

**Quantum Physics I PHY471, Fall 1999**  
**Homework set 6**  
**Due Monday, 10/18/1999**

*Please clearly state your assumptions, number the equations and indicate logical connections between different lines.*

**1. [2+2+2+2+2 pt] Infinite square well**

Consider the potential  $V(x) = \begin{cases} \infty & \text{for } x < -L/2 \text{ and } x > L/2 \\ 0 & \text{for } -L/2 < x < L/2 \end{cases}$ .

- State all applicable boundary conditions.
- Find the time-dependent wavefunctions of the stationary states over the region  $-\infty < x < \infty$ .
- Find the energy eigenvalues.
- For the ground state, evaluate  $\Delta x$  and  $\Delta p$  according to their definitions as rms deviation from the mean. What is the product of  $\Delta x$  and  $\Delta p$ ?
- For the first excited state, evaluate  $\Delta x$  and  $\Delta p$  according to their definitions as rms deviation from the mean. What is the product of  $\Delta x$  and  $\Delta p$ ?

**2. [4 pt] Orthonormality of eigenfunctions of the infinite square well**

Prove that the eigenfunctions of the infinite square well are orthonormal (eq. (35) on page 67). Hint: You can write  $\sin(ax)$  in as  $(e^{iax} - e^{-iax})/(2i)$  and then do the integral.

**3. [1+1+2+1+1pt] Particle in infinite square well**

Ohanian, #3.5, p. 92