ComplexInfinity

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Notations

Traditional name

The complex quantity with infinite magnitude but indeterminate phase

Traditional notation

$\tilde{\infty}$

Mathematica StandardForm notation

ComplexInfinity

Primary definition

$\tilde{\infty}$ represents an infinite numerical quantity whose direction in the complex plane is unknown (undetermined).

General characteristics

$\tilde{\infty}$ is a special symbol. On the Riemann sphere it is the north pole. In the projective complex plane it is the line at infinity.

Limit representations

02.12.09.0001.01

$$\tilde{\infty} = \lim_{z \to 0} \frac{1}{z}$$

Transformations

Products, sums, and powers of the direct function

Products involving the direct function

02.12.16.0001.01

$$0\, \tilde{\infty} = ¿$$

02.12.16.0002.01

$$a\, \tilde{\infty} = \tilde{\infty} \;/;\; a \neq 0$$

02.12.16.0003.01

$\frac{\tilde{\infty}}{\tilde{\infty}} = ¿$

Sums of the direct function

02.12.16.0004.01

$\tilde{\infty} + \tilde{\infty} = ¿$

02.12.16.0005.01

$\tilde{\infty} - \tilde{\infty} = ¿$

Related transformations

02.12.16.0006.01

$\tilde{\infty}^0 = ¿$

02.12.16.0007.01

$1^{\tilde{\infty}} = ¿$

02.12.16.0008.01

$(\tilde{\infty})^{\infty} = \tilde{\infty}$

Identities

Functional identities

02.12.17.0001.01

$\tilde{\infty} = \tilde{\infty}\,\infty$

Complex characteristics

Real part

02.12.19.0001.01

$\text{Re}(\tilde{\infty}) = ¿$

Imaginary part

02.12.19.0002.01

$\text{Im}(\tilde{\infty}) = ¿$

Absolute value

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$|\tilde{\infty}| = \infty$

Argument

02.12.19.0004.01

$\arg(\tilde{\infty}) \in (-\pi, \pi]$

Conjugate value

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$$\overline{\tilde{\infty}} = \tilde{\infty}$$

Differentiation

Low-order differentiation

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$$\frac{\partial \tilde{\infty}}{\partial z} = 0$$

Integration

Indefinite integration

02.12.21.0001.01

$$\int \tilde{\infty} \, dz = z \infty$$

Summation

Finite summation

02.12.23.0001.01

$$\sum_{k=0}^{m} \tilde{\infty} = \tilde{\infty}$$

02.12.23.0002.01

$$\tilde{\infty} - \tilde{\infty} = ¿$$

Integral transforms

Fourier exp transforms

02.12.22.0001.01

$$\mathcal{F}_t[\tilde{\infty}](z) = \tilde{\infty}$$

Inverse Fourier exp transforms

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$$\mathcal{F}_t^{-1}[\tilde{\infty}](z) = \tilde{\infty}$$

Fourier cos transforms

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$$\mathcal{F}c_t[\tilde{\infty}](z) = \tilde{\infty}$$

Fourier sin transforms

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$\mathcal{F}s_t[\tilde{\infty}](z) = \tilde{\infty}$

Laplace transforms

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$\mathcal{L}_t[\tilde{\infty}](z) = \tilde{\infty}$

Inverse Laplace transforms

02.12.22.0006.01

$\mathcal{L}_t^{-1}[\tilde{\infty}](z) = \tilde{\infty}$

Representations through more general functions

Through other functions

02.12.26.0001.01

$\tilde{\infty} = ¿ \infty$

02.12.26.0002.01

$\tilde{\infty} = (0 \infty)$

Representations through equivalent functions

02.12.27.0001.01

$$\tilde{\infty} = \frac{1}{0}$$

History

– John Wallis (1655) introduced the sign ∞ to signify infinite number

– K. Weierstrass (1876) used symbol ∞ to represent an actual infinity, which is prototype ofsymbol ComplexInfinity $\tilde{\infty}$ in Mathematica

The symbol ∞ is encountered often in mathematics and the natural sciences.

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