Homework #6; Due Monday 3/16. (Review on 3/16; Midterm 2 on 3/18.)

NOTE: Most, if not all, of the integrals you need to do this homework are in Appendix 3 or 6. Or you can just look them up...

1. Explicitly show that the sum of **any** two solutions to the Schrodinger equation will lead to a third solution. (Don't assume that the solutions take any particular form.)

2. Normalize the stationary states of the infinite square well. Do it for arbitrary "n".

3. A particle with mass M is in the second-lowest energy state in an infinite square well of width 'a'. What is the probability it will be found within a distance D from one of the two walls? (Assume D < a/2. Check your answer for the special case D=a/2.)

4. Normalize the wavefunction $\psi(x) = A\exp\left(-\frac{x^2}{a^2}\right)$. (See Appendix 6.) "a" is known; Here A is the normalization constant. This wavefunction is not in a box; it goes to infinity.

5. (4 points). At t=0, an electron in a one-dimensional box of length L is a superposition of the lowest two energy states; $\psi = 3\psi_1 + 4\psi_2$. You can assume that ψ_1 and ψ_2 are **individually** normalized, but ψ is (obviously!) not normalized.
A) Normalize the full wavefunction without plugging in for ψ_1 or ψ_2. (There are two ways to do this!)
B) What does the explicit wavefunction look like as a function of (x,t) at a later time?
C) Where is the most likely place that you will find the particle at a given time t? (Where is the probability maximum?) Make sure you plug your full answer from part B) so that your answer is a function of time.
D) Show that your answer to C) is real, and describe its behavior with time.
E) What might you find if you made an energy measurement of the electron, and with what probabilities? (You can do this at t=0, because the answer doesn't change with time.)
F) Suppose you measured the maximum possible value of the energy, that it is possible to measure given this particular wavefunction. What would the "collapsed" wavefunction look like?