

Birzeit University
Department of Physics
Quantum Mechanics I, Phys433
Fall 2020
Homework 2: Due date Oct. 5th 2020

1. Consider a particle of mass m in the one dimensional harmonic oscillator with frequency ω . At time $t = 0$, the probability that the particle in state $n = 2$ is $3/5$ and at state $n = 3$ is $2/5$.
 - (a) Write $\Psi(x, t)$.
 - (b) Calculate $\langle \hat{H} \rangle$
 - (c) Calculate $\langle x \rangle (t)$ and $\langle p \rangle (t)$
 - (d) Calculate $\langle N^2 \rangle$

2. Consider a particle of mass m in the one dimensional harmonic oscillator with frequency ω . At time $t = 0$, the probability that the particle in state n $|c_n|^2 = \frac{\alpha^n}{\sqrt{n!}} |c_0|^2$, where $|c_0|^2$ is the probability for finding the particle at $n=0$ state.
 - (a) Find c_0
 - (b) Find $\langle x \rangle$, $\langle x^2 \rangle$, $\langle p \rangle$ and $\langle p^2 \rangle$
 - (c) Check the effect of a_- on the wavefunction at $t = 0$

Hint: You might want to do part c before part b