Sheet (1)

1.1. A continuous-time signal $x(t)$ is shown in Fig. 1-17. Sketch and label each of the following signals.

(*a*) $x(t-2)$; (*b*) $x(2t)$; (*c*) $x(t/2)$; (*d*) $x(-t)$

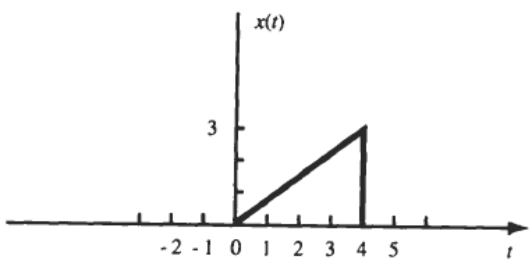

Fig. 1-17

1.3. Given the continuous-time signal specified by

$$x(t) = \begin{cases} 1-|t| & -1 \le t \le 1 \\ 0 & \text{otherwise} \end{cases}$$

determine the resultant discrete-time sequence obtained by uniform sampling of $x(t)$ with a sampling interval of (*a*) 0.25 s, (*b*) 0.5 s, and (*c*) 1.0 s.

1.4. Using the discrete-time signals $x_1[n]$ and $x_2[n]$ shown in Fig. 1-22, represent each of the following signals by a graph and by a sequence of numbers.

(*a*) $y_1[n] = x_1[n] + x_2[n]$; (*b*) $y_2[n] = 2x_1[n]$; (*c*) $y_3[n] = x_1[n]x_2[n]$

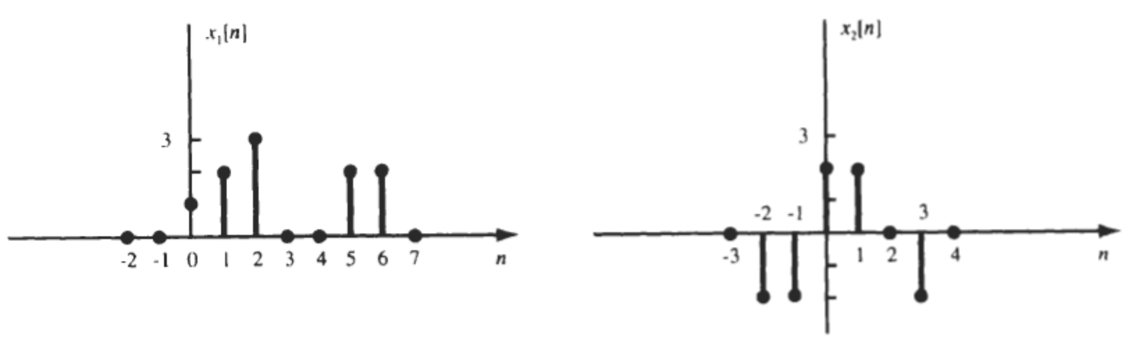

Fig. 1-22

1.5. Sketch and label the even and odd components of the signals shown in Fig. 1-24.

Sheet (1)

