

IMGS-261      Homework #8      Due 04/28/2015 (T)

0. Read about Fourier transforms in Chapter 9: §9.1-§9.7.6

1. Evaluate and sketch the following, where “ $\mathcal{F}_1$ ” is the 1-D Fourier transform operator:

$$\mathcal{F}_1 \{f[x]\} = \int_{x=-\infty}^{x=+\infty} f[x] \cdot \exp[-i \cdot 2\pi \cdot \xi x] dx$$

(a)  $\mathcal{F}_1 \left\{ \cos\left(2\pi \frac{x}{2}\right) + \sin\left(2\pi \frac{x}{2}\right) \right\}$

(b)  $\mathcal{F}_1 \{SINC[x]\}$

(c)  $\mathcal{F}_1 \left\{ SINC \left[ x - \frac{1}{2} \right] \right\}$

(d)  $\mathcal{F}_1 \left\{ SINC \left[ \frac{x}{3} \right] \right\}$

(e)  $\mathcal{F}_1 \left\{ SINC \left[ \frac{x}{3} - \frac{1}{2} \right] \right\}$

2. Evaluate and sketch:

$$RECT[x-1] \star RECT[x+1] = RECT[x-1] * (RECT[-x+1])^*$$

3. Evaluate and sketch

$$g[x] = SINC \left[ \frac{x}{a_0} \right] * SINC \left[ \frac{x}{b_0} \right] = SINC \left[ \frac{x}{b_0} \right] * SINC \left[ \frac{x}{a_0} \right]$$

where  $a_0, b_0$  are real-valued and positive parameters.

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

(a)  $\cos \left[ 2\pi \frac{x}{4} \right] * RECT[x]$

(b)  $\cos \left[ 2\pi \frac{x}{2} \right] * RECT[x]$

(c)  $\cos \left[ 2\pi \frac{x}{1} \right] * RECT[x]$

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

(a)  $SINC[x] \cdot SINC \left[ \frac{x}{2} \right]$

(b)  $\cos[2\pi\xi_0 x] \cdot RECT \left[ \frac{x}{b_0} \right]$

(c)  $\sin[2\pi\xi_0 x] \cdot RECT \left[ \frac{x}{b_0} \right]$