2017 Systems and Signals HW7

Hw7: 4.21(a,c,e,g), 4.22 (a,b,c,d) 4.23, 4.28 (a) (for your practice)

4.21. Compute the Fourier transform of each of the following signals:

(a) $[e^{-\alpha t} \cos \omega_0 t]u(t), \alpha > 0$

(b) $e^{-3|t|} \sin 2t$

(c) $x(t) = \begin{cases} 1 + \cos \pi t, & |t| \leq 1 \\ 0, & |t| > 1 \end{cases}$

(d) $\sum_{k=0}^{\infty} \alpha^k \delta(t - kT), |\alpha| < 1$

(e) $[te^{-2t} \sin 4t]u(t)$

(f) $\left[\frac{\sin \pi t}{\pi t}\right]\left[\frac{\sin 2\pi(t-1)}{\pi(t-1)}\right]$

(g) $x(t)$ as shown in Figure P4.21(a)

(h) $x(t)$ as shown in Figure P4.21(b)

(i) $x(t) = \begin{cases} 1 - t^2, & 0 < t < 1 \\ 0, & \text{otherwise} \end{cases}$
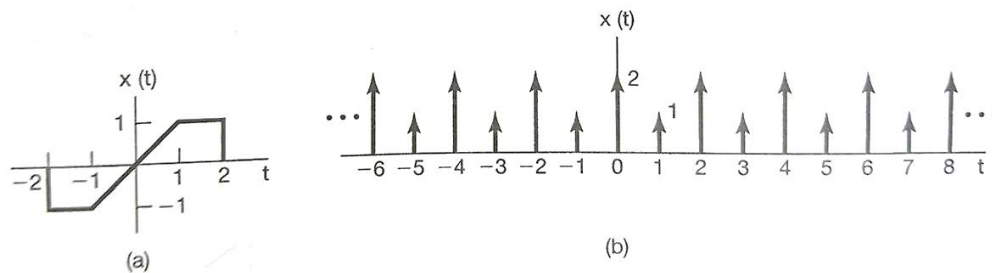
(j) $\sum_{n=-\infty}^{+\infty} e^{-|t-2n|}$

Figure P4.21

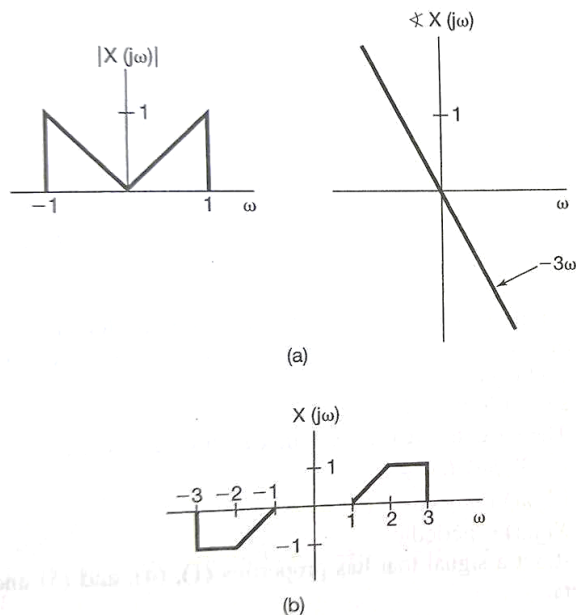**4.22.** Determine the continuous-time signal corresponding to each of the following transforms.

Figure P4.22

(a) $X(j\omega) = \frac{2\sin[3(\omega - 2\pi)]}{(\omega - 2\pi)}$

(b) $X(j\omega) = \cos(4\omega + \pi/3)$

(c) $X(j\omega)$ as given by the magnitude and phase plots of Figure P4.22(a)

(d) $X(j\omega) = 2[\delta(\omega - 1) - \delta(\omega + 1)] + 3[\delta(\omega - 2\pi) + \delta(\omega + 2\pi)]$

(e) $X(j\omega)$ as in Figure P4.22(b)

4.23. Consider the signal

$$x_0(t) = \begin{cases} e^{-t}, & 0 \le t \le 1 \\ 0, & \text{elsewhere} \end{cases}.$$

Determine the Fourier transform of each of the signals shown in Figure P4.23. You should be able to do this by explicitly evaluating *only* the transform of $x_0(t)$ and then using properties of the Fourier transform.
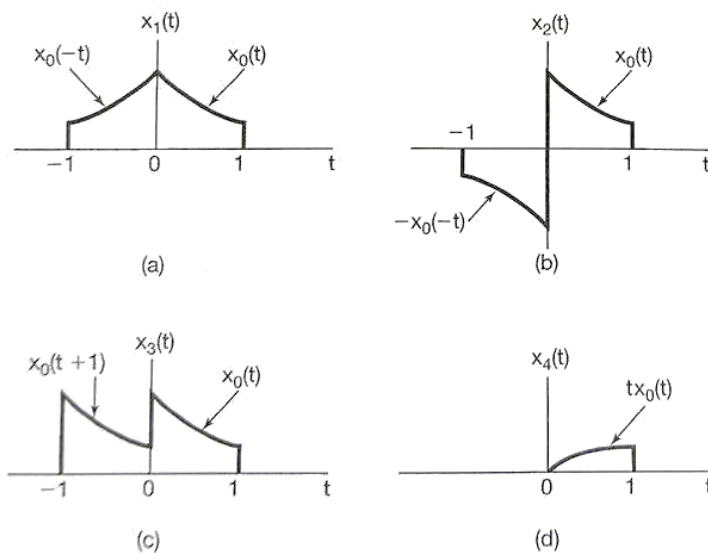

(a)

(b)

(c)

(d)

Figure P4.23

4.28. **(a)** Let $x(t)$ have the Fourier transform $X(j\omega)$, and let $p(t)$ be periodic with fundamental frequency ω_0 and Fourier series representation

$$p(t) = \sum_{n=-\infty}^{+\infty} a_n e^{jn\omega_0 t}.$$

Determine an expression for the Fourier transform of

$$y(t) = x(t)p(t). \tag{P4.28–1}$$