ChE 230A  Fall 2012  Homework Set #1

**Recommended practice (answers given):**

Final 2011, #2, 3, 4a,b,c
Final 2010, #1, 2 (a case where must remember that $k^2 = k_x^2 + k_y^2 + k_z^2$
Final 2009, #1, 2, 3, 4, 6
Final 2007, #2, 4d

The problems above require integral transforms, Green functions, or variational calculus. But don’t forget the old stuff!

**Recommended practice**

1. **A.** Fourier transform the equation

   $$-\frac{d^2 \phi}{dx^2} + K^2 \phi = f(x) \quad -\infty < x < \infty$$

   and show that the solution is

   $$\phi(x) = \int_{-\infty}^{\infty} dx_0 \left[ \frac{1}{2\pi} \int_{-\infty}^{\infty} dk \frac{e^{ik(x-x_0)}}{k^2 + K^2} f(x_0) \right].$$

   **B.** Use

   $$\int_{-\infty}^{\infty} \frac{\cos[kx]}{k^2 + K^2} dk = \frac{e^{-|Kx|}}{|K|} \pi$$

   to show that the solution in part A can be simplified to

   $$\phi(x) = \int_{-\infty}^{\infty} dx_0 \frac{e^{-|K(x-x_0)|}}{2|K|} f(x_0).$$

   Identify the point source solution.

**Graded problem: Final 2008, #2**