Coulomb's law and charge

Reading assignment
Ulaby, 4-1, 4-2, 4-3
Connor and Salon, I-16 → I-24

Software
Java applet on E of point charges - linked from Course Schedule

Problem 1 - Charge density

a. Find the charge in the spherical volume $r \le a$ containing a charge distribution $\rho = \rho_0 r^2/a^2$. Evaluate the result symbolically. Then find a numerical result when $a = 2$ meters and $\rho_0 = 10^{-6}$ C/m^3.

b. A surface charge on a disk increases linearly from $\rho_s = 0$ in the center to $\rho_s = 4 \times 10^{-6}$ C/m^2 at the outer edge where r = 2 meters. Determine the charge density as a function of position. Find the total charge on the disk.

Problem 2 - Electric field lines & Coulomb's law
Sketch the electric field lines for the electric quadrupole shown below.
Across what planes do you expect the field to be symmetric? Across what planes do you expect the field to be anti-symmetric? *After completing your sketch,* verify your result with the applet linked from today's date in the course schedule. Dipole results can be seen with the applet or with the Mathcad worksheet for Sect. 3.6.2