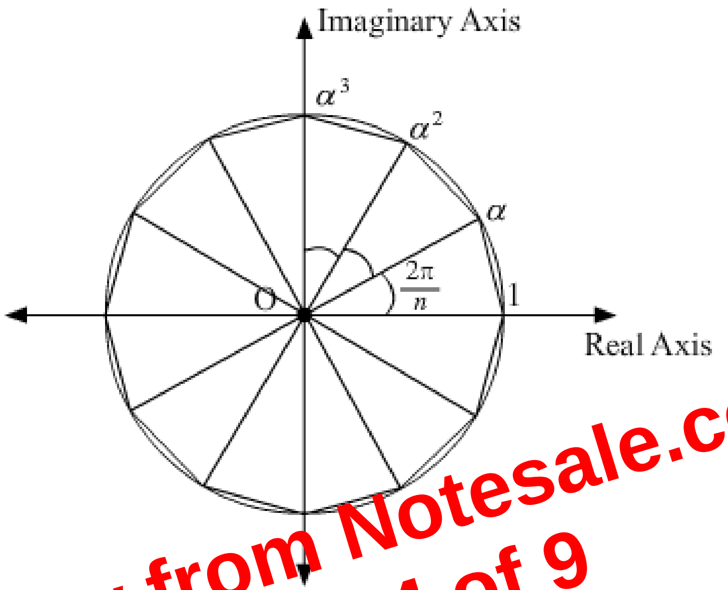
If $r = n - 1$, then $x = \cos\frac{2(n-1)\pi}{n} + i\sin\frac{2(n-1)\pi}{n} = e^{i\frac{2(n-1)\pi}{n}}$

The roots $1, e^{i\frac{2\pi}{n}}, e^{i\frac{4\pi}{n}}, \ldots, e^{i\frac{2(n-1)\pi}{n}}$ are the n^{th} roots of unity.

If $e^{i\frac{2\pi}{n}} = \alpha$ 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 $|z| = 1$.



Properties of *nth* 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 Re z) and b is called the imaginary part (denoted by Im z) of the complex number z.

  Example: For the complex number $z = \frac{-5}{9} + i\frac{\sqrt{3}}{17}$, Re $z = \frac{-5}{9}$ and 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,

$z_1 + z_2 = (a + ib) + (c + id) = (a + c) + i(b + d)$