LAB 6: NUMERICAL SOLUTION OF SCHRÖDINGER'S EQUATION

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QUICK START FOR PROCEDURE

For convenience, we are typing u instead of ψ in this document for the wavefunction. It's just easier to type.

1. Set up your Excel file for whichever potential shape you're working on
    a. You will examine a *finite square well* and a *harmonic oscillator*
    b. See **Figure 1** and **Excel Tips** (pages 5-6) in the full handout for help
2. Make graphs of the potential, $V(x)\ vs\ x$, and the wavefunction, $u(x)\ vs\ x$.
    a. *Optional:* You might want to graph $E\ vs\ x$ on the same potential plot
        i. *Optional*: If you want to be very fancy, plot the wavefunction using the energy level line as your horizontal axis for the wavefunction. This is a standard way to display wavefunctions together with the potential.
    b. *Optional:* You might want to graph the probability density, $u^2(x)\ vs\ x$.
3. Find the energy eigenvalues for the potential, checking that the wavefunction $u(x)$ obeys the appropriate boundary conditions
    a. You must find the eigenvalues to at least 4 significant figures. See **Footnote 5** in the full handout for more details about the appropriate level of precision for this lab.
    b. You should find the first two energy eigenvalues of the finite square well by hand, but can use the SOLVER add-in to find the next two energy levels. Your instructor can help you set SOLVER up.
    c. We recommend making a new tab in your spreadsheet for each eigenvalue by copying the previous one. See **Figure 3** on page 7 of the full handout.
    d. You may need to adjust the range of x as you find higher energies or switch potentials

4. Explore the optional expansions on page 8 of the full handout if there is time