Problem Set #5

Due Friday, April 18 by 5pm to Dickinson 104

Unless otherwise indicated, all problems come from "Quantum Physics: A Fundamental Approach to Modern Physics"

1. Problem 3.14
2. Problem 4.1
3. Problem 4.2
4. Problem 4.7 (*Hint: Start with a continuity condition in order to get rid of the constant "A" by writing it in terms of "C." Warning: Unlike your previous experiences, the normalization constant will not be pretty.)*
5. The allowed energies of a particle in a finite well is given by Equations 4.26 and 4.30 in your book. Consider a well with a potential of:

$$V_0 = 4\left(\frac{\hbar^2\pi^2}{2ma^2}\right)$$

   a. For this potential, simplify the right-hand side of 4.26 and 4.30 and graph the two sides of each equation as a function of ξ. Find solutions for the two bound-state energies allowed by the energy equations (see figure 4.3 for an illustration of this technique).
   b. Compare these two energies to the first two energy states of a particle in the infinite square well (Equation 4.31). Is the energy of the first two states in the finite square well higher or lower than the first two states in the infinite square well? Does this make sense considering the qualitative behavior of the wave function for the finite square well shown in Figure 4.4?