Electrodynamics: Homework Assignment 5. Due November 1 either 11:00am in class or 10:45am in the instructor's mailbox.

1. Consider the "two hemispheres of radius *R* at different potentials" problem, similar to that of Jackson page 101. In this problem, ground the bottom hemisphere and set the upper hemisphere potential to constant Φ_0. Find the potential outside up to order $1/r^4$.

2. As an undergraduate, you probably studied the neutral conducting sphere placed in a uniform E field. (See, e.g., Griffiths 4th ed., example 3.8.) Do this in a different way: Consider a neutral conducting sphere of radius *R* placed in a uniform electric field $\mathbf{E_0}$ in the z-direction. The potential outside can be considered as that due to the uniform E field plus the surface charges on the sphere: this surface charge is *a priori* unknown, let's for now call it $\sigma(\theta)$.
a. Find an integral expression for the Coulomb ~~field~~ potential on the z-axis outside the sphere.
b. And from (a) find the potential everywhere outside the sphere. Try expanding "1/r" and applying orthogonality properties of Legendre polynomials in order to evaluate the Coulomb integral in (a).

3. Reconsider problem 1 on homework assignment #4, the line charge between two grounded plates. You may have found the potential by separation-of-variables and choosing the sign of separation constant so that the sine and cosine solutions are in the vertical (y) direction, and the hyperbolic sine and hyperbolic cosine solutions are in the horizontal (x) direction. Now, choose the separation constant to have the opposite sign and find the form for the potential. (You can choose to leave the potential in the form of integrals.) The point of this exercise is to show that the same potential can look completely different with the opposite sign of the separation parameter.

[ver 29Oct18 11:00]