Linear Systems
(2023-2024)

EXERCISE 4

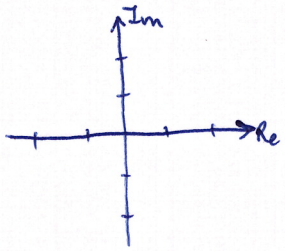
1 2 3 4 5
6 7 8 9 10

E4.Problem 1. z-Transforms [a b c d e f g h]

Determine the z-transforms, & sketch the pole-zero plot and indicate the ROC. Indicate whether or not the Fourier Transforms exist.

a) $x[n] = \delta[n], \quad n \in \mathbb{Z}$

$$\hat{x}(z) = \sum_{n=-\infty}^{\infty} x[n] z^{-n} = \sum_{n=-\infty}^{\infty} \delta[n] z^{-n} = z^0 = 1 = \hat{x}(z)$$

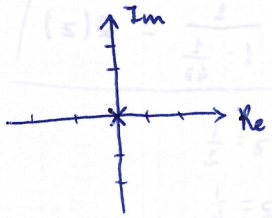


ROC: $\{z \in \mathbb{C}\}$

$\{|z|=1\} \in$ ROC $\Rightarrow$ F.T. exists.

b) $x[n] = \delta[n-1]$

$$\hat{x}(z) = \sum_{n=-\infty}^{\infty} \delta[n-1] z^{-n} = z^{-1} = \hat{x}(z)$$



ROC: $\{z \in \mathbb{C} \setminus \{0\}\}$

$\{|z|=1\} \in$ ROC $\Rightarrow$ F.T. Exists