

Physics 106B: Electricity and Magnetism
Homework 7: Electrostatics – Laplace’s Equation, Multipole
expansion

DUE: TUESDAY, MARCH 11 2003

NOTE: UNUSUAL DUE DATE FOR THIS HW. YOU MAY TURN IN UP TO 3 DAYS LATE FOR 50% Further extensions only with note from the Dean or health official.

Reading: Griffiths, Chapter 3

1. Griffiths 2.39
2. Griffiths 3.10
3. Griffiths 3.14
4. Griffiths 3.38
5. Show that for a point dipole

$$\vec{E}(\vec{x}) = -\nabla V = \frac{3\hat{\mathbf{r}}(\vec{p} \cdot \hat{\mathbf{r}}) - \vec{p}}{4\pi\epsilon_0 r^3} \quad (1)$$

6. Express the potential of a pointlike linear quadrupole, oriented parallel to the z axis, in Legendre polynomials. There are three charges: $+q$, $-2q$, and $+q$ on the z axis, with $-2q$ at the origin, and $+q$ at $z = -a$ and $+a$.