Signal & Systems

Lecture # 6

Revision Before Mids

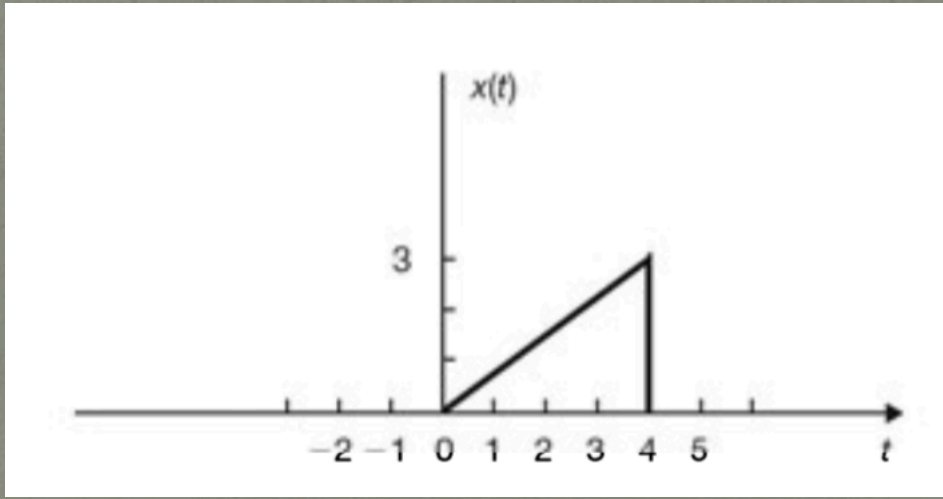
5th November 18

Signal Operations

Example #1

- A continuous-time signal x(t) is shown below. Sketch and label the following signal:

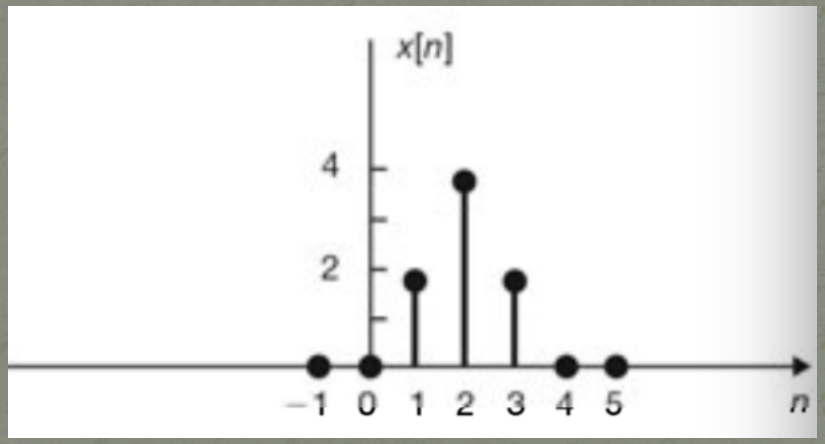
$$-x\left(2t-2\right)$$



Example #2

- A discrete-time signal x [n] is shown below. Sketch and label the following signal:

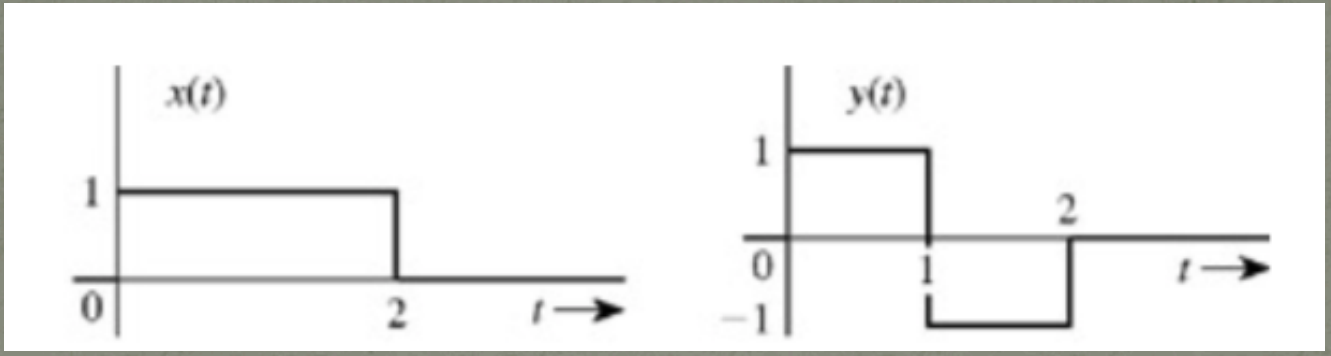
$$2x\left[2n+3\right]$$



Energy & Power

Example #3

- Find the energies of the pair of signals x(t) and y(t) shown below. Sketch and find the energies of signals of x(t)+y(t) and x(t)-y(t).



