` Physics 471 – Fall 2009

Homework #3, due Friday, September 25

Point values are in square brackets.

1. [6] Griffiths problem 2.5
   This problem is rather long, especially part (c). Use the following trigonometric identities:
   $\sin^2(x) = ½ (1-\cos(2x))$ and $\sin(x) \sin(y) = ½ (\cos(x-y) – \cos(x+y))$
   and use the integrals shown on the inside back cover of your textbook.
   If you really don't like doing integrals, here is the most difficult one, from Mathematica:
   $$\int_0^a x\sin\left(\frac{n\pi x}{a}\right)\sin\left(\frac{m\pi x}{a}\right)dx = \frac{a^2}{2\pi^2}\left(\frac{\cos((m-n)\pi)-1}{(m-n)^2}+\frac{1-\cos((m+n)\pi)}{(m+n)^2}\right)$$
   for m, n integers and $m \neq n$.

   When you get to part (d), compare Equations [1.35] and the first part of [1.33]. When are you allowed to use [1.33] (" the quick way")? When must you use [1.35]? By the way, Griffiths' quote is from the 1944 movie, "Arsenic and Old Lace."

2. [5] Griffiths problem 2.7.
   Hint: Draw pictures of the first few stationary states of the infinite square well, and compare them with $\Psi(x,0)$. Can you eliminate some of the c_n coefficients just by symmetry?
   For part (d), you can use Mathematica to evaluate the infinite sum, or just leave it as a sum.

3. [4] Griffiths problem 2.10. Note for part (a): If you use Equation [2.66], then your ψ_2 will already be normalized. Don't bother to check the normalization unless you really feel like doing extra work.

4. [5] Griffiths problem 2.11. Do this problem ONLY for ψ_0. It's too long otherwise.