Electrodynamics I: Assignment 2.
Due October 10 at 11:00am in class or 10:45am in the instructor's mailbox.

1. Consider two infinitesimal electric dipoles separated by the vector **r** with dipole moments $\mathbf{p}_1$ and $\mathbf{p}_2$. The two dipoles need not have any particular orientation with respect to each other. Find the interaction force between the dipoles and the interaction energy (essentially Jackson eqn. 4.26, but arrived at by a simpler treatment). You may want to recall the elementary result of the second term in Jackson eqn. 4.24.

2. Consider a point charge *q* at the center of a sphere of radius *R*. What uniform surface charge and surface dipole layer placed on the sphere will cancel the electric potential outside the sphere while leaving the potential inside unchanged?

3. Consider a plane where Φ_s is specified (Dirichlet boundary conditions) and a field point r above the plane. What's the Green's function for this configuration? (You might want to recall the very simple image-charge problem with a related geometry). Hence, with the Green's function integrals of Jackson section 1.10, find the potential at the field point. (This last has a simple form when expressed as a surface integral over the solid angle of the surface "viewed" by the field point.

4. Jackson problem 1.7. Two long, cylindrical conductors of radii a_1 and a_2 are parallel and separated distance *d*, which is large compared with either radius. Show that the capacitance of this [a transmission line, as we shall see] is given approximately by $C \approx \pi\epsilon_0 \left(ln\frac{d}{a}\right)^{-1}$, where *a* is the geometrical mean of the two radii.

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