1. $y(t) = e^{-t} x^a (t-b)$; $a=3$, $b=2$, $c=2$

Causalidad

Es causal pues la salida no depende de valores futuros.

Linealidad

Homogeneidad

$y(t) = e^{-t} x^3 (2t-2)$

$x(t) = \alpha x(t) \Rightarrow y(t) = \alpha y(t)$

$y(t) = e^{-t} (\alpha x)^3 (2t-2) = e^{-t} \alpha^3 x^3 (2t-2)$

$y(t) \neq \alpha y(t) \Rightarrow$ No es lineal

2. $y[n] = n^c x[bn-a]$; $a=15$; $b=5$, $c=0$

Invarianza:

$x[n] = x[n-\tau]$

$y_1[n] = x[5n - 15 - \tau]$

Es variante pues no es de la forma $x[n-\tau]$

Linealidad

Homogéneo

$x[n] = \alpha x[n] \Rightarrow y[n] = \alpha y[n]$

$y[n] = \alpha \, x[5n - 15]$

$y[n] = \alpha \, y[n] \Rightarrow$ cumple

Aditividad

$x_1[n] \, ; \quad y_1[n] = x_1[n]$

$x_2(n) \, ; \quad y_2(n) = x_2(n)$

$x[n] = x_1[n] + x_2[n] \Rightarrow y(n) = y_1[n] + y_2[n]$

$y(n) = x_1[5n - 15] + x_2[5n - 15]$

$\Rightarrow$ Cumple con aditividad

Es lineal.

3. Sea $x[n] = \cos[\pi/3 \, n + 9\pi/12] + sen[\pi \, 2/3 \, n +$

$\cdots + \frac{\pi}{12}]$

Periodicidad

$N_1 = \dfrac{2\pi}{w_0} = \dfrac{2\pi}{\frac{\pi}{3}} = \dfrac{6\pi}{\pi} = 6m \Rightarrow m = 1$

$\qquad\qquad\qquad\qquad N_1 = 6 \ \text{si} \ m = 1$

$N_2 = \dfrac{\frac{2\pi}{1}}{\frac{12\pi}{3}} = \dfrac{6\pi}{12\pi} = \dfrac{1}{2} m \Rightarrow m = 2 \, ; \ N_2 = 1$

$MCM = 6 \cdot 1 = 6 \Rightarrow$ Periodo fundamental $= 6$

$\qquad\qquad 1 \cdot 6 = 6$

4. Sea $x(t) = a^t + bt$ con $a = 7$, $b = 7$

a)

$$X_e(t) = \frac{x(t) + x(-t)}{2}$$

$$X_e(t) = \frac{(7)(7^t - 7t) + 7^{-t} + (-7)(-t)}{2}$$

$$X_e(t) = \frac{7^t - 7t + 7^{-t} + 7t}{2} = \frac{7^t + 7^{-t}}{2}$$

$$X_e(10) = \frac{7^{10} + 7^{-10}}{2} = 141'237624,5$$

b)

$$X_o(t) = \frac{x(t) - x(-t)}{2}$$

$$X_o(t) = \frac{7^t - 7t - [7^{-t} + 7t]}{2}$$

$$X_o(t) = \frac{7^t - 7t - 7^{-t} - 7t}{2} = \frac{7^t - 7^{-t} - 14t}{2}$$

$$X_o(4) = 1172,499$$