Due: Friday, 9/26, 2:10pm, PHYS360 Assignment 4

Reading:

1. Griffiths, Ch.2, read pg. 56-78. Note: We skipped the “Analytic Method” (pg 51-56), but do read page 56 (starting with “In general, …”) and page 57 of that section.

2. Prepare for Reading Quiz: Friday, 9/26, questions on anything in Griffiths, pages 56-78, but especially:
   a) given a table of Hermite polynomials, be able to construct \( \psi_n(x) \)
   b) be able to define terms:
      - wave packet
      - Fourier transform
      - group velocity
      - phase velocity
      - dispersion relation
      - turning points
      - bound state
      - scattering state
      - tunneling
      - Dirac delta function
   c) understand the discussion on the bottom half of page 75
   c) be able to write down both time dependent as well as time independent Schr. Eq. from memory.

Problems:

1. Problem 2.11, pg. 50

2. If an arbitrary initial state function for a particle in a one-dimensional infinite well is expanded in the discrete series of stationary states of the infinite well, one obtains:

   \[
   \Psi(x,0) = \sum_{n=1}^{\infty} c_n \psi_n(x)
   \]

   On the other hand, if the particle is free, its Hamiltonian has a continuous spectrum of energies and any arbitrary initial state is a superposition of \( \psi_k(x) = e^{ikx} \) expressed as an integral:

   \[
   \Psi(x,0) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} \phi(k) \psi_k(x) dk
   \]

   a) What are the dimensions of \( |c_n|^2 \) and \( |\phi(k)|^2 \), respectively?
   b) If there is a difference in dimensionality, why is that so?
   c) What are the dimensions and the physical interpretation of the integral

   \[
   \int_{-\infty}^{\infty} |\phi(k)|^2 dk
   \]

3. Problem 2.21, pg 67  SCROLL TO THE NEXT PAGE
4. Problem 2.22 part a), b), and c), pg 67
5. Problem 2.23, pg 76
6. Problem 2.27, pg 77