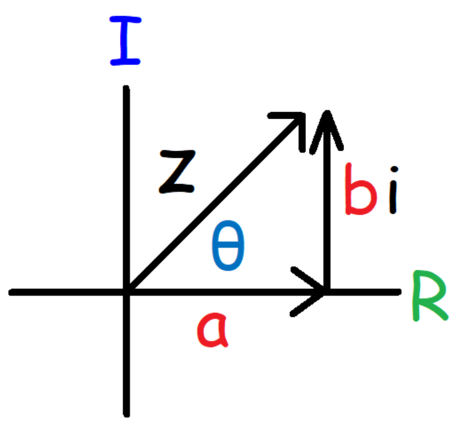
Complex Numbers – Formula Sheet:

Complex Numbers in Rectangular Form:



Imaginary Numbers:

$$i = \sqrt{-1} \qquad i^2 = -1 \qquad i^3 = -i \qquad i^4 = 1$$

Complex Number in Rectangular Form:

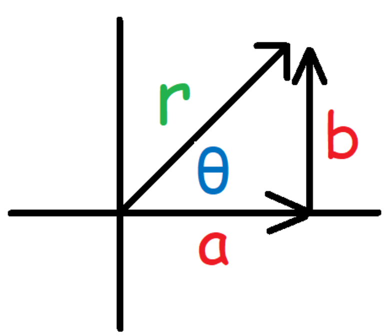
$$z = a + bi$$

$$a = r\cos\theta \qquad b = r\sin\theta$$

Absolute Value:

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

Complex Numbers in Polar Form:



Complex Numbers in Polar Form:

$$z_1 = r_1[\cos\theta_1 + i\sin\theta_1]$$
$$z_2 = r_2[\cos\theta_2 + i\sin\theta_2]$$

Modulus (r) and Argument (θ):

$$r = \sqrt{a^2 + b^2}$$

$$\theta = tan^{-1}\left(\frac{b}{a}\right)$$

Product of Two Complex Numbers:

$$z_1 \cdot z_2 = r_1 r_2[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$$

Quotient of Two Complex Numbers:

$$\frac{z_1}{z_2} = \frac{r_1}{r_2}[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)]$$

De Moivre's Theorem – Power of Complex Number:

$$z^n = r^n[\cos(n\theta) + i\sin(n\theta)]$$

Exponential to Polar Form:

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

$$e^{i(0°)} = 1 \qquad e^{i(90°)} = i$$

$$e^{i(180°)} = -1 \qquad e^{i(270°)} = -i$$

De Moivre's Theorem – Roots of Complex Number:

$$z_k = \sqrt[n]{r}\left[\cos\left(\frac{\theta + 2\pi k}{n}\right) + i\sin\left(\frac{\theta + 2\pi k}{n}\right)\right]$$

$$z_k = \sqrt[n]{r}\left[\cos\left(\frac{\theta + 360°k}{n}\right) + i\sin\left(\frac{\theta + 360°k}{n}\right)\right]$$

$$k = 0, 1, 2, 3, 4, \ldots n - 1$$

Shortcut Notation:

$$r\ cis\ \theta = r[\cos\theta + i\sin\theta]$$

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