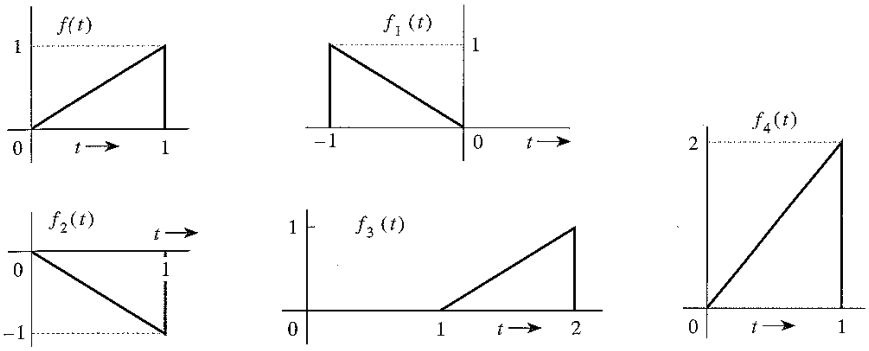
ELEN3801 - Fall 2009
Homework 2

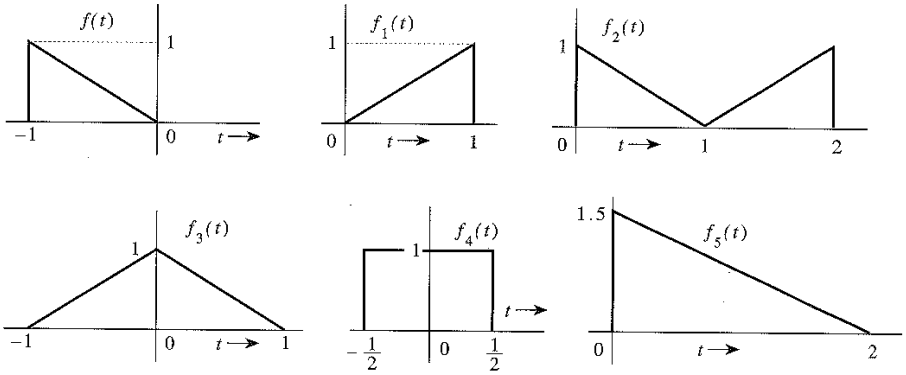
Due Thursday September 24th at the beginning of class
(Mudd 227 9:10am)[1]

Carefully justify ALL your answers

2.1 - Find the energy of the signals sketched below. How does the energy change when transforming a signal by time-shifting or time-reversing it? How does the energy of a signal $f(t)$ changes when it is multiplied by a factor $a \in \mathbb{R}$.



2.2 - Express the signals $f_i(t)$ $i = 1, \ldots, 5$ in the figure below using only $f(t)$, and its time-shifted, time-scaled and time-inverted versions. For example $f_2(t) = f(t-1) + f(1-t)$.

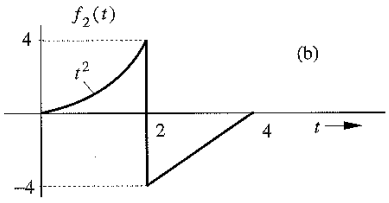


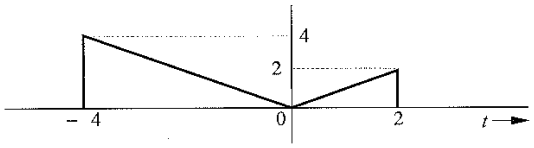
2.3 - Sketch the following signals, and state if these are causal, anti-causal, or non-causal.

[1] You can always hand-in the homework earlier if you so desire - just give it to me or to one of the TAs, or leave it in my mailbox (in the EE office on the 13th floor of Mudd).

(a) $f(t) = \exp(-2t)u(t)$
(b) $f(t) = tu(t) + (\exp(1-t) - t)u(t-1)$
(c) $f(t) = \mathrm{Re}\{\exp((1+2\pi j)t)\}u(1-t)$

2.4 - **(a) -** Express the signals in the figure below by a single expression valid for all t.
(b) - Carefully sketch the signals $f_2(t-3)$, $3f_2(2t+2)$ and $f_2(2t-1)$. *(Note: the use of the step function $u(t)$ will come in handy for the first part)*





2.5 - Simplify the following expressions:

(a) $\left(\frac{\sin t}{t^3+2}\right)\delta(t)$ (b) $\frac{5+jt}{2-jt}\delta(t-2)$
(c) $\int_{-\infty}^{\infty}(2t-5)\delta(t-2)dt$ (d) $\exp(3k)\cos(401\pi k)\delta(k+1)$
(e) $\int_{-\infty}^{x+1}(2t-5)\delta(t-x)dt$ (f) $\int_{-\infty}^{\infty}\exp(3x)\cos(401\pi x)\delta(x+1)dx$

2.6 - Find and sketch the even and odd components of

$$f(t) = t(u(t+1) - u(t-2)) \ .$$