

# Quiz 1

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Download all python codes from

<https://github.com/srikan-p/EE3900/tree/main/Quiz1/codes>

Download all latex codes from

<https://github.com/srikan-p/EE3900/tree/main/Quiz1>

## PROBLEM

(2.28d) Determine if  $x[n] = e^{jn}$  is periodic. If it is periodic, determine its period.

## SOLUTION

**Definition 1.** A signal  $x[n]$  is said to be periodic if for all  $n$ , for some  $N \in \mathbb{N}$ , it satisfies

$$x[n + N] = x[n] \quad (0.0.1)$$

The exponential signal can be generalised as,

$$x[n] = e^{j2\pi fn} \quad (0.0.2)$$

For an exponential signal to be periodic,

$$e^{j2\pi f(n+N)} = e^{j2\pi fn} \quad (0.0.3)$$

$$e^{j2\pi fN} = 1 \quad (0.0.4)$$

$$e^{j2\pi fN} = e^{j2\pi k} \quad (0.0.5)$$

$$fN = k \quad (0.0.6)$$

where,  $k$  is a integer.

$$\frac{1}{f} = \frac{N}{k} \quad (0.0.7)$$

Since  $N$  and  $k$  are integers,  $\frac{N}{k} \in \mathbb{Q}$  for a periodic exponential signal. The frequency of the given signal is  $f = \frac{1}{2\pi}$

$$\frac{N}{k} = 2\pi \quad (0.0.8)$$

Since  $\frac{N}{k}$  is an irrational number, the given signal is aperiodic.

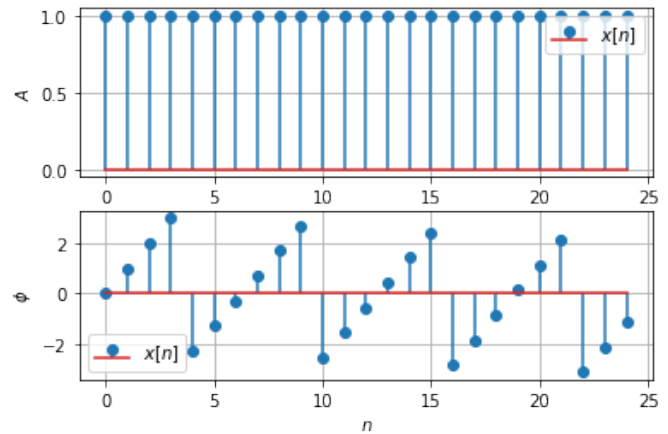


Fig. 0: Amplitude and Phase v/s n plots