Cot

Notations

Traditional name

Cotangent

Traditional notation

$\cot(z)$

Mathematica StandardForm notation

`Cot[z]`

Primary definition

01.09.02.0001.01

$$\cot(z) = \frac{\cos(z)}{\sin(z)} = \frac{i\left(e^{iz} + e^{-iz}\right)}{e^{iz} - e^{-iz}}$$

Specific values

Specialized values

01.09.03.0001.01

$$\cot(\pi m) = \tilde{\infty} \;/;\; m \in \mathbb{Z}$$

01.09.03.0002.01

$$\cot\left(\pi\left(\frac{1}{2} + m\right)\right) = 0 \;/;\; m \in \mathbb{Z}$$

Values at fixed points

01.09.03.0003.01

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

01.09.03.0004.01

$$\cot\left(\frac{\pi}{12}\right) = 2 + \sqrt{3}$$

01.09.03.0005.01

$$\cot\left(\frac{\pi}{10}\right) = \sqrt{5 + 2\sqrt{5}}$$

01.09.03.0006.01

$$\cot\left(\frac{\pi}{10}\right) == \left(z;\, z^4 - 10\, z^2 + 5\right)_4^{-1}$$

01.09.03.0007.01

$$\cot\left(\frac{\pi}{9}\right) == -\frac{\left(-1 + i\sqrt{3}\right)^{4/3} + \left(-1 - i\sqrt{3}\right)^{4/3}}{\left(i + \sqrt{3}\right)\sqrt[3]{-1 + i\sqrt{3}} + \left(-i + \sqrt{3}\right)\sqrt[3]{-1 - i\sqrt{3}}}$$

01.09.03.0008.01

$$\cot\left(\frac{\pi}{9}\right) == \left(z;\, 3\, z^6 - 27\, z^4 + 33\, z^2 - 1\right)_6^{-1}$$

01.09.03.0009.01

$$\cot\left(\frac{\pi}{9}\right) == \frac{i\left(1 + (-1)^{2/9}\right)}{-1 + (-1)^{2/9}}$$

01.09.03.0010.01

$$\cot\left(\frac{\pi}{8}\right) == 1 + \sqrt{2}$$

01.09.03.0011.01

$$\cot\left(\frac{\pi}{7}\right) == \left(\sqrt[3]{2}\left(-\left(i + \sqrt{3}\right)\left(\sqrt[3]{28 - 84\, i\sqrt{3}} + 2\sqrt{7}\, i\right)\sqrt[3]{14 + i\sqrt{7} + 3\sqrt{21}} + \left(-i + \sqrt{3}\right)\sqrt[3]{28 + 2\, i\sqrt{7} + 6\sqrt{21}}\right.\right.$$
$$\left.\left(14 - i\sqrt{7} - 3\sqrt{21}\right)^{2/3} - 2\sqrt{7}\left(-i + \sqrt{3}\right)\sqrt[3]{14 - i\sqrt{7} - 3\sqrt{21}}\; i\right) - \left. 4\, i\sqrt[3]{14 - 42\, i\sqrt{3}}\right) \Big/$$
$$\left(4\, 7^{5/6}\, i\sqrt[3]{2 - 6\, i\sqrt{3}} + \sqrt[3]{2}\left(-\left(i + \sqrt{3}\right)\left(i\sqrt[3]{28 - 84\, i\sqrt{3}} + 2\sqrt{7}\right)\sqrt[3]{14 + i\sqrt{7} + 3\sqrt{21}} + \right.\right.$$
$$\left.\left. 2\sqrt{7}\left(-i + \sqrt{3}\right)\sqrt[3]{14 - i\sqrt{7} - 3\sqrt{21}} + \left(-1 - i\sqrt{3}\right)\sqrt[3]{28 + 2\, i\sqrt{7} + 6\sqrt{21}}\left(14 - i\sqrt{7} - 3\sqrt{21}\right)^{2/3}\right)\right)$$

01.09.03.0012.01

$$\cot\left(\frac{\pi}{7}\right) == \left(z;\, 7\, z^6 - 35\, z^4 + 21\, z^2 - 1\right)_6^{-1}$$

01.09.03.0013.01

$$\cot\left(\frac{\pi}{7}\right) == \frac{i\left(1 + (-1)^{2/7}\right)}{-1 + (-1)^{2/7}}$$

01.09.03.0014.01

$$\cot\left(\frac{\pi}{6}\right) == \sqrt{3}$$

01.09.03.0015.01

$$\cot\left(\frac{\pi}{5}\right) == \sqrt{1 + \frac{2}{\sqrt{5}}}$$

01.09.03.0016.01

$$\cot\left(\frac{\pi}{5}\right) == \left(z;\, 5\, z^4 - 10\, z^2 + 1\right)_4^{-1}$$

01.09.03.0017.01

$$\cot\left(\frac{2\pi}{9}\right) == -\frac{i\left(\sqrt[3]{-\frac{1}{2}\,i\left(-i+\sqrt{3}\right)}+\sqrt[3]{\frac{1}{2}\,i\left(i+\sqrt{3}\right)}\right)}{\sqrt[3]{-\frac{1}{2}\,i\left(-i+\sqrt{3}\right)}-\sqrt[3]{\frac{1}{2}\,i\left(i+\sqrt{3}\right)}}$$

01.09.03.0018.01

$$\cot\left(\frac{2\pi}{9}\right) == \left(z;\,3z^6-27z^4+33z^2-1\right)_5^{-1}$$

01.09.03.0019.01

$$\cot\left(\frac{2\pi}{9}\right) == \frac{i\left(1+(-1)^{4/9}\right)}{-1+(-1)^{4/9}}$$

01.09.03.0020.01

$$\cot\left(\frac{\pi}{4}\right) == 1$$

01.09.03.0021.01

$$\cot\left(\frac{2\pi}{7}\right) == \left(4\left(7\,2^{2/3}\sqrt[3]{1-3\,i\sqrt{3}}-\sqrt[3]{14}\left(1-3\,i\sqrt{3}\right)^{2/3}+7^{2/3}\left(1-3\,i\sqrt{3}\right)\right)\right)\Big/$$
$$\left(\sqrt[3]{1-3\,i\sqrt{3}}\left(4\,7^{5/6}\sqrt[3]{2-6\,i\sqrt{3}}+\sqrt[3]{2}\left(2\left(\sqrt[3]{28-84\,i\sqrt{3}}+\sqrt{7}\,i-\sqrt{21}\right)i\sqrt[3]{14+i\sqrt{7}+3\sqrt{21}}+\right.\right.\right.$$
$$\left.\left.\left.4\sqrt{7}\sqrt[3]{14-i\sqrt{7}-3\sqrt{21}}+\left(i+\sqrt{3}\right)\sqrt[3]{28+2\,i\sqrt{7}+6\sqrt{21}}\left(14-i\sqrt{7}-3\sqrt{21}\right)^{2/3}\right)\right)\right)$$

01.09.03.0022.01

$$\cot\left(\frac{2\pi}{7}\right) == \left(z;\,7z^6-35z^4+21z^2-1\right)_5^{-1}$$

01.09.03.0023.01

$$\cot\left(\frac{2\pi}{7}\right) == \frac{i\left(1+(-1)^{4/7}\right)}{-1+(-1)^{4/7}}$$

01.09.03.0024.01

$$\cot\left(\frac{3\pi}{10}\right) == \sqrt{5-2\sqrt{5}}$$

01.09.03.0025.01

$$\cot\left(\frac{3\pi}{10}\right) == \left(z;\,z^4-10z^2+5\right)_3^{-1}$$

01.09.03.0026.01

$$\cot\left(\frac{\pi}{3}\right) == \frac{1}{\sqrt{3}}$$

01.09.03.0027.01

$$\cot\left(\frac{3\pi}{8}\right) == \sqrt{2}-1$$

01.09.03.0028.01

$$\cot\left(\frac{2\pi}{5}\right) = \sqrt{1 - \frac{2}{\sqrt{5}}}$$

01.09.03.0029.01

$$\cot\left(\frac{2\pi}{5}\right) = \left(z;\, 5 z^4 - 10 z^2 + 1\right)_3^{-1}$$

01.09.03.0030.01

$$\cot\left(\frac{5\pi}{12}\right) = 2 - \sqrt{3}$$

01.09.03.0031.01

$$\cot\left(\frac{3\pi}{7}\right) = \left(\sqrt[3]{2}\left(-4\sqrt{7}\sqrt[3]{14 + i\sqrt{7} + 3\sqrt{21}} + \left(-i + \sqrt{3}\right)\sqrt[3]{28 - 2 i\sqrt{7} - 6\sqrt{21}}\left(14 + i\sqrt{7} + 3\sqrt{21}\right)^{2/3} + 2\sqrt{7}\left(i + \sqrt{3}\right)\sqrt[3]{14 - i\sqrt{7} - 3\sqrt{21}}\, i + 2\sqrt[3]{28 + 2 i\sqrt{7} + 6\sqrt{21}}\left(14 - i\sqrt{7} - 3\sqrt{21}\right)^{2/3} i\right) - 4 i\sqrt[3]{14 - 42 i\sqrt{3}}\right) \Big/ \left(\sqrt[3]{2}\left(-2\left(14 - i\sqrt{7} - 3\sqrt{21}\right)^{2/3}\sqrt[3]{28 + 2 i\sqrt{7} + 6\sqrt{21}} + 2\sqrt{7}\left(i + \sqrt{3}\right)\sqrt[3]{14 - i\sqrt{7} - 3\sqrt{21}} - i\sqrt[3]{98 + 7 i\sqrt{7} + 21\sqrt{21}}\left(2^{2/3}\left(-i + \sqrt{3}\right)\sqrt[3]{1 - 3 i\sqrt{3}} + 4\sqrt[6]{7}\right)\right) - 4 i\, 7^{5/6}\sqrt[3]{2 - 6 i\sqrt{3}}\right)$$

01.09.03.0032.01

$$\cot\left(\frac{3\pi}{7}\right) = \left(z;\, 7 z^6 - 35 z^4 + 21 z^2 - 1\right)_4^{-1}$$

01.09.03.0033.01

$$\cot\left(\frac{3\pi}{7}\right) = \frac{i\left(1 + (-1)^{6/7}\right)}{-1 + (-1)^{6/7}}$$

01.09.03.0034.01

$$\cot\left(\frac{4\pi}{9}\right) = \frac{\left(i + \sqrt{3}\right) i \sqrt[3]{-\frac{1}{2} i\left(-i + \sqrt{3}\right)} + \sqrt[3]{\frac{1}{2} i\left(i + \sqrt{3}\right)}\left(-1 - i\sqrt{3}\right)}{\left(i + \sqrt{3}\right)\sqrt[3]{-\frac{1}{2} i\left(-i + \sqrt{3}\right)} + \left(-i + \sqrt{3}\right)\sqrt[3]{\frac{1}{2} i\left(i + \sqrt{3}\right)}}$$

01.09.03.0035.01

$$\cot\left(\frac{4\pi}{9}\right) = \left(z;\, 3 z^6 - 27 z^4 + 33 z^2 - 1\right)_4^{-1}$$

01.09.03.0036.01

$$\cot\left(\frac{4\pi}{9}\right) = \frac{i\left(1 + (-1)^{8/9}\right)}{-1 + (-1)^{8/9}}$$

01.09.03.0037.01

$$\cot\left(\frac{\pi}{2}\right) = 0$$

01.09.03.0038.01

$$\cot\left(\frac{5\pi}{9}\right) == \frac{\left(1 - i\sqrt{3}\right)\sqrt[3]{-\frac{1}{2}\,i\left(-i+\sqrt{3}\right)} + \sqrt[3]{\frac{1}{2}\,i\left(i+\sqrt{3}\right)}\left(1+i\sqrt{3}\right)}{\left(i+\sqrt{3}\right)\sqrt[3]{-\frac{1}{2}\,i\left(-i+\sqrt{3}\right)} + \left(-i+\sqrt{3}\right)\sqrt[3]{\frac{1}{2}\,i\left(i+\sqrt{3}\right)}}$$

01.09.03.0039.01

$$\cot\left(\frac{5\pi}{9}\right) == \left(z;\, 3z^6 - 27z^4 + 33z^2 - 1\right)_3^{-1}$$

01.09.03.0040.01

$$\cot\left(\frac{5\pi}{9}\right) == \frac{i\left(-1+\sqrt[9]{-1}\right)}{1+\sqrt[9]{-1}}$$

01.09.03.0041.01

$$\cot\left(\frac{4\pi}{7}\right) == \left(\sqrt[3]{14}\left(4\,i\sqrt[3]{1-3\,i\sqrt{3}} + \sqrt[3]{7}\left(i+\sqrt{3}\right)\left(2-6\,i\sqrt{3}\right)^{2/3} - 2\sqrt[3]{2}\;7^{2/3}\left(-i+\sqrt{3}\right)\right)\right) \Big/ \left(\sqrt[3]{2}\left(-2\left(14 - i\sqrt{7} - 3\sqrt{21}\right)^{2/3}\sqrt[3]{28+2\,i\sqrt{7}+6\sqrt{21}} + 2\sqrt{7}\left(i+\sqrt{3}\right)\sqrt[3]{14 - i\sqrt{7} - 3\sqrt{21}} - i\sqrt[3]{98+7\,i\sqrt{7}+21\sqrt{21}}\left(2^{2/3}\left(-i+\sqrt{3}\right)\sqrt[3]{1-3\,i\sqrt{3}} + 4\sqrt[6]{7}\right)\right) - 4\,i\,7^{5/6}\sqrt[3]{2-6\,i\sqrt{3}}\right)$$

01.09.03.0042.01

$$\cot\left(\frac{4\pi}{7}\right) == \left(z;\, 7z^6 - 35z^4 + 21z^2 - 1\right)_3^{-1}$$

01.09.03.0043.01

$$\cot\left(\frac{4\pi}{7}\right) == \frac{i\left(-1+\sqrt[7]{-1}\right)}{1+\sqrt[7]{-1}}$$

01.09.03.0044.01

$$\cot\left(\frac{7\pi}{12}\right) == -2+\sqrt{3}$$

01.09.03.0045.01

$$\cot\left(\frac{3\pi}{5}\right) == -\sqrt{1-\frac{2}{\sqrt{5}}}$$

01.09.03.0046.01

$$\cot\left(\frac{3\pi}{5}\right) == \left(z;\, 5z^4 - 10z^2 + 1\right)_2^{-1}$$

01.09.03.0047.01

$$\cot\left(\frac{5\pi}{8}\right) == 1-\sqrt{2}$$

01.09.03.0048.01

$$\cot\left(\frac{2\pi}{3}\right) == -\frac{1}{\sqrt{3}}$$

01.09.03.0049.01

$$\cot\left(\frac{7\pi}{10}\right) = -\sqrt{5-2\sqrt{5}}$$

01.09.03.0050.01

$$\cot\left(\frac{7\pi}{10}\right) = \left(z;\, z^4 - 10\, z^2 + 5\right)_2^{-1}$$

01.09.03.0051.01

$$\cot\left(\frac{5\pi}{7}\right) = \left(4\sqrt[3]{14-42\,i\sqrt{3}} + \sqrt[3]{2}\left(-2\left(\sqrt[3]{28-84\,i\sqrt{3}} + \sqrt{7}\,(-i) + \sqrt{21}\right)\sqrt[3]{14+i\sqrt{7}+3\sqrt{21}} + \left(1-i\sqrt{3}\right)\sqrt[3]{28+2\,i\sqrt{7}+6\sqrt{21}}\left(14-i\sqrt{7}-3\sqrt{21}\right)^{2/3} + 4\sqrt{7}\sqrt[3]{14-i\sqrt{7}-3\sqrt{21}}\; i\right)\right) \Big/ \left(4\, 7^{5/6}\sqrt[3]{2-6\,i\sqrt{3}} + \sqrt[3]{2}\left(2\left(\sqrt[3]{28-84\,i\sqrt{3}} + \sqrt{7}\; i - \sqrt{21}\right) i\sqrt[3]{14+i\sqrt{7}+3\sqrt{21}} + 4\sqrt{7}\sqrt[3]{14-i\sqrt{7}-3\sqrt{21}} + \left(i+\sqrt{3}\right)\sqrt[3]{28+2\,i\sqrt{7}+6\sqrt{21}}\left(14-i\sqrt{7}-3\sqrt{21}\right)^{2/3}\right)\right)$$

01.09.03.0052.01

$$\cot\left(\frac{5\pi}{7}\right) = \left(z;\, 7\, z^6 - 35\, z^4 + 21\, z^2 - 1\right)_2^{-1}$$

01.09.03.0053.01

$$\cot\left(\frac{5\pi}{7}\right) = \frac{i\left(-1+(-1)^{3/7}\right)}{1+(-1)^{3/7}}$$

01.09.03.0054.01

$$\cot\left(\frac{3\pi}{4}\right) = -1$$

01.09.03.0055.01

$$\cot\left(\frac{7\pi}{9}\right) = \frac{i\left(\sqrt[3]{-\frac{1}{2}\, i\left(-i+\sqrt{3}\right)} + \sqrt[3]{\frac{1}{2}\, i\left(i+\sqrt{3}\right)}\right)}{\sqrt[3]{-\frac{1}{2}\, i\left(-i+\sqrt{3}\right)} - \sqrt[3]{\frac{1}{2}\, i\left(i+\sqrt{3}\right)}}$$

01.09.03.0056.01

$$\cot\left(\frac{7\pi}{9}\right) = \left(z;\, 3\, z^6 - 27\, z^4 + 33\, z^2 - 1\right)_2^{-1}$$

01.09.03.0057.01

$$\cot\left(\frac{7\pi}{9}\right) = \frac{i\left(-1+(-1)^{5/9}\right)}{1+(-1)^{5/9}}$$

01.09.03.0058.01

$$\cot\left(\frac{4\pi}{5}\right) = -\sqrt{1+\frac{2}{\sqrt{5}}}$$

01.09.03.0059.01

$$\cot\left(\frac{4\pi}{5}\right) = \left(z;\, 5\, z^4 - 10\, z^2 + 1\right)_1^{-1}$$

01.09.03.0060.01

$$\cot\left(\frac{5\pi}{6}\right) == -\sqrt{3}$$

01.09.03.0061.01

$$\cot\left(\frac{6\pi}{7}\right) == \left(-4\sqrt[3]{7-21\,i\sqrt{3}} + \left(-1-i\sqrt{3}\right)\left(14-42\,i\sqrt{3}\right)^{2/3} + 14\sqrt[3]{2}\left(i+\sqrt{3}\right)i\right) \Big/ \left(-4\,7^{5/6}\sqrt[3]{1-3\,i\sqrt{3}} + 2\left(\sqrt{7}+i\sqrt{21}\right)\sqrt[3]{14-i\sqrt{7}-3\sqrt{21}} + \left(-i+\sqrt{3}\right)\sqrt[3]{28+2\,i\sqrt{7}+6\sqrt{21}} \left(14-i\sqrt{7}-3\sqrt{21}\right)^{2/3} + 2\sqrt[3]{7}\left(i+\sqrt{3}\right)\left(\sqrt[3]{7-21\,i\sqrt{3}-13\,i\sqrt{7}+3\sqrt{21}} - i\sqrt[6]{7}\sqrt[3]{14+i\sqrt{7}+3\sqrt{21}}\right)\right)$$

01.09.03.0062.01

$$\cot\left(\frac{6\pi}{7}\right) == \left(z;\, 7z^6 - 35z^4 + 21z^2 - 1\right)_1^{-1}$$

01.09.03.0063.01

$$\cot\left(\frac{6\pi}{7}\right) == \frac{i\left(-1+(-1)^{5/7}\right)}{1+(-1)^{5/7}}$$

01.09.03.0064.01

$$\cot\left(\frac{7\pi}{8}\right) == -1-\sqrt{2}$$

01.09.03.0065.01

$$\cot\left(\frac{8\pi}{9}\right) == \frac{\left(i+\sqrt{3}\right)i\sqrt[3]{-1+i\sqrt{3}} + \left(-1-i\sqrt{3}\right)^{4/3}}{\left(i+\sqrt{3}\right)\sqrt[3]{-1+i\sqrt{3}} + \left(-i+\sqrt{3}\right)\sqrt[3]{-1-i\sqrt{3}}}$$

01.09.03.0066.01

$$\cot\left(\frac{8\pi}{9}\right) == \left(z;\, 3z^6 - 27z^4 + 33z^2 - 1\right)_1^{-1}$$

01.09.03.0067.01

$$\cot\left(\frac{8\pi}{9}\right) == \frac{i\left(-1+(-1)^{7/9}\right)}{1+(-1)^{7/9}}$$

01.09.03.0068.01

$$\cot\left(\frac{9\pi}{10}\right) == -\sqrt{5+2\sqrt{5}}$$

01.09.03.0069.01

$$\cot\left(\frac{9\pi}{10}\right) == \left(z;\, z^4 - 10z^2 + 5\right)_1^{-1}$$

01.09.03.0070.01

$$\cot\left(\frac{11\pi}{12}\right) == -2-\sqrt{3}$$

01.09.03.0071.01

$$\cot(\pi) == \tilde{\infty}$$

01.09.03.0072.01

$$\cot\left(\frac{\pi}{17}\right) = \sqrt{\left(\left(\sqrt{2\left(\sqrt{34\left(17-\sqrt{17}\right)}+6\sqrt{17}-8\sqrt{2\left(17+\sqrt{17}\right)}-\sqrt{34-2\sqrt{17}}+34\right)}+\sqrt{17}+\sqrt{34-2\sqrt{17}}+15\right) \Big/ \left(16-2\sqrt{\left(2\left(\sqrt{\left(2\left(-\sqrt{34\left(17-\sqrt{17}\right)}+6\sqrt{17}+8\sqrt{2\left(17+\sqrt{17}\right)}+\sqrt{34-2\sqrt{17}}+34\right)\right)}+\sqrt{17}-\sqrt{34-2\sqrt{17}}+15\right)\right)}\right)\right)}$$

01.09.03.0073.01

$$\cot\left(\frac{\pi}{30}\right) = \sqrt{23+10\sqrt{5}+2\sqrt{255+114\sqrt{5}}}$$

$\cot\left(\frac{n\pi}{m}\right)$ can be expressed using only square roots if $n \in \mathbb{Z}$ and m is a product of a power of 2 and distinct Fermat primes $\{3, 5, 17, 257, \ldots\}$.

