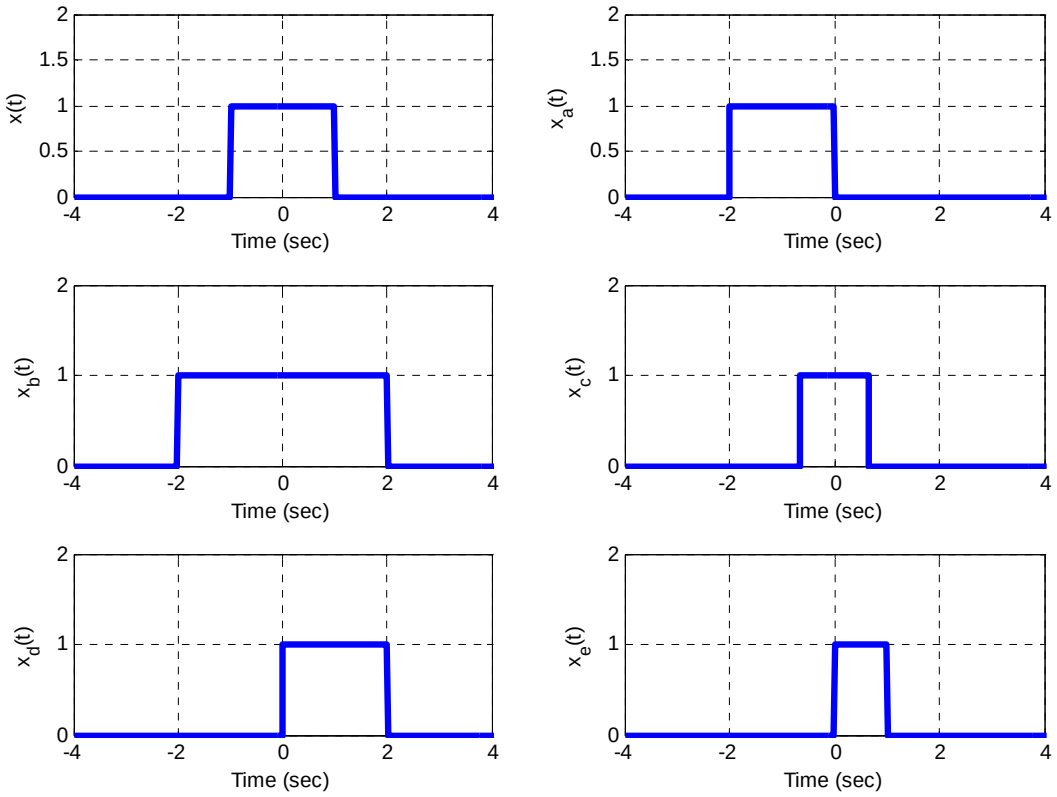
Short Answer Review

In the figure below, $x(t)$ is the original signal (in the upper left corner)



1) Which signal represents $x\left(\frac{t}{2}\right)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

2) Which signal represents $x(2t-1)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

3) Which signal represents $x(t+1)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

