

# PH 451: Capstone in Quantum Mechanics

## Homework 1

Due 1/11/08

- 1) (Goswami 3.10) Calculate the uncertainty product  $\Delta p \cdot \Delta x$  using the box wave functions

$$\psi_n(x) = \sqrt{\frac{2}{a}} \sin \frac{n\pi x}{a}$$

- 2) (Goswami 3.13) An electron is in the ground state of a box with sides at  $x=0$  and  $x=a$ . Suddenly one wall is moved from  $x=a$  to  $x=2a$ . What is the probability that the electron will be found in:
- the ground state of the new box?
  - the first excited state of the new box?

- 3) (Townsend 3.17) A spin-1 particle is in the state

$$|\psi\rangle \doteq \frac{1}{\sqrt{14}} \begin{pmatrix} 1 \\ 2 \\ 3i \end{pmatrix}$$

- What are the probabilities that a measurement of  $S_z$  will yield the values  $\hbar, 0, -\hbar$  for this state? What is  $\langle S_z \rangle$ ?
- What is  $\langle S_x \rangle$  for this state?
- What is the probability that a measurement of  $S_x$  will yield the value  $\hbar$  for this state?