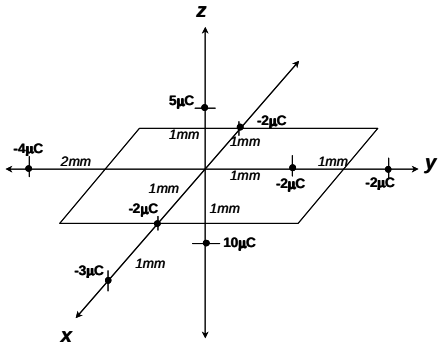
4th Assignment : Physics II (Electrodynamics)
Date:11th Feb 2012

Multipole Expansion

1. Find out dipole moment of the following charge configuration. What is the electrostatic potential of this charge configuration at a distant point (0.4m, 0.3m, 0)?



Problem 3.30 Two point charges, $3q$ and $-q$, are separated by a distance a. For each of the arrangements in Fig. 3.35, find (i) the monopole moment, (ii) the dipole moment, and (iii) the approximate potential (in spherical coordinates) at large r (include both the monopole and dipole contributions). Calculate dipole moment with respect to the origin

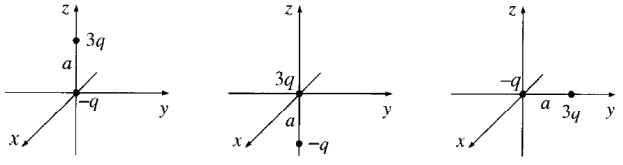


Figure 3.35

Method of image

Problem 3.6 Find the force on the charge $+q$ in Fig. 3.14. (The xy plane is a grounded conductor.)

1. A uniform line charge λ is place on an infinite straight wire, a distance d above a grounded conducting plane. (let's say the conducting plane is the xy plane and the wire runs parallel to x-axis)

(a) Find the potential above the plane.
(b) Find the charge density σ induced on the conducting plane.

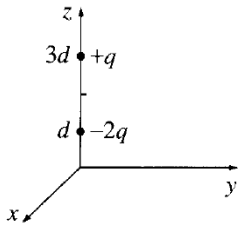


Figure 3.14

2. A dipole of dipole moment $\vec{p}$ is placed with its axis vertical at a distance d from an infinite conducting horizontal grounded plane. Calculate the force exerted on the plane by the dipole.

3. A point dipole of moment $\vec{p}$ is placed at a distance d above an infinite grounded conducting plane. The dipole makes an angle θ with the perpendicular to the conducting plane. Find the torque acting on the dipole. If the dipole is free to rotate, find its equilibrium position.