

# Physics 106b: Electrodynamics

## Problem Set 2

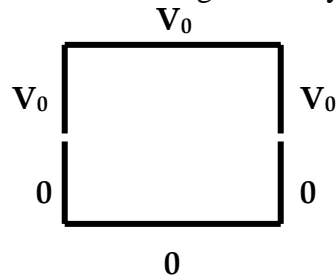
Due: Friday 4:00 pm, February 27, 2009

Remember: Late homework will be granted 50% credit up to one week late, unless you have a note from the Dean or a health official.

**Reading:** Griffiths Chapter 3

**Problems:**

1. Griffiths 3.14
2. Griffiths 3.48, part a) only.
3. An infinite plane surface carries an oscillatory charge density,  $\sigma = \sigma_0 \sin(kx)$ .
  - a) Find the electrostatic potential everywhere. Roughly how far from the plane must you be in order that the potential becomes “small”?
  - b) Find the electric field everywhere and sketch the field vector on both sides of the plane. Demonstrate that all appropriate boundary conditions are met.
  - c) Determine the stored electrostatic energy in this system, per unit area of plane surface.
4. Find the electric potential everywhere inside a long conducting pipe of square cross-section (with side  $a$ ) on which the following boundary conditions are imposed:



In other words, the pipe has been split down the middle lengthwise. One half is held at zero potential and the other at potential  $V_0$ . Assume the gap between the halves is infinitesimal. *Hint:* The potentials in the top and bottom halves are related by symmetry. *Also:* I assign this problem most every year, so you can surely find a solution from a previous 106b student. But do it yourself; it's interesting and instructive and will be useful later on.