COMPLEX NUMBERS & VECTOR REPRESENTATION

Reference Chart for Physics and Engineering

1. Rectangular Form (Cartesian)

Represented as a point on the Complex Plane (Argand Diagram).

$$z = a + jb$$

- **a:** Real part (x-axis)
- **b:** Imaginary part (y-axis)
- **j:** Unit imaginary (âˆš-1)

2. Polar Form (Vector)

Represented by magnitude and direction.

$$z = r \angle \theta$$

- **r:** Magnitude / Amplitude
- **Î¸:** Phase / Argument
- **r = âˆš(aÂ² + bÂ²)**

3. Exponential Form (Euler's)

Crucial for AC circuit analysis and wave mechanics.

$$z = r e^{j\theta} = r(\cos \theta + j \sin \theta)$$

Vector Translation Matrix

Operation	Rectangular Form	Polar Form
Addition	(a+jc) + (b+jd)	Convert to Rectangular first
Multiplication	(ac-bd) + j(ad+bc)	(r1 Ã— r2) âˆ (Î¸1 + Î¸2)
Division	Multiply by conjugate	(r1 / r2) âˆ (Î¸1 - Î¸2)

Operation	Rectangular Form	Polar Form
Phasor Notation	x(t) = A cos(Ï‰t + Ï†)	X = A âˆ Ï†

Geometric Representation

Real (a) Imaginary (jb) r (Hypotenuse) Î¸

Physics Reference Sheet â€¢ Unit: Radians or Degrees â€¢ jÂ² = -1