

Homework Assignment #3

Reading Assignment:

Ch. 1, Sect. 1-4, 6-8 in *Linear Signals & Systems, 2nd Ed.* by Lathi

Problem Assignment:

Work the following problems from Chapter 1 in *Linear Signals & Systems, 2nd Ed.* by Lathi:

1.1-1, 1.1-2, 1.1-5, 1.1-6 (See note on problem 1.1-1 below)

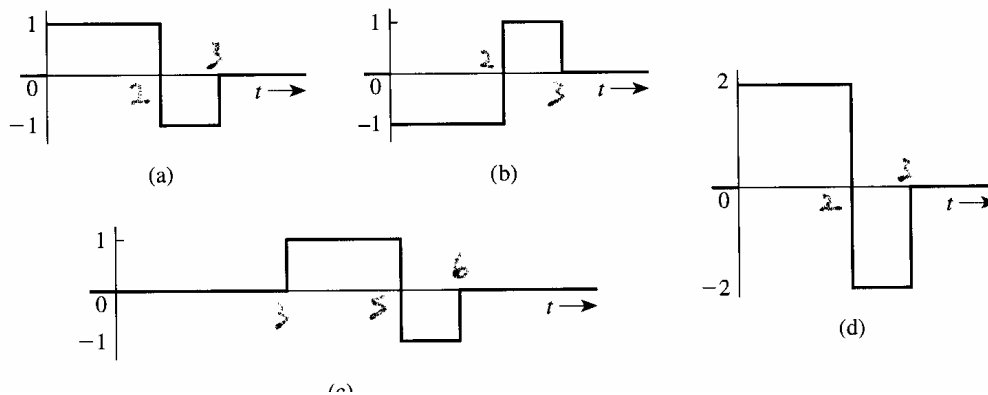
1.2-2, 1.2-3 (find $x_1(t)$ and $x_2(t)$ only)

1.4-1, 1.4-2, 1.4-3, 1.4-4

1.7-1, 1.7-7, 1.7-8, 1.7-11

1.8-1, 1.8-2

Problem 1.1-1) The waveforms in the text left off the time values on the t axis. They are shown below.



Selected Answers:

1.1-1 3, 3, 3, 12

1.1-2 $1/3, 1/3, 1/3, 1/3, 4/3$

1.1-5 75, 178, 51, 25, 25, $1/2$

1.1-6 $P_x = A^2/6, E_x = \infty$

1.2-3 $x_1(t) = x(t+1) + x(1-t), x_2(t) = x([t+1]/2) + x([1-t]/2)$

1.4-2 $x_1(t) = (4t+1)[u(t+1) - u(t)] + (-2t+4)[u(t) - u(t-2)]$

$x_2(t) = t^2[u(t) - u(t-2)] + (2t-8)[u(t-2) - u(t-4)]$

1.4-3 0, $2/9\delta(\omega), 1/2\delta(t), -1/5\delta(t-1), 1/(2-j3)\delta(\omega+3), k\delta(\omega)$

1.4-4 $x(t), x(t), 1, 0, e^3, 5, x(-1), -e^2$

1.7-1 Only b, f, and h are linear. Use the procedure discussed in Example 1.9 for each part.

1.7-7 Only part a is causal. Explain why in each case!

1.7-8 a) Invertible. Inverse system equation is $y(t) = dx/dt$.

b) Non-invertible. Why? c) Non-invertible. Why?

d) Invertible (but noncausal). Inverse system equation is $y(t) = x(t/3 + 3)$

e) Non-invertible. Why? f) Invertible. $x(t) = \ln[y(t)]$

1.7-11 No, Yes, No, Yes, Yes (explain why in each case)

1.8-1 $\frac{d}{dt}y_1(t) + 3y_1(t) = x(t)$ or $(D + 3)y_1(t) = x(t)$

$$\frac{d}{dt}y_2(t) + 3y_2(t) = \frac{d}{dt}x(t) \quad \text{or} \quad (D + 3)y_2(t) = Dx(t)$$

1.8-2 $\frac{d^2}{dt^2}y_1(t) + 2\frac{d}{dt}y_1(t) + 2y_1(t) = \frac{d^2}{dt^2}x(t)$ or $(D^2 + 2D + 2)y_1(t) = D^2x(t)$

$$\frac{d^2}{dt^2}y_2(t) + 2\frac{d}{dt}y_2(t) + 2y_2(t) = \frac{d}{dt}x(t) \quad \text{or} \quad (D^2 + 2D + 2)y_2(t) = Dx(t)$$