

Homework 5: due on Oct. 13th

1. Textbook 2.10
2. Textbook 2.12
3. One major difference between classical and quantum mechanics on a harmonic oscillator is that in quantum mechanics you may find probability of the particle until $|x| \rightarrow \infty$, while in classical mechanics the particle can only be in so-called “classical range $-x_c < x < x_c$ ” which is defined as: $\frac{1}{2}m\omega^2 x_c^2 \leq E$. For the ground state, find the total probability of the particle beyond the “classical range”.
4. The Hamiltonian of a coupled harmonic oscillator can be expressed as
$$H = \frac{1}{2m}(p_1^2 + p_2^2) + \frac{1}{2}m\omega^2(x_1^2 + x_2^2) + \lambda x_1 x_2$$
 where $p_1 = -i\hbar \frac{\partial}{\partial x_1}$ and $p_2 = -i\hbar \frac{\partial}{\partial x_2}$. Assume $\lambda < m\omega^2$, find the energy levels of the coupled oscillator.