OPTI 330 Homework 2 Spring 2015

ASSIGNMENT DATE: February 6, 2015
DUE DATE: February 12, 2015 (by 5pm)
LATE DUE DATE: February 13, 2015 (by 5pm)

1. Compute and plot (as a function of x when appropriate) the following:
a. $\int_{-2}^{+2} \mathrm{tri}(y)\delta(y)dy$
b. $\int_{-1/2}^{+1/2} \mathrm{tri}(y)\delta(y-1)dy$
c. f(x) = $\int_{-\infty}^{x} y \cdot \mathrm{rect}(y)dy$
d. g(x) = $\int_{-\infty}^{+\infty} \mathrm{sinc}(y) \cdot \delta\left(x-y\right) dy$
e. $h(x) = \int_{-\infty}^{x} \mathrm{rect}(y/2) \left[\delta(y-2) + \delta(y+2)\right] dy$

[40 points]

2. Show that:
a. $\delta\left(x/\beta - x_o\right) = |\beta|\delta(x - x_o\beta)$
b. $\int_{-\infty}^{+\infty} f(x)\delta^{(n)}(x-x_o)dx = (-1)^n f^{(n)}(x_o)$
where $\delta^{(n)}(x)$ and $f^{(n)}(x)$ denote the n^{th} derivates with respect to x.

[30 points]

3. [Gaskill Problem 3-4] With ξ a real parameter and b and x_o real constants, show that :
a. $\int_{-\infty}^{+\infty} \delta(x)e^{j2\pi\xi x}dx = 1$
b. $\int_{-\infty}^{+\infty} \delta(\frac{x-x_o}{b})e^{j2\pi\xi x}dx = |b|e^{j2\pi\xi x_o}$

[20 points]