University of Notre Dame
Department of Electrical Engineering
EE 344 – Signals and Systems I
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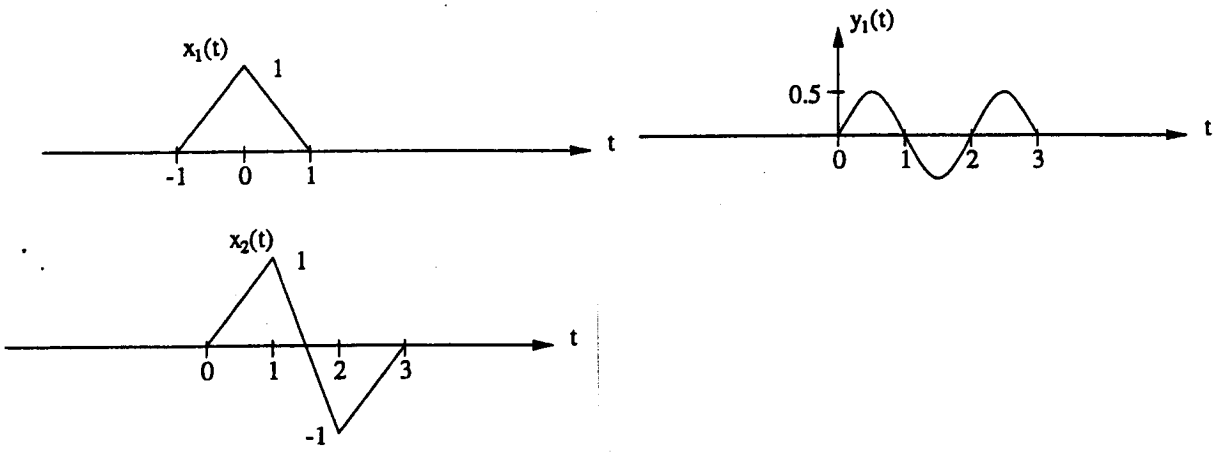
September 18, 2004 mh

Practice Exam for Midterm 1

1. (15 pts.) When $x_1(t)$ below is the input to a CT LTI system, $y_1(t)$ is the output. Sketch precisely, labelling all critical points on both axes, the output when $x_2(t)$ is the input.



2. $z(t) = \sin(7\pi t + 0.1)$ is the signal considered in the two exercises below.

   (a) (5 pts.) Find the minimum period for $z(t)$.

   (b) (10 pts.) Find the Fourier series coefficients for $z(t)$ using an interval of length $T = 4$.

3. (20 pts.) Compute the result of convolving the following two DT functions:

$$h[n] = (0.5)^n u[n], \quad x[n] = u[n] - u[n-5].$$

   Give your answer in the simplest mathematical form you can and sketch it as well.

4. (10 pts.) Show that functions of the form e^{st}, with s a complex number, are eigenfunctions of an LTI system described by the convolution integral. Explain briefly how your mathematical result establishes the desired property.

5. (10 pts.) Compute the following integral:

$$\int_{-\infty}^{\infty} e^{-|t|} \cos\left(\frac{\pi t}{4}\right) \delta(t+12)dt$$

6. A certain DT filter with input $x[n]$ and output $y[n]$ is described by the difference equation

$$y[n] + 0.9y[n-1] = x[n] - 0.5x[n-1].$$

(a) (10 pts.) Draw a block diagram using delay elements, multipliers and adders to implement the given difference equation.

(b) (10 pts.) Find the frequency response of this system, $H_D(e^{j\omega})$.

(c) (10 pts.) Find the output of the system if the signal $x[n] = \cos(\pi n)$ is used as input.