University of Notre Dame
Department of Electrical Engineering
EE 30344 – Signals and Systems I
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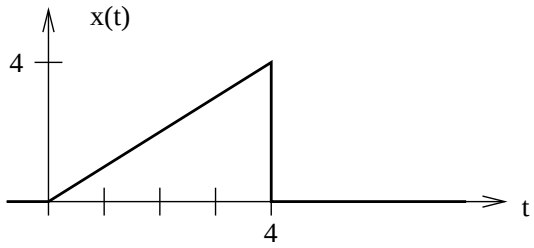
Practice Final Exam

1. A CT LTI system is described by the frequency response [10]

$$H(j\omega) = \frac{e^{-j\omega}}{3+\omega^2}\,.$$

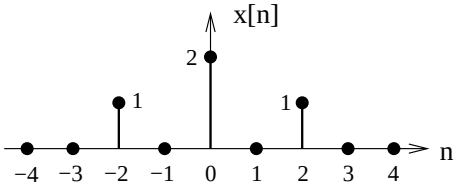
Find the output of this system when the input is $\cos(4t)$.

2. Given $x(t)$, [10]



find $X(j0)$.

3. Give the simplest form possible for $X(e^{j\omega})$ for the signal [10]



4. A DT system is characterized by the difference equation [15]

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

Find the frequency response $H(e^{j\omega})$ and the output if the input is $\cos(\pi n)$.

5. An LTI system has the transfer function [10]

$$H(s) = \frac{s+1}{s^2+7s+12}$$

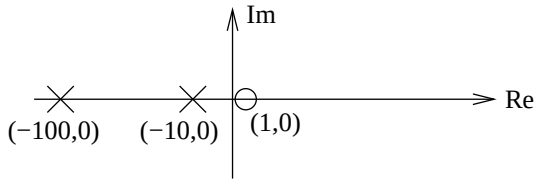
with ROC $\mathrm{Re}\{s\} > -3$. Find the impulse response $h(t)$.

6. Given are two DT signals $x[n] = \sin(\pi n/16)$ and $z[n] = \cos(\pi n/2)$. [20]

   (a) Find the DT Fourier series of $z[n]$, when an interval of length $N = 32$ is used. [10]

   (b) Write the mathematical form of the DTFT of $w[n] = x[n]z[n]$ and sketch it accurately. [10]

7. Given is the pole-zero plot of a system function $H(s)$. [25]



The response of the system to the constant signal $x(t) = 1$ is $y(t) = 2$.

   (a) Find $H(s)$. [7]

   (b) Write a differential equation (zero-state response only) describing the relationship between input and output. [8]

   (c) Sketch the magnitude response. [10]