Physics 106b: Electrodynamics
Problem Set 3
Due: Friday 4:00 pm, March 2, 2012

Remember: Late homework will be granted 50% credit up to one week late, unless you have a note from the Dean or a health official.

Reading: Griffiths Chapter 4
Problems:

1. Griffiths 3.21

2. Find the monopole, dipole, and quadrupole moments of the disk in problem 1. Show explicitly that the quadrupole tensor is diagonal and traceless and, in the process, evaluate $Q_{xx}$, $Q_{yy}$, and $Q_{zz}$.

3. Consider a thin disk of material which has a uniform polarization $\mathbf{P}$ directed perpendicular to the disk. Let the radius of the disk be $R$ and the thickness be $d \ll R$. Show that the electrostatic potential $V(r, \theta)$ at locations far from the disk depends only on the product $Pd$ and the solid angle $\Omega$ subtended by the disk.

4. Two concentric spherical surfaces have radii $a$ and $b$. If the potential on the inner surface is given by $V_a P_3(\cos \theta)$, and the potential on the outer surface is given by $V_b P_5(\cos \theta)$, find the potential in the region between the two surfaces. ($V_a$ and $V_b$ are constants.)