HW 3 – Gauss's Law and Potentials

Due September 18, 2009, 5 pm

These problems will give you insight into the relationships between fields, charges, and forces. You will learn how to derive the field from a charge distribution and the charge distribution from a field. You will also start learning how to derive a potential from a field.

All problems are from Griffiths, Chapter 2.

1. Problem 2.1a & b (p. 60)
2. Problem 2.5 (p. 64)
3. Problem 2.6 (p. 64)
4. Problem 2.11 (p. 75)
5. The average electrostatic field in the Earths atmosphere has been found to be roughly $\vec{E} = -E_0(Ae^{-\alpha z} + Be^{-\beta z})\hat{z}$, where z is the height above sea-level and the other variables are all (positive) constants. Find the average charge density in the atmosphere as a function of height.
6. Can the vector field $\vec{E}(\vec{r}) = (yz - y^2)\hat{x} + xz\hat{y} + xy\hat{z}$ be an electrostatic field?
7. Consider $\vec{E}(\vec{r}) = (yz - 2x)\hat{x} + xz\hat{y} + xy\hat{z}$. Derive a potential $V(\vec{r})$ for this field. What is your reference point?