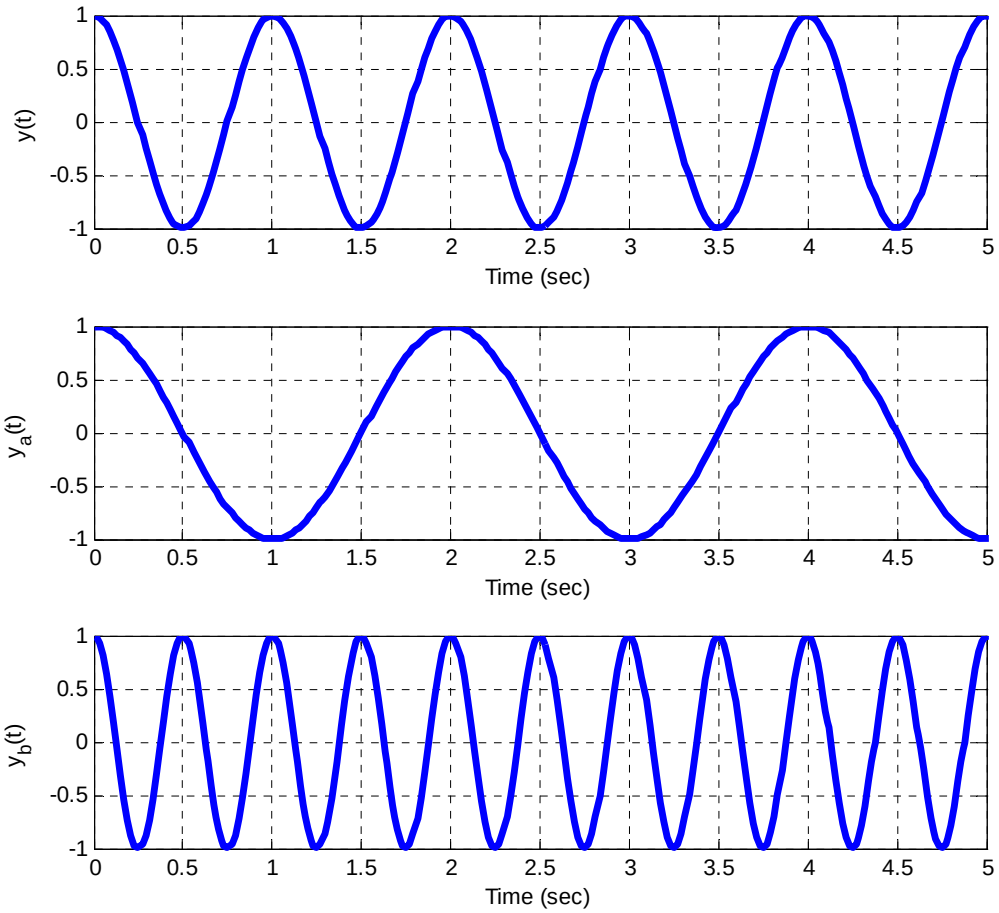
4) Which signal represents $x(1.5t)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

5) Which signal represents $x(t-1)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

6) Which signal represents a **compressed** $x(t)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

7) Which signal represents an **expanded** $x(t)$? $x_a(t)$ $x_b(t)$ $x_c(t)$ $x_d(t)$ $x_e(t)$