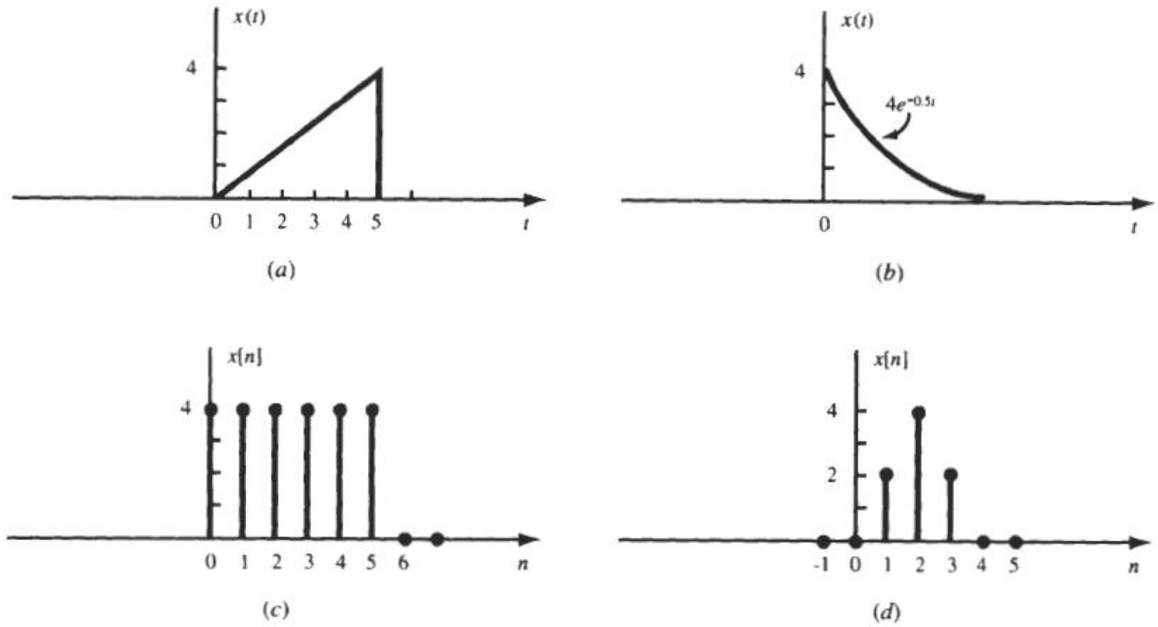

Fig. 1-24

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

1.10. Show that the sinusoidal signal

$$x(t) = \cos(\omega_0 t + \theta)$$

is periodic and that its fundamental period is $2\pi/\omega_0$.

1.16. Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period.

(a) $x(t) = \cos\left(t + \dfrac{\pi}{4}\right)$ (b) $x(t) = \sin \dfrac{2\pi}{3} t$

(c) $x(t) = \cos \dfrac{\pi}{3} t + \sin \dfrac{\pi}{4} t$ (d) $x(t) = \cos t + \sin \sqrt{2}\, t$

(e) $x(t) = \sin^2 t$ (f) $x(t) = e^{j[(\pi/2)t - 1]}$

(g) $x[n] = e^{j(\pi/4)n}$ (h) $x[n] = \cos \frac{1}{4} n$

(i) $x[n] = \cos \dfrac{\pi}{3} n + \sin \dfrac{\pi}{4} n$ (j) $x[n] = \cos^2 \dfrac{\pi}{8} n$

1.20. Determine whether the following signals are energy signals, power signals, or neither.

(a) $x(t) = e^{-at}u(t), \quad a > 0$ (b) $x(t) = A\cos(\omega_0 t + \theta)$

(c) $x(t) = tu(t)$ (d) $x[n] = (-0.5)^n u[n]$

(e) $x[n] = u[n]$ (f) $x[n] = 2e^{j3n}$

Sheet (1)

1.22. A continuous-time signal $x(t)$ is shown in Fig. 1-27. Sketch and label each of the following signals.

(a) $x(t)u(1-t)$; (b) $x(t)[u(t)-u(t-1)]$; (c) $x(t)\delta(t-\frac{3}{2})$

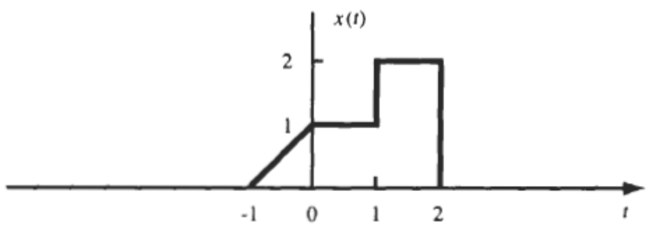

Fig. 1-27

1.27. Show that

(a) $t\delta(t) = 0$

(b) $\sin t\,\delta(t) = 0$

(c) $\cos t\,\delta(t-\pi) = -\delta(t-\pi)$

1.30. Evaluate the following integrals:

(a) $\int_{-1}^{1} (3t^2+1)\delta(t)\,dt$

(b) $\int_{1}^{2} (3t^2+1)\delta(t)\,dt$

(c) $\int_{-\infty}^{\infty} (t^2+\cos \pi t)\,\delta(t-1)\,dt$

(d) $\int_{-\infty}^{\infty} e^{-t}\delta(2t-2)\,dt$

(e) $\int_{-\infty}^{\infty} e^{-t}\delta'(t)\,dt$