2.5 Determine whether the given signals are periodic. For periodic signals, determine the period.

1. $\sin(4000\pi t) + \cos(11{,}000\pi t)$
2. $\sin(4000\pi t) + \cos(11{,}000t)$
3. $\sin(4000\pi n) + \cos(11{,}000\pi n)$
4. $\sin(4000\pi n) + \cos(11{,}000n)$

2.7 Classify these signals into energy-type signals, power-type signals, and signals that are neither energy-type nor power-type signals. For energy-type and power-type signals, find the energy or the power content of the signal.

1. $x_1(t) = (e^{-t}\cos t)\,u_{-1}(t)$
2. $x_2(t) = e^{-t}\cos t$
3. $x_3(t) = \mathrm{sgn}(t)$
4. $x_4(t) = A\cos 2\pi f_1 t + B\cos 2\pi f_2 t$

2.16 Classify these systems into linear and nonlinear:

1. $y(t) = 2x(t) - 3$
2. $y(t) = |x(t)|$
3. $y(t) = 0$
4. $y(t) = 2^{x(t)}$
5. $y(t) = \begin{cases} 1 & x(t) > 0 \\ 0 & x(t) \le 0 \end{cases}$
6. $y(t) = e^{-t}x(t)$
7. $y(t) = x(t)u_{-1}(t)$
8. $y(t) = x(t) + y(t-1)$
9. $y(t) =$ Algebraic sum of jumps in $x(t)$ in the interval $[-\infty, t]$

2.39 Determine the Fourier-series expansion of the following signals:

1. $x(t) = \cos(2\pi t) + \cos(4\pi t)$
2. $x(t) = \cos(2\pi t) - \cos(4\pi t + \pi/3)$
3. $x(t) = 2\cos(2\pi t) - \sin(4\pi t)$
4. $x(t) = \sum_{n=-\infty}^{\infty} \Lambda(t - 2n)$
5. $x(t) = \sum_{n=-\infty}^{\infty} \Lambda(t - n)u_{-1}(t - n)$
6. $x(t) = |\cos 2\pi f_0 t|$ (full-wave rectifier output)

2.46 Determine the Fourier transform of each of the following signals:

1. $x(t) = \frac{1}{1+t^2}$
2. $\Pi(t - 3) + \Pi(t + 3)$
3. $4\Pi\left(\frac{t}{4}\right)\cos(2\pi f_0 t)$
4. $t\,\mathrm{sinc}t$
5. $t\cos 2\pi f_0 t$

2.47 The Fourier transform of a signal is shown in Figure P-2.47. Determine and sketch the Fourier transform of the signal $x_1(t) = -x(t) + x(t)\cos(2000\pi t) + 2x(t)\cos^2(3000\pi t)$.

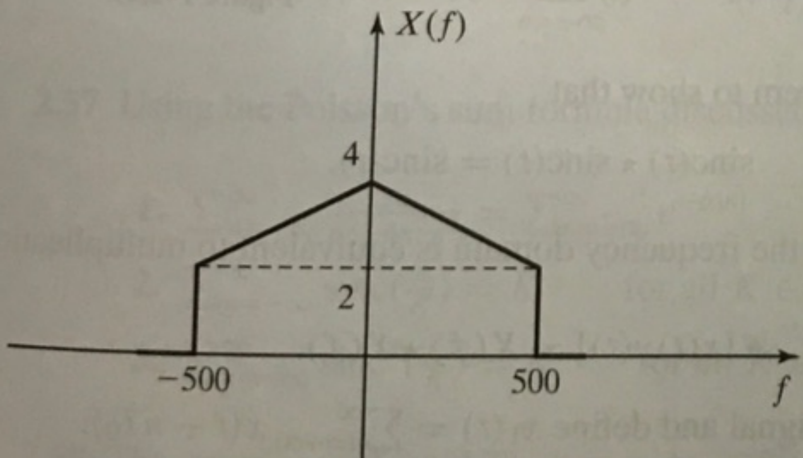

Figure P-2.47

2.50 Use the convolution theorem to show that

$$\mathrm{sinc}(t) \star \mathrm{sinc}(t) = \mathrm{sinc}(t).$$

2.51 Prove that convolution in the frequency domain is equivalent to multiplication in the time domain. That is,

$$\mathscr{F}[x(t)y(t)] = X(f) \star Y(f).$$