

Complex Numbers and Quadratic Equations

CBSE Class 11 Maths · Knowledge organiser

KEY DEFINITIONS

Complex number

$z = a + ib$ with $i^2 = -1$; a is the real part and b the imaginary part.

Conjugate

The conjugate of $a + ib$ is $a - ib$.

Modulus

$|a + ib| = \sqrt{a^2 + b^2}$, the distance from the origin on an Argand plane.

KEY FORMULAS

$$i^2 = -1; i^{4k} = 1 \quad (a + ib)(c + id) = (ac - bd) + i(ad + bc)$$

$$\text{Modulus; conjugate} \quad |z| = \sqrt{a^2 + b^2}, \quad z\bar{z} = |z|^2, \quad z^{-1} = \frac{\bar{z}}{|z|^2}$$

$$|z_1 z_2| = |z_1| |z_2|; \overline{z_1 z_2} = \bar{z}_1 \bar{z}_2; \text{Argand: } a + ib \mapsto (a, b)$$

WORKED EXAMPLE

Find i^{-39} .

$$i^{-39} = i^{-40} i = i.$$

YOU SHOULD BE ABLE TO...

- Simplify powers of i , add, multiply and take conjugates and moduli.
- Divide complex numbers, compare real and imaginary parts and plot numbers on the Argand plane.
- Combine the properties of modulus and conjugate in longer calculations and in circuit or rotation contexts.
- Solve equations in $z = x + iy$ and interpret them on the Argand plane.

COMMON MISTAKES

- ✗ $i^2 = 1$, or forgetting to replace i^2 by -1 .
- ✗ Rationalising with $a + ib$ instead of the conjugate $a - ib$.
- ✗ $|a + ib| = a + b$, or including i in the modulus: $|3 - 4i| = \sqrt{9 + 16}$.
- ✗ Using $\sqrt{a}\sqrt{b} = \sqrt{ab}$ with negative a, b .