Values at infinities

01.09.03.0074.01

$$\cot(i\,\infty) = -i$$

01.09.03.0075.01

$$\cot(-i\,\infty) = i$$

01.09.03.0076.01

$$\cot(\tilde{\infty}) = ¿$$

General characteristics

Domain and analyticity

$\cot(z)$ is an analytical function of z which is defined over the whole complex z-plane.

01.09.04.0001.01

$$z \longrightarrow \cot(z) :: \mathbb{C} \longrightarrow \mathbb{C}$$

Symmetries and periodicities

Parity

$\cot(z)$ is an odd function.

01.09.04.0002.01

$$\cot(-z) = -\cot(z)$$

Mirror symmetry

01.09.04.0003.01

$\cot(\bar{z}) == \overline{\cot(z)}$

Periodicity

$\cot(z)$ is a periodic function with period π.

01.09.04.0009.01

$\cot(z + \pi) == \cot(z)$

01.09.04.0004.01

$\cot(z + \pi\, m) == \cot(z)$ /; $m \in \mathbb{Z}$

Poles and essential singularities

The function $\cot(z)$ has an infinite set of singular points:

a) $z == \pi\, k$ /; $k \in \mathbb{Z}$ are the simple poles with residues 1;

b) $z == \tilde{\infty}$ is an essential singular point.

01.09.04.0005.01

$\mathcal{Sing}_z(\cot(z)) == \{\{\{\pi\, k, 1\} /; k \in \mathbb{Z}\}, \{\tilde{\infty}, \infty\}\}$

01.09.04.0006.01

$\text{res}_z(\cot(z))\,(\pi\, k) == 1$ /; $k \in \mathbb{Z}$

Branch points

The function $\cot(z)$ does not have branch points.

01.09.04.0007.01

$\mathcal{BP}_z(\cot(z)) == \{\}$

Branch cuts

The function $\cot(z)$ does not have branch cuts.

01.09.04.0008.01

$\mathcal{BC}_z(\cot(z)) == \{\}$

Series representations

Generalized power series

Expansions at $z == z_0$

For the function itself

01.09.06.0020.01

$$\cot(z) \propto \cot(z_0) - \csc^2(z_0)\,(z - z_0) + \frac{1}{2} \sin(2\, z_0)\, \csc^4(z_0)\,(z - z_0)^2 + \ldots \;/;\; (z \to z_0)$$

01.09.06.0021.01

$$\cot(z) \propto \cot(z_0) - \csc^2(z_0)(z - z_0) + \frac{1}{2}\sin(2 z_0)\csc^4(z_0)(z - z_0)^2 + O\left((z - z_0)^3\right)$$

01.09.06.0022.01

$$\cot(z) = \sum_{k=0}^{\infty} \frac{1}{k!}\left(\cot(z_0)\,\delta_k - \delta_{k-1}\csc^2(z_0) - k \sum_{m=0}^{k-1}\sum_{j=0}^{m-1} \frac{(-1)^j}{m+1}\binom{k-1}{m}\sin^{-2m-2}(z_0)\,2^{k-2m}\binom{2m}{j}(m-j)^{k-1}\sin\left(\frac{\pi k}{2} + 2(m-j)z_0\right)\right)(z - z_0)^k$$

01.09.06.0023.01

$$\cot(z) \propto \cot(z_0)\,(1 + O(z - z_0))$$

Expansions at $z = 0$

For the function itself

01.09.06.0001.02

$$\cot(z) \propto \frac{1}{z} - \frac{z}{3} - \frac{z^3}{45} - \frac{2z^5}{945} - \ldots /; (z \to 0)$$

01.09.06.0024.01

$$\cot(z) \propto \frac{1}{z} - \frac{z}{3} - \frac{z^3}{45} - \frac{2z^5}{945} - O\left(z^7\right)$$

01.09.06.0002.01

$$\cot(z) = \frac{1}{z} + \sum_{k=1}^{\infty} \frac{(-1)^k\,2^{2k}\,B_{2k}\,z^{2k-1}}{(2k)!} /; |z| < \pi$$

01.09.06.0003.02

$$\cot(z) \propto \frac{1}{z} - \frac{z}{3} + O\left(z^3\right)$$

Expansions at $z = \frac{\pi}{2}$

For the function itself

01.09.06.0004.02

$$\cot(z) \propto -\left(z - \frac{\pi}{2}\right) - \frac{1}{3}\left(z - \frac{\pi}{2}\right)^3 - \frac{2}{15}\left(z - \frac{\pi}{2}\right)^5 - \ldots /; \left(z \to \frac{\pi}{2}\right)$$

01.09.06.0025.01

$$\cot(z) \propto -\left(z - \frac{\pi}{2}\right) - \frac{1}{3}\left(z - \frac{\pi}{2}\right)^3 - \frac{2}{15}\left(z - \frac{\pi}{2}\right)^5 - O\left(\left(z - \frac{\pi}{2}\right)^7\right)$$

01.09.06.0005.02

$$\cot(z) = \sum_{k=1}^{\infty} \frac{(-1)^k\,2^{2k}\left(2^{2k} - 1\right)B_{2k}}{(2k)!}\left(z - \frac{\pi}{2}\right)^{2k-1} /; \left|z - \frac{\pi}{2}\right| < \frac{\pi}{2}$$

01.09.06.0006.02

$$\cot(z) \propto -\left(z - \frac{\pi}{2}\right) + O\left(\left(z - \frac{\pi}{2}\right)^3\right)$$

q-series

01.09.06.0007.01

$$\cot(z) = -i\left(1 + 2\sum_{k=1}^{\infty} q^{2k}\right) /; q = e^{iz}$$

Dirichlet series

01.09.06.0008.01

$$\cot(z) = -i - 2i\sum_{k=0}^{\infty} e^{2iz(k+1)} /; \operatorname{Im}(z) > 0$$

01.09.06.0009.01

$$\cot(z) = i + 2i\sum_{k=0}^{\infty} e^{-2iz(k+1)} /; \operatorname{Im}(z) < 0$$

Asymptotic series expansions

01.09.06.0010.01

$$\cot(z) \propto -i - 2i\,e^{2iz}\,{}_1F_0\left(1;\,;\,e^{2iz}\right) /; (|z| \to \infty) \land \operatorname{Im}(z) > 0$$

01.09.06.0011.01

$$\cot(z) \propto -i - 2i\,e^{2iz}\left(1 + O\left(e^{2iz}\right)\right) /; (|z| \to \infty) \land \operatorname{Im}(z) > 0$$

01.09.06.0012.01

$$\cot(z) \propto i + 2i\,e^{-2iz}\,{}_1F_0\left(1;\,;\,e^{-2iz}\right) /; (|z| \to \infty) \land \operatorname{Im}(z) < 0$$

01.09.06.0013.01

$$\cot(z) \propto i + 2i\,e^{-2iz}\left(1 + O\left(e^{-2iz}\right)\right) /; (|z| \to \infty) \land \operatorname{Im}(z) < 0$$

01.09.06.0014.01

$$\cot(z) \propto \cot(z) /; (|z| \to \infty)$$

01.09.06.0015.01

$$\cot(z) \propto -i \;/; \left(z \to e^{i\phi}\infty\right) \bigwedge 0 < \phi < \pi$$

01.09.06.0016.01

$$\cot(z) \propto i \;/; \left(z \to e^{i\phi}\infty\right) \bigwedge -\pi < \phi < 0$$

01.09.06.0026.01

$$\cot(z) \propto \begin{cases} i & -\pi < \arg(z) < 0 \\ -i & 0 < \arg(z) < \pi \\ \cot(z) & \text{True} \end{cases} /; (|z| \to \infty)$$

Other series representations

01.09.06.0017.01

$$\cot(z) = \frac{1}{z} + 2z\sum_{k=1}^{\infty} \frac{1}{z^2 - k^2\pi^2} /; \frac{z}{\pi} \notin \mathbb{Z}$$

01.09.06.0018.01

$$\cot(z) = \frac{1}{z} + \frac{z}{\pi} \sum_{\substack{k=-\infty \\ k \neq 0}}^{\infty} \frac{1}{k (z - \pi k)} \;/;\; \frac{z}{\pi} \notin \mathbb{Z}$$

01.09.06.0019.01

$$\cot(z) = \sum_{k=-\infty}^{\infty} \frac{z}{z^2 - \pi^2 k^2} \;/;\; \frac{z}{\pi} \notin \mathbb{Z}$$

Integral representations

On the real axis

Of the direct function

01.09.07.0001.01

$$\cot(z) = -\int_{\frac{\pi}{2}}^{z} \csc^2(t) \, dt$$

01.09.07.0002.01

$$\cot(z) = \frac{2}{\pi} \int_0^{\infty} \frac{t^{1-\frac{2z}{\pi}} - 1}{t^2 - 1} \, dt \;/;\; 0 < \operatorname{Re}(z) < \frac{\pi}{2}$$

Limit representations

01.09.09.0001.01

$$\cot(z) = \lim_{n \to \infty} \sum_{k=-n}^{n} \frac{1}{z - \pi k} \;/;\; \frac{z}{\pi} \notin \mathbb{Z}$$

Continued fraction representations

01.09.10.0003.01

$$\cot(z) = \frac{1}{z} - \cfrac{z}{3 - \cfrac{z^2}{5 - \cfrac{z^2}{7 - \cfrac{z^2}{9 - \cfrac{z^2}{11 - \ldots}}}}}$$

Andreas Lauschke (2006)

01.09.10.0004.01

$$\cot(z) = \frac{1}{z} + \frac{1}{z} \operatorname{K}_k\left(-z^2, 2k + 1\right)_1^{\infty}$$

Andreas Lauschke (2006)

01.09.10.0001.01

$$\cot(z) = \frac{1}{z} - \cfrac{4\pi^{-2}z}{1+\cfrac{1-4\pi^{-2}z^2}{3+\cfrac{4(4-4\pi^{-2}z^2)}{5+\cfrac{9(9-4\pi^{-2}z^2)}{7+\cfrac{16(16-4\pi^{-2}z^2)}{9+\cfrac{25(25-4\pi^{-2}z^2)}{11+\cfrac{36(36-4\pi^{-2}z^2)}{13+\ldots}}}}}}}$$

01.09.10.0002.01

$$\cot(z) = \frac{1}{z} - \frac{4z}{\pi^2\left(1+\mathrm{K}_k\left(k^2\left(k^2-\frac{4z^2}{\pi^2}\right), 2k+1\right)_1^\infty\right)}$$

01.09.10.0005.01

$$\cot(z) = \frac{1}{z} + \cfrac{z/2}{-\frac{3}{2}-\cfrac{z^2/4}{-\frac{5}{2}-\cfrac{z^2/4}{-\frac{7}{2}-\cfrac{z^2/4}{-\frac{9}{2}-\cfrac{z^2/4}{-\frac{11}{2}-\cfrac{z^2/4}{-\frac{13}{2}-\cfrac{z^2/4}{-\frac{15}{2}-\cfrac{z^2/4}{-\frac{17}{2}-\cfrac{z^2/4}{\ldots}}}}}}}}}$$

A.Lauschke (2006)

01.09.10.0006.01

$$\cot(z) = \frac{1}{z} + \frac{z}{-3+2\,\mathrm{K}_k\left(-\frac{z^2}{4}, -k-\frac{3}{2}\right)_1^\infty}$$

A.Lauschke (2006)

Differential equations

Ordinary nonlinear differential equations

01.09.13.0001.01

$$w'(z) + w(z)^2 + 1 = 0 \;/;\; w(z) = \cot(z) \bigwedge w\left(\frac{\pi}{2}\right) = 0$$

01.09.13.0002.01

$$w'(z) - a\,w(z)^2 - b\,w(z) - c = 0 \;/;\; w(z) = -\frac{1}{2a}\left(b + \sqrt{4ac-b^2}\,\cot\left(\frac{a\sqrt{4ac-b^2}\,z + \sqrt{4ac-b^2}\,c_1}{2a}\right)\right)$$

Transformations

Transformations and argument simplifications

Argument involving basic arithmetic operations

01.09.16.0001.01

$$\cot(-z) = -\cot(z)$$

01.09.16.0002.01

$$\cot(a\,(b\,z^c)^m) = \frac{(b\,z^c)^m}{b^m\,z^{m\,c}}\cot(a\,b^m\,z^{m\,c})\;/;\;2\,m \in \mathbb{Z}$$

01.09.16.0003.01

$$\cot\left(\sqrt{z^2}\right) = \frac{\sqrt{z^2}}{z}\cot(z)$$

Argument involving inverse trigonometric and hyperbolic functions

Involving $\sin^{-1}$

01.09.16.0004.01

$$\cot\left(\sin^{-1}(z)\right) = \frac{\sqrt{1-z^2}}{z}$$

01.09.16.0016.01

$$\cot\left(\frac{1}{2}\sin^{-1}(z)\right) = \frac{\sqrt{1-z^2}+1}{z}$$

01.09.16.0065.01

$$\cot\left(i\sin^{-1}(z)\right) = \frac{i\left(\left(i\,z+\sqrt{1-z^2}\right)^{2\,i}+1\right)}{\left(i\,z+\sqrt{1-z^2}\right)^{2\,i}-1}$$

01.09.16.0066.01

$$\cot\left(a\sin^{-1}(z)\right) = \frac{i\left(\left(i\,z+\sqrt{1-z^2}\right)^{2\,a}+1\right)}{\left(i\,z+\sqrt{1-z^2}\right)^{2\,a}-1}$$

Involving $\cos^{-1}$

01.09.16.0005.01

$$\cot\left(\cos^{-1}(z)\right) = \frac{z}{\sqrt{1-z^2}}$$

01.09.16.0017.01

$$\cot\left(\frac{1}{2}\cos^{-1}(z)\right) = \frac{\sqrt{1+z}}{\sqrt{1-z}}$$

01.09.16.0067.01

$$\cot(i\cos^{-1}(z)) = -i\left(1 + \frac{2}{e^{\pi}\left(i z + \sqrt{1-z^2}\right)^{2i} - 1}\right)$$

01.09.16.0068.01

$$\cot(a\cos^{-1}(z)) = -i\left(1 + \frac{2}{e^{-i a \pi}\left(i z + \sqrt{1-z^2}\right)^{2a} - 1}\right)$$

Involving $\tan^{-1}$

01.09.16.0006.01

$$\cot(\tan^{-1}(z)) = \frac{1}{z}$$

01.09.16.0069.01

$$\cot(\tan^{-1}(x, y)) = \frac{x}{y}$$

01.09.16.0018.01

$$\cot\left(\frac{1}{2}\tan^{-1}(z)\right) = \frac{\sqrt{z^2+1} + 1}{z}$$

01.09.16.0070.01

$$\cot\left(\frac{\tan^{-1}(x, y)}{2}\right) = \frac{x + \sqrt{x^2+y^2}}{y}$$

01.09.16.0071.01

$$\cot(i\tan^{-1}(z)) = i - \frac{2i}{1 - (1 - i z)^{-i}(i z + 1)^{i}}$$

01.09.16.0072.01

$$\cot(i\tan^{-1}(x, y)) = \frac{i\left(\left(\frac{x+i y}{\sqrt{x^2+y^2}}\right)^{2i} + 1\right)}{\left(\frac{x+i y}{\sqrt{x^2+y^2}}\right)^{2i} - 1}$$

01.09.16.0073.01

$$\cot(a\tan^{-1}(z)) = i - \frac{2i}{1 - (1 - i z)^{-a}(i z + 1)^{a}}$$

01.09.16.0074.01

$$\cot(a\tan^{-1}(x, y)) = \frac{i\left(\left(\frac{x+i y}{\sqrt{x^2+y^2}}\right)^{2a} + 1\right)}{\left(\frac{x+i y}{\sqrt{x^2+y^2}}\right)^{2a} - 1}$$

Involving $\cot^{-1}$

01.09.16.0007.01

$$\cot\left(\cot^{-1}(z)\right) == z$$

01.09.16.0019.01

$$\cot\left(\frac{1}{2}\cot^{-1}(z)\right) == z\left(\sqrt{1+\frac{1}{z^2}}+1\right)$$

01.09.16.0075.01

$$\cot\left(i\cot^{-1}(z)\right) = i - \frac{2\,i}{1-\left(\frac{-i+z}{z}\right)^{-i}\left(\frac{i+z}{z}\right)^{i}}$$

01.09.16.0076.01

$$\cot\left(a\cot^{-1}(z)\right) = i - \frac{2\,i}{1-\left(\frac{-i+z}{z}\right)^{-a}\left(\frac{i+z}{z}\right)^{a}}$$

01.09.16.0028.01

$$\cot\left(n\cot^{-1}(z)\right) == \frac{i\left((z-i)^n+(z+i)^n\right)}{(z+i)^n-(z-i)^n} \;/;\; n\in\mathbb{N}^+$$

Involving $\csc^{-1}$

01.09.16.0008.01

$$\cot\left(\csc^{-1}(z)\right) == z\sqrt{1-\frac{1}{z^2}}$$

01.09.16.0020.01

$$\cot\left(\frac{1}{2}\csc^{-1}(z)\right) == z\left(\sqrt{1-\frac{1}{z^2}}+1\right)$$

01.09.16.0077.01

$$\cot\left(i\csc^{-1}(z)\right) = \frac{i\left(1+\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2\,i}\right)}{-1+\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2\,i}}$$

01.09.16.0078.01

$$\cot\left(a\csc^{-1}(z)\right) = \frac{i\left(\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2\,a}+1\right)}{\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2\,a}-1}$$

Involving $\sec^{-1}$

01.09.16.0009.01

$$\cot\left(\sec^{-1}(z)\right) = \frac{\sqrt{z^2}}{z\sqrt{z^2-1}}$$

01.09.16.0021.01

$$\cot\left(\frac{1}{2}\sec^{-1}(z)\right) = \frac{\sqrt{-z-1}\,\sqrt{z}}{\sqrt{z-1}\,\sqrt{-z}}$$

01.09.16.0079.01

$$\cot\left(i\sec^{-1}(z)\right) = -i\left(1+\frac{2}{e^{\pi}\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2i}-1}\right)$$

01.09.16.0080.01

$$\cot\left(a\sec^{-1}(z)\right) = -i\left(1+\frac{2}{e^{-i a\pi}\left(\sqrt{1-\frac{1}{z^2}}+\frac{i}{z}\right)^{2a}-1}\right)$$

