

# ECEN 220 Homework 4 Questions

Source: Oppenheim, Willsky & Nawab, Signals and Systems, 2nd Edition

3.22. Determine the Fourier series representations for the following signals:

(a) Each  $x(t)$  illustrated in Figure P3.22(a)–(f).

~~(b)  $x(t)$  periodic with period 2 and~~

$$x(t) = e^{-t} \quad \text{for} \quad -1 < t < 1$$

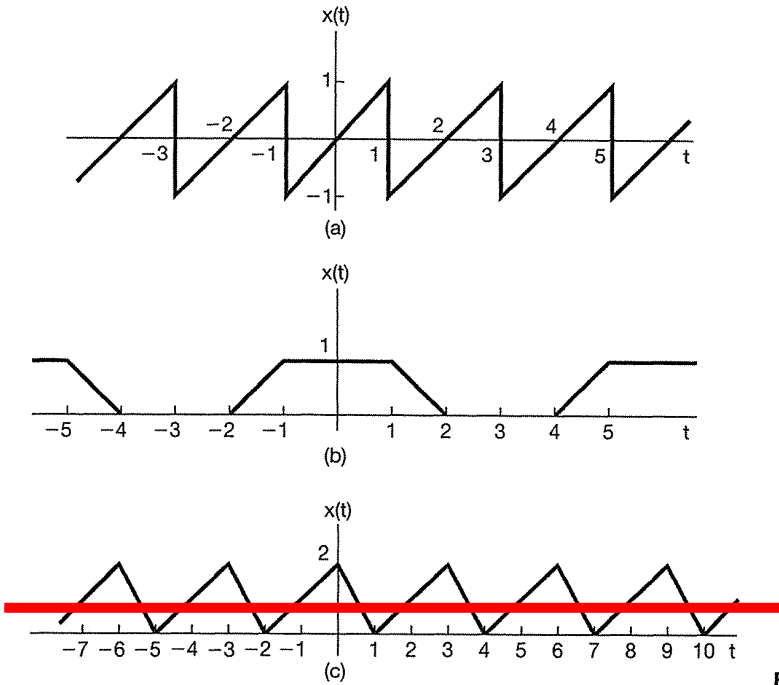


Figure P3.22

3.24. Let

$$x(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 2 - t, & 1 \leq t \leq 2 \end{cases}$$

be a periodic signal with fundamental period  $T = 2$  and Fourier coefficients  $a_k$ .

- Determine the value of  $a_0$ .
- Determine the Fourier series representation of  $dx(t)/dt$ .
- Use the result of part (b) and the differentiation property of the continuous-time Fourier series to help determine the Fourier series coefficients of  $x(t)$ .

3.25. Consider the following three continuous-time signals with a fundamental period of  $T = 1/2$ :

$$x(t) = \cos(4\pi t),$$

$$y(t) = \sin(4\pi t),$$

$$z(t) = x(t)y(t).$$

- Determine the Fourier series coefficients of  $x(t)$ .
- Determine the Fourier series coefficients of  $y(t)$ .
- Use the results of parts (a) and (b), along with the multiplication property of the continuous-time Fourier series, to determine the Fourier series coefficients of  $z(t) = x(t)y(t)$ .
- Determine the Fourier series coefficients of  $z(t)$  through direct expansion of  $z(t)$  in trigonometric form, and compare your result with that of part (c).

3.26. Let  $x(t)$  be a periodic signal whose Fourier series coefficients are

$$a_k = \begin{cases} 2, & k = 0 \\ j(\frac{1}{2})^{|k|}, & \text{otherwise} \end{cases}$$

Use Fourier series properties to answer the following questions:

- Is  $x(t)$  real?
- Is  $x(t)$  even?
- Is  $dx(t)/dt$  even?