Complex Analysis:

$ax^2 + bx + c = 0$

$$\alpha, \beta = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$D = b^2 - 4ac$

$\alpha, \beta \Rightarrow$ real & unequal $(D > 0)$

$\Rightarrow$ real & equal $(D = 0)$

$\Rightarrow$ Imaginary

$D < 0$

$N \rightarrow 1, 2, 3 \dots$ (Natural)

$W \rightarrow 0, 1, 2, \dots$ (whole)

$I/Z \rightarrow \dots -2, -1, 0, 1, 2 \dots$ (Integers)

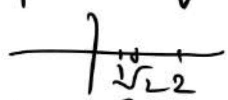
$Q \rightarrow$ (Rational Nos)

$\Rightarrow \left\{ \frac{p}{q} : q \neq 0,\ p, q \in R \right\}$

$\frac{a}{0} = \infty$

Terminating, Repeating

$R = Q^c \cup Q$



$Q^c = \underset{(\pi)}{}$ non-terminating & non-repeating

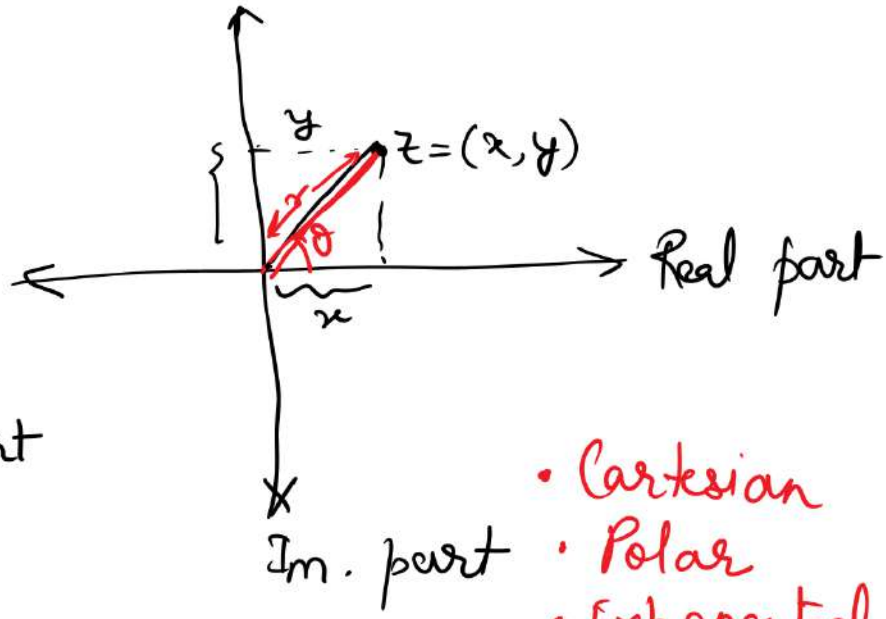
$$x^2+1=0$$

$$x^2=-1$$

$$x=\pm\sqrt{-1}$$

$$\sqrt{-1}=i$$

$$z=\underset{\substack{\downarrow\\ \text{Re part}}}{x}+i\,y \rightarrow \text{Im. part}$$



- Cartesian
- Polar
- Exponential.

z = Cartesian representation

$z = re^{i\theta}$ (exponential)

Complex no. An ordered pair of real no^s a, b

$$z = (a, b) = a + ib$$

1. Equality of Comp. No. $(a, b) = (c, d)$

$a + ib = c + id$ if $a = c$ & $b = d$

2. Sum of two Comp. No. $z_1 = (a, b)$, $z_2 = (c, d)$

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

$$= (a + c, b + d)$$

3. Commutative: $z_1 + z_2 = z_2 + z_1 \quad \forall z_1, z_2 \in C$ (Prove it)

$$z_1 + z_2 = (a+ib) + (c+id) \quad \because \ a, c, b, d \in \mathbb{R}$$

$$= (a+c) + i(b+d) \quad \because \text{ Add}^n \text{ is comm. in } \mathbb{R}$$

$$= (c+a) + i(d+b) \quad \therefore \ a+c = c+a$$

$$\therefore \ b+d = d+b$$

$$= (c+id) + (a+ib)$$

$$= z_2 + z_1$$

Matrix multiplication is not comm. $\Rightarrow AB \neq BA$

Hence complex nos. commute.

4. Addition composition is Associative.

$$(z_1 + z_2) + z_3 = z_1 + (z_2 + z_3)$$

5. Identity element. (Addition)

$e = (0,0)$

$z_1 + e = (a,b) + (0,0) = (\underbrace{a+0}_{R}, \underbrace{b+0}_{R})$

$= (a, b)$

$= z_1$

$\cancel{\times}e$

$a + e = a$

$5 + 0 = 5$

$-2 + 0 = -2$

$3 \times 1 = 3$

$(3+i) + (1+i)$

$= 4 + 2i$

6. Additive inverse of complex no.

$z_1 + (z_2) = (0, 0)$

$z_1 = (a, b)$; $z_2 = (-a, -b)$

Additive inverse

1. closure
2. comm
3. Ass.
4. ident.
5. inverse

abelian gp.