

## 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.

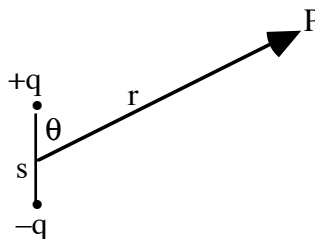
(3) (10 points).

(a) Show that:

$$V = \frac{1}{|\mathbf{r} - \mathbf{r}'|} = \sum_l \frac{(r')^l}{r^{l+1}} P_l(\cos \gamma), \text{ if } |\mathbf{r}| > |\mathbf{r}'| \text{ and } \gamma \text{ is the angle between the vectors.}$$

(Hint, choose the z-axis along  $\mathbf{r}'$ . 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  $r \gg s$ .