SP5.

(a) (2 points) Show that the stationary-state wave functions remain unchanged if the potential energy $V(x)$ is changed by a constant amount everywhere. What happens to the energy eigenvalues in this case?

(b) (3 points) You are given a quantum state with a known Hamiltonian. At $t = 0$ a measurement of the energy of the state is made. Answer the following questions *TRUE* or *FALSE*:

(i) Your energy measurement will yield an energy eigenvalue only if the initial state before the measurement was an energy eigenstate.

(ii) For $t > 0$ the expectation value of x ($\langle x \rangle$) may depend on time.

(iii) For $t > 0$ a measurement of position for the particle (x) will not leave the particle in a stationary state.

(c) (3 points) Show that the product $\hat{x}\hat{p}$ is not a Hermitian operator.

(d) Buckaroo Banzai is driving a car of mass 500 kg along a smooth road at a speed of 100 km/hour when he runs into a smoothhill of heigh 80 m and width 200 m. Making suitable approximations, what is the numerical (non-zero) order of magnitude quantum mechanical probability of the car going pas the hill? [Hint: You may find that your calculator is of little use!]