1. Normalize the following wavefunctions

   a) $\psi = \sin \frac{2\pi x}{L}$ on (0,L)

   b) $\psi = C$ on (-a, a), C = constant

   c) $\psi = e^{-x^2}$ on $(-\infty, \infty)$

   d) $\psi = e^{-\alpha r}$ in 3-dimensional space

2. Consider the wavefunction $\psi = \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$ for a particle in a box of length L ($0 \le x \le L$). What is the probability of finding the particle between x = L/4 and 3L/4? What is the probability of finding it between 0 and L/2?

3. Consider a particle described by the wavefunction $\psi = e^{ikx}$. What is the momentum? Would mutliple measurements of the momentum give the same value? Why or why not?

4. Consider the wavefunction $\psi = ae^{ikx} + be^{-ikx}$. What is the momentum? Would multiple measurements of the momentum give the same value? Why or why not?

5. If an electron is known to be located between x = 0 and 10Å, what is the uncertainty in its momentum?

6. Consider a conjugated polyene containing 16 C atoms. If you model the π electrons of this system with a one dimensional particle in the box, the ground state would place two electrons in each of the eight lowest energy orbitals. What is the energy gap (in ev) between the 8^{th} and 9^{th} orbitals? What is the frequency of the transition between these two energy levels.