Fourier Optics EOP513
Assignment 2

1. Use Matlab to plot the following convolutions:

   (a) $p(x) = \text{rect}(x) * \text{rect}(x-2)$

   (b) $r(x) = \text{rect}(x) * \text{rect}(\frac{x}{4})$

   (c) $s(x) = \text{step}(x) * (\text{rect}(x+2) + \text{rect}(x-2))$

2. Perform the following convolutions and plot the results:

   (a) $f(x) = \text{step}(x) * \text{step}(x)$

   (b) $g(x) = \text{step}(x) * \text{rect}(x)$

   (c) $h(x) = \text{step}(x) * \text{tri}(x)$

3. Find the piecewise polynomial representation of the following convolutions. Superimpose a plot of your resulting function on that obtained by using the matlab `convn` function:

   (a) $f(x) = \text{rect}(x) * \text{tri}(x)$ (quadratic BSpline)

   (b) $g(x) = \text{tri}(x) * \text{tri}(x)$ (cubic BSpline)

4. Given a LSI system with impulse response $h(x) = \exp(-x)\text{step}(x)$, find the output $g_i(x) = f_i(x) * h(x)$ for each of the following input signals $f_i(x)$. Plot both input and output signals.

   (a) $f_1(x) = \text{step}(x-5)$

   (b) $f_2(x) = \text{rect}(10x - 0.5)$

   (c) $f_3(x) = \text{rect}(0.1x - 0.5)$

   (d) $f_4(x) = 5\,(\delta(x+0.1) - \delta(x-0.1))$