

EllipticExp

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Notations

Traditional name

Elliptic exponential

Traditional notation

$\text{eexp}(z; a, b)$

Mathematica StandardForm notation

`EllipticExp[z, {a, b}]`

Primary definition

09.55.02.0001.01

$\text{eexp}(z; a, b) = \{x, y\} /; (z = \text{e log}(x, y; a, b) /; y^2 - x(x^2 + ax + b) = 0)$

Specific values

Specialized values

09.55.03.0001.01

$\text{eexp}\left(-\frac{\sqrt{y^2}}{\sqrt{x}y} F_1\left(\frac{1}{2}; \frac{1}{2}, \frac{1}{2}, \frac{3}{2}; \frac{-a - \sqrt{a^2 - 4b}}{2x}, \frac{\sqrt{a^2 - 4b} - a}{2x}\right); a, b\right) = \{x, y\} /; y^2 - x(x^2 + ax + b) = 0$

General characteristics

Domain and analyticity

$\text{eexp}(z; a, b)$ is an vector-valued function of z , a and b , that is analytic in each component and it is defined over \mathbb{C}^3 .

09.55.04.0001.01

$(z * \{a * b\}) \rightarrow \text{eexp}(z; a, b) :: (\mathbb{C} \otimes \{\mathbb{C} \otimes \mathbb{C}\}) \rightarrow \{\mathbb{C} \otimes \mathbb{C}\}$

Symmetries and periodicities

Mirror symmetry

09.55.04.0002.01

$\text{eexp}(\bar{z}; \bar{a}, \bar{b}) = \overline{\text{eexp}(z; a, b)}$

Periodicity

No periodicity

Branch points

Branch points locations: complicated

Branch cuts

Branch cut locations: complicated

Differential equations

Ordinary nonlinear differential equations

09.55.13.0001.01

$$4 w(z)^3 + 4 a w(z)^2 + 4 b w(z) - w'(z)^2 = 0 /; \{w(z), v(z)\} = \text{eexp}(z; a, b)$$

Identities

Functional identities

09.55.17.0001.01

$$\text{eexp}(z; a, b) = \text{eexp} \left[z - n \sqrt{8} \sqrt{\frac{a - \sqrt{a^2 - 4b}}{b}} K \left(\frac{2\sqrt{a^2 - 4b}}{a + \sqrt{a^2 - 4b}} \right); a, b \right] /; n \in \mathbb{Z}$$

09.55.17.0002.01

$$\text{eexp}(z; a, b) = \text{eexp} \left[z - i n \sqrt{8} \sqrt{\frac{a - \sqrt{a^2 - 4b}}{b}} K \left(1 - \frac{2\sqrt{a^2 - 4b}}{a + \sqrt{a^2 - 4b}} \right); a, b \right] /; n \in \mathbb{Z}$$

Differentiation

Low-order differentiationWith respect to z

09.55.20.0001.01

$$\frac{\partial \text{eexp}(z; a, b)}{\partial z} = \text{eexp}'_z(z; a, b)$$

Representations through equivalent functions

With inverse function

09.55.27.0001.01

$$\text{eexp}(\text{elog}(z_1, z_2; a, b); a, b) = \{z_1, z_2\} /; z_1^3 + a z_1^2 + b z_1 - z_2^2 = 0$$

With related functions

Involving Jacobi functions

09.55.27.0002.01

$$x = \frac{1}{2} \left(a + \sqrt{a^2 - 4b} \right) \cot^2 \left(\text{am} \left(- \frac{\sqrt{2} z}{\sqrt{\frac{a - \sqrt{a^2 - 4b}}{b}}}, \left| \frac{2 \sqrt{a^2 - 4b}}{a + \sqrt{a^2 - 4b}} \right. \right) \right) /; \{x, y\} = \text{eexp}(z; a, b)$$

Involving Weierstrass functions

09.55.27.0003.01

$$x = \sqrt[3]{4} \wp \left(\sqrt[3]{2} z; \sqrt[3]{4} \left(\frac{a^2}{3} - b \right), \frac{ab}{3} - \frac{2a^3}{27} \right) - \frac{a}{3} /; \{x, y\} = \text{eexp}(z; a, b)$$

History

–D. Masser (1975)

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