Involving $\sinh^{-1}$

01.09.16.0081.01

$$\cot\left(\sinh^{-1}(z)\right) = \frac{i\left(\left(z+\sqrt{z^2+1}\right)^{2i}+1\right)}{\left(z+\sqrt{z^2+1}\right)^{2i}-1}$$

01.09.16.0010.01

$$\cot\left(i\sinh^{-1}(z)\right) = -\frac{i\sqrt{1+z^2}}{z}$$

01.09.16.0022.01

$$\cot\left(\frac{i}{2}\sinh^{-1}(z)\right) = -\frac{i}{z}\left(1+\sqrt{1+z^2}\right)$$

01.09.16.0082.01

$$\cot\left(a\sinh^{-1}(z)\right) = \frac{i\left(\left(z+\sqrt{z^2+1}\right)^{2ia}+1\right)}{\left(z+\sqrt{z^2+1}\right)^{2ia}-1}$$

Involving $\cosh^{-1}$

01.09.16.0083.01

$$\cot\left(\cosh^{-1}(z)\right) = \frac{i\left(\left(z+\sqrt{z-1}\,\sqrt{z+1}\right)^{2i}+1\right)}{\left(z+\sqrt{z-1}\,\sqrt{z+1}\right)^{2i}-1}$$

01.09.16.0011.01

$$\cot\left(i\cosh^{-1}(z)\right) = -\frac{i\,z}{\sqrt{z-1}\,\sqrt{z+1}}$$

01.09.16.0023.01

$$\cot\left(\frac{i}{2}\cosh^{-1}(z)\right) = -\frac{i\sqrt{z+1}}{\sqrt{z-1}}$$

01.09.16.0084.01

$$\cot\left(a\cosh^{-1}(z)\right) = \frac{i\left(\left(z+\sqrt{z-1}\,\sqrt{z+1}\right)^{2ia}+1\right)}{\left(z+\sqrt{z-1}\,\sqrt{z+1}\right)^{2ia}-1}$$

Involving $\tanh^{-1}$

01.09.16.0085.01

$$\cot\left(\tanh^{-1}(z)\right) = i - \frac{2i}{1-(1-z)^{-i}(z+1)^{i}}$$

01.09.16.0012.01

$$\cot\left(i\tanh^{-1}(z)\right) = -\frac{i}{z}$$

01.09.16.0024.01

$$\cot\left(\frac{i}{2}\tanh^{-1}(z)\right) = -\frac{i\left(1+\sqrt{1-z^2}\right)}{z}$$

01.09.16.0086.01

$$\cot\left(a\tanh^{-1}(z)\right) = i - \frac{2i}{1-(1-z)^{-ia}(z+1)^{ia}}$$

Involving $\coth^{-1}$

01.09.16.0087.01

$$\cot\left(\coth^{-1}(z)\right) = -i\left(1+\frac{2}{\left(1+\frac{1}{z}\right)^{-i}\left(\frac{z-1}{z}\right)^{i}-1}\right)$$

01.09.16.0013.01

$$\cot\left(i\coth^{-1}(z)\right) = -i\,z$$

01.09.16.0025.01

$$\cot\left(\frac{i}{2}\coth^{-1}(z)\right) = -\frac{i\sqrt{z^2}}{z}\left(\sqrt{z^2}+\sqrt{-1+z^2}\right)$$

01.09.16.0088.01

$$\cot\left(a \coth^{-1}(z)\right) = -i \left(1 + \frac{2}{\left(1+\frac{1}{z}\right)^{-i a} \left(\frac{z-1}{z}\right)^{i a} - 1}\right)$$

Involving csch^{-1}

01.09.16.0089.01

$$\cot\left(\mathrm{csch}^{-1}(z)\right) = \frac{i \left(\left(\sqrt{1+\frac{1}{z^2}} + \frac{1}{z}\right)^{2 i} + 1\right)}{\left(\sqrt{1+\frac{1}{z^2}} + \frac{1}{z}\right)^{2 i} - 1}$$

01.09.16.0014.01

$$\cot\left(i \,\mathrm{csch}^{-1}(z)\right) = -i\, z \sqrt{1+\frac{1}{z^2}}$$

01.09.16.0026.01

$$\cot\left(\frac{i}{2} \mathrm{csch}^{-1}(z)\right) = -i\, z \left(\sqrt{1+\frac{1}{z^2}} + 1\right)$$

01.09.16.0090.01

$$\cot\left(a \,\mathrm{csch}^{-1}(z)\right) = \frac{i \left(\left(\sqrt{1+\frac{1}{z^2}} + \frac{1}{z}\right)^{2 i a} + 1\right)}{\left(\sqrt{1+\frac{1}{z^2}} + \frac{1}{z}\right)^{2 i a} - 1}$$

Involving sech^{-1}

01.09.16.0091.01

$$\cot\left(\mathrm{sech}^{-1}(z)\right) = \frac{i \left(\left(\sqrt{\frac{1}{z}-1} \sqrt{1+\frac{1}{z}} + \frac{1}{z}\right)^{2 i} + 1\right)}{\left(\sqrt{\frac{1}{z}-1} \sqrt{1+\frac{1}{z}} + \frac{1}{z}\right)^{2 i} - 1}$$

01.09.16.0015.01

$$\cot\left(i \,\mathrm{sech}^{-1}(z)\right) = -\frac{i}{1-z} \sqrt{\frac{1-z}{1+z}}$$

01.09.16.0027.01

$$\cot\left(\frac{i}{2} \mathrm{sech}^{-1}(z)\right) = -i \bigg/ \sqrt{\frac{1-z}{1+z}}$$

01.09.16.0092.01

$$\cot\left(a\,\operatorname{sech}^{-1}(z)\right) = \frac{i\left(\left(\sqrt{\frac{1}{z}-1}\,\sqrt{1+\frac{1}{z}}+\frac{1}{z}\right)^{2\,i\,a}+1\right)}{\left(\sqrt{\frac{1}{z}-1}\,\sqrt{1+\frac{1}{z}}+\frac{1}{z}\right)^{2\,i\,a}-1}$$

Addition formulas

01.09.16.0029.01

$$\cot(a+b) = \frac{\cot(a)\cot(b)-1}{\cot(a)+\cot(b)}$$

01.09.16.0030.01

$$\cot\left(a+\frac{\pi}{4}\right) = \frac{\cot(z)-1}{\cot(z)+1}$$

01.09.16.0031.01

$$\cot(a-b) = \frac{\cot(a)\cot(b)+1}{\cot(b)-\cot(a)}$$

01.09.16.0032.01

$$\cot\left(a-\frac{\pi}{4}\right) = \frac{1+\cot(z)}{1-\cot(z)}$$

01.09.16.0033.01

$$\cot(a+i\,b) = \frac{\sin(2\,a)-i\sinh(2\,b)}{\cosh(2\,b)-\cos(2\,a)}$$

01.09.16.0034.01

$$\cot(a-i\,b) = \frac{\sin(2\,a)+i\sinh(2\,b)}{\cosh(2\,b)-\cos(2\,a)}$$

01.09.16.0035.01

$$\cot(z_1+z_2+z_3) = \frac{\cot(z_1)+\cot(z_2)+\cot(z_3)-\cot(z_2)\cot(z_3)\cot(z_1)}{1-\cot(z_1)\cot(z_2)-\cot(z_3)\cot(z_2)-\cot(z_1)\cot(z_3)}$$

Half-angle formulas

01.09.16.0036.01

$$\cot\left(\frac{z}{2}\right) = \cot(z)+\csc(z)$$

01.09.16.0037.01

$$\cot\left(\frac{z}{2}\right) = \frac{\sin(z)}{1-\cos(z)}$$

01.09.16.0038.02

$$\cot\left(\frac{z}{2}\right) = \sqrt{\frac{1+\cos(z)}{1-\cos(z)}} \;/;\; 0<\operatorname{Re}(z)<\pi \lor \operatorname{Re}(z)=0 \land \operatorname{Im}(z)<0 \lor \operatorname{Re}(z)=\pi \land \operatorname{Im}(z)\le 0.$$

01.09.16.0039.01

$$\cot\left(\frac{z}{2}\right) = (-1)^{\left\lceil \frac{2\,\mathrm{Re}(z)-\pi}{2\pi} \right\rceil} \sqrt{\frac{1+\cos(z)}{1-\cos(z)}} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\mathrm{Re}(z)}{\pi} \right\rfloor}\right) \theta(\mathrm{Im}(z))\right)$$

Multiple arguments

Argument involving numeric multiples of variable

01.09.16.0040.01

$$\cot(2\,z) = \frac{1}{2}\,(\cot(z) - \tan(z))$$

01.09.16.0041.01

$$\cot(3\,z) = \frac{\cot^3(z) - 3\cot(z)}{3\cot^2(z) - 1}$$

Argument involving symbolic multiples of variable

01.09.16.0042.01

$$\cot(n\,z) = \frac{(-1)^{n-1}}{\cot^{(-1)^n}(z) \sum_{k=0}^{\left\lfloor \frac{n-1}{2} \right\rfloor} (-1)^k \binom{n}{2\left\lfloor \frac{n-1}{2} \right\rfloor - 2\,k + 1} \cot^{2\,k}(z)} \sum_{k=0}^{\left\lfloor \frac{n}{2} \right\rfloor} (-1)^k \binom{n}{2\left\lfloor \frac{n}{2} \right\rfloor - 2\,k} \cot^{2\,k}(z) \;/;\; n \in \mathbb{N}^+$$

01.09.16.0043.01

$$\cot(n\,z) = \frac{1}{n} \sum_{k=0}^{n-1} \cot\left(z + \frac{\pi\,k}{n}\right) /;\; n \in \mathbb{N}^+$$

01.09.16.0044.01

$$\cot(n\,z) = \frac{T_n(\cos(z))}{\sin(z)\,U_{n-1}(\cos(z))}$$

Products, sums, and powers of the direct function

Products of the direct function

01.09.16.0045.01

$$\cot(a)\cot(b) = \frac{\cos(a-b) + \cos(a+b)}{\cos(a-b) - \cos(a+b)}$$

Products involving the direct function

01.09.16.0046.01

$$\cot(a)\tan(b) = \frac{\sin(a+b) - \sin(a-b)}{\sin(a-b) + \sin(a+b)}$$

Sums of the direct function

01.09.16.0047.01

$$\cot(a) + \cot(b) = \csc(a)\csc(b)\sin(a+b)$$

01.09.16.0048.01

$$\cot(a) - \cot(b) = -\csc(a)\csc(b)\sin(a-b)$$

Sums involving the direct function

Involving other trigonometric functions

Involving tan

01.09.16.0055.01

$$\cot(z) + \tan(z) = \sec(z)\csc(z)$$

01.09.16.0056.01

$$\cot(z) - \tan(z) = \cos(2z)\sec(z)\csc(z)$$

01.09.16.0049.01

$$\cot(a) + \tan(b) = \cos(a - b)\csc(a)\sec(b)$$

01.09.16.0050.01

$$\cot(a) - \tan(b) = \cos(a + b)\csc(a)\sec(b)$$

Involving hyperbolic functions

Involving tanh

01.09.16.0057.01

$$\cot(z) + i\tanh(z) = \cos\left(z\sqrt{2}\, e^{-\frac{1}{4}(i\pi)}\right)\csc(z)\operatorname{sech}(z)$$

01.09.16.0058.01

$$\cot(z) - i\tanh(z) = \cos\left(z\sqrt{2}\, e^{\frac{i\pi}{4}}\right)\csc(z)\operatorname{sech}(z)$$

01.09.16.0059.01

$$\cot(a) + i\tanh(b) = \cos(a - i\,b)\csc(a)\operatorname{sech}(b)$$

01.09.16.0060.01

$$\cot(a) - i\tanh(b) = \cos(a + b\,i)\csc(a)\operatorname{sech}(b)$$

Involving coth

01.09.16.0061.01

$$\cot(z) + i\coth(z) = i\csc(z)\operatorname{csch}(z)\sin\left(z\sqrt{2}\, e^{-\frac{1}{4}(i\pi)}\right)$$

01.09.16.0062.01

$$\cot(z) - i\coth(z) = -i\csc(z)\operatorname{csch}(z)\sin\left(z\sqrt{2}\, e^{\frac{i\pi}{4}}\right)$$

01.09.16.0063.01

$$\cot(a) + i\coth(b) = i\csc(a)\operatorname{csch}(b)\sin(a - i\,b)$$

01.09.16.0064.01

$$\cot(a) - i\coth(b) = -i\csc(a)\operatorname{csch}(b)\sin(a + b\,i)$$

Powers of the direct function

01.09.16.0051.01

$$\cot^2(z) = \frac{1+\cos(2z)}{1-\cos(2z)}$$

01.09.16.0052.01

$$\cot^3(z) = \frac{3\cos(z)+\cos(3z)}{3\sin(z)-\sin(3z)}$$

Sums of powers involving the direct function

01.09.16.0053.01

$$\cot^2(a)-\cot^2(b) = -\csc^2(a)\csc^2(b)\sin(a-b)\sin(a+b)$$

Related transformations

01.09.16.0054.01

$$\cot\left(z-\frac{\pi}{3}\right)\cot(z)+\cot\left(z+\frac{\pi}{3}\right)\cot(z)+\cot\left(z-\frac{\pi}{3}\right)\cot\left(z+\frac{\pi}{3}\right) = -3$$

Identities

Functional identities

01.09.17.0001.01

$$\cot(z)\cot(2z) = \frac{1}{2}\left(\cot^2(z)-1\right)$$

01.09.17.0002.01

$$w(z) = w\left(\frac{z}{2n+1}\right)\prod_{k=1}^{n} w\left(\frac{\pi k+z}{2n+1}\right) w\left(\frac{\pi k-z}{2n+1}\right) /;\ w(z) = \cot(z) \land n \in \mathbb{Z}$$

Complex characteristics

Real part

01.09.19.0001.01

$$\mathrm{Re}(\cot(x+i y)) = -\frac{\sin(2x)}{\cos(2x)-\cosh(2y)}$$

01.09.19.0007.01

$$\mathrm{Re}(\cot(z)) = -\frac{\sin(2\,\mathrm{Re}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}$$

Imaginary part

01.09.19.0002.01

$$\mathrm{Im}(\cot(x+i y)) = \frac{\sinh(2y)}{\cos(2x)-\cosh(2y)}$$

01.09.19.0008.01

$$\mathrm{Im}(\cot(z)) = \frac{\sinh(2\,\mathrm{Im}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}$$

Absolute value

01.09.19.0003.01

$$|\cot(x+i\,y)| = \sqrt{-\frac{\cos(2\,x)+\cosh(2\,y)}{\cos(2\,x)-\cosh(2\,y)}}$$

01.09.19.0009.01

$$|\cot(z)| = \sqrt{-\frac{\cos(2\,\mathrm{Re}(z))+\cosh(2\,\mathrm{Im}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}}$$

Argument

01.09.19.0004.01

$$\arg(\cot(x+i\,y)) = \tan^{-1}\left(-\frac{\sin(2\,x)}{\cos(2\,x)-\cosh(2\,y)}, \frac{\sinh(2\,y)}{\cos(2\,x)-\cosh(2\,y)}\right)$$

01.09.19.0005.01

$$\arg(\cot(x+i\,y)) = \frac{1}{2}\left(\mathrm{sgn}\left(\frac{\mathrm{sgn}(\sinh(2\,y))}{\mathrm{sgn}(\cos(2\,x)-\cosh(2\,y))}+\frac{1}{2}\right)\left(\pi-\frac{\pi\,\mathrm{sgn}(\sin(2\,x))}{\mathrm{sgn}(\cosh(2\,y)-\cos(2\,x))}\right)-2\tan^{-1}(\csc(2\,x)\sinh(2\,y))\right)$$

01.09.19.0010.01

$$\arg(\cot(z)) = \tan^{-1}\left(-\frac{\sin(2\,\mathrm{Re}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}, \frac{\sinh(2\,\mathrm{Im}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}\right)$$

01.09.19.0011.01

$$\arg(\cot(z)) = \frac{1}{2}\left(\mathrm{sgn}\left(\frac{\mathrm{sgn}(\sinh(2\,\mathrm{Im}(z)))}{\mathrm{sgn}(\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z)))}+\frac{1}{2}\right)\left(\pi-\frac{\pi\,\mathrm{sgn}(\sin(2\,\mathrm{Re}(z)))}{\mathrm{sgn}(\cosh(2\,\mathrm{Im}(z))-\cos(2\,\mathrm{Re}(z)))}\right)-2\tan^{-1}(\csc(2\,\mathrm{Re}(z))\sinh(2\,\mathrm{Im}(z)))\right)$$

Conjugate value

01.09.19.0006.01

$$\overline{\cot(x+i\,y)} = -\frac{\sin(2\,x)+i\sinh(2\,y)}{\cos(2\,x)-\cosh(2\,y)}$$

01.09.19.0012.01

$$\overline{\cot(z)} = -\frac{\sin(2\,\mathrm{Re}(z))+i\sinh(2\,\mathrm{Im}(z))}{\cos(2\,\mathrm{Re}(z))-\cosh(2\,\mathrm{Im}(z))}$$

Signum value

01.09.19.0013.01

$$\mathrm{sgn}(\cot(x+i\,y)) = \frac{\sin(2\,x)-i\sinh(2\,y)}{\sqrt{\cosh^2(2\,y)-\cos^2(2\,x)}}$$

01.09.19.0014.01

$$\mathrm{sgn}(\cot(z)) = -\frac{\sin(2\,\mathrm{Re}(z))-i\sinh(2\,\mathrm{Im}(z))}{\sqrt{\cosh^2(2\,\mathrm{Im}(z))-\cos^2(2\,\mathrm{Re}(z))}}$$

Differentiation

Low-order differentiation

01.09.20.0001.01

$$\frac{\partial \cot(z)}{\partial z} = -\csc^2(z)$$

01.09.20.0002.01

$$\frac{\partial^2 \cot(z)}{\partial z^2} = 2\cot(z)\csc^2(z)$$

Symbolic differentiation

01.09.20.0003.01

$$\frac{\partial^n \cot(z)}{\partial z^n} = (-1)^n\, n!\, z^{-n-1} + \sum_{k=1}^{\infty} \frac{(-1)^k\, 2^{2k-1}\, B_{2k}\, z^{2k-n-1}}{k\,(2k-n-1)!} \;/;\; |z| < \pi \bigwedge n \in \mathbb{N}^+$$

01.09.20.0004.01

$$\frac{\partial^n \cot(z)}{\partial z^n} = \cot(z)\,\delta_n - \delta_{n-1}\csc^2(z) - n \sum_{k=0}^{n-1}\sum_{j=0}^{k-1} \frac{(-1)^j \sin^{-2k-2}(z)\, 2^{n-2k}\,(k-j)^{n-1}}{k+1} \binom{n-1}{k}\binom{2k}{j} \sin\!\left(\frac{\pi n}{2} + 2(k-j)z\right) /;\; n \in \mathbb{N}$$

01.09.20.0006.01

$$\frac{\partial^n \cot(z)}{\partial z^n} = -\delta_n\, i + (-i)^{n+1}\, 2^n\,(i\cot(z) - 1) \sum_{k=0}^{n} \frac{(-1)^k\, k!\, \mathcal{S}_n^{(k)}}{2^k}\,(i\cot(z)+1)^k \;/;\; n \in \mathbb{N}$$

Victor Adamchik (2005)

Fractional integro-differentiation

01.09.20.0005.01

$$\frac{\partial^\alpha \cot(z)}{\partial z^\alpha} = \mathcal{FC}_{\exp}^{(\alpha)}(z, -1)\, z^{-\alpha-1} + \sum_{k=1}^{\infty} \frac{(-1)^k\, 2^{2k-1}\, B_{2k}\, z^{2k-\alpha-1}}{\Gamma(2k-\alpha)\, k} \;/;\; |z| < \pi$$

01.09.20.0007.01

$$\cot^{(\alpha)}(c\,z) = \lim_{\nu\to\alpha} \frac{(c\,z)^{-\nu-1}}{\Gamma(-\nu)}\,(2\log(\pi) - \log(-c\,z) + \psi(-\nu) + \gamma) + \pi^{-\alpha-1}\left((-c\,z)^\alpha\,(c\,z)^{-\alpha}\,\psi^{(\alpha)}\!\left(-\frac{c\,z}{\pi}\right) - \psi^{(\alpha)}\!\left(\frac{c\,z}{\pi}\right)\right)$$

