



Islamic University of Gaza
Electrical Engineering Department
EEL 3310 Signals & Systems
Mid-Term Exam
November 22, 2018

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Name:

Exam Time 1:00-2:00
ID #

1. a) Express the signal in the following figure in terms of elementary signals.

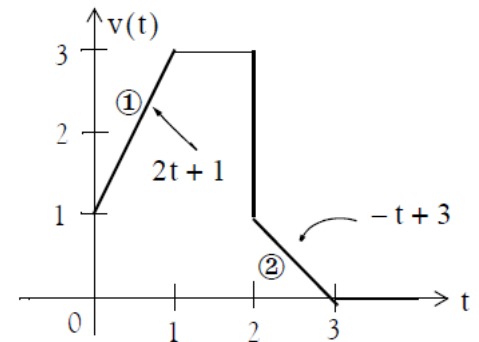
(4 PT)

$$v(t) = (2t+1)[u_0(t) - u_0(t-1)] + 3[u_0(t-1) - u_0(t-2)] \\ + (-t+3)[u_0(t-2) - u_0(t-3)]$$

$$v(t) = (2t+1)u_0(t) - 2(t-1)u_0(t-1) - tu_0(t-2) + (t-3)u_0(t-3)$$

OR

$$V(t) = u(t) + 2r(t) - 2r(t-1) - 2u(t-2) - r(t-2) + r(t-3)$$



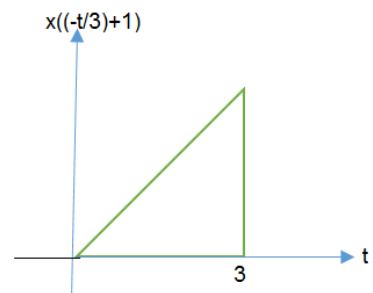
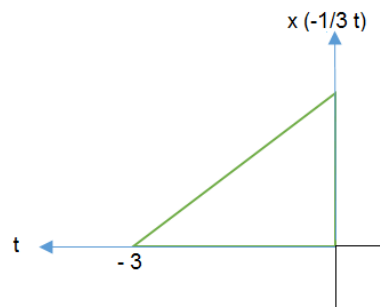
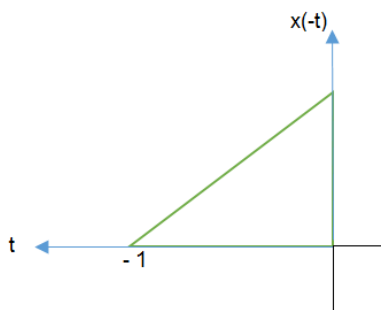
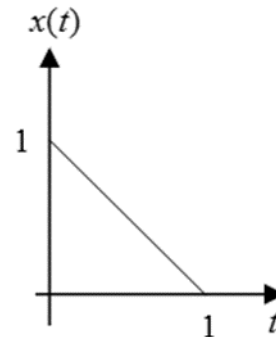
b) Given $x(t) = \begin{cases} 1-t, & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$

(4 PT)

Sketch the following signal $x((-t/3) + 1)$

Solution

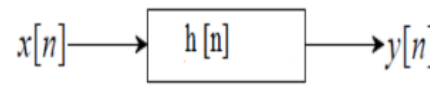
$$x((-t/3) + 1) = x(-1/3 (t-3))$$



2. Find $y[n]$ for given $x[n]$, and $h[n]$.

(8PT)

$$x[n] = u[n], \quad h[n] = 2(0.8)^n u[n]$$



$$\sum_{k=m}^n r^k = \frac{r^{n+1} - r^m}{r-1} \quad r \neq 1$$

Solution

$$x[n] = u[n], \quad h[n] = 2(0.8)^n u[n]$$

$$y[n] = \sum_{k=-\infty}^{\infty} x[k] h[n-k] = \sum_{k=-\infty}^{\infty} u[k] 2(0.8)^{n-k} u[n-k]$$

$$y[n] = \sum_{k=0}^n 2(0.8)^{n-k}$$

$$= 2(0.8)^n \sum_{k=0}^n 1.25^k = 2(0.8)^n \frac{1 - 1.25^{n+1}}{1 - 1.25}$$

$$y[n] = -8(0.8^n - 1.25), \quad n \geq 0$$

$$y[n] = -8(0.8)^n + 10, \quad n \geq 0$$

$$y[n] = [-8(0.8)^n + 10] u[n]$$

3. Consider the discrete -time system described by
 $y[n] + 2 y[n-1] = x[n+1]$

(6 PT)

- i. Is the system memoryless? Justify your answer
- ii. Is the system causal? Justify your answer
- iii. Is the system linear? Justify your answer
- iv. Is the system time invariant? Justify your answer

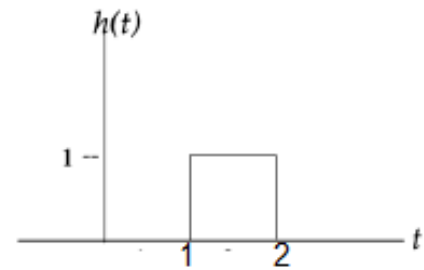
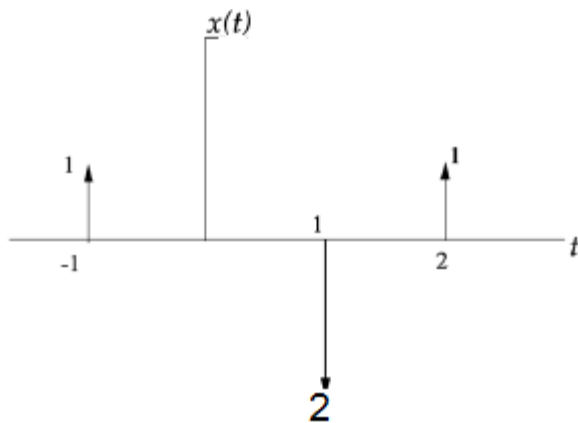
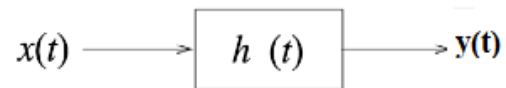
Solution

This is a difference equation with constant coefficients; therefore, it is **linear** and **time-invariant**. It has **memory**, and is **noncausal** since the output depends on future values of x . Specifically, let $x[n] = u[n]$, then $y[-1] = 1$.

- **Linear**
- **Time-Invariant**
- **Memory**
- **Noncausal**

4. Determine $y(t)$ where $x(t)$ and $h(t)$ is as shown in the figure below.

(8 PT)



Solution

$$x(t) = \delta(t + 1) - 2\delta(t - 1) + \delta(t - 2)$$

$$y(t) = x(t) * h(t) = h(t+1) - 2h(t-1) + h(t-2)$$

