In the Name of God

Assignment #1 EE, Signals & Systems 1393-94

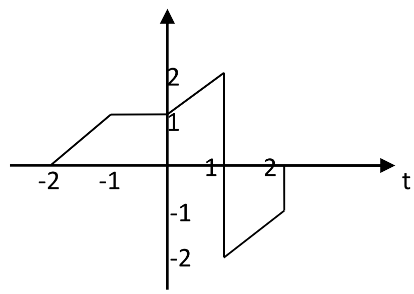
Due: Saturday 2/12/93 in class

Q1. Show that causality for a continuous-time linear system is equivalent to the following statement :

For any time t_0 and any input x(t) such that x(t)=0 for t < t_0, the corresponding output y(t) must also be zero for t < t_0.

Q2. Signal x(t) is depicted in the figure. Sketch the following signals:

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



Q3. Determine which of the listed properties Memoryless, Time invariant, Linear, Causal, Stable,

Invertible hold and which do not hold for each of the following systems:

a) $y(t)=\begin{Bmatrix} 0 & t<0 \\ x(t)+x(t-1) & t\geq 0 \end{Bmatrix}$
b) $y(t)=\int_{-\infty}^{t} x(\sqrt[3]{\tau})d\tau$
c) $y[n]=Even\{x[n-3]\}$
d) $y[n]=\begin{Bmatrix} x[n]+\sum_{k=-\infty}^{n_0} x[k] & n\geq n_0 \\ 0 & n<n_0 \end{Bmatrix}$
e) $\begin{Bmatrix} x[n] & n\geq 1 \\ 0 & n=0 \\ x[n] & n\leq -1 \end{Bmatrix}$
f) $y(t)=a.x(t-t1)+b.x(t-t2) \quad t1>0 \quad t2>0$
g) $y[n]=x[2n+1]$

Q4. Determine whether or not each of the following continuous-time signals is periodic.

If the signal is periodic determine its fundamental period.

a) $x(t)=Even\{\cos(4\pi t)\,u(t)\}$
b) $x(t)=Even\{sin(4\pi t)\,u(t)\}$
c) $x[n]=\cos(\frac{\pi}{8}n^2)$
d) $x[n]=\cos(\frac{4\pi}{5}n^3)$

Q5. Suppose that $x_1(t)$ is periodic with period T_1 and $x_2(t)$ is periodic with period T_2.under which condition is the sum $x(t) = x_1(t) + x_2(t)$ periodic? Find the fundamental period T_0 of $x(t)$.

Q6. Let $x(t) = \sqrt{2}(1+j)e^{j\frac{\pi}{4}} e^{(-1+2\pi j)t}$ .sketch and label the following:

a) $Re\{x(t)\}$
b) $Im\{x(t)\}$
c) $x(t+2) + x^*(t+2)$

Q7. Determine if each of the following systems is invertible. If it is construct the inverse system.

a) $y(t) = \frac{1}{2}x(4-2t)$

b) $y(t) = \left\{\begin{matrix} -x^2(t) & x(t) < 0 \\ \frac{1}{2}x(t) & 0 \leq x(t) < 2 \\ x(t) & x(t) \geq 2 \end{matrix}\right\}$

c) $y[n] = \sum_{k=-\infty}^{n} (\frac{1}{2})^{n-k}\, x[k]$