

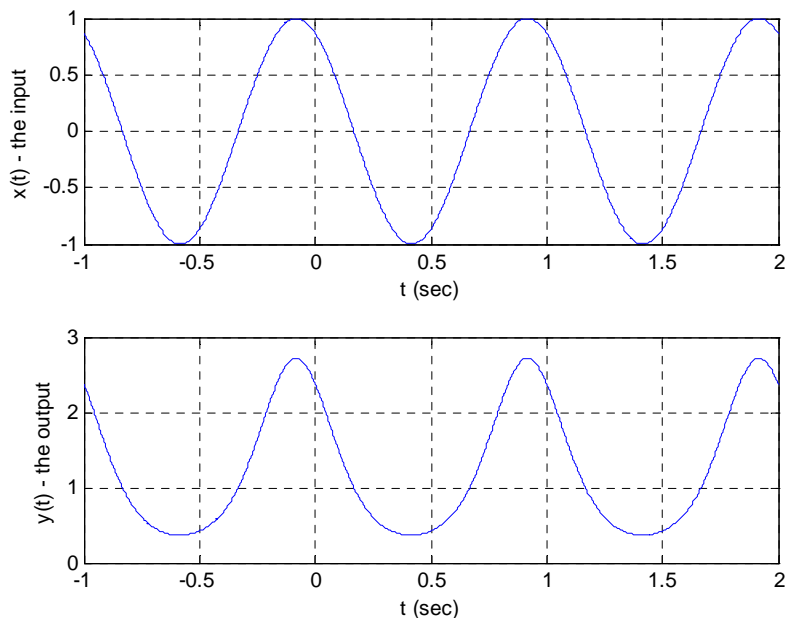
## Practice Quiz 4

(no calculators allowed)

1) 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

2) 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.

3) The **impulse response** for the LTI system  $y(t) = \frac{1}{2}[x(t) - x(t-1)]$  is

- a)  $h(t) = \frac{1}{2}[u(t) - u(t-1)]$    b)  $h(t) = \frac{1}{2}[\delta(t) - \delta(t-1)]$    c) neither of these

4) The **impulse response** for the LTI system  $y(t) = \int_{-\infty}^{t+1} e^{-(t-\lambda)} x(\lambda) d\lambda$  is

- a)  $h(t) = e^{-t}u(t)$    b)  $h(t) = e^{-t}u(t+1)$    c)  $h(t) = e^{-t}\delta(t)$    d) none of these

5) The **impulse response** for the LTI system  $y(t) = 2x(t) + \int_{-\infty}^{t-2} e^{-(t-\lambda)} x(\lambda + 3) d\lambda$  is

- a)  $h(t) = 2u(t) + e^{-(t+3)}u(t+1)$     b)  $h(t) = 2\delta(t) + e^{-(t+3)}u(t+1)$   
 c)  $h(t) = 2\delta(t) + e^{-(t+3)}u(t)$     d)  $h(t) = 2\delta(t) + e^{-(t+3)}u(t-2)$   
 e)  $h(t) = 2\delta(t) + e^{-(t+3)}u(t+3)$     f) none of these

6) The **impulse response** for the LTI system  $\dot{y}(t) + y(t) = x(t-1)$  is

- a)  $h(t) = e^t u(t)$     b)  $h(t) = e^{-t} u(t)$     c)  $h(t) = e^{-(t-1)} u(t)$   
 d)  $h(t) = e^{-(t-1)} u(t-1)$     e)  $h(t) = e^{(t-1)} u(t-1)$     f) none of these

7) The **impulse response** for the LTI system  $\dot{y}(t) - 2y(t) = 3x(t+1)$  is

- a)  $h(t) = 3e^{2(t+1)} u(t+1)$     b)  $h(t) = 3e^{-2(t+1)} u(t+1)$     c)  $h(t) = 3e^{-2(t+1)} u(t-1)$   
 d)  $h(t) = 3e^{-2(t+1)} u(t)$     e)  $h(t) = 3e^{2(t+1)} u(t)$     f) none of these

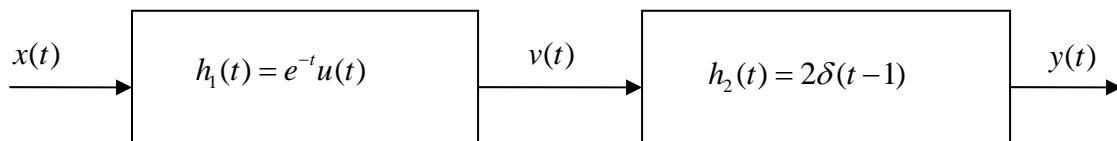
8) The **unit step response** of a system with impulse response  $h(t) = e^{-(t-1)} u(t-1)$  is

- a)  $y(t) = [1 - e^{-(t-1)}] u(t-1)$     b)  $y(t) = [1 - e^{-(t-1)}] u(t)$     c)  $y(t) = [1 - e^{(t-1)}] u(t)$   
 d)  $y(t) = [1 - e^{(t-1)}] u(t-1)$     e) none of these

9) If the unit step response of a system is  $y(t) = A(1 - e^{-t/\tau}) u(t)$ , the **impulse response** of the system is

