

PROBLEM SET 1

Due: Monday, September 10, 2012

1.

Consider a particle of mass  $m$  moving in a potential  $V(x) = \frac{1}{2}kx^2$ . The particle is initially in the ground state  $\psi_0(x)$  of the harmonic oscillator. At  $t=0$ , the potential is suddenly changed to  $V(x) = \frac{1}{2}k'x^2$ , where  $k' > k$ . The wave function immediately after the change is  $\psi_0(x)$ . Calculate the probability that the particle is found in the ground state of the new potential at a later time  $t$ .

2. Consider a particle of mass  $m$  moving in a potential  $V(x) = \frac{1}{2}kx^2$ . The particle is initially in the ground state  $\psi_0(x)$  of the harmonic oscillator. At  $t=0$ , the potential is suddenly changed to  $V(x) = \frac{1}{2}k'x^2$ , where  $k' > k$ . The wave function immediately after the change is  $\psi_0(x)$ . Calculate the probability that the particle is found in the first excited state of the new potential at a later time  $t$ .