Integration

Indefinite integration

Involving only one direct function

01.09.21.0012.01

$$\int \cot(b + a\,z)\,dz = \frac{\log(\sin(b + a\,z))}{a}$$

01.09.21.0013.01

$$\int \cot(a\,z)\,dz = \frac{\log(\sin(a\,z))}{a}$$

01.09.21.0014.01

$$\int \cot(z)\,dz = \log(\sin(z))$$

Involving one direct function and elementary functions

Involving power function

Involving power

Involving z^n and linear arguments

01.09.21.0015.01

$$\int z\cot(b+a\,z)\,dz = \frac{1}{2\,a^2}\left(-i\,a^2\,z^2-2\,i\,a\,b\,z+2\,a\log\left(1-e^{2\,i\,(b+a\,z)}\right)z+\pi\,i\,a\,z+\pi\log\left(1+e^{-2\,i\,a\,z}\right)+2\,b\log\left(1-e^{2\,i\,(b+a\,z)}\right)-\pi\log(\cos(a\,z))-2\,b\log(\sin(b+a\,z))-i\,\mathrm{Li}_2\left(e^{2\,i\,(b+a\,z)}\right)\right)$$

01.09.21.0016.01

$$\int z^n\cot(a\,z)\,dz = -\frac{i\,z^{n+1}}{n+1}-2\,i\,e^{2\,i\,a\,z}\,n!\sum_{j=0}^{n}\frac{(-1)^j\,2^{-j-1}\,(i\,a)^{-j-1}\,z^{n-j}}{(n-j)!}\;{}_{j+2}F_{j+1}\left(1,\,\ldots,\,1,\,1;\,2,\,\ldots,\,2;\,e^{2\,i\,a\,z}\right)\;/;\;n\in\mathbb{N}$$

01.09.21.0243.01

$$\int z^n\cot(a\,z)\,dz = -\frac{i\,z^{n+1}}{n+1}-2\,i\sum_{j=0}^{n}\binom{n}{j}(-1)^j\,j!\,(2\,i)^{-j-1}\,a^{-j-1}\,z^{n-j}\,\mathrm{Li}_{j+1}\left(e^{2\,i\,a\,z}\right)\;/;\;n\in\mathbb{N}$$

01.09.21.0244.01

$$\int z^n\cot(a\,z)\,dz = \frac{i\,z^{n+1}}{n+1}-2\,i\sum_{j=0}^{n}\binom{n}{j}j!\,(2\,i)^{-j-1}\,a^{-j-1}\,z^{n-j}\,\mathrm{Li}_{j+1}\left(e^{-2\,i\,a\,z}\right)\;/;\;n\in\mathbb{N}$$

01.09.21.0017.01

$$\int z\cot(a\,z)\,dz = -\frac{i\left(a\,z\left(a\,z+2\,i\log\left(1-e^{2\,i\,a\,z}\right)\right)+\mathrm{Li}_2\left(e^{2\,i\,a\,z}\right)\right)}{2\,a^2}$$

01.09.21.0018.01

$$\int z^2\cot(a\,z)\,dz = \frac{8\,a^3\,i\,z^3+24\,a^2\log\left(1-e^{-2\,i\,a\,z}\right)z^2+24\,a\,i\,\mathrm{Li}_2\left(e^{-2\,i\,a\,z}\right)z-i\,\pi^3+12\,\mathrm{Li}_3\left(e^{-2\,i\,a\,z}\right)}{24\,a^3}$$

01.09.21.0019.01

$$\int z^3\cot(a\,z)\,dz = \frac{1}{64\,a^4}\left(i\left(16\,a^4\,z^4-64\,i\,a^3\log\left(1-e^{-2\,i\,a\,z}\right)z^3+96\,a^2\,\mathrm{Li}_2\left(e^{-2\,i\,a\,z}\right)z^2-96\,i\,a\,\mathrm{Li}_3\left(e^{-2\,i\,a\,z}\right)z-\pi^4-48\,\mathrm{Li}_4\left(e^{-2\,i\,a\,z}\right)\right)\right)$$

01.09.21.0020.01

$$\int z^4\cot(a\,z)\,dz = \frac{i\,z^5}{5}+\frac{\log\left(1-e^{-2\,i\,a\,z}\right)z^4}{a}+\frac{2\,i\,\mathrm{Li}_2\left(e^{-2\,i\,a\,z}\right)z^3}{a^2}+\frac{3\,\mathrm{Li}_3\left(e^{-2\,i\,a\,z}\right)z^2}{a^3}-\frac{3\,i\,\mathrm{Li}_4\left(e^{-2\,i\,a\,z}\right)z}{a^4}-\frac{3\,\mathrm{Li}_5\left(e^{-2\,i\,a\,z}\right)}{2\,a^5}-\frac{i\,\pi^5}{160\,a^5}$$

01.09.21.0245.01

$$\int (z-t)^n \cot(a\,t)\,dt = \sum_{k=0}^{n} \binom{n}{k} (-1)^k z^{n-k} \left(-\frac{i\,t^{k+1}}{k+1} - 2\,i \sum_{j=0}^{k} \binom{k}{j} (-1)^j\, j!\,(2\,i)^{-j-1} a^{-j-1} t^{k-j} \operatorname{Li}_{j+1}\left(e^{2\,i\,a\,t}\right) \right) /;\, n \in \mathbb{N}$$

Involving exponential function

Involving exp

Involving $a^{b\,z}$

01.09.21.0021.01

$$\int a^{b\,z} \cot(c\,z)\,dz = \frac{1}{b\log(a)\,(i\,b\log(a)-2\,c)} \left(a^{b\,z} \left(b\,e^{2\,i\,c\,z}\, {}_2F_1\left(1-\frac{i\,b\log(a)}{2\,c}, 1; 2-\frac{i\,b\log(a)}{2\,c}; e^{2\,i\,c\,z}\right) \log(a) + {}_2F_1\left(-\frac{i\,b\log(a)}{2\,c}, 1; 1-\frac{i\,b\log(a)}{2\,c}; e^{2\,i\,c\,z}\right)(2\,i\,c+b\log(a)) \right) \right)$$

01.09.21.0022.01

$$\int e^{b\,z} \cot(a\,z)\,dz = -\frac{(b+2\,i\,a)\,e^{b\,z}\, {}_2F_1\left(-\frac{i\,b}{2\,a}, 1; 1-\frac{i\,b}{2\,a}; e^{2\,i\,a\,z}\right) + b\,e^{(b+2\,i\,a)\,z}\, {}_2F_1\left(1-\frac{i\,b}{2\,a}, 1; 2-\frac{i\,b}{2\,a}; e^{2\,i\,a\,z}\right)}{(2\,a-i\,b)\,b}$$

01.09.21.0023.01

$$\int e^{-i\,a\,z} \cot(a\,z)\,dz = \frac{\log\left(-1+e^{-i\,a\,z}\right) + e^{-i\,a\,z} - \log\left(1+e^{-i\,a\,z}\right)}{a}$$

01.09.21.0024.01

$$\int e^{i\,a\,z} \cot(a\,z)\,dz = \frac{\log\left(-1+e^{i\,a\,z}\right) + e^{i\,a\,z} - \log\left(1+e^{i\,a\,z}\right)}{a}$$

Involving exponential function and a power function

Involving exp and power

Involving $z^n\, e^{b\,z}$

01.09.21.0025.01

$$\int z^n e^{b\,z} \cot(c\,z)\,dz = -i\,n!\left(e^{b\,z} \sum_{j=0}^{n} \frac{(-1)^j b^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(-\frac{i\,b}{2\,c}, \ldots, -\frac{i\,b}{2\,c}, 1; 1-\frac{i\,b}{2\,c}, \ldots, 1-\frac{i\,b}{2\,c}; e^{2\,i\,c\,z}\right) + e^{(b+2\,i\,c)\,z} \sum_{j=0}^{n} \frac{(-1)^j (b+2\,i\,c)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(\frac{-i\,b+2\,c}{2\,c}, \ldots, \frac{-i\,b+2\,c}{2\,c}, 1; \frac{-i\,b+2\,c}{2\,c}+1, \ldots, \frac{-i\,b+2\,c}{2\,c}+1; e^{2\,i\,c\,z}\right) \right) /;\, n \in \mathbb{N}$$

Arguments involving inverse trigonometric functions

Involving $\sin^{-1}$

01.09.21.0026.01

$$\int \cot\left(\sin^{-1}(z)\right) dz = \log(z) - \log\left(\sqrt{1-z^2} + 1\right) + \sqrt{1-z^2}$$

01.09.21.0027.01

$$\int \cot\left(a \sin^{-1}(z)\right) dz = -\frac{1}{8a^2-2} \left(e^{-2i\sin^{-1}(z)} \left((2a-1)\left((2a+1) e^{i\sin^{-1}(z)} \left(e^{2i\sin^{-1}(z)} {}_2F_1\left(\frac{1}{2a}, 1; 1+\frac{1}{2a}; e^{2ia\sin^{-1}(z)}\right) - {}_2F_1\left(-\frac{1}{2a}, 1; 1-\frac{1}{2a}; e^{2ia\sin^{-1}(z)}\right)\right) + e^{i(2a+3)\sin^{-1}(z)} {}_2F_1\left(1+\frac{1}{2a}, 1; 2+\frac{1}{2a}; e^{2ia\sin^{-1}(z)}\right)\right) + (2a+1) e^{i(2a+1)\sin^{-1}(z)} {}_2F_1\left(1-\frac{1}{2a}, 1; 2-\frac{1}{2a}; e^{2ia\sin^{-1}(z)}\right)\right)\right)$$

Involving $\cos^{-1}$

01.09.21.0028.01

$$\int \cot\left(\cos^{-1}(z)\right) dz = -\sqrt{1-z^2}$$

01.09.21.0029.01

$$\int \cot\left(a \cos^{-1}(z)\right) dz = \frac{1}{8a^2-2} \left(i\, e^{-2i\cos^{-1}(z)} \left((2a+1) e^{i(2a+1)\cos^{-1}(z)} {}_2F_1\left(1-\frac{1}{2a}, 1; 2-\frac{1}{2a}; e^{2ia\cos^{-1}(z)}\right) - (2a-1)\left((2a+1) e^{i\cos^{-1}(z)} \left(e^{2i\cos^{-1}(z)} {}_2F_1\left(\frac{1}{2a}, 1; 1+\frac{1}{2a}; e^{2ia\cos^{-1}(z)}\right) + {}_2F_1\left(-\frac{1}{2a}, 1; 1-\frac{1}{2a}; e^{2ia\cos^{-1}(z)}\right)\right) + e^{i(2a+3)\cos^{-1}(z)} {}_2F_1\left(1+\frac{1}{2a}, 1; 2+\frac{1}{2a}; e^{2ia\cos^{-1}(z)}\right)\right)\right)\right)$$

Involving $\tan^{-1}$

01.09.21.0030.01

$$\int \cot\left(\tan^{-1}(z)\right) dz = \log(z)$$

Involving $\cot^{-1}$

01.09.21.0031.01

$$\int \cot\left(\cot^{-1}(z)\right) dz = \frac{z^2}{2}$$

Involving $\csc^{-1}$

01.09.21.0032.01

$$\int \cot\left(\csc^{-1}(z)\right) dz = \frac{\sqrt{1-\frac{1}{z^2}}\, z\left(z\sqrt{z^2-1} - \log\left(z+\sqrt{z^2-1}\right)\right)}{2\sqrt{z^2-1}}$$

Involving $\sec^{-1}$

01.09.21.0033.01

$$\int \cot\left(\sec^{-1}(z)\right) dz = \frac{z\log\left(z+\sqrt{z^2-1}\right)}{\sqrt{z^2-1}}\sqrt{1-\frac{1}{z^2}}$$

Arguments involving inverse hyperbolic functions

Involving $\sinh^{-1}$

01.09.21.0034.01

$$\int \cot\left(\sinh^{-1}(z)\right) dz = \frac{1}{10}\left(5\, e^{-\sinh^{-1}(z)}\, i\, {}_2F_1\left(\frac{i}{2}, 1; 1+\frac{i}{2}; e^{2 i \sinh^{-1}(z)}\right) - 5\, e^{\sinh^{-1}(z)}\, i\, {}_2F_1\left(-\frac{i}{2}, 1; 1-\frac{i}{2}; e^{2 i \sinh^{-1}(z)}\right) - (2-i)\, e^{(-1+2 i)\sinh^{-1}(z)}\, {}_2F_1\left(1+\frac{i}{2}, 1; 2+\frac{i}{2}; e^{2 i \sinh^{-1}(z)}\right) - (2+i)\, e^{(1+2 i)\sinh^{-1}(z)}\, {}_2F_1\left(1-\frac{i}{2}, 1; 2-\frac{i}{2}; e^{2 i \sinh^{-1}(z)}\right)\right)$$

01.09.21.0035.01

$$\int \cot\left(a\sinh^{-1}(z)\right) dz = -\frac{1}{2\left(4a^2+1\right)}\left(i\, e^{-\sinh^{-1}(z)}\left((2a-i)\left((2a+i)\left(e^{2\sinh^{-1}(z)}\, {}_2F_1\left(-\frac{i}{2a}, 1; 1-\frac{i}{2a}; e^{2 i a \sinh^{-1}(z)}\right) - {}_2F_1\left(\frac{i}{2a}, 1; 1+\frac{i}{2a}; e^{2 i a \sinh^{-1}(z)}\right)\right) - i\, e^{2 i a \sinh^{-1}(z)}\, {}_2F_1\left(1+\frac{i}{2a}, 1; 2+\frac{i}{2a}; e^{2 i a \sinh^{-1}(z)}\right)\right) + (1-2 i a)\, e^{2(1+i a)\sinh^{-1}(z)}\, {}_2F_1\left(1-\frac{i}{2a}, 1; 2-\frac{i}{2a}; e^{2 i a \sinh^{-1}(z)}\right)\right)\right)$$

Involving $\cosh^{-1}$

01.09.21.0036.01

$$\int \cot\left(\cosh^{-1}(z)\right) dz = -\frac{1}{10}\, e^{-\cosh^{-1}(z)}\left(5\, i\, {}_2F_1\left(\frac{i}{2}, 1; 1+\frac{i}{2}; e^{2 i \cosh^{-1}(z)}\right) + 5\, e^{2\cosh^{-1}(z)}\, i\, {}_2F_1\left(-\frac{i}{2}, 1; 1-\frac{i}{2}; e^{2 i \cosh^{-1}(z)}\right) + e^{2 i \cosh^{-1}(z)}\left((2+i)\, e^{2\cosh^{-1}(z)}\, {}_2F_1\left(1-\frac{i}{2}, 1; 2-\frac{i}{2}; e^{2 i \cosh^{-1}(z)}\right) - (2-i)\, {}_2F_1\left(1+\frac{i}{2}, 1; 2+\frac{i}{2}; e^{2 i \cosh^{-1}(z)}\right)\right)\right)$$

01.09.21.0037.01

$$\int \cot\left(a\cosh^{-1}(z)\right) dz = \frac{1}{2\left(4a^2+1\right)}\left(e^{-\cosh^{-1}(z)}\left((2a-i)\left((1-2 i a)\left({}_2F_1\left(\frac{i}{2a}, 1; 1+\frac{i}{2a}; e^{2 i a \cosh^{-1}(z)}\right) + e^{2\cosh^{-1}(z)}\, {}_2F_1\left(-\frac{i}{2a}, 1; 1-\frac{i}{2a}; e^{2 i a \cosh^{-1}(z)}\right)\right) + e^{2 i a \cosh^{-1}(z)}\, {}_2F_1\left(1+\frac{i}{2a}, 1; 2+\frac{i}{2a}; e^{2 i a \cosh^{-1}(z)}\right)\right) - (2a+i)\, e^{2(1+i a)\cosh^{-1}(z)}\, {}_2F_1\left(1-\frac{i}{2a}, 1; 2-\frac{i}{2a}; e^{2 i a \cosh^{-1}(z)}\right)\right)\right)$$

Involving trigonometric functions

Involving sin

Involving $\sin(b\,z)$

01.09.21.0038.01

$$\int \sin(b\,z)\cot(c\,z)\,dz = \frac{1}{2\left(b^3-4\,b\,c^2\right)}\left(i\,e^{-i\,b\,z}\left((b-2\,c)\left((b+2\,c)\left(e^{2\,i\,b\,z}\,{}_2F_1\!\left(\frac{b}{2\,c},1;\frac{b}{2\,c}+1;e^{2\,i\,c\,z}\right)+{}_2F_1\!\left(-\frac{b}{2\,c},1;1-\frac{b}{2\,c};e^{2\,i\,c\,z}\right)\right)+ b\,e^{2\,i\,(b+c)\,z}\,{}_2F_1\!\left(\frac{b}{2\,c}+1,1;\frac{b}{2\,c}+2;e^{2\,i\,c\,z}\right)\right)+b\,(b+2\,c)\,e^{2\,i\,c\,z}\,{}_2F_1\!\left(1-\frac{b}{2\,c},1;2-\frac{b}{2\,c};e^{2\,i\,c\,z}\right)\right)\right)$$

01.09.21.0039.01

$$\int \sin(c\,z)\cot(c\,z)\,dz = \frac{\sin(c\,z)}{c}$$

01.09.21.0040.01

$$\int \sin(c\,z)\cot(2\,c\,z)\,dz = \frac{\log\left(\cos\left(\frac{c\,z}{2}\right)-\sin\left(\frac{c\,z}{2}\right)\right)-\log\left(\cos\left(\frac{c\,z}{2}\right)+\sin\left(\frac{c\,z}{2}\right)\right)+2\sin(c\,z)}{2\,c}$$

01.09.21.0041.01

$$\int \sin(c\,z)\cot(3\,c\,z)\,dz = \frac{\sqrt{3}\left(\log\left(\sqrt{3}-2\sin(c\,z)\right)-\log\left(2\sin(c\,z)+\sqrt{3}\right)\right)+6\sin(c\,z)}{6\,c}$$

01.09.21.0042.01

$$\int \sin(c\,z)\cot(4\,c\,z)\,dz = \frac{1}{4\,c}\left((-1)^{3/4}\,(1+i)\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)-1}{\sqrt{2}}\right)- (1-i)\sqrt[4]{-1}\,\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)+1}{\sqrt{2}}\right)+\log\left(\cos\left(\frac{c\,z}{2}\right)-\sin\left(\frac{c\,z}{2}\right)\right)-\log\left(\cos\left(\frac{c\,z}{2}\right)+\sin\left(\frac{c\,z}{2}\right)\right)+4\sin(c\,z)\right)$$

01.09.21.0043.01

$$\int \sin(2\,c\,z)\cot(c\,z)\,dz = z+\frac{\sin(2\,c\,z)}{2\,c}$$

01.09.21.0044.01

$$\int \sin(3\,c\,z)\cot(c\,z)\,dz = \frac{6\sin(c\,z)+\sin(3\,c\,z)}{3\,c}$$

01.09.21.0045.01

$$\int \sin(4\,c\,z)\cot(c\,z)\,dz = \frac{4\,c\,z+4\sin(2\,c\,z)+\sin(4\,c\,z)}{4\,c}$$