- a)  $h(t) = \frac{A}{\tau} e^{-t/\tau} \delta(t)$     b)  $h(t) = \frac{A}{\tau} e^{-t/\tau} u(t)$     c)  $h(t) = \frac{A}{\tau} e^{-t/\tau}$     d)  $h(t) = A\tau e^{-t/\tau} u(t)$

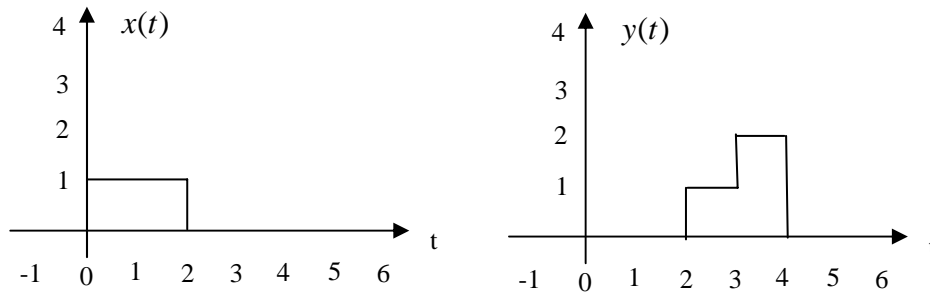
10) The **impulse response** of the system



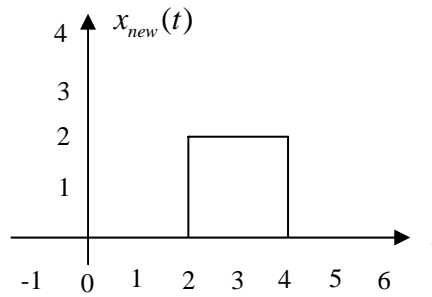
is

- 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)  $h(t) = 2e^{-(t-1)} u(t)$

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

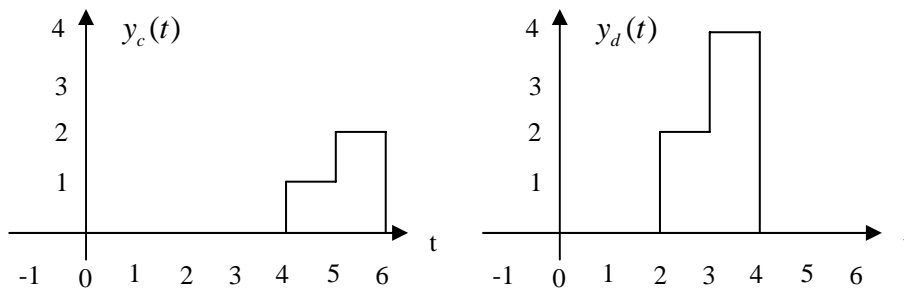
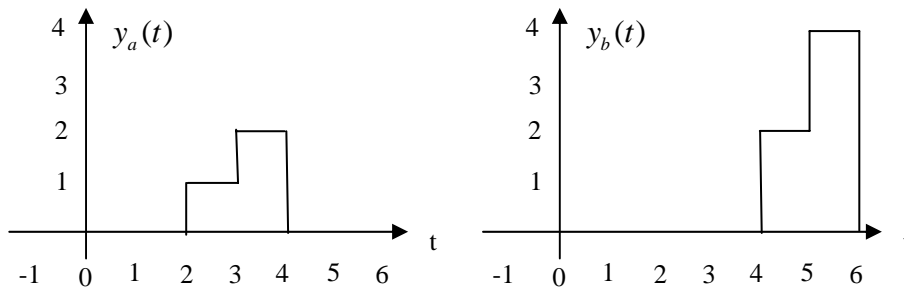


If the input to the system is now  $x_{new}(t)$

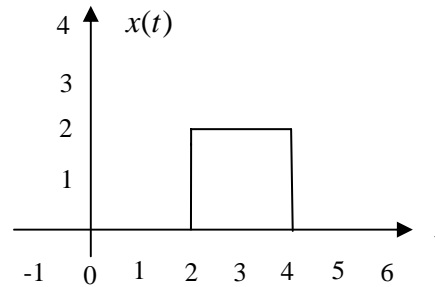
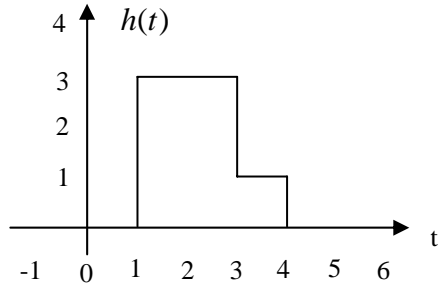


Which of the following best represents the output of the system?

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



Problems 12 - 15 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,  $y(t) = h(t) * x(t)$ .



- 12) Is this LTI system causal? a) Yes b) No
- 13) The maximum value of  $y(t)$  is a) 4 b) 5 c) 6 d) 12 e) 14
- 14)  $y(t)$  is zero until what time? a) 0 b) 1 c) 2 d) 3 e) 4
- 15)  $y(t)$  will return to zero at what time? a) 6 b) 7 c) 8 d) 9 e) 10

**Answers:** 1-b, 2-b, 3-b, 4-b, 5-b, 6-d, 7-a, 8-a,  
9-b, 10-c, 11-b, 12-a, 13-d, 14-d, 15-c