

COMPLEX NUMBERS

Identities & Mathematical Properties

Standard Form: $z = a + bi$

where $a, b \in \mathbb{R}$ and $i^2 = -1$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = -i$$

$$i^4 = 1$$

ARITHMETIC

$$\text{Addition } (a+bi) + (c+di) = (a+c) + (b+d)i$$

$$\text{Subtraction } (a+bi) - (c+di) = (a-c) + (b-d)i$$

$$\text{Multiplication } (a-bd) + (ad+bc)i$$

KEY PROPERTIES

$$\text{Conjugate } (z), \bar{z} = a - bi$$

$$\text{Modulus } |z| = \sqrt{a^2 + b^2}$$

$$\text{Reciprocal } 1/z = \bar{z} / |z|^2$$

EULER'S IDENTITY

$$e^{i\theta} = \cos(\theta) + i \sin(\theta)$$

$$e^{i\pi} + 1 = 0$$

Reference Chart of Complex Number System