In the following figure, the original signal $y(t)$ is in the top panel



8) Which signal has the highest frequency? $y(t)$ $y_a(t)$ $y_b(t)$

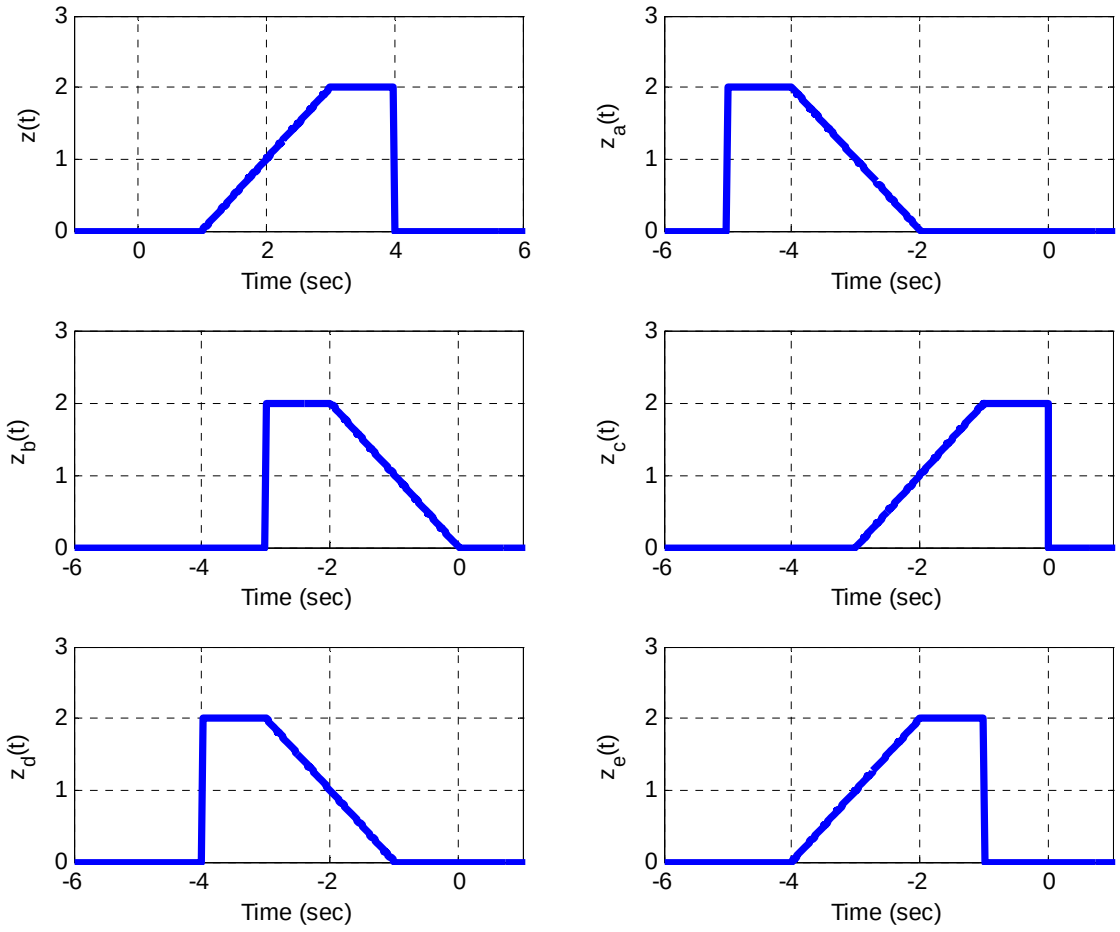
9) Which signal has the lowest frequency? $y(t)$ $y_a(t)$ $y_b(t)$

10) $y(t) = y_a(ct)$ for what value of c ? $c = 0.5$ $c = 1.0$ $c = 1.5$ $c = 2.0$

11) $y(t) = y_b(ct)$ for what value of c ? $c = 0.5$ $c = 1.0$ $c = 1.5$ $c = 2.0$

12) Which signal is a **compressed** version of $y(t)$? $y_a(t)$ $y_b(t)$

The original signal z(t) is in the top left panel.



13) Which of the above signals represents $z(-t)$? $z_a(t)$ $z_b(t)$ $z_c(t)$ $z_d(t)$ $z_e(t)$

14) Which of the above signals represents $z(-t+1)$ $z_a(t)$ $z_b(t)$ $z_c(t)$ $z_d(t)$ $z_e(t)$

15) The function $x(t) = e^{j\frac{t}{4}} + e^{j\frac{t}{2}}$ is

a) not periodic
b) periodic with fundamental period π second
c) periodic with fundamental period 2π seconds
d) periodic with fundamental period 8π seconds

16) The function $x(t) = \cos(t) + \sin(2\pi t)$ is

a) not periodic
b) periodic with fundamental period 1 second
c) periodic with fundamental period π seconds
d) periodic with fundamental period 2π seconds

17) The function $x(t) = \sin\left(\frac{\pi}{2}t\right)\delta(t-1) + t$ can be simplified as

a) $x(t) = 2$ b) $x(t) = 1 + t$ c) $x(t) = \delta(t-1) + t$ d) $x(t) = \delta(t-1) + 1$

