**ECEn 560**
**Electromagnetic Wave Theory**

Homework #5
Due January 21, 2016 (may be turned in late for half credit)

1. Fill in the blanks: A Green's function is the unique solution to a _____,
   which consists of a _____, a _____,
   and a _____. A Green's function is the spatial analog of the
   _____ of a linear system. The solution to a boundary value problem
   for an arbitrary source distribution can be obtained by _____ the
   _____ with the _____. In electromagnetic theory,
   this type of integral is called a _____ _____.

2. (a) The 1D scalar Green's function is defined by

$$\left( \frac{d^2}{dx^2} + k^2 \right) g(x, x') = -\delta(x - x')$$

   with an outgoing radiation boundary condition at $\pm\infty$. Show that the Green's function is
   given by

$$g(x, x') = \frac{i}{2k} e^{ik|x-x'|}$$

   (b) Is $g(x, x') = ie^{ik|x-x'|}/(2k) + e^{ikx}$ a Green's function for this problem? Why or why not?

3. Use MATLAB and the 2D scalar free space Green's function to create two-dimensional image
   plots of the magnitude of the field radiated by (a) a time-harmonic line source at the origin
   and (b) two line sources, one at $x = -\lambda/4$, $y = 0$ and the other at $x = \lambda/4$, $y = 0$. Assume
   the currents on the two line sources are in phase and equal in amplitude.

4. Work through and understand the steps in the derivation of the 3D scalar free space Green's
   function.