Involving power of sin

Involving $\sin^{\mu}(b\,z)$

01.09.21.0046.01

$$\int \sin^m(b\,z)\cot(c\,z)\,dz = \frac{2^{-m}\log(\sin(c\,z))}{c}\binom{m}{\frac{m}{2}}(1 - m \bmod 2) + \frac{2^{-m}}{b}\sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor}\left((-1)^k\binom{m}{k}e^{-i\,b\,(m-2k)\,z}\left(e^{2\,i\,b\,(m-2k)\,z-\frac{i\,m\,\pi}{2}}\left(b^2\,(m-2k)^2-4\,c^2\right){}_2F_1\left(\frac{b\,(m-2k)}{2\,c},1;\frac{b\,(m-2k)}{2\,c}+1;e^{2\,i\,c\,z}\right)+e^{\frac{i\,m\,\pi}{2}}\left(4\,c^2-b^2\,(m-2k)^2\right){}_2F_1\left(-\frac{b\,(m-2k)}{2\,c},1;1-\frac{b\,(m-2k)}{2\,c};e^{2\,i\,c\,z}\right)-b\,e^{2\,i\,(c+b\,(m-2k))\,z-\frac{i\,m\,\pi}{2}}\,(m-2k)\,(2\,c-b\,(m-2k))\,{}_2F_1\left(\frac{b\,(m-2k)}{2\,c}+1,1;\frac{b\,(m-2k)}{2\,c}+2;e^{2\,i\,c\,z}\right)-b\,e^{\frac{i\,\pi\,m}{2}+2\,i\,c\,z}\,(m-2k)\,(2\,c+b\,(m-2k))\,{}_2F_1\left(1-\frac{b\,(m-2k)}{2\,c},1;2-\frac{b\,(m-2k)}{2\,c};e^{2\,i\,c\,z}\right)\right)\right)\Big/\left((m-2k)\left(4\,c^2-b^2\,(m-2k)^2\right)\right)\;/;\;m\in\mathbb{N}^+$$

01.09.21.0047.01

$$\int \sin^\mu(c\,z)\cot(c\,z)\,dz = \frac{\sin^\mu(c\,z)}{c\,\mu}$$

01.09.21.0048.01

$$\int \sin^2(c\,z)\cot(c\,z)\,dz = -\frac{\cos^2(c\,z)}{2\,c}$$

01.09.21.0049.01

$$\int \sin^3(c\,z)\cot(c\,z)\,dz = \frac{\sin^3(c\,z)}{3\,c}$$

01.09.21.0050.01

$$\int \sin^2(c\,z)\cot(2\,c\,z)\,dz = -\frac{\cos(2\,c\,z)-2\log(\cos(c\,z))}{4\,c}$$

01.09.21.0051.01

$$\int \sin^3(c\,z)\cot(3\,c\,z)\,dz = \frac{3\sqrt{3}\left(\log\left(\sqrt{3}-2\sin(c\,z)\right)-\log\left(2\sin(c\,z)+\sqrt{3}\right)\right)+18\sin(c\,z)-2\sin(3\,c\,z)}{24\,c}$$

01.09.21.0052.01

$$\int \sin^3(c\,z)\cot(4\,c\,z)\,dz = \frac{1}{24\,c}\left((-1)^{3/4}(3+3\,i)\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)-1}{\sqrt{2}}\right)+(-1)^{3/4}(3+3\,i)\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)+1}{\sqrt{2}}\right)+6\log\left(\cos\left(\frac{c\,z}{2}\right)-\sin\left(\frac{c\,z}{2}\right)\right)-6\log\left(\cos\left(\frac{c\,z}{2}\right)+\sin\left(\frac{c\,z}{2}\right)\right)+18\sin(c\,z)-2\sin(3\,c\,z)\right)$$

01.09.21.0053.01

$$\int \sin^{\frac{1}{2}}(c\,z)\cot(c\,z)\,dz = \frac{2\sin^{\frac{1}{2}}(c\,z)}{c}$$

01.09.21.0054.01

$$\int \frac{\cot(c\,z)}{\sin^{\frac{1}{2}}(c\,z)}\,dz = -\frac{2}{c\sin^{\frac{1}{2}}(c\,z)}$$

01.09.21.0055.01

$$\int \frac{\cot(c\,z)}{\sqrt{\sin^3(2\,c\,z)}}\,dz = \left(-4\,F\!\left(\sin^{-1}(\cos(c\,z)-\sin(c\,z)) \,\middle|\, \frac{1}{2}\right)(\cos(c\,z)+\sin(c\,z))\,(\cos(c\,z)\sin(c\,z))^{3/2} - 4\cos^2(c\,z)\sqrt{\sin(2\,c\,z)+1}\right) \Big/ \left(6\,c\,\sqrt{\sin^3(2\,c\,z)}\,\sqrt{\sin(2\,c\,z)+1}\right)$$

Involving rational functions of sin

Involving $(a+b\sin(c\,z))^{-n}$

01.09.21.0056.01

$$\int \frac{\cot(c\,z)}{a+b\sin(c\,z)}\,dz = \frac{\log(\sin(c\,z))-\log(a+b\sin(c\,z))}{a\,c}$$

01.09.21.0057.01

$$\int \frac{A+B\cot(c\,z)}{a+b\sin(c\,z)}\,dz = \frac{1}{c}\left(\frac{2\,A}{\sqrt{a^2-b^2}}\tan^{-1}\!\left(\frac{b+a\tan\left(\frac{c\,z}{2}\right)}{\sqrt{a^2-b^2}}\right) + \frac{B\,(\log(\sin(c\,z))-\log(a+b\sin(c\,z)))}{a}\right)$$

01.09.21.0058.01

$$\int \frac{\cot(c\,z)}{a+b\sin(2\,c\,z)}\,dz = \frac{1}{2\,a\,c}\left(-\frac{2\,b}{\sqrt{a^2-b^2}}\tan^{-1}\!\left(\frac{b+a\tan(c\,z)}{\sqrt{a^2-b^2}}\right) + 2\log(\sin(c\,z)) - \log(a+b\sin(2\,c\,z))\right)$$

01.09.21.0059.01

$$\int \frac{(A+B\sin(c\,z))\cot(c\,z)}{a+b\sin(c\,z)}\,dz = \frac{A\,b\log(\sin(c\,z)) + (a\,B-A\,b)\log(a+b\sin(c\,z))}{a\,b\,c}$$

01.09.21.0060.01

$$\int \frac{\cot(c\,z)}{(a+b\sin(c\,z))^2}\,dz = \frac{1}{a^2\,c}\left(\frac{a}{a+b\sin(c\,z)} + \log(\sin(c\,z)) - \log(a+b\sin(c\,z))\right)$$

Involving algebraic functions of sin

Involving $(a+b\sin(c\,z))^{\beta}$

01.09.21.0061.01

$$\int (a+b\sin(c\,z))^{\beta}\cot(c\,z)\,dz = \frac{(a+b\sin(c\,z))^{\beta}}{c\,\beta}\left(\frac{a\csc(c\,z)}{b}+1\right)^{-\beta} {}_2F_1\!\left(-\beta,-\beta;1-\beta;-\frac{a\csc(c\,z)}{b}\right)$$

01.09.21.0062.01

$$\int \sqrt{a+b\sin(c\,z)}\,\cot(c\,z)\,dz = \frac{\left(2\sqrt{a+b\sin(c\,z)}\right)}{c}\left(1 - \frac{\sqrt{a}\,\csc^{\frac{1}{2}}(c\,z)}{\sqrt{b}\sqrt{\frac{a\csc(c\,z)}{b}+1}}\sinh^{-1}\!\left(\frac{\sqrt{a}\,\csc^{\frac{1}{2}}(c\,z)}{\sqrt{b}}\right)\right)$$

01.09.21.0063.01

$$\int \sqrt{a + a\sin(c z)}\ \cot(c z)\, dz = \frac{\left(2\cos\left(\frac{cz}{2}\right) + \log\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right) - 1\right) - \log\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right) + 1\right) + 2\sin\left(\frac{cz}{2}\right)\right)\sqrt{a\,(\sin(c z) + 1)}}{c\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right)\right)}$$

01.09.21.0064.01

$$\int \sqrt{a - a\sin(c z)}\ \cot(c z)\, dz = \frac{\left(2\cos\left(\frac{cz}{2}\right) + \log\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right) - 1\right) - \log\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right) + 1\right) - 2\sin\left(\frac{cz}{2}\right)\right)\sqrt{a - a\sin(c z)}}{c\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right)\right)}$$

01.09.21.0065.01

$$\int \frac{\cot(c z)}{\sqrt{a + b\sin(c z)}}\, dz = -\frac{2\sqrt{b}}{\sqrt{a}\ c\csc^{\frac{1}{2}}(c z)\sqrt{a + b\sin(c z)}}\sinh^{-1}\left(\frac{\sqrt{a}\ \csc^{\frac{1}{2}}(c z)}{\sqrt{b}}\right)\sqrt{\frac{a\csc(c z)}{b} + 1}$$

01.09.21.0066.01

$$\int \frac{\cot(c z)}{\sqrt{a + a\sin(c z)}}\, dz = \frac{\left(\log\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right) - 1\right) - \log\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right) + 1\right)\right)\left(\cos\left(\frac{cz}{2}\right) + \sin\left(\frac{cz}{2}\right)\right)}{c\sqrt{a\,(\sin(c z) + 1)}}$$

01.09.21.0067.01

$$\int \frac{\cot(c z)}{\sqrt{a - a\sin(c z)}}\, dz = \frac{\left(\log\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right) - 1\right) - \log\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right) + 1\right)\right)\left(\cos\left(\frac{cz}{2}\right) - \sin\left(\frac{cz}{2}\right)\right)}{c\sqrt{a - a\sin(c z)}}$$

Involving cos

Involving cos(*b z*)

01.09.21.0068.01

$$\int \cos(b z)\cot(c z)\, dz = \frac{1}{2\left(b^3 - 4 b c^2\right)} \left(e^{-2 i b z}\left(b\,(b + 2c)\, e^{i(b+2c)z}\, {}_2F_1\left(1 - \frac{b}{2c}, 1; 2 - \frac{b}{2c}; e^{2icz}\right) - (b - 2c)\left((b + 2c)\, e^{ibz}\left(e^{2ibz}\, {}_2F_1\left(\frac{b}{2c}, 1; \frac{b}{2c} + 1; e^{2icz}\right) - {}_2F_1\left(-\frac{b}{2c}, 1; 1 - \frac{b}{2c}; e^{2icz}\right)\right) + b\, e^{i(3b+2c)z}\, {}_2F_1\left(\frac{b}{2c} + 1, 1; \frac{b}{2c} + 2; e^{2icz}\right)\right)\right)\right)$$

01.09.21.0069.01

$$\int \cos(c z)\cot(c z)\, dz = \frac{\cos(c z) - \log\left(\cos\left(\frac{cz}{2}\right)\right) + \log\left(\sin\left(\frac{cz}{2}\right)\right)}{c}$$

01.09.21.0070.01

$$\int \cos(c z)\cot(2 c z)\, dz = \frac{2\cos(c z) - \log\left(\cos\left(\frac{cz}{2}\right)\right) + \log\left(\sin\left(\frac{cz}{2}\right)\right)}{2c}$$

01.09.21.0071.01

$$\int \cos(c z)\cot(3 c z)\, dz = \frac{6\cos(c z) - 2\log\left(\cos\left(\frac{cz}{2}\right)\right) + \log(2\cos(c z) - 1) - \log(2\cos(c z) + 1) + 2\log\left(\sin\left(\frac{cz}{2}\right)\right)}{6c}$$

01.09.21.0072.01

$$\int \cos(c\,z)\cot(4\,c\,z)\,dz = \frac{1}{4\,c}\left((-1)^{3/4}(-1-i)\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)-1}{\sqrt{2}}\right)-(1-i)\sqrt[4]{-1}\,\tanh^{-1}\left(\frac{\tan\left(\frac{c\,z}{2}\right)+1}{\sqrt{2}}\right)+4\cos(c\,z)-\log\left(\cos\left(\frac{c\,z}{2}\right)\right)+\log\left(\sin\left(\frac{c\,z}{2}\right)\right)\right)$$

01.09.21.0073.01

$$\int \cos(2\,c\,z)\cot(c\,z)\,dz = \frac{\cos(2\,c\,z)+2\log(\sin(c\,z))}{2\,c}$$

01.09.21.0074.01

$$\int \cos(3\,c\,z)\cot(c\,z)\,dz = \frac{6\cos(c\,z)+\cos(3\,c\,z)-3\log\left(\cos\left(\frac{c\,z}{2}\right)\right)+3\log\left(\sin\left(\frac{c\,z}{2}\right)\right)}{3\,c}$$

01.09.21.0075.01

$$\int \cos(4\,c\,z)\cot(c\,z)\,dz = \frac{4\cos(2\,c\,z)+\cos(4\,c\,z)+4\log(\sin(c\,z))}{4\,c}$$

Involving power of cos

Involving $\cos^{\mu}(b\,z)$

01.09.21.0076.01

$$\int \cos^{m}(b\,z)\cot(c\,z)\,dz = \frac{2^{-m}\log(\sin(c\,z))\,(1-m \bmod 2)}{c}\binom{m}{\frac{m}{2}}-2^{-m}\sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor}\binom{m}{k}\left(\frac{e^{-i\,b\,(2\,k-m)\,z}\,{}_2F_1\left(1,\,\frac{b\,m}{2\,c}-\frac{b\,k}{c};\,-\frac{b\,k}{c}+\frac{b\,m}{2\,c}+1;\,e^{2\,i\,c\,z}\right)}{b\,(m-2\,k)}+\right.$$
$$\frac{e^{i\,(2\,c+b\,(m-2\,k))\,z}\,{}_2F_1\left(1,\,-\frac{b\,k}{c}+\frac{b\,m}{2\,c}+1;\,-\frac{b\,k}{c}+\frac{b\,m}{2\,c}+2;\,e^{2\,i\,c\,z}\right)}{2\,c+b\,(m-2\,k)}-\frac{e^{i\,b\,(2\,k-m)\,z}\,{}_2F_1\left(1,\,\frac{b\,k}{c}-\frac{b\,m}{2\,c};\,\frac{b\,k}{c}-\frac{b\,m}{2\,c}+1;\,e^{2\,i\,c\,z}\right)}{b\,(m-2\,k)}+$$
$$\left.\frac{e^{i\,(2\,c+2\,b\,k-b\,m)\,z}\,{}_2F_1\left(1,\,\frac{b\,k}{c}-\frac{b\,m}{2\,c}+1;\,\frac{b\,k}{c}-\frac{b\,m}{2\,c}+2;\,e^{2\,i\,c\,z}\right)}{2\,c-b\,(m-2\,k)}\right)\,/;\,m\in\mathbb{N}^{+}$$

01.09.21.0077.01

$$\int \cos^{\mu}(c\,z)\cot(c\,z)\,dz = \frac{\cos^{\mu}(c\,z)\left(-\cot^{2}(c\,z)\right)^{-\frac{\mu}{2}}}{c\,\mu}\,{}_2F_1\left(-\frac{\mu}{2},\,-\frac{\mu}{2};\,1-\frac{\mu}{2};\,\csc^{2}(c\,z)\right)$$

01.09.21.0078.01

$$\int \cos^{2}(c\,z)\cot(c\,z)\,dz = \frac{\cos(2\,c\,z)+4\log(\sin(c\,z))}{4\,c}$$

01.09.21.0079.01

$$\int \cos^{3}(c\,z)\cot(c\,z)\,dz = \frac{15\cos(c\,z)+\cos(3\,c\,z)+12\left(\log\left(\sin\left(\frac{c\,z}{2}\right)\right)-\log\left(\cos\left(\frac{c\,z}{2}\right)\right)\right)}{12\,c}$$

01.09.21.0080.01

$$\int \sqrt{\cos^2(c z)}\, \cot(c z)\, dz = \frac{\sqrt{\cos^2(c z)}\, \left(\cos(c z) - \log\left(\cos\left(\frac{c z}{2}\right)\right) + \log\left(\sin\left(\frac{c z}{2}\right)\right)\right) \sec(c z)}{c}$$

01.09.21.0081.01

$$\int \cos^2(c z) \cot(3 c z)\, dz = \frac{3 \cos(2 c z) + \log(2 \cos(2 c z) + 1) + 4 \log(\sin(c z))}{12 c}$$

01.09.21.0082.01

$$\int \cos^{\frac{1}{2}}(c z) \cot(c z)\, dz = \frac{2 \cos^{\frac{9}{2}}(c z) \csc^4(c z)}{c \left(-\cot^2(c z)\right)^{9/4}}\, {}_2F_1\left(-\frac{1}{4}, -\frac{1}{4}; \frac{3}{4}; \csc^2(c z)\right)$$

01.09.21.0083.01

$$\int \frac{\cot(c z)}{\cos^{\frac{1}{2}}(c z)}\, dz = -\frac{2 \sqrt[4]{-\cot^2(c z)}}{c \cos^{\frac{1}{2}}(c z)}\, {}_2F_1\left(\frac{1}{4}, \frac{1}{4}; \frac{5}{4}; \csc^2(c z)\right)$$

01.09.21.0084.01

$$\int \cos^{\frac{1}{2}}(2 c z) \cot(c z)\, dz = \frac{\cos^{\frac{1}{2}}(2 c z) - \tanh^{-1}\left(\cos^{\frac{1}{2}}(2 c z)\right)}{c}$$

01.09.21.0085.01

$$\int \frac{\cot(c z)}{\cos^{\frac{1}{2}}(2 c z)}\, dz = -\frac{\tanh^{-1}\left(\cos^{\frac{1}{2}}(2 c z)\right)}{c}$$

Involving rational functions of cos

Involving $(a + b \cos(c z))^{-n}$

01.09.21.0086.01

$$\int \frac{\cot(c z)}{a + b \cos(c z)}\, dz = \frac{(a + b) \log\left(\cos\left(\frac{c z}{2}\right)\right) - a \log(a + b \cos(c z)) + (a - b) \log\left(\sin\left(\frac{c z}{2}\right)\right)}{(a - b)(a + b) c}$$

01.09.21.0087.01

$$\int \frac{A + B \cot(c z)}{a + b \cos(c z)}\, dz = \frac{(A + B \cot(c z))\, \sin(c z)}{c (B \cos(c z) + A \sin(c z))} \left(\frac{B \left((a + b) \log\left(\cos\left(\frac{c z}{2}\right)\right) - a \log(a + b \cos(c z)) + (a - b) \log\left(\sin\left(\frac{c z}{2}\right)\right)\right)}{(a - b)(a + b)} - \frac{2 A}{\sqrt{b^2 - a^2}} \tanh^{-1}\left(\frac{(a - b) \tan\left(\frac{c z}{2}\right)}{\sqrt{b^2 - a^2}}\right)\right)$$

01.09.21.0088.01

$$\int \frac{A + B \cot(z)}{1 - \cos(z)}\, dz = \frac{B \cos(z) \left(\log\left(\cos\left(\frac{z}{2}\right)\right) - \log\left(\sin\left(\frac{z}{2}\right)\right)\right) + B \left(-\log\left(\cos\left(\frac{z}{2}\right)\right) + \log\left(\sin\left(\frac{z}{2}\right)\right) + 1\right) + 2 A \sin(z)}{2 (\cos(z) - 1)}$$

01.09.21.0089.01

$$\int \frac{A + B \cot(z)}{1 + \cos(z)}\, dz = \frac{-B \cos(z) \left(\log\left(\cos\left(\frac{z}{2}\right)\right) - \log\left(\sin\left(\frac{z}{2}\right)\right)\right) + B \left(-\log\left(\cos\left(\frac{z}{2}\right)\right) + \log\left(\sin\left(\frac{z}{2}\right)\right) - 1\right) + 2 A \sin(z)}{2 (\cos(z) + 1)}$$

01.09.21.0090.01

$$\int \frac{\cot(c\,z)}{a+b\cos(2\,c\,z)}\,dz = -\frac{\log(a+b\cos(2\,c\,z)) - 2\log(\sin(c\,z))}{2\,(a+b)\,c}$$

01.09.21.0091.01

$$\int \frac{(A+B\cos(c\,z))\cot(c\,z)}{a+b\cos(c\,z)}\,dz = \frac{b\,(a+b)\,(A-B)\log\left(\cos\left(\frac{c\,z}{2}\right)\right) + a\,(a\,B-A\,b)\log(a+b\cos(c\,z)) + (a-b)\,b\,(A+B)\log\left(\sin\left(\frac{c\,z}{2}\right)\right)}{(a-b)\,b\,(a+b)\,c}$$

01.09.21.0092.01

$$\int \frac{(A+B\cos(z))\cot(z)}{\cos(z)-1}\,dz = \frac{1}{4}\left((A+B)\csc^2\left(\frac{z}{2}\right) + 2\,(B-A)\log\left(\cos\left(\frac{z}{2}\right)\right) + 2\,(A+3\,B)\log\left(\sin\left(\frac{z}{2}\right)\right)\right)$$