18) The integral $\int_0^{10} \delta(\lambda - 1)\delta(\lambda - 2)d\lambda$ can be simplified as

a) 0 b) 1 c) none of these

19) The integral $\int_{-1}^{5} t\delta(\lambda - 2)d\lambda$ can be simplified as

a) 2 b) t c) $2\delta(t-2)$ d) $t\delta(t-2)$

20) The integral $\int_{-1}^{2} \delta(t-3)dt$ can be simplified as

a) 1 b) 0 c) 3 d) $\delta(t-3)$

21) The integral $\int_{-\infty}^{\infty} u(t+1)u(t-2)e^{-t}dt$ can be simplified as

a) $\int_{-1}^{\infty} e^{-t}dt$ b) $\int_{2}^{\infty} e^{-t}dt$ c) $\int_{-1}^{2} e^{-t}dt$ d) none of these

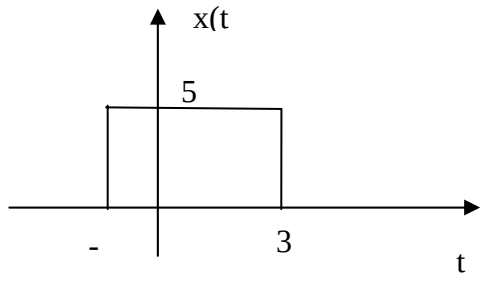
22) The integral $\int_{-\infty}^{\infty} u(-1-\lambda)e^{-|\lambda|}d\lambda$ can be simplified as

a) $\int_{-\infty}^{-1} e^{-|\lambda|}d\lambda$ b) $\int_{-1}^{\infty} e^{-|\lambda|}d\lambda$ c) $\int_{1}^{\infty} e^{-|\lambda|}d\lambda$ d) none of these

23) The function $x(t)$ below can best be represented by the function

a) $x(t) = 5\Pi\left(\frac{t}{2}\right)$ b) $x(t) = 5\Pi\left(\frac{t-1}{2}\right)$

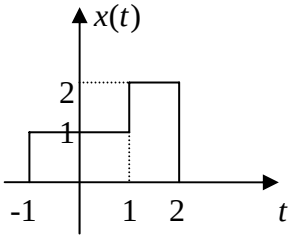
c) $x(t) = 5\Pi\left(\frac{t}{4}\right)$ d) $x(t) = 5\Pi\left(\frac{t-1}{4}\right)$



24) The function $x(t)$ below can best be modeled by the function

a) $x(t) = u(t+1) + u(t-1) - u(t-2)$ b) $x(t) = u(t+1) + 2u(t-1) - 2u(t-2)$

c) $x(t) = u(t+1) + u(t-1) - 2u(t-2)$ d) $x(t) = u(t+1) + 2u(t-1) - 3u(t-2)$



25) The **average power** in the signal $x(t) = ce^{j\omega t}$ is

a) 0 b) $\frac{|c|}{2}$ c) $|c|^2$ d) $\frac{|c|^2}{2}$

26) The **average power** in the signal $x(t) = A\cos(\omega t + \theta)$ is

a) $\frac{A}{2}$ b) A c) A^2 d) $\frac{A^2}{2}$

27) The signal $x(t) = A\cos(\omega t)[u(t) - u(t-10)]$ is

a) an energy signal b) a power signal c) neither an energy or power signal

28) The signal $x(t) = 2\cos(2t) + j2\sin(2t)$ is

a) an energy signal b) a power signal c) neither

29) The signal $x(t) = 2u(t) - u(t-1) - 2u(t-2)$ is

a) an energy signal b) a power signal c) neither

30) The signal $x(t) = e^{t}u(t)$ is

a) an energy signal b) a power signal c) neither

31) Fill in the following table with a Y (yes) or N (no) for each of the system models given. Assume $-\infty < t < \infty$ for all of the systems.

