

Complex Number Formulas

1. Complex number: $z = a + ib$
2. Conjugate: $\bar{z} = a - ib$
3. Modulus: $|z| = \sqrt{a^2 + b^2}$
4. Argument: $\arg(z) = \tan^{-1}\left(\frac{b}{a}\right)$
5. Polar form: $z = r(\cos \theta + i \sin \theta)$, where $r = |z|$ and $\theta = \arg(z)$
6. Exponential form: $z = re^{i\theta}$
7. Addition: $(a + ib) + (c + id) = (a + c) + i(b + d)$
8. Subtraction: $(a + ib) - (c + id) = (a - c) + i(b - d)$
9. Multiplication: $(a + ib)(c + id) = (ac - bd) + i(ad + bc)$
10. Division: $\frac{a+ib}{c+id} = \frac{(a+ib)(c-id)}{c^2+d^2} = \frac{(ac+bd)+i(bc-ad)}{c^2+d^2}$
11. De Moivre's theorem: $(re^{i\theta})^n = r^n e^{in\theta}$
12. Powers of i : $i^1 = i, i^2 = -1, i^3 = -i, i^4 = 1$
13. Roots of unity: $z^n = 1 \Rightarrow z = e^{2k\pi i/n}$ for $k = 0, 1, 2, \dots, n - 1$
14. Euler's formula: $e^{i\theta} = \cos \theta + i \sin \theta$
15. Distance between two complex numbers z_1 and z_2 : $|z_1 - z_2|$
16. Rotation of a complex number: Rotating z by angle α gives $z' = ze^{i\alpha}$