

* DT signals are very different from CT signals:

Ex: Compute the fund. period of

$$x_1[n] = e^{j(3\pi n)} \quad \text{or} \quad x_2[n] = \cos(3\pi n)$$

Ans:

Ex: Q: Is e^{jn} periodic?

A:

* The fundamental period of a DT signal is always an integer.

* The fund. freq. of DT signal
 \Rightarrow always $\frac{2\pi}{\text{fund. period}} = \frac{2\pi}{\text{integer}}$

* DT. Harmonically Related Complex Exponentials

Consider a DT fund. freq $\omega_d = \frac{2\pi}{Nd}$

The DT HRCE is

$$x_k[n] =$$

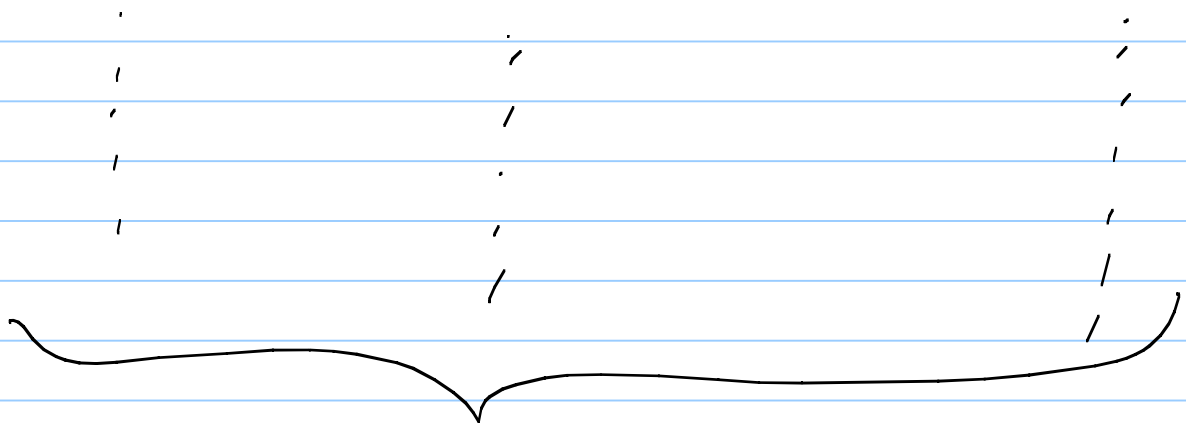
Q: How many distinct DT HRCEs can we have?

Ans:

$$\Rightarrow e^{j\left(\frac{2\pi}{N}n\right)}, e^{j\left(\frac{2\pi}{N}n\right)}, \dots, e^{j\left(\frac{2\pi}{N}n\right)},$$

$$e^{j\left(\frac{2\pi}{N}n\right)}, e^{j\left(\frac{2\pi}{N}n\right)}, \dots, e^{j\left(\frac{2\pi}{N}n\right)},$$

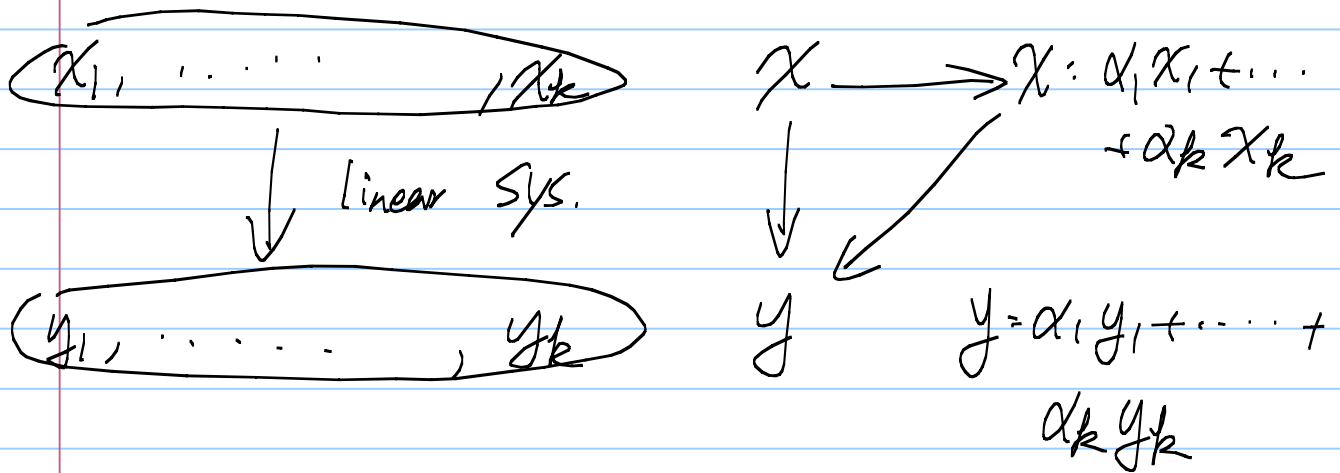
$$e^{j\left(\frac{2\pi}{N}n\right)}, e^{j\left(\frac{2\pi}{N}n\right)}, \dots, e^{j\left(\frac{2\pi}{N}n\right)},$$



This is a major difference between
CT & DT signals.

Q: Why are we interested in HRCEs.

A: Recall that we are interested in linear systems.



✗ We use HRCEs as our test signals.

CT HRCE

Test sig. $x_k(t) =$

New $x(t) =$

DT HRCE

Test sig. $x_k[n] =$

New $x[n] =$