System Model	Linear?	Time-Invariant?	Causal?	Memoryless?
$y(t) = 3\sin(t+1)x(t-1)$				
$y(t) = x\left(\frac{t}{2} - 1\right)$				
$y(t) = x(1-t)$				
$\dot{y}(t) + t^2 y(t) = \sin(t)x(t)$				

32) The average power in the signal $x(t) = ce^{j\omega t}$ is

a) 0 b) $\frac{|c|}{2}$ c) $|c|^2$ d) $\frac{|c|^2}{2}$

33) The average power in the signal $x(t) = A\cos(\omega t + \theta)$ is

a) $\frac{|A|}{2}$ b) $|A|$ c) A^2 d) $\frac{A^2}{2}$

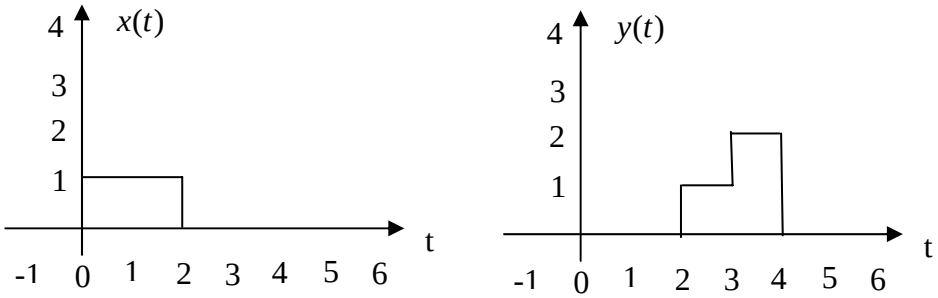
34) The average power in the signal $x(t) = ce^{j\omega t} + de^{j2\omega t}$ is

a) 0 b) $\frac{|c|}{2} + \frac{|d|}{2}$ c) $|c|^2 + |d|^2$ d) $\frac{|c|^2}{2} + \frac{|d|^2}{2}$

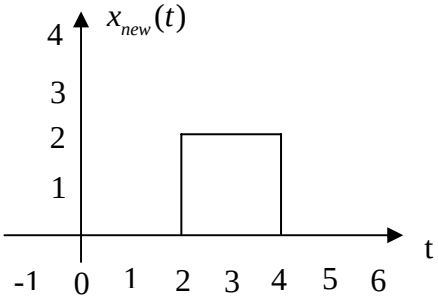
35) The average power in the signal $x(t) = A\cos(\omega t + \theta) + B\cos(2\omega t + \phi)$ is

a) $\frac{|A|}{2} + \frac{|B|}{2}$ b) $|A| + |B|$ c) $A^2 + B^2$ d) $\frac{A^2}{2} + \frac{B^2}{2}$

36) Assume we know a system is a linear time invariant (LTI) system. We also know the following input $x(t)$ – output $y(t)$ pair:

