复数

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Outline

基本的概念

- 复数的定义：$z = x + iy$, $Rez = x$, $Imz = y$, $i^2 = -1$
- 四则运算
- 模：$|z| = \sqrt{x^2 + y^2}$
- 指数形式：$z = |z|e^{i\theta}$，θ：辐角($Argz$)，$argz$：主辐角，$(-\pi, \pi]$, $z = |z|(\cos\theta + i\sin\theta)$

基本计算

- 共轭计算：$\bar{z} = x - iy$, $\bar{\bar{z}} = z$, $\overline{z_1 z_2} = \bar{z}_1 \bar{z}_2$, $\overline{(\frac{z_1}{z_2})} = \frac{\bar{z}_1}{\bar{z}_2}$, $\overline{z_1 + z_2} = \bar{z}_1 + \bar{z}_2$
- $|z_1 z_2| = |z_1||z_2|$, $|\frac{z_1}{z_2}| = \frac{|z_1|}{|z_2|}$, $|z_1 + z_2| \leq |z_1| + |z_2|$
- $|z|^2 = z\bar{z}$
- $Arg(z_1 \cdot z_2) = Argz_1 + Argz_2$, $z^n = |z|^n e^{in\theta} = |z|^n(\cos(n\theta) + i\sin(n\theta))$,

  $z^{\frac{1}{n}} = |z|^{\frac{1}{n}} e^{i(2k\pi+\theta)/n} = |z|^{\frac{1}{n}}(\cos((2k\pi+\theta)/n)+i\sin((2k\pi+\theta)/n))$,

  $k = 0, 1, 2, \ldots, n-1$