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2(1).

ELM 367 ÖDEV #3

2.13 Indicate which of the following discrete-time signals are eigenfunctions of stable, LTI discrete time systems.

$\boxed{2.13(e) = (1/4)^n}$ → An LTI system generates an output signal obtained by subjecting an input signal to a linear and time-independent mathematical processing.

★ Eigenfunctions of LTI systems are of the form a^n so 2.13(e) $(1/4)^n$ is eigenfunction

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2.32 For $X(e^{jw}) = 1/(1-a.e^{-jw})$, with $-1<a<0$, determine and sketch the following as a function of w:

$\boxed{(2.32\ c)\ |X(e^{jw})|}$ in option C, we are asked for magnitude for $(-1<a<0)$

★ $|X(e^{jw})|$ representing the magnitude.

$$|X(e^{jw})| = [X(e^{jw})X^*(e^{jw})]^{\frac{1}{2}}$$

★ $$= \left(\frac{1}{1-2a\cos(w)+a^2}\right)^{\frac{1}{2}}$$

2.36 An LTI discrete-time system has frequency response given by

$$H(e^{jw}) = \frac{(1-je^{-jw})(1+je^{-jw})}{1-0.8e^{-jw}} = \frac{1+e^{-j2w}}{1-0.8e^{-jw}} = \frac{1}{1-0.8e^{-jw}} + \frac{e^{-j2w}}{1-0.8e^{-jw}}$$

(c) If the input to this system is

$x[n] = 4+2\cos(w_0 n)$ for $-\infty<n<\infty$

for what value of w_0 will the output be of the form

$y[n] = A =$ constant

for $-\infty<n<\infty$? What is the constant A?

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$$H(e^{j\omega}) = \frac{1}{1-0.8e^{-j\omega}} + \frac{e^{-j2\omega}}{1-0{,}8e^{-j\omega}}$$

$$=(0{,}8)^n \cdot u[n] + (0{,}8)^{n-2} \cdot u[n-2]$$

$$H(e^{j\omega}) = \frac{Y(e^{j\omega})}{X(e^{j\omega})} = \frac{1+e^{-j2\omega}}{1-0{,}8e^{-j\omega}}$$

$$Y(e^{j\omega}) - 0{,}8e^{-j\omega}Y(e^{j\omega}) = X(e^{j\omega}) + e^{-j2\omega}X(e^{j\omega})$$

$$y[n] - 0.8y[n-1] = x[n] + x[n-2]$$
$$y[n] = 0.8y[n-1] + x[n] + x[n-2]$$

$$y[n] = H(e^{j0}).4 + 2|H(e^{j\omega_0})|\cos(\omega_0 n + \angle H(e^{j\omega_0}))$$

To find the constant value

$$|H(e^{j\omega_0})| = 0$$

$$1+e^{-j2\omega_0} = 0 \longleftrightarrow \omega_0 = \frac{\pi}{2}$$

$$y[n] = 4 \cdot \frac{1+1}{1-0.8} = 4 \cdot \frac{2}{0{,}2} = \underline{\underline{40}}$$