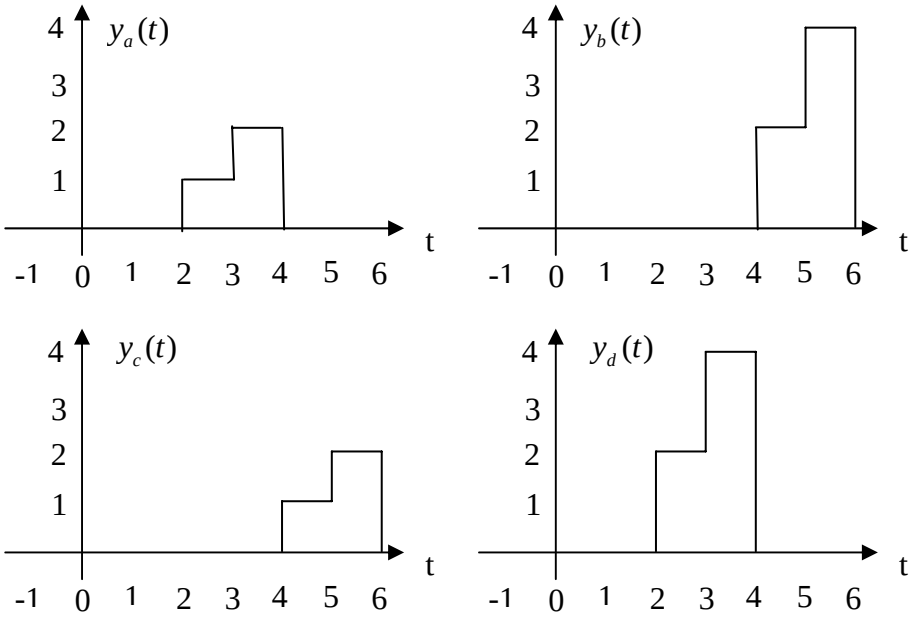


If the input to the system is now $x_{new}(t)$



Which of the following best represents the output of the system?

a) $y_a(t)$ b) $y_b(t)$ c) $y_c(t)$ d) $y_d(t)$



37) The impulse response of the mathematical model of a system $y(t) = 2x(t-1)$ is

a) $h(t) = \delta(t)$ b) $h(t) = 2\delta(t)$ c) $h(t) = 2\delta(t-1)$ d) $h(t) = 2u(t-1)$

38) The impulse response of the mathematical model of a system $y(t) = \int_{-\infty}^{t-1} x(\lambda)d\lambda$ is

a) $h(t) = u(t)$ b) $h(t) = 1$ c) $h(t) = u(t-1)$ d) $h(t) = t-1$

39) The impulse response of the mathematical model of a system $y(t) = \int_{-\infty}^{t-1} \lambda x(\lambda - 2)d\lambda$ is

a) $h(t) = 2u(t-1)$ b) $h(t) = 2u(t-2)$ c) $h(t) = 2u(t-3)$ d) $h(t) = 2u(t)$

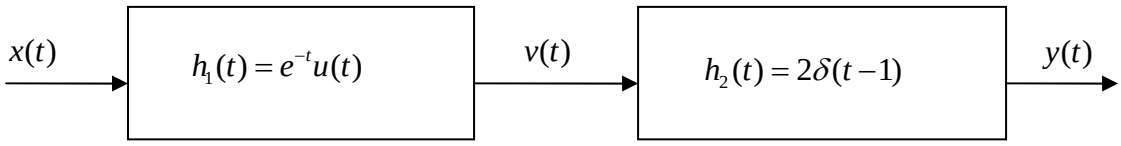
40) The impulse response of the mathematical model of a system $y(t) = \int_{t}^{\infty} \lambda x(\lambda - 2)d\lambda$ is

a) $h(t) = 2u(t)$ b) $h(t) = 2u(2-t)$ c) $h(t) = 2u(t-2)$ d) $h(t) = u(t)$

41) The impulse response of the mathematical model of a system $\dot{y}(t) + 2y(t) = 3x(t)$ is

a) $h(t) = 3e^{-2t}u(t)$ b) $h(t) = 3e^{2t}u(t)$ c) $h(t) = 3u(t)$ d) $h(t) = 6u(t)$

