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Sri Lanka  
**EN1060 SIGNALS AND SYSTEMS: TUTORIAL 01**

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1. A continuous time signal is given in Figure 1. Sketch and label the following signals.

(a)  $x(t-2)$  (b)  $x(t+1)$  (c)  $x(-t+1)$  (d)  $x(3t/2)$  (e)  $x(t/3)$

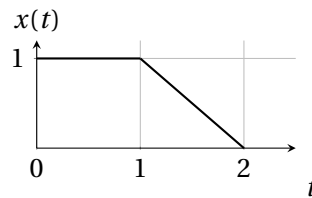


Figure 1:

2. A discrete time signal is shown in Figure 2. Sketch and label each of the following signals.

(a)  $x[n+1]$  (b)  $x[2n]$  (c)  $x[-n]$  (d)  $x[-n+2]$  (e)  $x[-2n+1]$

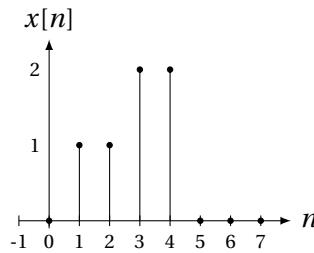


Figure 2:

3. Find the even and odd parts of the  $x(t)$  signal given in Figure 3.
4. Using the discrete time signals  $x_1[n]$  and  $x_2[n]$  shown in Figure 4, represent each of the following signals by a graph.
- (a)  $y[n] = x_1[n] + x_2[n]$  (b)  $y[n] = 2x_1[n]$  (c)  $y[n] = x_1[n]x_2[n]$
5. Show that

$$\int_{-a}^a x(t) dt = \begin{cases} 2 \int_0^a x(t) dt, & \text{if } x(t) \text{ is even,} \\ 0, & \text{if } x(t) \text{ is odd.} \end{cases}$$

6. Show that the complex exponential signal  $x(t) = e^{j\omega t}$  is periodic and that its fundamental period is  $2\pi/\omega$ .

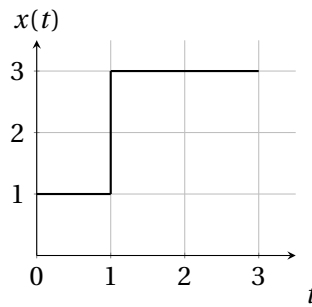


Figure 3:

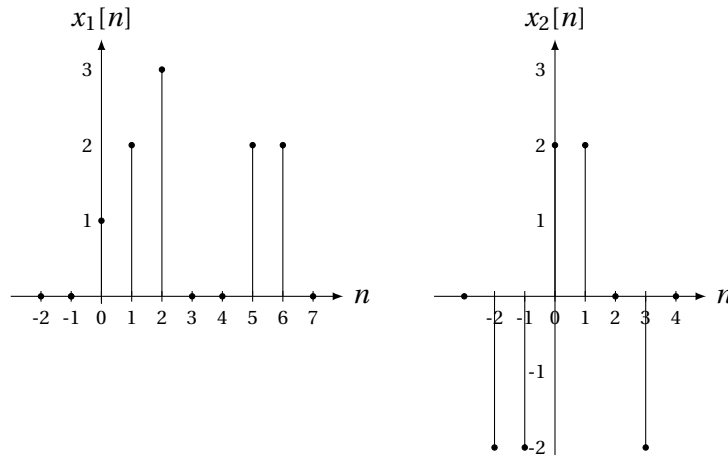


Figure 4:

7. Show that the complex exponential signal  $x[n] = e^{j\omega n}$  is periodic only if  $\omega/2\pi$  is a rational number.
8. Consider the sinusoidal signal  $x(t) = \cos(15t)$ .
  - (a) Find the value of sampling interval  $T$  such that  $x[n]$  is a periodic sequence.
  - (b) Find the fundamental period of  $x[n]$  if  $T = 0.1\pi$  seconds.
9. Determine whether or not each of the following signals are periodic. If periodic, find the fundamental period.
  - (a)  $x(t) = 2e^{j(t+\pi/4)}$
  - (b)  $x[n] = e^{j(\pi/4)n}$
  - (c)  $x(t) = \cos(t + \pi/4)$
  - (d)  $x(t) = \cos(t) + \sin(\sqrt{2}t)$
  - (e)  $x[n] = \cos^2(\pi n/8)$
10. Determine whether the following signals are energy signals, power signals, or neither.
  - (a)  $x(t) = e^{-at}u(t)$ ,  $a > 0$
  - (b)  $x(t) = A\cos(\omega t + \theta)$
  - (c)  $x[n] = 3u[n]$
  - (d)  $x[n] = 3e^{j3n}$