ENGINEERING MATHEMATICS: COMPLEX NUMBERS

Fundamental Forms

Type	Expression
Rectangular	$z = a + bi$
Polar	$z = r(\cos\theta + i\sin\theta)$
Exponential	$z = re^{i\theta}$
Phasor	$z = r\angle\theta$

Conversions

Variable	Formula
Modulus (r)	$\sqrt{(a^2 + b^2)}$
Argument (θ)	$\tan^{-1}(b/a)$
Real (a)	$r\cos\theta$
Imaginary (b)	$r\sin\theta$

Operations (Rectangular)

Addition	$(a+bi) + (c+di) = (a+c) + (b+d)i$
Conjugate	$z^* = a - bi$

Powers of i	$i^1=i, i^2=-1, i^3=-i, i^4=1$

Operations (Polar/Exp)

Multiplication	$r_1 r_2 \, e^{i(\theta_1+\theta_2)}$
Division	$(r_1/r_2) \, e^{i(\theta_1-\theta_2)}$
De Moivre's	$z^n = r^n(\cos n\theta + i \sin n\theta)$

Euler's Identity & Relations

$e^{i\pi} + 1 = 0$	Identity	$\cos\theta = (e^{i\theta} + e^{-i\theta}) / 2$	Trig Relation
$\ln(z) = \ln(r) + i\theta$	Logarithm	$\sin\theta = (e^{i\theta} - e^{-i\theta}) / 2i$	Trig Relation