

# 1051-716-20071 Homework Assignment #3 Due 10/10/2007 (W)

## 0. MIDTERM EXAM on 17 October 2007 (W)

Read Chapter 9 of notes *Fourier transforms of 1-D functions*.

1. Evaluate the Fourier transforms of the following functions and sketch them as BOTH real and imaginary parts AND as magnitude and phase:

- (a)  $f_1[x] = \text{RECT} \left[ \frac{x}{2} \right]$
- (b)  $f_2[x] = \text{RECT} [x - 1]$
- (c)  $f_3[x] = \frac{1}{2} \text{RECT} \left[ \frac{x-1}{2} \right]$
- (d)  $f_4[x] = \text{RECT} [x - 2] \cdot e^{+2\pi i x}$
- (e)  $f_5[x] = \frac{1}{2} \text{RECT} \left[ \frac{x}{2} \right] + \text{TRI} [x]$
- (f)  $f_6[x] = \text{RECT} \left[ \frac{x}{2} \right] - \text{TRI} [x]$
- (g)  $f_7[x] = 3 \text{SINC} [3x] - \text{SINC} [x]$
- (h)  $f_8[x] = \text{GAUS} [2x + 2]$
- (i)  $f_9[x] = \exp[-|x|]$

2. Evaluate the following Fourier transforms and sketch them as real-and-imaginary parts and as magnitude-phase

- (a)  $\text{RECT} [x] * \text{RECT} [x]$
- (b)  $\text{RECT} [x - 1] * \text{RECT} [x]$
- (c)  $\text{RECT} [x - 1] * \text{RECT} [x + 1]$
- (d)  $\text{RECT} [x - 1] \star \text{RECT} [x + 1]$  (hint: write as convolution)
- (e)  $\text{GAUS} \left[ \frac{x}{5} \right] * \text{GAUS} \left[ \frac{x}{12} \right]$
- (f)  $\text{SINC} \left[ \frac{x}{a} \right] * \text{SINC} \left[ \frac{x}{b} \right]$ , where  $a, b$  are real-valued and positive numbers

3. Evaluate the following Fourier transforms and sketch them as real-and-imaginary parts and as magnitude-phase

- (a)  $\text{SINC} [x] \cdot \text{SINC} \left[ \frac{x}{2} \right]$
- (b)  $\cos [\pi x] \cdot \text{GAUS} [x]$
- (c)  $\cos [2\pi \xi_0 x] \cdot \text{RECT} \left[ \frac{x}{b} \right]$
- (d)  $\sin [2\pi \xi_0 x] \cdot \text{RECT} \left[ \frac{x}{b} \right]$