
Deadline: lecture next Monday (2017-05-08)

1. (2 points) Variational method: We apply the test function

$$\psi_{tf} = \begin{cases} a^2 - x^2, & -a \leq x \leq a \\ 0, & \text{elsewhere} \end{cases}$$

onto the Schrödinger equation of the harmonic oscillator.

(a) Calculate the expectation value of the energy $\langle \varepsilon(a) \rangle$ for the testfunction.

(b) Determine the minimum of $\langle \varepsilon(a) \rangle$ and compare the result with $E_0 = \frac{\hbar\omega}{2}$.

2. (2 points) The potential of a particle in a one-dimensional ring is given by

$$V(\phi) = \begin{cases} 0, & \text{if } r = \rho \\ \infty, & \text{elsewhere} \end{cases}$$

Derive the eigenfunctions and their energies.