

## Complex Numbers Formulae for Competitive Exams

$i = \sqrt{-1}$  Note: - ;'j' often used rather than 'i'.

Exponential Notation

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

De Moivre's theorem

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

$n^{\text{th}}$  roots of complex number

If  $z = re^{i\theta} = r(\cos n\theta + i \sin n\theta)$  than

$$z^{\frac{1}{n}} = \sqrt[n]{re^{\frac{i(\theta+2k\pi)}{n}}}, k = 0, \pm 1, \pm 2, \dots$$

### HYPERBOLIC IDENTITIES

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

$$\tanh x = \frac{\sinh x}{\cosh x}$$

$$\operatorname{sech} x = \frac{1}{\cosh x}$$

$$\operatorname{cosech} x = \frac{1}{\sinh x}$$

$$\operatorname{coth} x = \frac{\cosh x}{\sinh x} = \frac{1}{\tanh x}$$

$$\cosh ix = \cos x$$

$$\cos ix = \cosh x$$

$$\sinh ix = i \sin x$$

$$\sin ix = i \sinh x$$

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$$\cosh^2 A - \sinh^2 A = 1$$

$$\operatorname{sech}^2 A = 1 - \tanh^2 A$$

$$\operatorname{cosech}^2 A = \operatorname{coth}^2 A - 1$$