Example #4

- Determine whether the following signal is power signal or not:

$$x[n] = 2e^{j3n}$$

Periodic/Aperiodic

Example #5

- Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period:
  - (1): $x(t) = \cos t + \sin \sqrt{2} t$
  - (2): $x[n] = e^{j(\pi/4)n}$

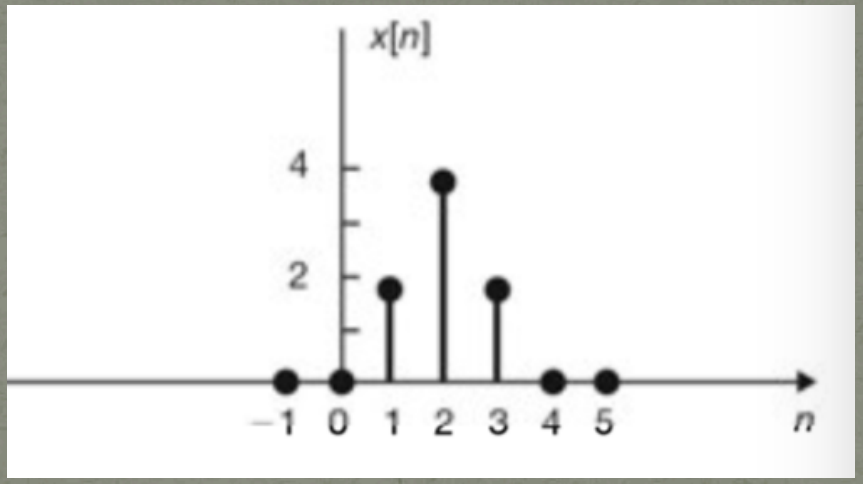
Even & Odd

Example #6

- Find the even and odd components of $x(t) = e^{jt}$.

Example #7

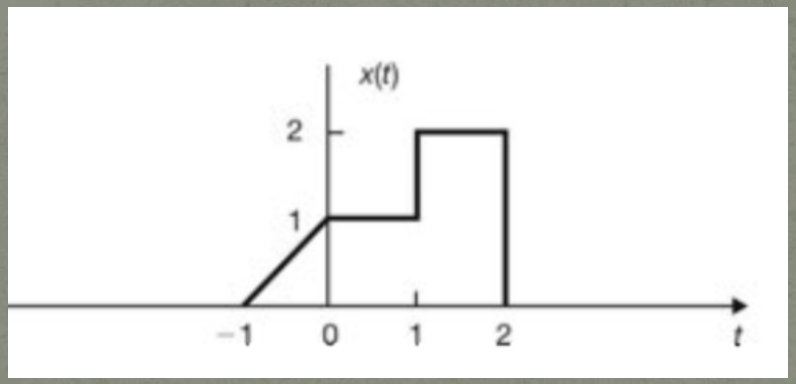
- Sketch and label the even and odd components of the signal shown below:



Unit Step & Unit Impulse Functions

Example #8

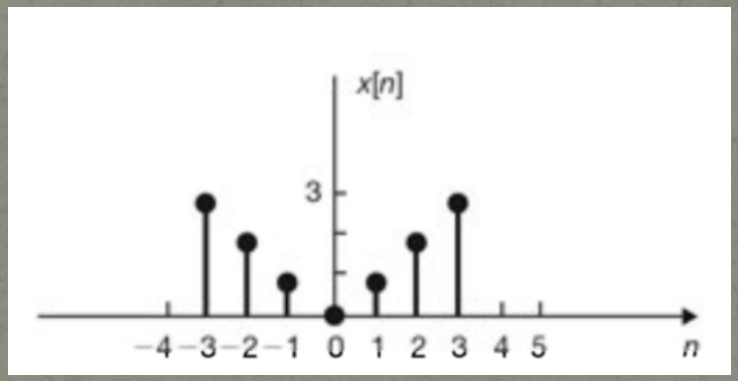
- A continuous time signal x(t) is shown below. Sketch and label the following signal.



  - (1): x(t) u(1-t)

Example #9

- A discrete time signal x [n]$ is shown below. Sketch and label the following signal.

