Coulomb's law and charge

Reading assignment
Paul, Whites, and Nasar, 3.1 -> 3.3

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 analytically. 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. 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? *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