**EE 102** # Homework #2 **Fall 2001**

**Professor Paganini** **Due Wednesday 10/10/01**

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1. Sketch $f(t)$ and $\frac{df}{dt}(t)$. State what $\frac{df}{dt}(t)$ is in the simplest form (e.g., $u(t-2)\delta(t-7)$ should be simplified to $\delta(t-7)$).

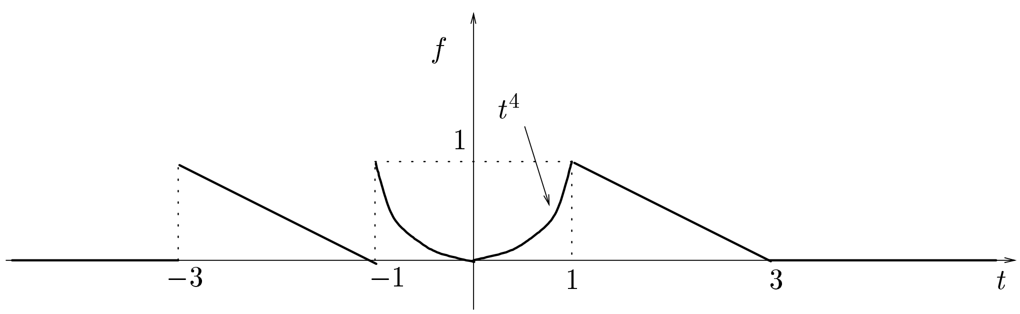
   (a) $f(t) = 1 - u(t+2) - u(t) + u(t-1)$.

   (b) $f(t) = \begin{cases} 2t+2 & \text{for } t \in (-1,0) \\ 2t-2 & \text{for } t \in (0,1) \\ 0 & \text{otherwise} \end{cases}$. Here you should first write an expression for $f(t)$.

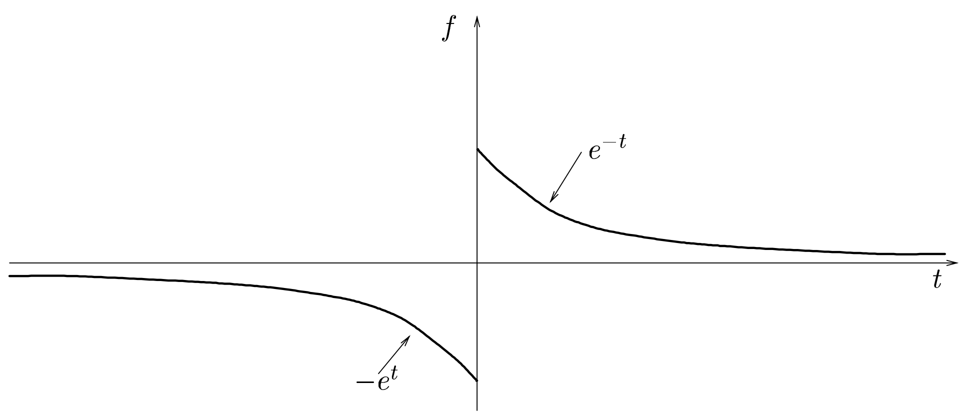
   (c) $f(t) = (t+1)^2[u(t+1) - u(t)] + (t-1)^2[u(t) - u(t-2)]$.

2. Sketch $\frac{df}{dt}(t)$, and find an expression for $f(t)$ and $\frac{df}{dt}(t)$.

   (a)




   (b)



3. Evaluate the following integrals.

$$\text{(a)} \quad \int_{-\infty}^{\infty} e^{\sin(\pi t)}\ \delta(t+\frac{1}{2})\ dt$$

$$\text{(b)} \quad \int_{-\infty}^{3} e^{t^2-3t-4}\delta(t-4)\ dt$$

$$\text{(c)} \quad \int_{a-}^{\infty} \cos(t)\delta(t-a)\ dt, \quad \text{where} \quad a \in \mathbb{R}.$$

4. Consider the system defined by the input-output relationship

$$y(t) = \int_{-\infty}^{t} \cos(t+\sigma)x(\sigma-1)d\sigma.$$

   (a) Find the system impulse response function $h(t,\tau)$.

   (b) Is the system time invariant? Causal?

5. Consider a system described by the differential equation

$$\frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt} - 2x(t),$$

studied in HW # 1. Signals are assumed to be zero for $t < 0$. i.e., the initial conditions are $y(0-) = x(0-) = 0$. Find the impulse response function $h(t)$.