Sample Instructor Solutions (these solutions are deliberately incomplete—a complete set of solutions will be provided for instructors who adopt the book for classroom use)

ENGINEERING SIGNALS AND SYSTEMS

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Problem 1.1 Is each of these 1-D signals:

- Analog or digital?
- Continuous-time or discrete-time?

(a) Daily closes of the stock market
(b) Output from phonograph record pickup
(c) Output from compact disc pickup

Solution:

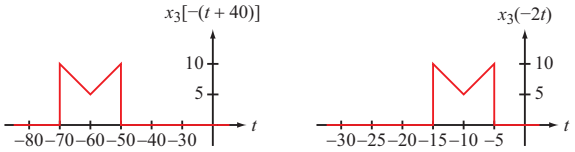
(a) Stock market closes are recorded only at the end of each day, but indices take on a continuous range of values. Analog and discrete time.

Problem 1.6 Given the waveform of $x_3(t)$ shown in Fig. P1.4(c), generate and plot the waveform of:

(a) $x_3[-(t+40)]$

(b) $x_3(-2t)$

Solution:



(a) (b)

(a) $x_3[-(t+40)]$ is $x_3(t)$ reversed in time, then advanced by 40.

Problem 1.16 For each of the following functions, indicate if it exhibits even symmetry, odd symmetry, or neither one:

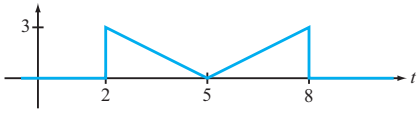
(a) $x_1(t) = 3t^2 + 4t^4$

(b) $x_2(t) = 3t^3$

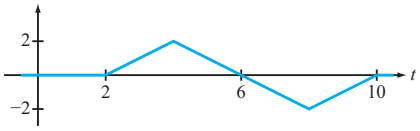
Solution: A function has even symmetry if $x(-t) = x(t)$, and odd symmetry if $x(-t) = -x(t)$.

(a) $x_1(-t) = 3(-t)^2 + 4(-t)^4 = 3t^2 + 4t^4 = x_1(t)$. Even.

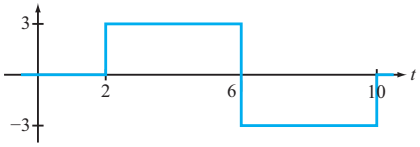
Problem 1.27 Provide expressions for the waveforms displayed in Fig. 1.27 in terms of ramp and step functions.



(a) $x_1(t)$ "M"



(b) $x_2(t)$ "triangle"



(c) $x_3(t)$ "Haar"

Figure P1.27: Waveforms for Problem 1.27.

Solution: A delayed step drops the waveform. A delayed ramp reduces its slope by one.

(a) $\boxed{x_1(t) = 3u(t-2) - r(t-2) + 2r(t-5) - r(t-8) - 3u(t-8).}$