PHY 308 INTRODUCTION TO QUANTUM MECHANICS SPRING 2005

Homework 5 (Due Wednesday 23 February 2005)

1. Let a normalized function in the interval $0 \leq x \leq a$ be given by $\Psi(x) = 1/\sqrt{a}$. If this function is to be expanded as $\Psi(x) \approx \sum_{n=1}^{\infty} c_n \psi_n$, with $\psi_n = (\sqrt{2/a})\sin(n\pi x/a)$, find the coefficients c_n.

2. In Prob. 1 keep only the first 5 terms with nonzero c_n. Evaluate the approximate function at the values $x = 0$, $x = 0.1a$, $x = 0.2a$, $x = 0.5a$, and compare with the constant function $\Psi(x) = 1/\sqrt{a}$. If you have access to a graphing calculator or computer graphics program, feel free to provide a graph instead of just these particular values

3. For Prob. 2, Let $\omega \equiv (\pi/2a)^2\hbar/2m$. For $\omega t = \pi$, evaluate the approximate function found in Prob. 2 at the values of x given in Prob. 2. Use $\Psi(x,t) \approx \sum_n c_n \psi_n e^{-i\omega n^2 t}$. Again, compare with the original function $\Psi(x) = 1/\sqrt{a}$.

4. Let $H/\hbar = \pi\sigma_3/T$. Let $\psi^\dagger(t=0) = (1/\sqrt{2}, 1/\sqrt{2})$. Find $\psi^\dagger(t = T/2)$.

5. In Prob. 4, is $\psi^\dagger(t = T)$ a different physical state from $\psi^\dagger(t = 0)$? Explain your reasoning.