

Quiz #7 (Particles in Potential Wells)

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Quantum Mechanics

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Prob. 1(3)

In the Youtube lecture, it was shown that $\tan(kL/2) = \kappa/k$ for even eigenstates and $-\cot(kL/2) = \kappa/k$ for odd eigenstates when a quantum mechanical particle having mass m and kinetic energy E is confined in a finite potential barrier having $V(x) = 0$ for $-L/2 < z < L/2$ and $V(x) = V_0$ for $z < -L/2$ or $z > L/2$.

(a) Give the expressions for k and κ .

(b) If $X = kL/2$ and $Y = \kappa L/2$, show that $Y = X \tan(X)$ for even eigenstates and $Y = X \tan(X - \pi/2)$ for odd eigenstates.

(c) Explain how one can determine how many eigenstates exist by plotting above relationships between X, Y obtained in (b).

Prob. 2(2)

Sketch the three-lowest eigenstates for a quantum mechanical harmonic oscillator. Give the corresponding eigen energy for each eigenstate.