01.09.21.0093.01

$$\int \frac{(A+B\cos(z))\cot(z)}{\cos(z)+1}\,dz = \frac{\left(2\,(A+B)\log\left(\sin\left(\frac{z}{2}\right)\right) - 2\,(A-3\,B)\log\left(\cos\left(\frac{z}{2}\right)\right)\right)\cos^2\left(\frac{z}{2}\right) - A + B}{2\,(\cos(z)+1)}$$

01.09.21.0094.01

$$\int \frac{\cot(c\,z)}{(a+b\cos(c\,z))^2}\,dz = \frac{1}{c}\left(\frac{a}{\left(a^2-b^2\right)(a+b\cos(c\,z))} + \frac{\log\left(\cos\left(\frac{c\,z}{2}\right)\right)}{(a-b)^2} + \frac{\log\left(\sin\left(\frac{c\,z}{2}\right)\right)}{(a+b)^2} - \frac{\left(a^2+b^2\right)\log(a+b\cos(c\,z))}{\left(a^2-b^2\right)^2}\right)$$

Involving algebraic functions of cos

Involving $(a+b\cos(c\,z))^\beta$

01.09.21.0095.01

$$\int (a+b\cos(c\,z))^\beta \cot(c\,z)\,dz = -\frac{(a+b\cos(c\,z))^{\beta+1}}{2\,(a-b)\,(a+b)\,c\,(\beta+1)}\left((a+b)\,{}_2F_1\left(\beta+1,\,1;\,\beta+2;\,\frac{a+b\cos(c\,z)}{a-b}\right) + (a-b)\,{}_2F_1\left(\beta+1,\,1;\,\beta+2;\,\frac{a+b\cos(c\,z)}{a+b}\right)\right)$$

01.09.21.0096.01

$$\int \sqrt{a+b\cos(c\,z)}\,\cot(c\,z)\,dz = -\frac{\sqrt{-a-b}\,\tan^{-1}\left(\frac{\sqrt{a+b\cos(c\,z)}}{\sqrt{-a-b}}\right) + \sqrt{b-a}\,\tan^{-1}\left(\frac{\sqrt{a+b\cos(c\,z)}}{\sqrt{b-a}}\right) - 2\sqrt{a+b\cos(c\,z)}}{c}$$

01.09.21.0097.01

$$\int \sqrt{a+a\cos(c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{a\,(\cos(c\,z)+1)}\,\left(2\cos\left(\frac{c\,z}{2}\right) - \log\left(\cos\left(\frac{c\,z}{4}\right)\right) + \log\left(\sin\left(\frac{c\,z}{4}\right)\right)\right)\sec\left(\frac{c\,z}{2}\right)}{c}$$

01.09.21.0098.01

$$\int \sqrt{a-a\cos(c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{a-a\cos(c\,z)}\,\csc\left(\frac{c\,z}{2}\right)\left(\log\left(\cos\left(\frac{c\,z}{4}\right)-\sin\left(\frac{c\,z}{4}\right)\right) - \log\left(\cos\left(\frac{c\,z}{4}\right)+\sin\left(\frac{c\,z}{4}\right)\right) + 2\sin\left(\frac{c\,z}{2}\right)\right)}{c}$$

01.09.21.0099.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+b\cos(c\,z)}}\,dz = -\frac{1}{c}\left(\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cos(c\,z)}}{\sqrt{a-b}}\right)}{\sqrt{a-b}} + \frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cos(c\,z)}}{\sqrt{a+b}}\right)}{\sqrt{a+b}}\right)$$

01.09.21.0100.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+a\cos(c\,z)}}\,dz = \frac{\cos\left(\frac{c\,z}{2}\right)\left(\log\left(\sin\left(\frac{c\,z}{4}\right)\right)-\log\left(\cos\left(\frac{c\,z}{4}\right)\right)\right)-1}{c\,\sqrt{a\,(\cos(c\,z)+1)}}$$

01.09.21.0101.01

$$\int \frac{\cot(c\,z)}{\sqrt{a-a\cos(c\,z)}}\,dz = \frac{\left(\log\left(\cos\left(\frac{c\,z}{4}\right)-\sin\left(\frac{c\,z}{4}\right)\right)-\log\left(\cos\left(\frac{c\,z}{4}\right)+\sin\left(\frac{c\,z}{4}\right)\right)\right)\sin\left(\frac{c\,z}{2}\right)-1}{c\,\sqrt{a-a\cos(c\,z)}}$$

Involving $(a+b\cos(2\,c\,z))^{\beta}$

01.09.21.0102.01

$$\int (a+b\cos(2\,c\,z))^{\beta}\cot(c\,z)\,dz = -\frac{(a+b\cos(2\,c\,z))^{\beta+1}}{2\,(a+b)\,c\,(\beta+1)}\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cos(2\,c\,z)}{a+b}\right)$$

01.09.21.0103.01

$$\int \sqrt{a+b\cos(2\,c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{a+b\cos(2\,c\,z)}-\sqrt{a+b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cos(2\,c\,z)}}{\sqrt{a+b}}\right)}{c}$$

01.09.21.0104.01

$$\int \sqrt{a+a\cos(2\,c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{\cos(2\,c\,z)\,a+a}\,\left(\cos(c\,z)-\log\left(\cos\left(\frac{c\,z}{2}\right)\right)+\log\left(\sin\left(\frac{c\,z}{2}\right)\right)\right)\sec(c\,z)}{c}$$

01.09.21.0105.01

$$\int \sqrt{a-a\cos(2\,c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{a-a\cos(2\,c\,z)}}{c}$$

01.09.21.0106.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+b\cos(2\,c\,z)}}\,dz = -\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cos(2\,c\,z)}}{\sqrt{a+b}}\right)}{\sqrt{a+b}\,c}$$

01.09.21.0107.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+a\cos(2\,c\,z)}}\,dz = \frac{\cos(c\,z)\left(\log\left(\sin\left(\frac{c\,z}{2}\right)\right)-\log\left(\cos\left(\frac{c\,z}{2}\right)\right)\right)}{c\,\sqrt{\cos(2\,c\,z)\,a+a}}$$

01.09.21.0108.01

$$\int \frac{\cot(c\,z)}{\sqrt{a-a\cos(2\,c\,z)}}\,dz = -\frac{1}{c\,\sqrt{a-a\cos(2\,c\,z)}}$$

Involving $\cos(c\,z)\,(a+b\cos(2\,c\,z))^{\beta}$

01.09.21.0109.01

$$\int \cos(c\,z)\,(a+b\cos(2\,c\,z))^{\beta}\cot(c\,z)\,dz =$$

$$\frac{\cos(c\,z)\,(a+b\cos(2\,c\,z))^{\beta}}{(2\,\beta\,c+c)\,\sqrt{-\cot^2(c\,z)}}\left(1-\frac{(a+b)\csc^2(c\,z)}{2\,b}\right)^{-\beta}F_1\left(-\beta-\frac{1}{2};-\frac{1}{2},-\beta;\frac{1}{2}-\beta;\csc^2(c\,z),\frac{(a+b)\csc^2(c\,z)}{2\,b}\right)$$

01.09.21.0110.01

$$\int \cos(c\,z)\sqrt{a+b\cos(2\,c\,z)}\,\cot(c\,z)\,dz = \frac{1}{4\sqrt{b}\sqrt{a+b}\,c}\left(\sqrt{a+b}\left(2\sqrt{b}\sqrt{a+b\cos(2\,c\,z)}\,\cos(c\,z)+\sqrt{2}\,(a+3\,b)\log\left(\sqrt{2}\sqrt{b}\,\cos(c\,z)+\sqrt{a+b\cos(2\,c\,z)}\right)\right)-4\sqrt{b}\,(a+b)\tanh^{-1}\left(\frac{\sqrt{a+b}\,\cos(c\,z)}{\sqrt{a+b\cos(2\,c\,z)}}\right)\right)$$

01.09.21.0111.01

$$\int \frac{\cos(c\,z)\cot(c\,z)}{\sqrt{a+b\cos(2\,c\,z)}}\,dz = \frac{1}{2\,c}\left(\frac{\sqrt{2}\,\log\left(\sqrt{2}\sqrt{b}\,\cos(c\,z)+\sqrt{a+b\cos(2\,c\,z)}\right)}{\sqrt{b}} - \frac{2}{\sqrt{a+b}}\tanh^{-1}\left(\frac{\sqrt{a+b}\,\cos(c\,z)}{\sqrt{a+b\cos(2\,c\,z)}}\right)\right)$$

Involving $\cos(2\,c\,z)\,(a+b\cos(2\,c\,z))^{\beta}$

01.09.21.0112.01

$$\int \cos(2\,c\,z)\,(a+b\cos(2\,c\,z))^{\beta}\cot(c\,z)\,dz = \frac{(a+b\cos(2\,c\,z))^{\beta+1}}{2\,b\,(a+b)\,c\,(\beta+1)}\left(a+b-b\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cos(2\,c\,z)}{a+b}\right)\right)$$

01.09.21.0113.01

$$\int \cos(2\,c\,z)\sqrt{a+b\cos(2\,c\,z)}\,\cot(c\,z)\,dz = \frac{\sqrt{a+b}\sqrt{a+b\cos(2\,c\,z)}\,(a+3\,b+b\cos(2\,c\,z))-3\,b\,(a+b)\tanh^{-1}\left(\frac{\sqrt{a+b\cos(2\,c\,z)}}{\sqrt{a+b}}\right)}{3\,b\sqrt{a+b}\,c}$$

01.09.21.0114.01

$$\int \frac{\cos(2\,c\,z)\cot(c\,z)}{\sqrt{a+b\cos(2\,c\,z)}}\,dz = \frac{1}{c}\left(\frac{\sqrt{a+b\cos(2\,c\,z)}}{b} - \frac{1}{\sqrt{a+b}}\tanh^{-1}\left(\frac{\sqrt{a+b\cos(2\,c\,z)}}{\sqrt{a+b}}\right)\right)$$

Involving tan

Involving $\tan(c\,z)$

01.09.21.0115.01

$$\int \tan(c\,z)\cot(c\,z)\,dz = z$$

01.09.21.0116.01

$$\int \tan(c\,z)\cot(2\,c\,z)\,dz = z - \frac{\tan(c\,z)}{2\,c}$$

Involving power of tan

Involving $\tan^{\mu}(c\,z)$

01.09.21.0117.01

$$\int \tan^{\mu}(c z) \cot(c z) \, dz = \frac{\tan^{\mu}(c z)}{c \mu} \, {}_2F_1\left(\frac{\mu}{2}, 1; \frac{\mu}{2} + 1; -\tan^2(c z)\right)$$

01.09.21.0118.01

$$\int \tan^2(c z) \cot(c z) \, dz = -\frac{\log(\cos(c z))}{c}$$

01.09.21.0119.01

$$\int \tan^3(c z) \cot(c z) \, dz = \frac{\tan(c z)}{c} - z$$

Involving sin and cos

Involving $\sin(c z) (a + b \cos(2 c z))^{\beta}$

01.09.21.0120.01

$$\int \sin(c z) (a + b \cos(2 c z))^{\beta} \cot(c z) \, dz = -\frac{(a + b \cos(2 c z))^{\beta+1} \csc(c z)}{2 \sqrt{2} \, b c (\beta + 1)} \sqrt{\frac{b \sin^2(c z)}{a + b}} \, {}_2F_1\left(\beta + 1, \frac{1}{2}; \beta + 2; \frac{a + b \cos(2 c z)}{a + b}\right)$$

01.09.21.0121.01

$$\int \sin(c z) \sqrt{a + b \cos(2 c z)} \cot(c z) \, dz = \frac{\sqrt{2} (a + b) \tan^{-1}\left(\frac{\sqrt{2} \sqrt{b} \sin(c z)}{\sqrt{a + b \cos(2 c z)}}\right) + 2 \sqrt{b} \sqrt{a + b \cos(2 c z)} \sin(c z)}{4 \sqrt{b} \, c}$$

01.09.21.0122.01

$$\int \frac{\sin(c z) \cot(c z)}{\sqrt{a + b \cos(2 c z)}} \, dz = \frac{1}{\sqrt{2} \sqrt{b} \, c} \tan^{-1}\left(\frac{\sqrt{2} \sqrt{b} \sin(c z)}{\sqrt{a + b \cos(2 c z)}}\right)$$

Other integrals

01.09.21.0123.01

$$\int \frac{(A + B \cos(c z)) \cot(c z)}{a + b \sin(c z)} \, dz = \frac{1}{a b \sqrt{a^2 - b^2} \, c} \left(2 \left(a^2 - b^2\right) B \tan^{-1}\left(\frac{b + a \tan\left(\frac{c z}{2}\right)}{\sqrt{a^2 - b^2}}\right) + \sqrt{a^2 - b^2} \left(-a B c z + b (A - B) \log\left(\cos\left(\frac{c z}{2}\right)\right) + b (A + B) \log\left(\sin\left(\frac{c z}{2}\right)\right) - A b \log(a + b \sin(c z))\right)\right)$$

01.09.21.0124.01

$$\int \frac{(A + B \sin(c z)) \cot(c z)}{a + b \cos(c z)} \, dz = \frac{B z}{b} + \frac{2 a B}{b \sqrt{b^2 - a^2} \, c} \tanh^{-1}\left(\frac{(a - b) \tan\left(\frac{c z}{2}\right)}{\sqrt{b^2 - a^2}}\right) + \frac{A \log\left(\cos\left(\frac{c z}{2}\right)\right)}{a c - b c} + \frac{a A \log(a + b \cos(c z))}{b^2 c - a^2 c} + \frac{A \log\left(\sin\left(\frac{c z}{2}\right)\right)}{(a + b) c}$$

01.09.21.0125.01

$$\int \sqrt{\cos(c z)\sin(c z)}\, \cot(c z)\, dz = -\frac{2 \cot(c z) (\cos(c z) \sin(c z))^{3/2}}{5 c \sqrt[4]{\sin^2(c z)}}\, {}_2F_1\left(\frac{5}{4}, \frac{3}{4}; \frac{9}{4}; \cos^2(c z)\right)$$

01.09.21.0126.01

$$\int \frac{\cot(d z)}{\sqrt{a \cos^2(d z) + b \sin(d z)\cos(d z) + c \sin^2(d z)}}\, dz = -\left(2\left(2 c - i b - \sqrt{4 a c - b^2}\right)\left(F\left(\sin^{-1}\left(\sqrt{\frac{\left(2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) + 1)}{\left(-2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) - 1)}}\right) \middle| -\frac{-a - c + \sqrt{4 a c - b^2}}{a + c + \sqrt{4 a c - b^2}}\right) - \right.\right.$$
$$\left. 2\,\Pi\left(\frac{-2 c + i b + \sqrt{4 a c - b^2}}{-2 c - i b - \sqrt{4 a c - b^2}}; \sin^{-1}\left(\sqrt{\frac{\left(2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) + 1)}{\left(-2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) - 1)}}\right) \middle| -\frac{-a - c + \sqrt{4 a c - b^2}}{a + c + \sqrt{4 a c - b^2}}\right)\right)$$
$$(\cos(d z) - i \sin(d z))^2 \sqrt{\frac{\left(2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) + 1)}{\left(-2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) - 1)}}$$
$$\sqrt{-\frac{\left(2 c + i b + \sqrt{4 a c - b^2}\right)(i \tan(d z) + 1)\left(i b + \sqrt{4 a c - b^2} + 2 i c \tan(d z)\right)}{\left(-2 c + i b + \sqrt{4 a c - b^2}\right)^2 (i \tan(d z) - 1)^2}}$$
$$\left.\sqrt{\frac{-2 a - i b + \left(-2 c + i b + \sqrt{4 a c - b^2}\right) i \tan(d z) + \sqrt{4 a c - b^2}}{(a - c + i b)(i \tan(d z) - 1)}}\right) \Bigg/$$
$$\left(\left(-2 c - i b - \sqrt{4 a c - b^2}\right) d \sqrt{-\frac{\left(a + c + \sqrt{4 a c - b^2}\right)(\cos(2 d z) + i \sin(2 d z))}{a - c + i b}}\right.$$
$$\left.\sqrt{a + c + (a - c)\cos(2 d z) + b \sin(2 d z)}\right)$$

Involving trigonometric and a power functions

Involving sin and power

Involving $z^n \sin(a + b z) \cot(c z)$

01.09.21.0127.01

$$\int z^n \sin(a+bz)\cot(cz)\,dz = -\frac{1}{2} n! \left(e^{-ia-ibz} \sum_{j=0}^{n} \frac{(ib)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(-\frac{b}{2c}, \ldots, -\frac{b}{2c}, 1; 1-\frac{b}{2c}, \ldots, 1-\frac{b}{2c}; e^{2icz}\right) + e^{ia+ibz} \sum_{j=0}^{n} \frac{(-1)^j (ib)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b}{2c}, \ldots, \frac{b}{2c}, 1; \frac{b}{2c}+1, \ldots, \frac{b}{2c}+1; e^{2icz}\right) - e^{-ia+i(2c-b)z} \sum_{j=0}^{n} \frac{(-1)^j (-ib+2ic)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{2c-b}{2c}, \ldots, \frac{2c-b}{2c}, 1; \frac{2c-b}{2c}+1, \ldots, \frac{2c-b}{2c}+1; e^{2icz}\right) + e^{ia+i(b+2c)z} \sum_{j=0}^{n} \frac{(-1)^j (ib+2ic)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b+2c}{2c}, \ldots, \frac{b+2c}{2c}, 1; \frac{b+2c}{2c}+1, \ldots, \frac{b+2c}{2c}+1; e^{2icz}\right)\right) /; n \in \mathbb{N}$$

01.09.21.0128.01

$$\int z^n \sin(bz)\cot(cz)\,dz = -\frac{1}{2} n! \left(e^{-ibz} \sum_{j=0}^{n} \frac{(ib)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(-\frac{b}{2c}, \ldots, -\frac{b}{2c}, 1; 1-\frac{b}{2c}, \ldots, 1-\frac{b}{2c}; e^{2icz}\right) + e^{ibz} \sum_{j=0}^{n} \frac{(-1)^j (ib)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b}{2c}, \ldots, \frac{b}{2c}, 1; \frac{b}{2c}+1, \ldots, \frac{b}{2c}+1; e^{2icz}\right) - e^{i(2c-b)z} \sum_{j=0}^{n} \frac{(-1)^j (-ib+2ic)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{2c-b}{2c}, \ldots, \frac{2c-b}{2c}, 1; \frac{2c-b}{2c}+1, \ldots, \frac{2c-b}{2c}+1; e^{2icz}\right) + e^{i(b+2c)z} \sum_{j=0}^{n} \frac{(-1)^j (ib+2ic)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b+2c}{2c}, \ldots, \frac{b+2c}{2c}, 1; \frac{b+2c}{2c}+1, \ldots, \frac{b+2c}{2c}+1; e^{2icz}\right)\right) /; n \in \mathbb{N}$$

Involving powers of sin and power

Involving $z^n \operatorname{sih}^m(b z) \cot(c z)$

01.09.21.0129.01

$$\int z^n \sin^m(b\,z)\cot(c\,z)\,dz = -i\,n!\,(2\,i)^{-m}\sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor}(-1)^k\binom{m}{k}\Bigg(e^{i\,b\,(m-2k)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(i\,b\,(m-2k))^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\Big(\frac{b\,(m-2k)}{2c},\ldots,\frac{b\,(m-2k)}{2c},1;\frac{b\,(m-2k)}{2c}+1,\ldots,\frac{b\,(m-2k)}{2c}+1;e^{2\,i\,c\,z}\Big)+(-1)^m\Big(e^{-i\,b\,(m-2k)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(-i\,b\,(m-2k))^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\Big(-\frac{b\,(m-2k)}{2c},\ldots,-\frac{b\,(m-2k)}{2c},1;1-\frac{b\,(m-2k)}{2c},\ldots,1-\frac{b\,(m-2k)}{2c};e^{2\,i\,c\,z}\Big)+e^{i\,(2c-b\,(m-2k))\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c-i\,b\,(m-2k))^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\Big(\frac{2c-b\,(m-2k)}{2c},\ldots,\frac{2c-b\,(m-2k)}{2c},1;\frac{2c-b\,(m-2k)}{2c}+1,\ldots,\frac{2c-b\,(m-2k)}{2c}+1;e^{2\,i\,c\,z}\Big)\Big)+e^{i\,(2c+b\,(m-2k))\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c+i\,b\,(m-2k))^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\Big(\frac{2c+b\,(m-2k)}{2c},\ldots,\frac{2c+b\,(m-2k)}{2c},1;\frac{2c+b\,(m-2k)}{2c}+1,\ldots,\frac{2c+b\,(m-2k)}{2c}+1;e^{2\,i\,c\,z}\Big)\Bigg)-i\,2^{-m}\binom{m}{\frac{m}{2}}\,n!\,(1-m\bmod 2)\Big(\frac{z^{n+1}}{(n+1)!}+2\,e^{2\,i\,c\,z}\sum_{j=0}^{n}\frac{(-1)^j\,2^{-j-1}\,(i\,c)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}(1,\ldots,1;2,\ldots,2;e^{2\,i\,c\,z})\Big)\;/;\;n\in\mathbb{N}\land m\in\mathbb{N}^+$$

