Homework 4 (Due Wednesday 16 February 2005)

1. For a wave incident from the left on a jump from $V = 0$ to $V = V_0$ at $x = 0$, obtain the wave function assuming $E = V_0$.

2. Now do the same thing for $E > V_0$, indicating how transmission and reflection coefficients (actually $|T|^2$ and $|R|^2$, which give the transmitted and reflected intensities) vary with E.

3. For the case in Prob. 2, do the same thing assuming a wave incident from the right. Compare the transmission and reflection coefficients between the cases of Prob. 2 and Prob. 3.

4. Consider the Schrödinger equation with dimensions scaled out, $-\partial_x^2\psi + x^2\psi = 2E\psi$. Here x and E are treated as pure numbers, rather than having dimensions of length and energy. Show that the choice $\psi = e^{-x^2/2}$ solves this equation for a special value of E, and determine that value.

5. Do the same thing as in Prob. 4 for the case $\psi = xe^{-x^2/2}$. Is E this time higher or lower? Does that make sense? Explain your reasoning.