Signals and Systems — 21 November 2012
Fall 2012 — Quiz: Wednesday 28 November 2012

Homework Assignment #14

1. A time function $x(t)$ has the Fourier transform

$$X(j\omega) = \frac{j\omega}{\omega^2 - 3j\omega - 2}.$$

Using the properties of the Fourier transform, write the Fourier transform of each of the following functions:

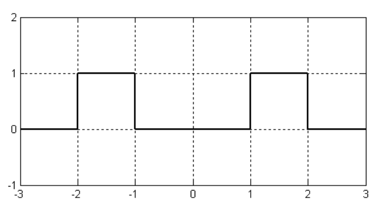
(a) $x(2t+1)$ (b) dx/dt (c) $x(t)\cos(t)$

2. Find the inverse Fourier transform of each of the following frequency domain functions. (You should use a table of Fourier transforms.)

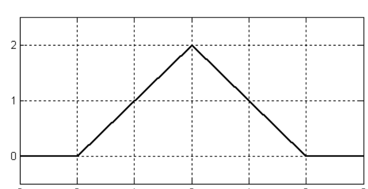
(a) $e^{-\omega^2}$ (b) $\dfrac{e^{j\omega}}{-j\omega+1}$ (c) $\dfrac{j\omega}{j\omega+1}$

3. Find the Fourier transforms of the signals shown. Feel free to use a table of Fourier transforms.

(a) $x(t) = \begin{cases} 1 & -2 < t < -1 \\ 1 & 1 < t < 2 \\ 0 & \text{otherwise} \end{cases}$



(b) $x(t) = \begin{cases} 2+t, & -2 < t < 0 \\ 2-t, & 0 < t < 2 \\ 0 & \text{otherwise} \end{cases}$



EXTRA CREDIT PROBLEM

A time function $x(t) = e^{-2t}u_s(t)$ is applied to an ideal low-pass filter for which

$$H(\omega) = \begin{cases} 1 & |\omega| \le M \\ 0 & \text{elsewhere} \end{cases}.$$

For what value of M does this filter pass exactly one half of the energy of the input signal?