

HW6: Shabani – QM1 Due on Thu Nov 11th

1. An infinitely deep 1D square well potential confines a particle between 0 and L. Sketch the wave function for its lowest eigen state. If a repulsive delta function: $\alpha\delta(x - L/2)$ (where $\alpha > 0$) is added at the center of the well, sketch the new wavefunction and state whether the energy increases or decreases. What happens to ground state energy of the infinite square well when alpha goes to infinity?

2. Consider a harmonic oscillator. Obtain an expression for the probability of finding the particle outside the classical region.

3. A particle in harmonic oscillator potential starts out in the state:

$$\Psi(x, 0) = A[3\psi_0(x) + 4\psi_1(x)]$$

- (a) Find A.

- (b) Construct $\Psi(x, t)$ and $|\Psi(x, t)|^2$.

- (c) Find expectation values of $\langle x \rangle$ and $\langle p \rangle$.

- (d) If you measured the energy of this particle, what values will you get? With what probabilities?