Physics 5382 Professor Scalise
Homework Assignment #6 Fall 2015

1. Read Griffiths sections 3-3 and 3-4. Did you read all the pages?

2. Simplify these expressions:

   (a) $\int_{x=-\infty}^{+\infty} \delta(x)\sin(x)dx$

   (b) $\int_{x=-\infty}^{+\infty} \delta(x)\sin(y)dx$

   (c) $\int_{x=-\infty}^{+\infty} \delta(x-y)\sin(x)dx$

   (d) $\int_{x=-\infty}^{+\infty} \delta(x-y)\sin(x+y)dx$

   (e) $\int_{x=-\infty}^{+\infty} \delta(3x)\cos(x)dx$

   (f) $\int_{x=14}^{+\infty} \delta(3x)\cos(x)dx$

   (g) $\int_{x=-\infty}^{+\infty} \delta'(x)(3x^2+x+7)dx$, where the prime means derivative.

   (h) Sketch the graph of $\int_{y=-\infty}^{x}\left[\int_{z=-\infty}^{y}\delta(z)dz\right]dy$ vs. x.

3. Consider the wave function $\psi(x) = \begin{cases} Ax, & 0 \le x \le \pi \\ 0, & \text{elsewhere} \end{cases}$.

   (a) Find A.

   (b) Graph the function $\psi(x)$.

   (c) Find the Fourier transform $c(k)$ of $\psi(x)$.

   (d) Graph the real part of $c(k)$ vs. k.

   (e) Is $c(k)$ normalized?

   (f) Find $< x >=< \psi|x|\psi >$, $< x^2 >$, and σ_x.

   (g) Find $< k >=< c|k|c >$, $< k^2 >$, and σ_k.

   (h) Is the Uncertainty Principle satisfied?

Bonus: Redo the last problem for a Gaussian wave function $\psi(x)$ with standard deviation 2 centered around the origin.