

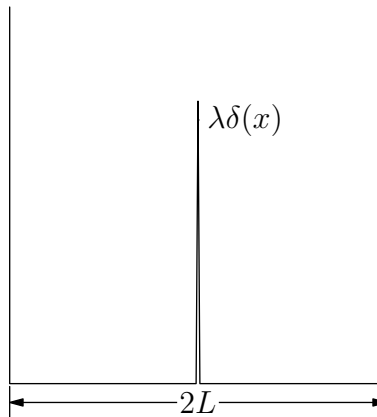
M07Q.3 - Delta Function in a Box

Problem

A particle of mass m is confined to a square potential well of width $2L$ with a delta function in the center:

$$V(x) = \begin{cases} \lambda\delta(x), & |x| < L \\ \infty, & |x| \geq L \end{cases}$$

In this problem λ is always large, $\lambda \gg \hbar^2/mL$.



- What are the energies of the two lowest energy eigenstates, which are odd and even under parity, when $\lambda \rightarrow \infty$?
- Now consider the case when λ is large but finite and find the energies of the lowest odd and even parity eigenstates to the lowest order in $1/\lambda$.
- Suppose that at $t = 0$ the particle is localized on the right-hand side of the well and has the lowest possible energy. Calculate the probability of finding the particle on the left-hand side of the well as a function of time.