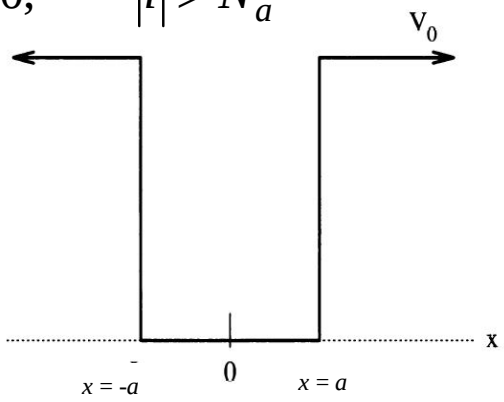
Homework assignment 10

10.1 Modify the ample code 10.5 by defining an infinite square potential of the form

$$V_i = \begin{cases} V_0, & |i| \le N_a \\ 0, & |i| > N_a \end{cases}$$

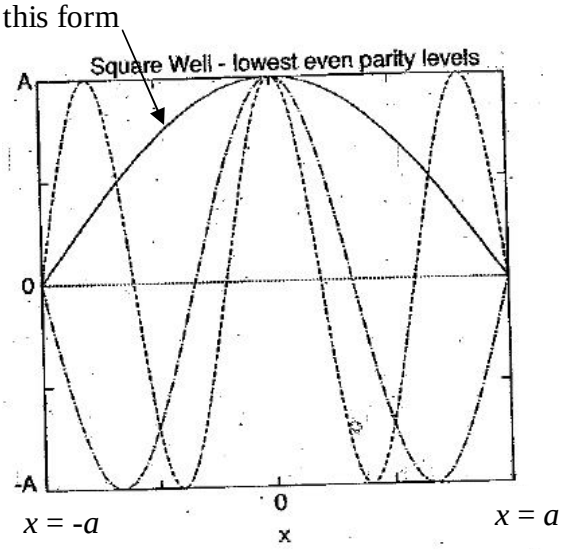


When solving infinite square well numerically, we can't set V_0 to ∞. To mimic "infinity" numerically, simply set V_0 to a very large value, i.e., 1000 or larger.

Calculate the GS energy and the error associated with it. Display also the solution. The theoretical eigen energies for a infinite square well is known to be

$$E_n = \frac{n^2\pi^2\hbar^2}{8ma^2}$$

Hence you should get a ground state energy consistent with E_0 =1.2337, in unit $\hbar = 1$, with mass and size of the well m = 1, a = 1. Estimate the error in E_0. The ground state is a cosines function of this form



10.2. Modify the sample code 10.5 to calculate the ground state energy of a particle confined by a 2-D harmonic potential, $V(x,y) = \frac{1}{2}k_x x^2 + \frac{1}{2}k_y y^2$. Display your ground state solution using the Mathematica command `ListPlot3D`. For simplicity sake, assume $k_x = k_y = 1$. You should get E_0 to be around the theoretical value of 1.0. (See page 329 - 330, Giordano 2nd edition.)