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Midterm 2 Review

University of Colorado

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Please type your name in the form: Last, First:

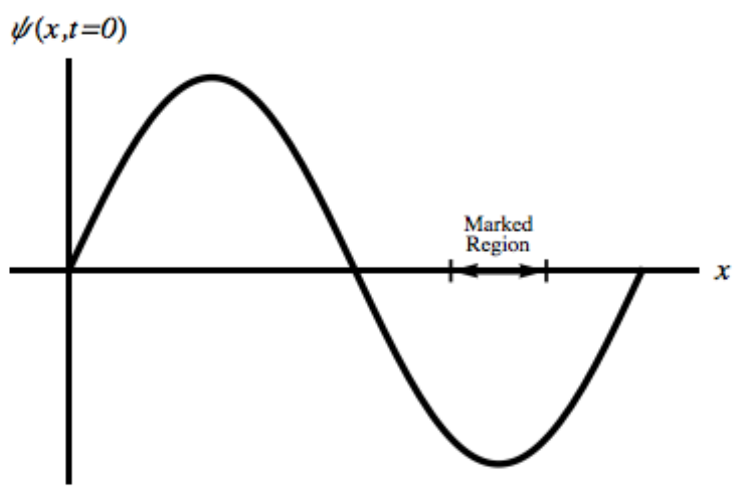
Required.

NOTE!! Please type in your CU userid (that's the username you use to log in to CULearn. We do NOT want your password. It probably looks like your last name, perhaps with a few extra characters. Note that it is definitely NOT your numerical (9 digit) student ID!!
This script cannot "error check", you have to be sure you type it in correctly! Thanks

Please type your CU userid:

Required.

Q1: Suppose a system consists of a particle in an infinite square well potential of width a. The wave function for the system at time t = 0 is shown at right. This state satisfies the eigenvalue equation $\hat{H}\psi = E_2\psi$, where $E_2 = \frac{2\pi^2\hbar^2}{ma^2}$. Consider the marked region along the x-axis. Rank from greatest to least the probabilities of finding the particle within

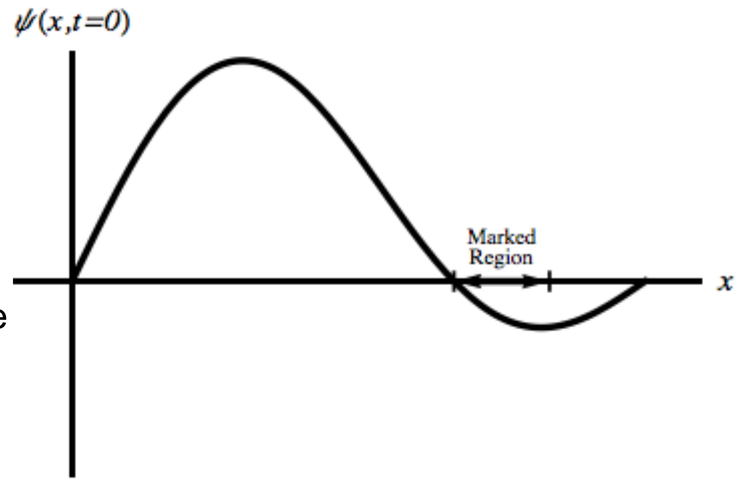


the marked region at the following five times: $t_0 = 0$, $t_1 = \frac{\pi\hbar}{2E_2}$, $t_2 = \frac{\pi\hbar}{E_2}$, $t_3 = \frac{3\pi\hbar}{E_2}$, and $t_4 = \lim\limits_{t\to\infty} t$. Use $P_0,\ P_1,\ P_2,\ P_3,\ \text{and}\ P_4$ as symbols for your probabilities.

Explain your ranking.

Required.

Q2: Another system consisting of a particle in an infinite square well potential of width a is initially prepared such that its wave function at time t = 0 is $\Psi(x,t=0) = \sqrt{\frac{1}{2}}\,(\psi_1(x) + \psi_2(x))$ as shown at right. ψ_1 and ψ_2 satisfy the eigenvalue equation $\hat{H}\psi_n = E_n\psi_n$. Here $\mathrm{E}_n = \frac{n^2\pi^2\hbar^2}{2ma^2}$. Consider the marked region along the x-axis. Rank the probabilities of finding the particle within the marked region at the following five times: $\mathrm{t}_0 = 0$, $\mathrm{t}_1 = \frac{2\hbar\pi}{E_2}$, $\mathrm{t}_2 = \frac{4\hbar\pi}{E_2}$, $\mathrm{t}_3 = \frac{6\hbar\pi}{E_2}$, and $\mathrm{t}_4 = \frac{8\hbar\pi}{E_2}$. Use $\mathrm{P}_0,\ P_1,\ P_2,\ P_3,\ \mathrm{and}\ P_4$ as symbols for your probabilities. Explain your ranking.



Required.

Assume that a quantum mechanical system is prepared so that its initial state is given by:

$$\Psi_i = \Psi(x,0) = i\sqrt{\tfrac{1}{3}}\psi_1 - \sqrt{\tfrac{2}{3}}\psi_2$$

where ψ_1 and ψ_2 are two states which satisfy the time independent Schrödinger equation:

$$\hat{H}\psi_1 = E_1\psi_1$$

and

$$\hat{H}\psi_2 = E_2\psi_2$$

Q3:
a) Consider an energy measurement made on this system. Are there times (before any measurement is made) when the probability of measuring E_2 is zero and the probability of measuring E_1 is one?

Required.
Select one...

b) If so, give the first such time. If not, explain why not.

Required.

Submit responses

Questions or Comments?
Contact the 123 tutorial pretest coordinator at uwttl123@u.washington.edu