ECEN/MAE 3723 Systems I
Fall 2006

Homework Assignment #1

Problem 1: Make labeled sketches of the following time signals, based on a given continuous time signal, \( x(t) \), shown on the right:

a) \( 0.5x(-t) \),
b) \( x(t - 2) + 1 \),
c) \( x(2t) \),
d) \( x(1-t) \),
e) \( -x(3-3t) + 0.5x(\frac{t}{2} - 1) \).

Problem 2: Exercise the algebra and express the signal \( e(t) = x(t) - y(t) \) in the form of \( A \sin(\omega t + \phi) \) where

\[
\begin{align*}
x(t) &= 3\sin(\omega t + 20^\circ) \\
y(t) &= 5\cos(\omega t - 20^\circ)
\end{align*}
\]
Find the parameters \( A \) and \( \phi \).

Problem 3: Evaluate the following integrals involving the impulse function:

a) \( \int_{-\infty}^{\infty} (\delta(t) \cos t + \delta(t-1) \sin t) dt \),
b) \( \int_{-\infty}^{\infty} u(t)e^{-t} (\delta(t+1) + \delta(t-1)) dt \),
c) \( \int_{-\infty}^{\infty} e^{j\omega t} \delta(t - \frac{1}{2}) dt \),
d) \( \int_{-\infty}^{\infty} [5\delta(t) + e^{-(t-1)} \delta(t) + \cos 5\pi t \delta(t)] dt \),
e) \( \int_{-\infty}^{\infty} e^{j\omega t} \delta'(\frac{t}{2} - 3) dt \),
f) \( \int_{-2}^{2} (e^{-t}u(\lambda)\delta'(\lambda - 1) + \sin(t - \lambda)\delta(\lambda - 3))d\lambda \).

Problem 4: Express the following signals, \( x_1(t), x_2(t), x_3(t) \) in terms of unit ramp functions.
Problem 5: Describe the periodic signal, \( x(t) \), shown below (the signal \( x(t) \) has only three periods).

Problem 6: Express the signal \( x(t) \) in terms of some basic functions.