Involving cos and power

Involving $z^n \cos(a+b\,z)\cot(c\,z)$

01.09.21.0130.01

$$\int z^n \cos(a+b\,z)\cot(c\,z)\,dz = -\frac{i}{2}\,n!\left(e^{-i\,a-i\,b\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(-i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(-\frac{b}{2\,c},\,\ldots,\,-\frac{b}{2\,c},\,1;\,1-\frac{b}{2\,c},\,\ldots,\,1-\frac{b}{2\,c};\,e^{2\,i\,c\,z}\right)+\right.$$
$$e^{-i\,a+i\,(2\,c-b)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c-i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{-b+2\,c}{2\,c},\,\ldots,\,\frac{-b+2\,c}{2\,c},\,1;\,\frac{-b+2\,c}{2\,c}+1,\,\ldots,\,\frac{-b+2\,c}{2\,c}+1;\,e^{2\,i\,c\,z}\right)+$$
$$e^{i\,a+i\,b\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b}{2\,c},\,\ldots,\,\frac{b}{2\,c},\,1;\,\frac{b}{2\,c}+1,\,\ldots,\,\frac{b}{2\,c}+1;\,e^{2\,i\,c\,z}\right)+$$
$$\left.e^{i\,a+i\,(2\,c+b)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c+i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2\,c}{2\,c},\,\ldots,\,\frac{b+2\,c}{2\,c},\,1;\,\frac{b+2\,c}{2\,c}+1,\,\ldots,\,\frac{b+2\,c}{2\,c}+1;\,e^{2\,i\,c\,z}\right)\right)\,/;\,n\in\mathbb{N}$$

01.09.21.0131.01

$$\int z^n \cos(b\,z)\cot(c\,z)\,dz = -\frac{i}{2}\,n!\left(e^{-i\,b\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(-i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(-\frac{b}{2\,c},\,\ldots,\,-\frac{b}{2\,c},\,1;\,1-\frac{b}{2\,c},\,\ldots,\,1-\frac{b}{2\,c};\,e^{2\,i\,c\,z}\right)+\right.$$
$$e^{i\,(2\,c-b)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c-i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{-b+2\,c}{2\,c},\,\ldots,\,\frac{-b+2\,c}{2\,c},\,1;\,\frac{-b+2\,c}{2\,c}+1,\,\ldots,\,\frac{-b+2\,c}{2\,c}+1;\,e^{2\,i\,c\,z}\right)+$$
$$e^{i\,b\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b}{2\,c},\,\ldots,\,\frac{b}{2\,c},\,1;\,\frac{b}{2\,c}+1,\,\ldots,\,\frac{b}{2\,c}+1;\,e^{2\,i\,c\,z}\right)+$$
$$\left.e^{i\,(2\,c+b)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(2\,i\,c+i\,b)^{-j-1}\,z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2\,c}{2\,c},\,\ldots,\,\frac{b+2\,c}{2\,c},\,1;\,\frac{b+2\,c}{2\,c}+1,\,\ldots,\,\frac{b+2\,c}{2\,c}+1;\,e^{2\,i\,c\,z}\right)\right)\,/;\,n\in\mathbb{N}$$

Involving powers of cos and power

Involving $z^n \cos^m(b\,z)\cot(c\,z)$

01.09.21.0132.01

$$\int z^n \cos^m(b z) \cot(c z) \, dz = -i\, 2^{-m} \binom{m}{\frac{m}{2}} n! \, (1 - m \bmod 2) \left(\frac{z^{n+1}}{(n+1)!} + 2\, e^{2 i c z} \sum_{j=0}^{n} \frac{(-1)^j\, 2^{-j-1} (i c)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+3}F_{j+2}(1, \ldots, 1, 2; 2, \ldots, 2; e^{2 i c z}) \right) - i\, 2^{-m} n! \sum_{k=0}^{\lfloor \frac{m-1}{2} \rfloor} \binom{m}{k} \left(e^{-i b (m-2k) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(-\frac{b(m-2k)}{2c}, \ldots, -\frac{b(m-2k)}{2c}, 1; 1 - \frac{b(m-2k)}{2c}, \ldots, 1 - \frac{b(m-2k)}{2c}; e^{2 i c z}\right) + e^{i b (m-2k) z} \sum_{j=0}^{n} \frac{(-1)^j (i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b(m-2k)}{2c}, \ldots, \frac{b(m-2k)}{2c}, 1; \frac{b(m-2k)}{2c} + 1, \ldots, \frac{b(m-2k)}{2c} + 1; e^{2 i c z}\right) + e^{(2 i c - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{2c - b(m-2k)}{2c}, \ldots, \frac{2c - b(m-2k)}{2c}, 1; \frac{2c - b(m-2k)}{2c} + 1, \ldots, \frac{2c - b(m-2k)}{2c} + 1; e^{2 i c z}\right) + e^{(2 i c + i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{2c + b(m-2k)}{2c}, \ldots, \frac{2c + b(m-2k)}{2c}, 1; \frac{2c + b(m-2k)}{2c} + 1, \ldots, \frac{2c + b(m-2k)}{2c} + 1; e^{2 i c z}\right) \right) /; n \in \mathbb{N} \land u \in \mathbb{N}^+$$

Involving trigonometric and exponential functions

Involving sin and exp

Involving $e^{p z} \sin(b z)$

01.09.21.0133.01

$$\int e^{p z} \sin(b z) \cot(c z) \, dz = \frac{1}{2} \left(-\frac{e^{i c z + (i b - i c + p) z} \, {}_2F_1\left(1, \frac{b}{2c} - \frac{i p}{2c}; \frac{b}{2c} - \frac{i p}{2c} + 1; e^{2 i c z}\right)}{i b + p} - \frac{e^{i c z + (i b + i c + p) z} \, {}_2F_1\left(1, \frac{b}{2c} - \frac{i p}{2c} + 1; \frac{b}{2c} - \frac{i p}{2c} + 2; e^{2 i c z}\right)}{i b + 2 i c + p} + \frac{e^{i c z + (-i b - i c + p) z} \, {}_2F_1\left(1, -\frac{b}{2c} - \frac{i p}{2c}; -\frac{b}{2c} - \frac{i p}{2c} + 1; e^{2 i c z}\right)}{-i b + p} + \frac{e^{i c z + (-i b + i c + p) z} \, {}_2F_1\left(1, -\frac{b}{2c} - \frac{i p}{2c} + 1; -\frac{b}{2c} - \frac{i p}{2c} + 2; e^{2 i c z}\right)}{-i b + 2 i c + p} \right)$$

01.09.21.0134.01

$$\int e^{i b z} \sin(b z) \cot(c z) \, dz = \frac{1}{4 b c (b+c)} \left(i \left(c (b+c) e^{2 i b z} {}_2F_1\left(\frac{b}{c}, 1; \frac{b+c}{c}; e^{2 i c z}\right) + b \left(c\, e^{2 i (b+c) z} {}_2F_1\left(\frac{b+c}{c}, 1; \frac{b}{c} + 2; e^{2 i c z}\right) + 2 (b+c) \log(\sin(c z)) \right) \right) \right)$$

01.09.21.0135.01

$$\int e^{-i b z} \sin(b z) \cot(c z) \, dz = \frac{1}{4 b (b-c) c} \left(i\, e^{-2 i b z} \left(b c\, e^{2 i c z} {}_2F_1\left(1 - \frac{b}{c}, 1; 2 - \frac{b}{c}; e^{2 i c z}\right) - (b-c) \left(2 b\, e^{2 i b z} \log(\sin(c z)) - c\, {}_2F_1\left(-\frac{b}{c}, 1; 1 - \frac{b}{c}; e^{2 i c z}\right) \right) \right) \right)$$

01.09.21.0136.01

$$\int e^{i (b - 2 c) z} \sin(a z) \cot(c z) \, dz = \frac{1}{2} i \left(\frac{e^{-i (a-b) z} {}_2F_1\left(\frac{b-a}{2 c}, 1; \frac{b-a}{2 c} + 1; e^{2 i c z}\right)}{a - b} + \frac{e^{i (a+b) z} {}_2F_1\left(\frac{a+b}{2 c}, 1; \frac{a+b}{2 c} + 1; e^{2 i c z}\right)}{a + b} + \frac{e^{i (a+b-2 c) z} {}_2F_1\left(\frac{a+b-2 c}{2 c}, 1; \frac{a+b}{2 c}; e^{2 i c z}\right)}{a + b - 2 c} + \frac{e^{-i (a-b+2 c) z} {}_2F_1\left(-\frac{a-b+2 c}{2 c}, 1; \frac{b-a}{2 c}; e^{2 i c z}\right)}{a - b + 2 c} \right)$$

01.09.21.0137.01

$$\int e^{-i (b + 2 c) z} \sin(a z) \cot(c z) \, dz = \frac{1}{2} i \left(\frac{e^{i (a-b) z} {}_2F_1\left(\frac{a-b}{2 c}, 1; \frac{a-b}{2 c} + 1; e^{2 i c z}\right)}{a - b} + \frac{e^{i (a-b-2 c) z} {}_2F_1\left(\frac{a-b-2 c}{2 c}, 1; \frac{a-b}{2 c}; e^{2 i c z}\right)}{a - b - 2 c} + \frac{e^{-i (a+b) z} {}_2F_1\left(-\frac{a+b}{2 c}, 1; -\frac{a+b-2 c}{2 c}; e^{2 i c z}\right)}{a + b} + \frac{e^{-i (a+b+2 c) z} {}_2F_1\left(-\frac{a+b+2 c}{2 c}, 1; -\frac{a+b}{2 c}; e^{2 i c z}\right)}{a + b + 2 c} \right)$$

Involving powers of sin and exp

Involving $e^{p z} \sin^m(b z)$

01.09.21.0138.01

$$\int e^{p z} \sin^m(b z) \cot(c z)\, dz = -\frac{1}{(2 c - i p) p} \left(2^{-m} \binom{m}{\frac{m}{2}} \left(e^{p z} (2 i c + p)\, {}_2F_1\left(-\frac{i p}{2 c}, 1; 1 - \frac{i p}{2 c}; e^{2 i c z}\right) + e^{(2 i c + p) z} p\, {}_2F_1\left(1 - \frac{i p}{2 c}, 1; 2 - \frac{i p}{2 c}; e^{2 i c z}\right)\right) (1 - m \bmod 2)\right) - 2^{-m} \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} (-1)^k \binom{m}{k} \left(\left(e^{\frac{i m \pi}{2}} \left(e^{(2 i c - i b (m - 2 k) + p) z} (p - i b (m - 2 k))\, {}_2F_1\left(\frac{2 c + 2 b k - b m - i p}{2 c}, 1; \frac{4 c + 2 b k - b m - i p}{2 c}; e^{2 i c z}\right) + e^{(p - i b (m - 2 k)) z} (2 i c - i b (m - 2 k) + p)\, {}_2F_1\left(-\frac{b (m - 2 k) + i p}{2 c}, 1; \frac{2 c + 2 b k - b m - i p}{2 c}; e^{2 i c z}\right)\right)\right) \Big/ ((2 c + 2 b k - b m - i p) (b i (2 k - m) + p)) + \left(e^{-\frac{1}{2} i m \pi} \left(e^{(2 i c + i b (m - 2 k) + p) z} (b i (m - 2 k) + p)\, {}_2F_1\left(\frac{2 c - 2 b k + b m - i p}{2 c}, 1; \frac{4 c - 2 b k + b m - i p}{2 c}; e^{2 i c z}\right) + e^{(b i (m - 2 k) + p) z} (2 i c + i b (m - 2 k) + p)\, {}_2F_1\left(\frac{b (m - 2 k) - i p}{2 c}, 1; \frac{2 c - 2 b k + b m - i p}{2 c}; e^{2 i c z}\right)\right)\right) \Big/ ((2 c + b (m - 2 k) - i p) (b i (m - 2 k) + p))\right) /; m \in \mathbb{N}^+$$

Involving cos and exp

Involving $e^{p z} \cos(b z)$

01.09.21.0139.01

$$\int e^{p z} \cos(b z) \cot(c z)\, dz = \frac{1}{2} \left(-\frac{e^{(i b + p) z}\, {}_2F_1\left(\frac{b - i p}{2 c}, 1; \frac{b - i p}{2 c} + 1; e^{2 i c z}\right)}{b - i p} + \frac{e^{(-i b + p) z}\, {}_2F_1\left(-\frac{b + i p}{2 c}, 1; 1 - \frac{b + i p}{2 c}; e^{2 i c z}\right)}{b + i p} + \frac{e^{(-i b + 2 i c + p) z}\, {}_2F_1\left(-\frac{b - 2 c + i p}{2 c}, 1; -\frac{b - 4 c + i p}{2 c}; e^{2 i c z}\right)}{b - 2 c + i p} - \frac{e^{(i b + 2 i c + p) z}\, {}_2F_1\left(\frac{b + 2 c - i p}{2 c}, 1; \frac{b + 4 c - i p}{2 c}; e^{2 i c z}\right)}{b + 2 c - i p}\right)$$

01.09.21.0140.01

$$\int e^{i b z} \cos(b z) \cot(c z)\, dz = \frac{1}{4 b c (b + c)} \left(b \left(2 (b + c) \log(\sin(c z)) - c\, e^{2 i (b + c) z}\, {}_2F_1\left(\frac{b + c}{c}, 1; \frac{b}{c} + 2; e^{2 i c z}\right)\right) - c (b + c)\, e^{2 i b z}\, {}_2F_1\left(\frac{b}{c}, 1; \frac{b + c}{c}; e^{2 i c z}\right)\right)$$

01.09.21.0141.01

$$\int e^{-i b z} \cos(b z) \cot(c z)\, dz = \frac{1}{4 b (b - c) c} \left(e^{-2 i b z} \left(b c\, e^{2 i c z}\, {}_2F_1\left(1 - \frac{b}{c}, 1; 2 - \frac{b}{c}; e^{2 i c z}\right) + (b - c) \left(c\, {}_2F_1\left(-\frac{b}{c}, 1; 1 - \frac{b}{c}; e^{2 i c z}\right) + 2 b\, e^{2 i b z} \log(\sin(c z))\right)\right)\right)$$

01.09.21.0142.01

$$\int e^{i(b-2c)z}\cos(a z)\cot(c z)\,dz = \frac{1}{2}\left(\frac{e^{-i(a-b)z}\,{}_2F_1\left(\frac{b-a}{2c}, 1; \frac{b-a}{2c}+1; e^{2icz}\right)}{a-b} + \frac{e^{-i(a-b+2c)z}\,{}_2F_1\left(-\frac{a-b+2c}{2c}, 1; \frac{b-a}{2c}; e^{2icz}\right)}{a-b+2c} - \frac{e^{i(a+b)z}\,{}_2F_1\left(\frac{a+b}{2c}, 1; \frac{a+b}{2c}+1; e^{2icz}\right)}{a+b} - \frac{e^{i(a+b-2c)z}\,{}_2F_1\left(\frac{a+b-2c}{2c}, 1; \frac{a+b}{2c}; e^{2icz}\right)}{a+b-2c}\right)$$

01.09.21.0143.01

$$\int e^{-i(b+2c)z}\cos(a z)\cot(c z)\,dz = \frac{1}{2}\left(-\frac{e^{i(a-b)z}\,{}_2F_1\left(\frac{a-b}{2c}, 1; \frac{a-b}{2c}+1; e^{2icz}\right)}{a-b} + \frac{e^{-i(a+b)z}\,{}_2F_1\left(-\frac{a+b}{2c}, 1; -\frac{a+b-2c}{2c}; e^{2icz}\right)}{a+b} + \frac{e^{-i(a+b+2c)z}\,{}_2F_1\left(-\frac{a+b+2c}{2c}, 1; -\frac{a+b}{2c}; e^{2icz}\right)}{a+b+2c} - \frac{e^{i(a-b-2c)z}\,{}_2F_1\left(\frac{a-b-2c}{2c}, 1; \frac{a-b}{2c}; e^{2icz}\right)}{a-b-2c}\right)$$

Involving powers of cos and exp

Involving $e^{p z}\cos^m(b z)$

01.09.21.0144.01

$$\int e^{p z}\cos^m(b z)\cot(c z)\,dz = -i\,2^{-m}\binom{m}{\frac{m}{2}}\left(\frac{e^{p z}}{p}\,{}_2F_1\left(1, -\frac{i p}{2c}; 1-\frac{i p}{2c}; e^{2icz}\right) + \frac{e^{(2ic+p)z}}{2ic+p}\,{}_2F_1\left(1, 1-\frac{i p}{2c}; 2-\frac{i p}{2c}; e^{2icz}\right)\right)(1-m \bmod 2) - i\,2^{-m}\sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor}\binom{m}{k}\left(\frac{e^{(-2bik+ibm+p)z}}{b\,i\,(m-2k)+p}\,{}_2F_1\left(1, -\frac{b k}{c}+\frac{b m}{2c}-\frac{i p}{2c}; -\frac{b k}{c}+\frac{b m}{2c}-\frac{i p}{2c}+1; e^{2icz}\right) + \frac{e^{(2ic-2ibk+ibm+p)z}}{2ic+ib(m-2k)+p}\,{}_2F_1\left(1, -\frac{b k}{c}+\frac{b m}{2c}-\frac{i p}{2c}+1; -\frac{b k}{c}+\frac{b m}{2c}-\frac{i p}{2c}+2; e^{2icz}\right) + \frac{e^{(bi(2k-m)+p)z}}{p-ib(m-2k)}\,{}_2F_1\left(1, \frac{b k}{c}-\frac{b m}{2c}-\frac{i p}{2c}; \frac{b k}{c}-\frac{b m}{2c}-\frac{i p}{2c}+1; e^{2icz}\right) + \frac{e^{(2ic+ib(2k-m)+p)z}}{2ic-ib(m-2k)+p}\,{}_2F_1\left(1, \frac{b k}{c}-\frac{b m}{2c}-\frac{i p}{2c}+1; \frac{b k}{c}-\frac{b m}{2c}-\frac{i p}{2c}+2; e^{2icz}\right)\right) /; m \in \mathbb{N}^+$$

Involving trigonometric, exponential and a power functions

Involving sin, exp and power

Involving $z^n e^{p z}\sin(a+b z)\cot(c z)$

01.09.21.0145.01

$$\int z^n e^{p z} \sin(a + b z) \cot(c z) \, dz = \frac{1}{2} n! \left(e^{-i a + (-i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p}{2 c}, \ldots, \frac{-b - i p}{2 c}, 1; \frac{-b - i p}{2 c} + 1, \ldots, \frac{-b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{-i a + (2 i c - i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c - i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c}{2 c}, \ldots, \frac{-b - i p + 2 c}{2 c}, 1; \frac{-b - i p + 2 c}{2 c} + 1, \ldots, \frac{-b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) - e^{i a + (i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p}{2 c}, \ldots, \frac{b - i p}{2 c}, 1; \frac{b - i p}{2 c} + 1, \ldots, \frac{b - i p}{2 c} + 1; e^{2 i c z} \right) - e^{i a + (2 i c + i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p + 2 c}{2 c}, \ldots, \frac{b - i p + 2 c}{2 c}, 1; \frac{b - i p + 2 c}{2 c} + 1, \ldots, \frac{b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) \right) /; n \in \mathbb{N}$$

