

Complex Numbers Cheat Sheet

What is a Complex Number?

A complex number is written in the form: $z = a + bi$

- a = real part
- b = imaginary part
- $i = \sqrt{-1}$ (imaginary unit where $i^2 = -1$)

Examples of Complex Numbers

- $2 + 3i \rightarrow a = 2, b = 3$
- $-4 - i \rightarrow a = -4, b = -1$
- $7 \rightarrow a = 7, b = 0$ (still a complex number)
- $0 + 5i \rightarrow$ purely imaginary

Important Terms

- Purely Real: Only the real part is present (e.g., 5, -2, 0)
- Purely Imaginary: Only imaginary part (e.g., 3i, -6i)
- Conjugate: Flip the sign of imaginary part (e.g., $4 + 3i \rightarrow 4 - 3i$)
- Modulus: Length of complex number from origin: $|a + bi| = \sqrt{a^2 + b^2}$

Operations on Complex Numbers

Addition: $(2 + 3i) + (4 + 5i) = 6 + 8i$

Subtraction: $(5 + 7i) - (2 + 3i) = 3 + 4i$

Multiplication: $(2 + 3i)(1 + 4i) = -10 + 11i$

Division: $(1 + 2i) / (3 - 4i)$: Multiply numerator and denominator by conjugate of denominator.

Graphical View - Argand Plane

- x-axis represents the real part.
- y-axis represents the imaginary part.
- Every complex number is a point (a, b) or vector $a + bi$.

Summary Table

- Complex Number $\rightarrow 5 + 3i$: Has both parts.
- Purely Real $\rightarrow -2$: Imaginary part is 0.
- Purely Imaginary $\rightarrow 6i$: Real part is 0.
- Conjugate $\rightarrow 5 - 3i$: Opposite imaginary sign.
- Modulus $\rightarrow |3 + 4i| = 5$: Length from origin.

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