P5.7

Consider the three discrete-time signals shown in Figure P5.7.

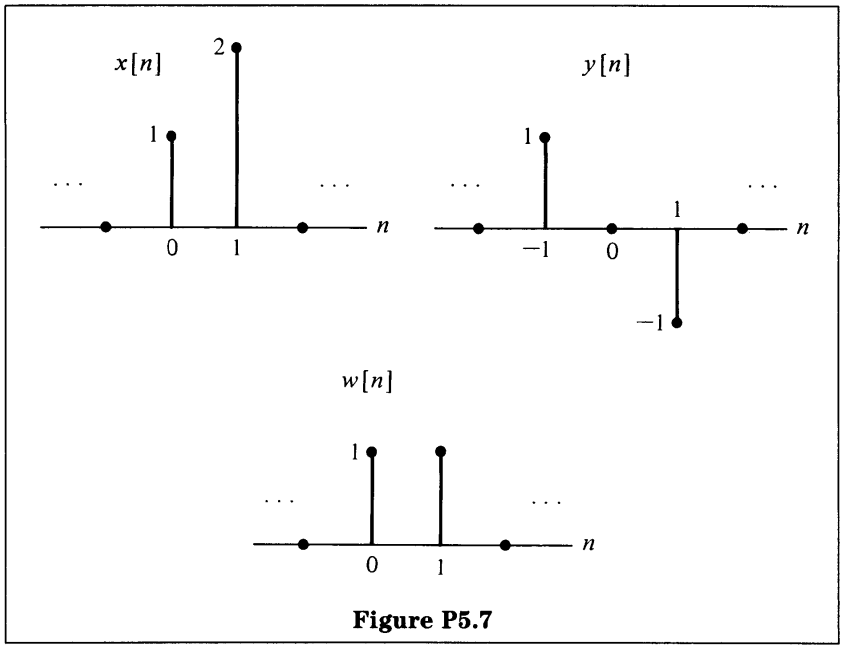

Figure P5.7

(a) Verify the distributive law of convolution:

$$(x + w) * y = (x * y) + (w * y)$$

(b) You may have noticed a similarity between the convolution operation and multiplication, but they are *not* equivalent. Verify that

$$(x * y) \cdot w \neq x * (y \cdot w)$$

P5.8

Let $y(t) = x(t) * h(t)$. Show the following.

(a) $\dfrac{dy(t)}{dt} = x(t) * \dfrac{dh(t)}{dt} = \dfrac{dx(t)}{dt} * h(t)$

(b) $y(t) = \left(\int_{-\infty}^{t} x(\tau)\, d\tau\right) * h'(t)$

(c) $y(t) = \int_{-\infty}^{t} [x'(\tau) * h(\tau)]\, d\tau$

(d) $y(t) = x'(t) * \int_{-\infty}^{t} h(\tau)\, d\tau$

P5.9

Determine if each of the following statements concerning LTI systems is true or false. Justify your answers.

(a) If $h(t)$ is the impulse response of an LTI system and $h(t)$ is periodic and nonzero, the system is unstable.