

Name: \_\_\_\_\_

PHYS 452: Quantum Mechanics II, Quiz #1

**Instruction: use additional sheets if you find it necessary**

1. Consider the following trial wave functions:

$$\psi_1 = a_1\phi_1 + \phi_2,$$

$$\psi_2 = b_1\phi_1 + b_2\phi_2,$$

$$\psi_3 = c_1\phi_1 + c_2\phi_2 + c_3\phi_3,$$

where  $\phi_i$  are some given functions (*i.e.* basis functions) and  $a_i$ ,  $b_i$ , and  $c_i$  are free parameters (linear coefficients) that can be adjusted arbitrarily. What are the relations (greater, equal, or smaller) between the lowest upper bounds to the ground state energy,  $E_1$ ,  $E_2$ , and  $E_3$  that correspond to the above trial wave functions.

2. Use a symmetric triangular function as a trial wave function to estimate the ground state energy of a particle in an infinite square well of length  $a$ . Compare your result to the exact ground state energy ( $E_1^{\text{exact}} = \frac{\pi^2\hbar^2}{2ma^2}$ )