.) The cylinder has charge density in the object (between radius r=a and r=b) but not in the hole (obviously!).

The charge density IS NOT UNIFORM. Instead, it is distributed according to $\rho=Ar^3$, everywhere it is not zero ($a<r<b$). "A" is a constant.

Find the magnitude of the Electric Field at any radius r. You may assume the cylinder is long enough that the edge effects are not important. Be sure to give your answer in terms of "r" (and the constants A,a,b.)

3) A pesky charge +Q is at the origin. Part A): Suppose you want to shield the effect of this charge from bothering anything outside a spherical radius of distance R. But you also want to leave the field unchanged inside the radius R. What should you do? (Where exactly do you put additional charge, and how much?)

Part B: Calculate how much work it would cost you to actually carry out your answer to part A), using the Electric field approach.