Discussion Section 1 Week of August 29 - September 2, 2005

Topics System properties, signal properties, convolution

Problem 1

For each of the following systems with input x(t) and output y(t), determine whether the system is (i) linear, (ii) time-invariant, (iii) memoryless, (iv) stable, and (v) causal.

(a)
$$y(t) = \frac{d}{dt}e^{-t}x(t)$$

(b) $y[n] = x[2^n + 1]$

Problem 2

Consider the following function:

$$x(t) = \begin{cases} 0, & |t| > 1\\ 1, & -1 \le t \le 0\\ 1 - t, & 0 \le t \le 1 \end{cases}$$

Sketch:

(a) x(3t)(b) x(t+2)(c) x(-3t+2)(d) $x(\frac{1}{3}t+2)$

Problem 3

Graphically convolve the following pairs of signals.

(a)
$$x(t) = \begin{cases} 0, & |t| > 1\\ 1 - |t|, & |t| \le 1 \end{cases}$$
 and $y(t) = \delta(t-2) + \delta(t+2)$
(b) $x(t) = \begin{cases} 0, & |t| > 1\\ 1 - |t|, & |t| \le 1 \end{cases}$ and $y(t) = u(t)$
(c) $x(t) = u(t) - u(t-1)$ and $y(t) = x(t-1) + x(t+2)$

Problem 4

Analytically convolve the following pairs of signals.

(a)
$$x(t) = e^{-t}u(t)$$
 and $y(t) = u(t)$
(b) $x(t) = e^{-t}u(t)$ and $y(t) = e^{-2t}u(t)$