# Worksheet 8

Numerically solve the 1-d Schrödinger equation

$$\frac{d^2\psi(x)}{d\ x^2} - 2[V(x) - E]\psi(x) = 0 \tag{1}$$

for the following potentials written in Hartree units.

**Problem 1** Infinite Well Potential:

$$\begin{aligned} V(x) &= 0 \quad |x| \leq L/2 \\ &= \infty \quad |x| > L/2 \end{aligned}$$

Find the ground state energy and the wave function.

**Problem 2** Finite Well Potential:

$$\begin{aligned} V(x) &= -V_0 \quad |x| \leq L/2 \\ &= 0 \quad\ \ |x| > L/2 \end{aligned}$$

Find the ground state energy and the wave function.

**Practice Problems:** (a) Excited states (b) Quantum harmonic oscillator