ECN-203: Signals & Systems (CSE)
Assignment 3
Due date: Tuesday 29 September 2020

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1. For each of the following input-output relationships, determine whether the corresponding system is linear, time invariant or both. Justify your answer. (Marks: 4*2.5=10)

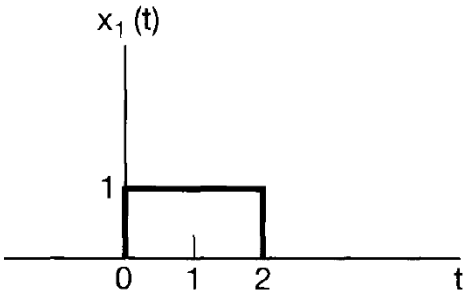
   (a) $y(t) = t^2 x(t-1)$

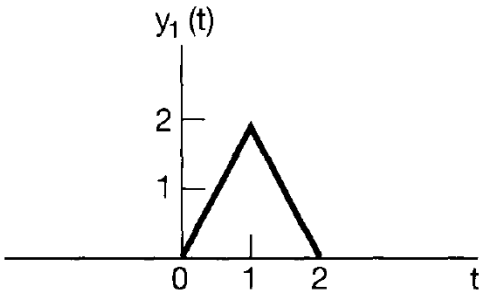
   (b) $y[n] = (x[n-2])^2$

   (c) $y[n] = x[n+1] - x[n-1]$

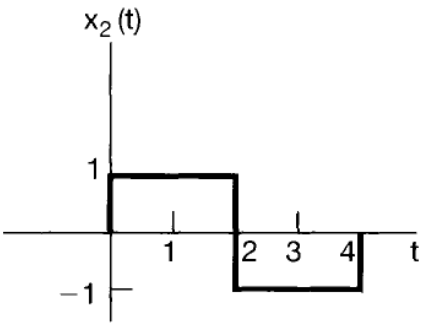
   (d) $y(t) = \mathbb{EV}(x(t))$

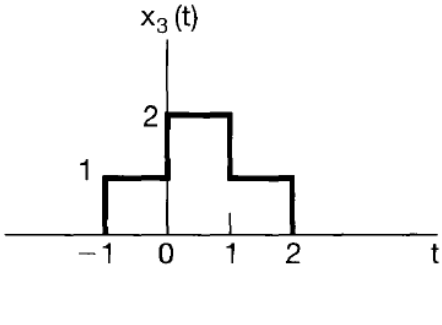
2. Consider an LTI system whose response to the signal $x_1(t)$ is the signal $y_1(t)$ shown below





Determine and sketch the response of this system to the inputs $x_2(t)$ and $x_3(t)$ shown below. (Marks: 5+5=10)





3. Consider an input $x[n]$ and a unit impulse response $h[n]$ given by:
$x[n] = (\frac{1}{2})^n u[n-2]$; and $h[n] = u[n+2]$
Determine and plot the output $y[n]$. (Marks: 5)

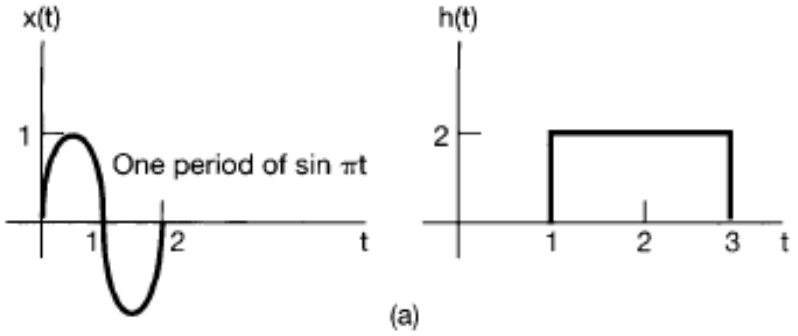
4. Let $x(t) = u(t-2) - u(t-6)$ and $h(t) = e^{-2t}u(t)$

   (a) Compute $y(t) = x(t) * h(t)$. (Marks: 4)

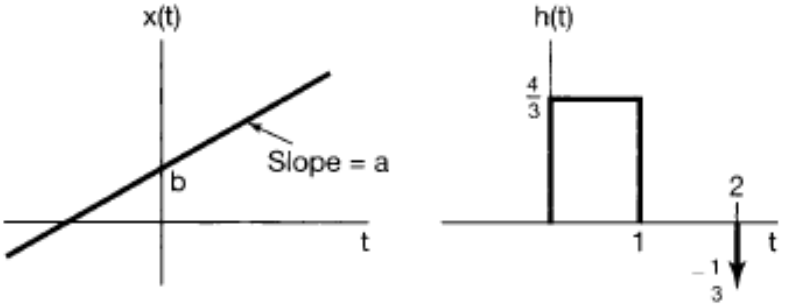
   (b) Compute $g(t) = (\frac{d}{dt}x(t)) * h(t)$. (Marks: 4)

   (c) How is $g(t)$ related to $y(t)$? (Marks: 2)

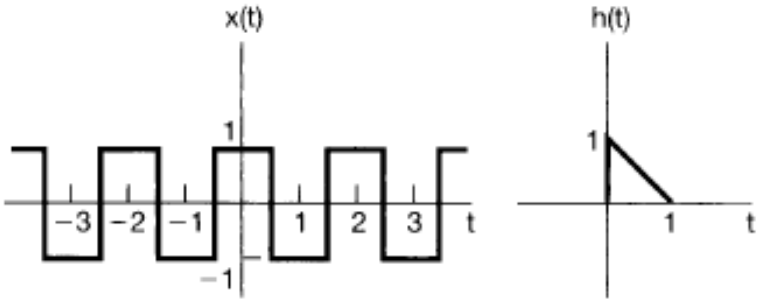
5. Plot $y(t)$ for following $x(t)$ and $h(t)$. (Marks: 3*10=30)



(a)



(b)



(c)

Note that $x(t)$ extends from $-\infty$ to ∞ for cases (b) and (c), but is just one time period for (a).