## 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) $y(t)=\frac{d}{d t} e^{-t} x(t)$
(b) $y[n]=x\left[2^{n}+1\right]$

## Problem 2

Consider the following function:
$x(t)= \begin{cases}0, & |t|>1 \\ 1, & -1 \leq t \leq 0 \\ 1-t, & 0 \leq t \leq 1\end{cases}$
Sketch:
(a) $x(3 t)$
(b) $x(t+2)$
(c) $x(-3 t+2)$
(d) $x\left(\frac{1}{3} t+2\right)$

## Problem 3

Graphically convolve the following pairs of signals.
(a) $x(t)=\left\{\begin{array}{ll}0, & |t|>1 \\ 1-|t|, & |t| \leq 1\end{array}\right.$ and $y(t)=\delta(t-2)+\delta(t+2)$
(b) $x(t)=\left\{\begin{array}{ll}0, & |t|>1 \\ 1-|t|, & |t| \leq 1\end{array}\right.$ 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 $y(t)=e^{-2 t} u(t)$

