Homework 5

Due Friday 3/1/2013 - at beginning of class

Griffiths' 4 Problems

3.9 (Griffiths 3rd Edition 3.8)

3.10 (Griffiths 3rd Edition 3.9)

3.30 (Griffiths 3rd Edition 3.28)

Additional Problems

E.5.1 An infinite grounded conducting plane occupies the area $z < 0$. A dipole is formed of two charges $\pm Q$ separated by a distance a. The dipole moment is parallel to the z axis. The center or the dipole is a distance R from the plane. Compute the force on each charge and the total force on the dipole. Is the dipole attracted or repelled from the plane?

E.5.2 A grounded conducting sphere of radius a is centered at the origin. Two charges $+q$ are at a location $\pm D\hat{x}$ along the x-axis. Compute the electric potential at the point $2D\hat{x}$.

E.5.3 The potential on the surface of an infinite cylinder is given by $V(a, \phi) = V_0(\sin(\phi) + \cos(\phi))$. Find the potential at all points inside the cylinder and the field inside the cylinder.

E.5.4 Find the potential in the region where $x > 0$ and $y > 0$. The $y - z$ plane is held at potential V_0 and the $x - z$ plane is grounded. Hint, look at the trivial solutions.

E.5.5 The potential of a rectangular system is independent of z. The system extends to infinity in the x direction. On the plane $y = 0$ and $y = a$ the potential is zero. On the plane $x = 0$, the potential is $V(0, y) = V_0 \sin^2(\pi y/a)$. Compute the potential in the channel. Report the integral you would use to calculate the coefficients in the series, but you do not have to evaluate the integral.