If \( r = n - 1 \), then 

\[
x = \cos \frac{2(n-1)\pi}{n} + i \sin \frac{2(n-1)\pi}{n} = e^{\frac{2(n-1)\pi}{n}}
\]

The roots \( \frac{i\pi}{n}, \frac{2i\pi}{n}, \ldots, \frac{(n-1)i\pi}{n} \) are the \( n \)th roots of unity.

If \( \frac{i\pi}{e^\frac{\pi}{n}} = \alpha \) then the \( n \)th roots of unity will be represented as \( 1, \alpha, \alpha^2, \ldots, \alpha^{n-1} \).

### Representation of \( n \)th roots of unity on the Argand plane:

The \( n \)th roots of unity when plotted on Argand plane represent the vertices of a regular polygon of \( n \) sides which are inscribed in the circle \( |z| = 1 \).

![Argand diagram](image.png)

### Properties of \( n \)th roots of unity:

- Sum of \( n \)th roots of unity, \( 1 + \alpha + \alpha^2 + \ldots + \alpha^n = 0 \)
- Product of \( n \)th roots of unity, \( 1 \times \alpha \times \alpha^2 \times \ldots \times \alpha^{n-1} = -1^{n-1} \)
- \( 1 + \alpha^r + \alpha^{2r} + \ldots + \alpha^{(n-1)r} = 0 \) if H.C.F \( (r, n) = 1 \)
- A number of the form \( a + ib \), where \( a \) and \( b \) are real numbers and \( i = \sqrt{-1} \), is defined as a complex number.
- For the complex numbers \( z = a + ib \), \( a \) is called the real part (denoted by \( \text{Re \, } z \)) and \( b \) is called the imaginary part (denoted by \( \text{Im \, } z \)) of the complex number \( z \).

Example: For the complex number \( z = -\frac{5}{9} + i\frac{\sqrt{3}}{17} \), \( \text{Re} \, z = -\frac{5}{9} \) and \( \text{Im} \, z = \frac{\sqrt{3}}{17} \)
- Two complex numbers \( z_1 = a + ib \) and \( z_2 = c + id \) are equal if \( a = c \) and \( b = d \).

### Addition of complex numbers

Two complex numbers \( z_1 = a + ib \) and \( z_2 = c + id \) can be added as,

\[
z_1 + z_2 = (a + ib) + (c + id) = (a + c) + i(b + d)
\]