

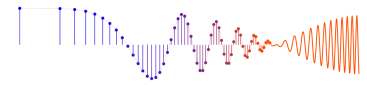
PROBLEM:

Solve the following complex-valued equations. Reduce the answers to a simple numerical form.

- (a) Find all solutions of $z^{13} = -1$. Express your answers for z in polar form. How many *different* solutions exist?
- (b) The following equation depends on n and T . Whenever T is assigned a value, the equation must then be true for all n .

$$e^{j(\pi/13)n} = e^{j13\pi nT} \quad \text{for all } n$$

Find all possible values for T for which the equation will be true.



$$(a) z^{13} = -1 = e^{j\pi} \cdot e^{j2\pi l} \quad \text{NOTE: } -1 = e^{j\pi}$$

$l = \text{integer}$

$$\Rightarrow z = e^{j(\pi + 2\pi l)/13} \quad l = 0, 1, 2, \dots, 12$$

There are 13 distinct solutions:

$$\left\{ e^{j\pi/13}, e^{j3\pi/13}, e^{j5\pi/13}, e^{j7\pi/13}, \dots, e^{j\pi}, e^{j15\pi/13}, \dots, e^{j25\pi/13} \right\}$$

$$(b) e^{j(\pi/13)n} = e^{j13\pi n T}$$

$$e^{j\pi/13 n} e^{j2\pi l n} = e^{j13\pi n T} \quad l = \text{integer}$$

EQUATE EXPONENTS:

$$\frac{\pi}{13} n + 2\pi l n = 13\pi n T \quad \swarrow \text{CANCEL } \pi \frac{1}{13} n.$$

$$\frac{1}{13} + 2l = 13 T$$

$$\Rightarrow T = \frac{1}{169} + \frac{2l}{13} \quad l = 0, \pm 1, \pm 2, \pm 3, \pm 4, \dots$$