PHY 6346, Fall 2015

Homework #1, Due Monday, August 31

1. Starting from equation (1.5) in the text, compute the electric field $\mathbf{E}(\mathbf{x})$ at every point in space produced by an infinite sheet of uniform surface charge density $\sigma$ lying in the $x$-$y$ plane.

2. Suppose that, while remaining radial with linear superposition, instead of scaling with distance as $1/r^2$ the force between charges varies as $1/r^{2+\delta}$. Recompute the electric field of Problem 1. What unsettling thing happens if $\delta < 0$? What happens if $\delta < -1$?

3. What is the cyclic sum $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) + \mathbf{b} \times (\mathbf{c} \times \mathbf{a}) + \mathbf{c} \times (\mathbf{a} \times \mathbf{b})$? Is this expression symmetric or antisymmetric (or otherwise) in $\mathbf{a}$, $\mathbf{b}$, and $\mathbf{c}$? What does your result say about the associativity of cross products?

4. Compute $\nabla_i \nabla_j \left( \frac{1}{r} \right)$?

5. What is the value of the integral $\int_1^\infty dx \delta(x) x^{-p}$?