... 1.29. (2)

... b)

ii) $y[n] = \begin{cases} \dfrac{x[n]x[n-2]}{x[n-1]} & x[n-1] \neq 0 \\ 0 & x[n-1] = 0 \end{cases}$

$x[n-1] = -x[n-1] \neq 0$

$\dfrac{x_1[n]x_1[n-2]}{x_1[n-1]} \neq -\dfrac{x_2[n]x_2[n-2]}{x_2[n-1]} \Rightarrow$

$\Rightarrow x_1[n]x_1[n-2] \neq x_2[n]x_2[n-2]$

• Let $x_1[n] = \delta[n+2] + \delta[n+1] + \delta[n]$, $x_2[n] = -\delta[n+1]$

$x'[n] = x_1[n] + x_2[n] = \delta[n+2] + \delta[n]$

$y'[0] = 0$ since $\cancel{x[n-1]}$ $x[0-1] = \delta[-1+2] + \delta[-1] = 0$

$$y_1[0] + y_2[0] = \left. \begin{cases} \dfrac{x_1[n]x_1[n-2]}{x_1[n-1]} & x_1[n-1] \neq 0 \\ 0 & x_1[n-1] = 0 \end{cases} + \begin{cases} \dfrac{x_2[n]x_2[n-2]}{x_2[n-1]} & x_2[n-1] \neq 0 \\ 0 & x_2[n-1] = 0 \end{cases} \right|_{n=0} =$$

$$= \begin{cases} \dfrac{(\delta[0+2]+\delta[0+1]+\delta[0])\cdot(\delta[-2+2]+\delta[-2+1]+\delta[-2])}{(\delta[-1+2]+\delta[-1+1]+\delta[-1])} & \text{if } (\delta[-1+2]+\delta[-1+1]+\delta[-1]) \neq 0 \\ 0 & \text{otherwise} \end{cases} +$$

$$+ \begin{cases} \dfrac{(-\delta[0+1])(-\delta[-2+1])}{(-\delta[-1+1])} & \text{if } -\delta[-1+1] \neq 0 \\ 0 & \text{otherwise} \end{cases} =$$

$$= \begin{cases} \dfrac{1\cdot 1}{1} & \text{if } 1 \neq 0 \\ 0 & \text{otherwise} \end{cases} + \begin{cases} 0 & \text{if } -1 \neq 0 \\ 0 & \text{otherwise} \end{cases} = 1 \neq y'[0] \Rightarrow \boxed{\text{not additive}}$$

• $x'[n] = \alpha x[n] \Rightarrow y'[n] = \begin{cases} \dfrac{\alpha x[n]\alpha x[n-2]}{\alpha x[n-1]} & \text{if } \alpha x[n-1] \neq 0 \\ 0 & \text{otherwise} \end{cases} = \begin{cases} \alpha\dfrac{x[n]x[n-2]}{x[n-1]} & \text{if } x[n-1] \neq 0 \\ 0 & \text{otherwise} \end{cases}$

$\alpha y[n] = \alpha \cdot \begin{cases} \dfrac{x[n]\cdot x[n-2]}{x[n-1]} & \text{if } x[n-1] \neq 0 \\ 0 & \text{otherwise} \end{cases} = \begin{cases} \alpha\dfrac{x[n]x[n-2]}{x[n-1]} & \text{if } x[n-1] \neq 0 \\ \alpha\cdot 0 & \text{otherwise} \end{cases} = y'[n] \Rightarrow$ ~~homogene~~

$\Rightarrow \boxed{\text{homogeneous}}$