Physics 405

Problem Set #7: DUE Friday 3/23/2007

Read Griffiths Chap. 3.3-3.4

(1) (10 points) Griffiths, Problem 3.18.

(2) (10 points) Griffiths, Problem 3.22.

(3) (10 points).

(a) Show that:
\[ V = \frac{1}{|r - r'|} = \sum_{l} (r')^l P_l(\cos \gamma), \text{ if } |r| > |r'| \text{ and } \gamma \text{ is the angle between the vectors.} \]

(Hint, choose the z-axis along r’. This sets a boundary condition for V at \(\gamma=0\). Find the coefficients \(A_l\) and \(B_l\) in the spherical coordinate expansion.)

(b) Write the exact potential for a true electric dipole drawn below in terms of Legendre polynomials in the region \(r>s\).

(c) What is the potential to lowest nonvanishing order when \(r >> s\).