

**ENEE 380 Spring 2003. Homework #2, 2/18/03**

**Due 2/25/03**

(1) Cheng Problem (3.17)

(2) A charge of 1C is uniformly distributed in the  $xy$  plane between  $-1 \leq x \leq 1$  and  $-1 \leq y \leq 1$ . Calculate and plot the electric field in the  $z$ -direction as  $z$  varies from 0 to 1000m.

(3) In Question (2) How far up the  $z$ -axis do you need to be before the field can be calculated within 1% accuracy by treating all the charge as if it were at the point(0,0,0).

(4) Cheng Problem (3.20)

(5) One type of quadrupole is an arrangement of 4 charges of magnitudes  $+q, -q, +q, -q$  arranged at the corners of a square. The spacing of the charges is negligible compared to the distance to an observation point where the field is measured. Derive expressions for the potential distribution from a quadrupole and thereby the various field components. Plot the equipotential surfaces in the plane of the quadrupole, and in a plane perpendicular to the plane of the quadrupole passing through the center of the square where the charges are located. Plot the radial electric field variation in the plane of the quadrupole.

(6) Repeat (5) for a linear quadrupole, where the charges are  $+q, -2q, +q$  arranged in a straight line