1. A particle is trapped in an infinite one dimensional well of width L. If the particle is in the ground state, evaluate probability to find the particle in interval (a) $[0, L/3]$, (b) $[L/3, 2L/3]$, (c) $[2L/3, L]$.

2. What is the minimum energy of a proton when confined to a region of space of nuclear dimensions, say 10 pm?

3. The wave function of a particle trapped in a box of length L is given by

$$\psi(x,0) = 3u_1(x) + 4u_2(x)$$

where u_1 and u_2 are normalized wave functions of the ground state and the first excited state.

   (a) Normalize ψ.
   (b) Find average energy and momentum of the particle.
   (c) Find the probability that the particle is found in interval $[0, L/2]$.
   (d) Write down $\psi(x,t)$.
   (e) Answer (b) and (c) at $t = (\hbar/3E_1)\pi/2$ and at $t = (\hbar/3E_1)\pi$. E_1 is the ground state energy.

4. At classical turning points $\pm A_0$ of a harmonic oscillator, total energy is equal to the potential energy. Find the turning points for the ground state and the first excited state. What is the probability that the particle in the ground state is found outside the classically forbidden region?

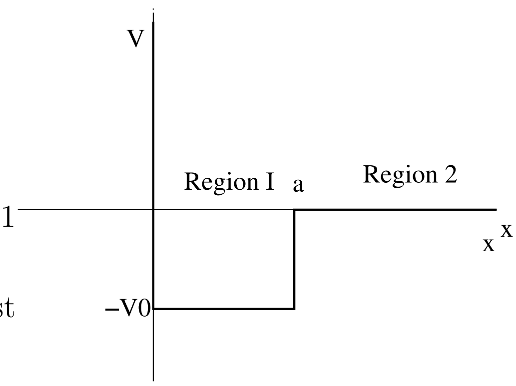
5. Evaluate $\Delta x \Delta p$ for the ground state of harmonic oscillator.

6. The first excited state of the harmonic oscillator has a wave function of the form $\psi(x) = Axe^{-ax^2}$. Find the energy E, a and A.

7. Consider a particle in potential energy function given by

$$V(x) = \begin{cases} \infty & \text{if } x < 0 \\ -V_0 & \text{if } 0 < x < a \\ 0 & \text{otherwise} \end{cases}$$

Assume that the energy of the particle is negative.



   (a) Write down the boundary conditions.
   (b) Write down wave functions in region 1 and region 2.
   (c) Find the condition on energy. Suggest one way of finding eigen energies.