42) The impulse response of the system



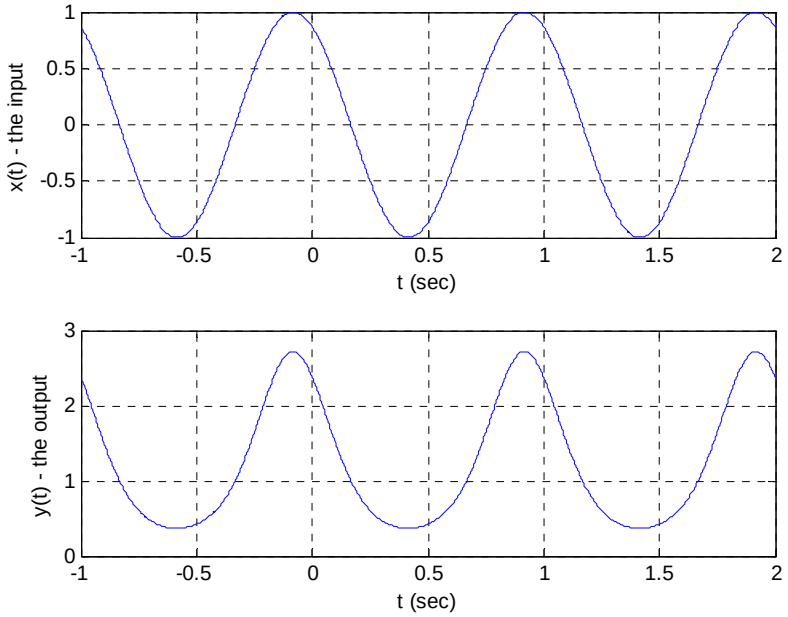
is

a) $h(t) = 2e^{-t}u(t)$ b) $h(t) = 2e^{-t}\delta(t-1)$ c) $h(t) = 2e^{-(t-1)}u(t-1)$ d) $h(t) = 2e^{-(t-1)}u(t)$

43) Consider an unknown system. When the input to the system is $x(t) = 2\cos(2t)$ the output of the system is $y(t) = 2\cos(2t) + \cos(4t)$. Is the system **linear**?

a) Yes b) No c) Can't tell, not enough information

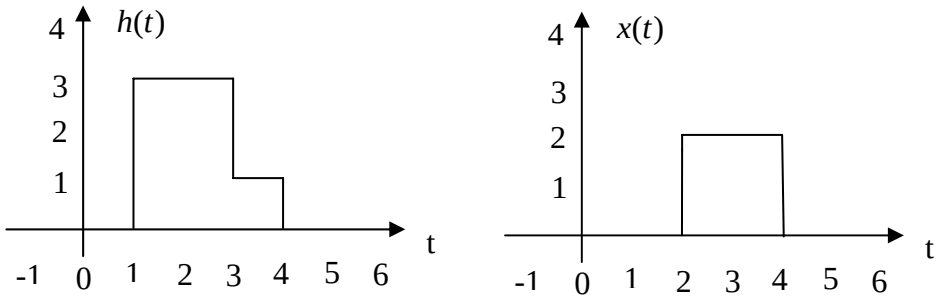
44) Consider the following input/output pair for an unknown system.



Which of the following is true:

a) The system is linear
b) The system is not linear
c) It is not possible to determine if the system is linear based on the information given.

Problems 45 -48 refer to the following linear time invariant (LTI) system, with impulse response $h(t)$ shown below on the left, and input $x(t)$ shown below on the right. The output of the system, $y(t)$, is the convolution of the impulse response with the input, $y(t) = h(t) * x(t)$.



45) Is this LTI system causal? a) Yes b) No

46) The maximum value of $y(t)$ is a) 4 b) 5 c) 6 d) 12 e) 14

47) $y(t)$ is zero until what time? a) 0 b) 1 c) 2 d) 3 e) 4

48) $y(t)$ will return to zero at what time? a) 6 b) 7 c) 8 d) 9 e) 10

Answers:

1) xb 2) xe 3) xa 4) xc 5) xd 6) xc (xe is compressed and shifted)

7) xb 8) yb 9) ya 10) c=2 11) c=0.5 12)yb 13) zd 14) zb

15) d 16) a 17) c 18) a 19) b 20) b 21) b 22) a (or c) 23) d 24) c

25) c 26) d 27) a 28) b 29) b 30) c

31a) L, not TI, C, not M 31b) L, not TI, not C, not M 31c) L, not TI, not C, not M

31d) L, not TI, C, not M 32) c 33) d 34) c 35) d 36) b

37) c 38) c 39) c 40) b 41) a 42) c 43) b 44) b 45) a 46) d 47) d 48) c