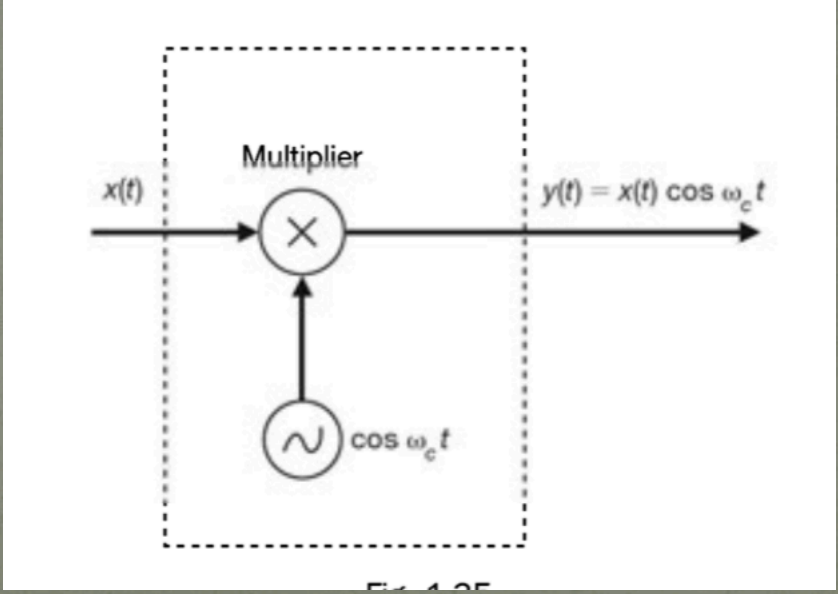


  - (1): x[n]δ [n]

Continuous & Discrete Systems

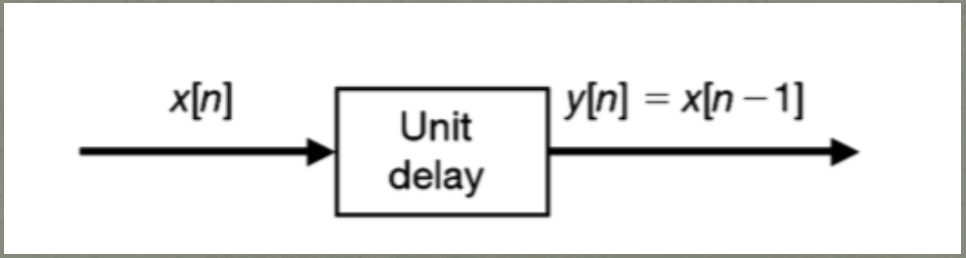
Example #10

- Consider the system shown below. Determine whether it is:
  - (1): Memoryless
  - (2): Causal
  - (3): Linear
  - (d): Time-invariant
  - (e): Stable



Example #11

- The discrete time system is shown below is known as the unit delay element. Determine whether it is:
  - (1): Memoryless
  - (2): Causal
  - (3): Linear
  - (d): Time-invariant
  - (e): Stable



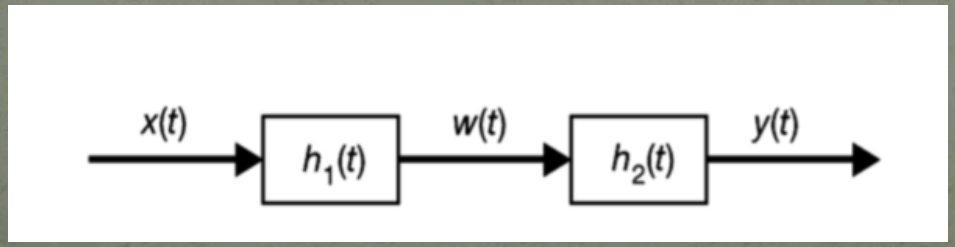
Convolution & Properties of LTI

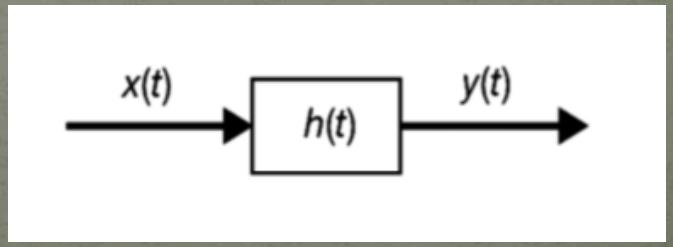
Example #12

- The system shown below is formed by connecting two systems in cascade. The impulse responses of the systems are given by $h_1(t)$ and $h_2(t)$, respectively and:

$$h_1(t) = e^{-2t}u(t) \quad and \quad h_2(t) = 2e^{-t}u(t)$$

- (a): Find the impulse response h(t) of the overall system.
- (b): Determine if the overall system is BIBO stable.





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