

PHYS 451: Quantum Mechanics I – Spring 2017
Quiz #3

Consider a particle in the harmonic oscillator potential $V(x) = \frac{m\omega^2 x^2}{2}$. The initial wave function of the particle is given by

$$\Psi(x, 0) = A \left(1 + \frac{x}{|x|} \right) f(x),$$

where $A > 0$ is a constant and $f(x)$ is a real normalized (on the interval $[-\infty, +\infty]$) function that is odd under space reflection, i.e. $f(-x) = -f(x)$.

- (a) Find constant A .
- (b) Find the value of the initial probability density at point $x = 0$.
- (c) What is the initial probability of finding the particle in the region $[-\infty, 0]$?
- (d) What is the initial probability of finding the particle in the region $[0, +\infty]$?
- (e) What is the parity of the initial wave function? What is the parity of the wave function at time $t > 0$?
- (f) Is there a time $t_1 > 0$ at which we can be certain that the particle will be in the region $x \geq 0$?
- (g) Is there a time $t_2 > 0$ at which we can be certain that the particle will be in the region $x \leq 0$?