01.09.21.0146.01

$$\int z^n e^{p z} \sin(b z) \cot(c z) \, dz = \frac{1}{2} n! \left(e^{(-i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p}{2 c}, \ldots, \frac{-b - i p}{2 c}, 1; \frac{-b - i p}{2 c} + 1, \ldots, \frac{-b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{(2 i c - i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c - i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c}{2 c}, \ldots, \frac{-b - i p + 2 c}{2 c}, 1; \frac{-b - i p + 2 c}{2 c} + 1, \ldots, \frac{-b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) - e^{(i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p}{2 c}, \ldots, \frac{b - i p}{2 c}, 1; \frac{b - i p}{2 c} + 1, \ldots, \frac{b - i p}{2 c} + 1; e^{2 i c z} \right) - e^{(2 i c + i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + i b + p)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p + 2 c}{2 c}, \ldots, \frac{b - i p + 2 c}{2 c}, 1; \frac{b - i p + 2 c}{2 c} + 1, \ldots, \frac{b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) \right) /; n \in \mathbb{N}$$

Involving powers of sin, exp and power

Involving $z^n e^{p z} \sin^m(b z) \cot(c z)$

01.09.21.0147.01

$$\int z^n e^{p z} \sin^m(b z) \cot(c z)\, dz = -i (2 i)^{-m} n! \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} (-1)^k \binom{m}{k} \Bigg((-1)^m \Bigg(e^{(p - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (p - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{-i p - b(-2k+m)}{2c}, \ldots, \frac{-i p - b(-2k+m)}{2c}, 1; \frac{-i p - b(-2k+m)}{2c} + 1, \ldots, \frac{-i p - b(-2k+m)}{2c} + 1; e^{2 i c z} \right) + e^{(2 i c + p - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{-i p - b(-2k+m) + 2c}{2c}, \ldots, \frac{-i p - b(-2k+m) + 2c}{2c}, 1; \frac{-i p - b(-2k+m) + 2c}{2c} + 1, \ldots, \frac{-i p - b(-2k+m) + 2c}{2c} + 1; e^{2 i c z} \right) \Bigg) + e^{(p + b i (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (p + b i (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{-i p + b(-2k+m)}{2c}, \ldots, \frac{-i p + b(-2k+m)}{2c}, 1; \frac{-i p + b(-2k+m)}{2c} + 1, \ldots, \frac{-i p + b(-2k+m)}{2c} + 1; e^{2 i c z} \right) + e^{(2 i c + p + b i (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p + b i (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{-i p + b(-2k+m) + 2c}{2c}, \ldots, \frac{-i p + b(-2k+m) + 2c}{2c}, 1; \frac{-i p + b(-2k+m) + 2c}{2c} + 1, \ldots, \frac{-i p + b(-2k+m) + 2c}{2c} + 1; e^{2 i c z} \right) \Bigg) - i\, 2^{-m} \binom{m}{\frac{m}{2}} n! (1 - m \bmod 2) \left(e^{p z} \sum_{j=0}^{n} \frac{(-1)^j p^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(-\frac{i p}{2c}, \ldots, -\frac{i p}{2c}, 1; 1 - \frac{i p}{2c}, \ldots, 1 - \frac{i p}{2c}; e^{2 i c z} \right) + e^{(2 i c + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(1 - \frac{i p}{2c}, \ldots, 1 - \frac{i p}{2c}, 1; 2 - \frac{i p}{2c}, \ldots, 2 - \frac{i p}{2c}; e^{2 i c z} \right) \right) /; n \in \mathbb{N} \land m \in \mathbb{N}^+$$

Involving cos, exp and power

Involving $z^n e^{p z} \cos(a + b z) \cot(c z)$

01.09.21.0148.01

$$\int z^n e^{p z} \cos(a + b z) \cot(c z) \, dz = -\frac{i}{2} n! \left(e^{-i a + (-i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - i p}{2 c}, \ldots, \frac{-b - i p}{2 c}, 1; \frac{-b - i p}{2 c} + 1, \ldots, \frac{-b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{-i a + (2 i c - i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c - i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c}{2 c}, \ldots, \frac{-b - i p + 2 c}{2 c}, 1; \frac{-b - i p + 2 c}{2 c} + 1, \ldots, \frac{-b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) + e^{i a + (i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b - i p}{2 c}, \ldots, \frac{b - i p}{2 c}, 1; \frac{b - i p}{2 c} + 1, \ldots, \frac{b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{i a + (2 i c + i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + 2 c - i p}{2 c}, \ldots, \frac{b + 2 c - i p}{2 c}, 1; \frac{b + 2 c - i p}{2 c} + 1, \ldots, \frac{b + 2 c - i p}{2 c} + 1; e^{2 i c z} \right) \right) /; n \in \mathbb{N}$$

01.09.21.0149.01

$$\int z^n e^{p z} \cos(b z) \cot(c z) \, dz = -\frac{i}{2} n! \left(e^{(-i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - i p}{2 c}, \ldots, \frac{-b - i p}{2 c}, 1; \frac{-b - i p}{2 c} + 1, \ldots, \frac{-b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{(2 i c - i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c - i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c}{2 c}, \ldots, \frac{-b - i p + 2 c}{2 c}, 1; \frac{-b - i p + 2 c}{2 c} + 1, \ldots, \frac{-b - i p + 2 c}{2 c} + 1; e^{2 i c z} \right) + e^{(i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b - i p}{2 c}, \ldots, \frac{b - i p}{2 c}, 1; \frac{b - i p}{2 c} + 1, \ldots, \frac{b - i p}{2 c} + 1; e^{2 i c z} \right) + e^{(2 i c + i b + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + i b + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + 2 c - i p}{2 c}, \ldots, \frac{b + 2 c - i p}{2 c}, 1; \frac{b + 2 c - i p}{2 c} + 1, \ldots, \frac{b + 2 c - i p}{2 c} + 1; e^{2 i c z} \right) \right) /; n \in \mathbb{N}$$

Involving powers of cos, exp and power

Involving $z^n e^{p z} \cos^m(b z) \cot(c z)$

01.09.21.0150.01

$$\int z^n e^{p z} \cos^m(b z) \cot(c z) \, dz = -i \, 2^{-m} n! \sum_{k=0}^{\lfloor \frac{m-1}{2} \rfloor} \binom{m}{k} \Bigg(e^{(p - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (p - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(\frac{-i p - b(-2k+m)}{2c}, \ldots, \frac{-i p - b(-2k+m)}{2c}, 1; \frac{-i p - b(-2k+m)}{2c} + 1, \ldots, \frac{-i p - b(-2k+m)}{2c} + 1; e^{2 i c z} \bigg) + e^{(2 i c + p - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(\frac{-i p - b(-2k+m) + 2c}{2c}, \ldots, \frac{-i p - b(-2k+m) + 2c}{2c}, 1; \frac{-i p - b(-2k+m) + 2c}{2c} + 1, \ldots, \frac{-i p - b(-2k+m) + 2c}{2c} + 1; e^{2 i c z} \bigg) + e^{(p + b i (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (p + b i (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(\frac{-i p + b(-2k+m)}{2c}, \ldots, \frac{-i p + b(-2k+m)}{2c}, 1; \frac{-i p + b(-2k+m)}{2c} + 1, \ldots, \frac{-i p + b(-2k+m)}{2c} + 1; e^{2 i c z} \bigg) + e^{(2 i c + p + b i (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p + b i (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(\frac{-i p + b(-2k+m) + 2c}{2c}, \ldots, \frac{-i p + b(-2k+m) + 2c}{2c}, 1; \frac{-i p + b(-2k+m) + 2c}{2c} + 1, \ldots, \frac{-i p + b(-2k+m) + 2c}{2c} + 1; e^{2 i c z} \bigg) \Bigg) - i \, 2^{-m} \binom{m}{\frac{m}{2}} n! \, (1 - m \bmod 2) \Bigg(e^{p z} \sum_{j=0}^{n} \frac{(-1)^j p^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(-\frac{i p}{2c}, \ldots, -\frac{i p}{2c}, 1; 1 - \frac{i p}{2c}, \ldots, 1 - \frac{i p}{2c}; e^{2 i c z} \bigg) + e^{(2 i c + p) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\bigg(1 - \frac{i p}{2c}, \ldots, 1 - \frac{i p}{2c}, 1; 2 - \frac{i p}{2c}, \ldots, 2 - \frac{i p}{2c}; e^{2 i c z} \bigg) \Bigg) /; n \in \mathbb{N} \land m \in \mathbb{N}^+$$

Involving functions of the direct function

Involving powers of the direct function

Involving powers of cot

Linear argument

01.09.21.0151.01

$$\int \cot^{\nu}(c z) \, dz = -\frac{\cot^{\nu+1}(c z)}{\nu c + c} \, {}_2F_1\left(\frac{\nu+1}{2}, 1; \frac{\nu+3}{2}; -\cot^2(c z) \right)$$

01.09.21.0152.01

$$\int \cot^2(c z) \, dz = -\frac{c z + \cot(c z)}{c}$$

01.09.21.0153.01

$$\int \cot^3(c\,z)\,dz = -\frac{\csc^2(c\,z) + 2\log(\sin(c\,z))}{2\,c}$$

01.09.21.0154.01

$$\int \cot^4(c\,z)\,dz = \frac{3\,c\,z - \cot(c\,z)\left(\csc^2(c\,z) - 4\right)}{3\,c}$$

01.09.21.0155.01

$$\int \cot^5(c\,z)\,dz = \frac{-\csc^4(c\,z) + 4\csc^2(c\,z) + 4\log(\sin(c\,z))}{4\,c}$$

01.09.21.0156.01

$$\int \cot^6(c\,z)\,dz = \frac{\cot(c\,z)\left(-3\csc^4(c\,z) + 11\csc^2(c\,z) - 23\right) - 15\,c\,z}{15\,c}$$

01.09.21.0157.01

$$\int \cot^7(c\,z)\,dz = -\frac{2\csc^6(c\,z) - 9\csc^4(c\,z) + 18\csc^2(c\,z) + 12\log(\sin(c\,z))}{12\,c}$$

01.09.21.0158.01

$$\int \cot^8(c\,z)\,dz = \frac{105\,c\,z + \cot(c\,z)\left(-15\csc^6(c\,z) + 66\csc^4(c\,z) - 122\csc^2(c\,z) + 176\right)}{105\,c}$$

01.09.21.0246.01

$$\int \cot^{2n}(a\,z)\,dz = (-1)^n\,z - \frac{(-1)^n\tan(a\,z)}{a}\sum_{k=1}^{n}\frac{(-1)^k\cot^{2k}(a\,z)}{2\,k-1}\;/;\; n \in \mathbb{N}$$

01.09.21.0247.01

$$\int \cot^{2n+1}(a\,z)\,dz = \frac{(-1)^n\log(\sin(a\,z))}{a} - \frac{S_{n+1}^{(2)}}{2\,a\,n!} - \frac{(-1)^n}{2\,a}\sum_{k=1}^{n}\frac{(-1)^k\cot^{2k}(a\,z)}{k}\;/;\; n \in \mathbb{N}$$

01.09.21.0248.01

$$\int \cot^{2n}(a\,z)\,dz = \frac{(-1)^n\left(a\,z + \tan^{-1}(\cot(a\,z))\right)}{a} - \frac{\cot^{2n+1}(a\,z)}{a\,(2\,n+1)}\,{}_2F_1\!\left(1,\,n+\frac{1}{2};\,n+\frac{3}{2};\,-\cot^2(a\,z)\right)\;/;\; n \in \mathbb{N}$$

01.09.21.0249.01

$$\int \cot^{2n+1}(a\,z)\,dz = -\frac{\cot^{2n+2}(a\,z)}{2\,a\,(n+1)}\,{}_2F_1\!\left(n+1,\,1;\,n+2;\,-\cot^2(a\,z)\right) + \frac{(-1)^n\left(\log\!\left(\csc^2(a\,z)\right) + 2\log(\sin(a\,z))\right)}{2\,a} - \frac{S_{n+1}^{(2)}}{2\,a\,n!}\;/;\; n \in \mathbb{N}$$

01.09.21.0159.01

$$\int \cot^{\frac{1}{2}}(c\,z)\,dz = \frac{1}{2\sqrt{2}\,c}\left(-2\tan^{-1}\!\left(\sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) + 1\right) + 2\tan^{-1}\!\left(1 - \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z)\right) - \log\!\left(-\cot(c\,z) + \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) - 1\right) + \log\!\left(\cot(c\,z) + \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) + 1\right)\right)$$

01.09.21.0160.01

$$\int \frac{1}{\cot^{\frac{1}{2}}(c\,z)}\,dz = \frac{1}{2\sqrt{2}\,c}\left(-2\tan^{-1}\!\left(\sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) + 1\right) + 2\tan^{-1}\!\left(1 - \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z)\right) + \log\!\left(-\cot(c\,z) + \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) - 1\right) - \log\!\left(\cot(c\,z) + \sqrt{2}\,\cot^{\frac{1}{2}}(c\,z) + 1\right)\right)$$

Involving products of the direct functions

01.09.21.0161.01

$$\int \cot(b + a z) \cot(a z) \, dz = \frac{\cot(b) (\log(\sin(a z)) - \log(\sin(b + a z))) - a z}{a}$$

01.09.21.0162.01

$$\int \cot(b - a z) \cot(a z) \, dz = \frac{a z + \cot(b) (\log(-\sin(a z)) - \log(\sin(b - a z)))}{a}$$

Involving powers of products of the direct function

01.09.21.0163.01

$$\int \sqrt{\cot(c z) \cot(2 c z)} \, dz = \frac{\sqrt{\cot(c z) \cot(2 c z)} \, \sin(c z)}{c \cos^{\frac{1}{2}}(2 c z)} \left(\sqrt{2} \log\left(\sqrt{2} \cos(c z) + \cos^{\frac{1}{2}}(2 c z) \right) - \tanh^{-1}\left(\frac{\cos(c z)}{\cos^{\frac{1}{2}}(2 c z)} \right) \right)$$

Involving rational functions of the direct function

Involving $(a + b \cot(z))^{-n}$

01.09.21.0164.01

$$\int \frac{1}{a + b \cot(z)} \, dz = \frac{a z - b \log(b \cos(z) + a \sin(z))}{a^2 + b^2}$$

01.09.21.0165.01

$$\int \frac{1}{(a + b \cot(z))^2} \, dz = \frac{1}{\left(a^2 + b^2\right)^2 (a + b \cot(z))} \left(z a^3 + b a^2 - 2 b \log(b \cos(z) + a \sin(z)) a^2 - b^2 z a + b^3 + b \cot(z) \left(\left(a^2 - b^2\right) z - 2 a b \log(b \cos(z) + a \sin(z))\right)\right)$$

01.09.21.0166.01

$$\int \frac{A + B \cot(z)}{(a + b \cot(z))^2} \, dz = \left((A + B \cot(z)) \csc(z) (b \cos(z) + a \sin(z)) \left(\left(a^2 + b^2\right) (A b - a B) \sin(z) + \left(A a^2 + 2 b B a - A b^2\right) z (b \cos(z) + a \sin(z)) + \left(B a^2 - 2 A b a - b^2 B\right) \log(b \cos(z) + a \sin(z)) (b \cos(z) + a \sin(z))\right)\right) \Big/ \left(\left(a^2 + b^2\right)^2 (a + b \cot(z))^2 (B \cos(z) + A \sin(z))\right)$$

01.09.21.0167.01

$$\int \frac{A + B \cot(z)}{(a + b \cot(z))^3} \, dz = \left((A + B \cot(z)) \csc^2(z) (b \cos(z) + a \sin(z)) \left(\left(a^2 + b^2\right) (A b - a B) b^2 + 2 \left(A a^3 + 3 b B a^2 - 3 A b^2 a - b^3 B\right) z (b \cos(z) + a \sin(z))^2 + 2 \left(B a^3 - 3 A b a^2 - 3 b^2 B a + A b^3\right) \log(b \cos(z) + a \sin(z)) (b \cos(z) + a \sin(z))^2 + 2 \left(a^2 + b^2\right) \left(-2 B a^2 + 3 A b a + b^2 B\right) \sin(z) (b \cos(z) + a \sin(z))\right)\right) \Big/ \left(2 \left(a^2 + b^2\right)^3 (a + b \cot(z))^3 (B \cos(z) + A \sin(z))\right)$$

01.09.21.0168.01

$$\int \frac{A + B\cot(z) + C\cot^2(z)}{(a + b\cot(z))^3}\, dz = \left(\left(C\cot^2(z) + B\cot(z) + A\right)\csc(z)\,(b\cos(z) + a\sin(z)) \left(2\left((A - C)\,a^3 + 3\,b\,B\,a^2 + 3\,b^2\,(C - A)\,a - b^3\,B\right) z\,(b\cos(z) + a\sin(z))^2 + 2\left(B\,a^3 + 3\,b\,(C - A)\,a^2 - 3\,b^2\,B\,a + b^3\,(A - C)\right)\log(b\cos(z) + a\sin(z))\,(b\cos(z) + a\sin(z))^2 + b\left(a^2 + b^2\right)\left(A\,b^2 + a\,(a\,C - b\,B)\right) + \frac{2\left(a^2 + b^2\right)\left(C\,a^3 - 2\,b\,B\,a^2 + b^2\,(3\,A - 2\,C)\,a + b^3\,B\right)\sin(z)\,(b\cos(z) + a\sin(z))}{b} \right)\right) \Big/ \left(\left(a^2 + b^2\right)^3 (a + b\cot(z))^3\,(A + C + (C - A)\cos(2\,z) + B\sin(2\,z))\right)$$

Involving $\left(a + b\cot^2(z)\right)^{-n}$

01.09.21.0169.01

$$\int \frac{1}{a + b\cot^2(z)}\, dz = \frac{1}{a - b}\left(z - \frac{\sqrt{b}}{\sqrt{a}}\tan^{-1}\left(\frac{\sqrt{a}\,\tan(z)}{\sqrt{b}}\right)\right)$$

01.09.21.0170.01

$$\int \frac{1}{\left(a + b\cot^2(z)\right)^2}\, dz = \left((-a - b + (a - b)\cos(2\,z))\csc^4(z) \left(\sqrt{a}\,(-2\,a\,(a + b)\,z + 2\,a\,(a - b)\cos(2\,z)\,z - (a - b)\,b\sin(2\,z)) - \sqrt{b}\,(b - 3\,a)\tan^{-1}\left(\frac{\sqrt{a}\,\tan(z)}{\sqrt{b}}\right)(a + b + (b - a)\cos(2\,z)) \right)\right) \Big/ \left(8\,a^{3/2}\,(a - b)^2\left(b\cot^2(z) + a\right)^2\right)$$

Involving algebraic functions of the direct function

Involving $(a + b\cot(c\,z))^{\beta}$

01.09.21.0171.01

$$\int (a + b\cot(c\,z))^{\beta}\, dz = -\frac{(a + b\cot(c\,z))^{\beta+1}}{2\left(a^2 + b^2\right)c\,(\beta + 1)}\left((b + i\,a)\,{}_2F_1\left(\beta + 1, 1; \beta + 2; \frac{a + b\cot(c\,z)}{a + i\,b}\right) + (b - i\,a)\,{}_2F_1\left(\beta + 1, 1; \beta + 2; \frac{a + b\cot(c\,z)}{a - i\,b}\right)\right)$$

01.09.21.0172.01

$$\int \sqrt{a + b\cot(c\,z)}\, dz = \frac{i}{c}\left(\sqrt{a - i\,b}\,\tanh^{-1}\left(\frac{\sqrt{a + b\cot(c\,z)}}{\sqrt{a - i\,b}}\right) - \sqrt{a + i\,b}\,\tanh^{-1}\left(\frac{\sqrt{a + b\cot(c\,z)}}{\sqrt{a + i\,b}}\right)\right)$$

01.09.21.0173.01

$$\int \frac{1}{\sqrt{a+b\cot(c\,z)}}\,dz = \frac{i}{c}\left(\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a-i\,b}}\right)}{\sqrt{a-i\,b}} - \frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a+i\,b}}\right)}{\sqrt{a+i\,b}}\right)$$

01.09.21.0174.01

$$\int \cot(c\,z)\,(a+b\cot(c\,z))^{\beta}\,dz = \frac{(a+b\cot(c\,z))^{\beta+1}}{2\left(a^2+b^2\right)c\,(\beta+1)}\left((a-i\,b)\,{}_2F_1\left(\beta+1,\,1;\,\beta+2;\,\frac{a+b\cot(c\,z)}{a+i\,b}\right)+(a+i\,b)\,{}_2F_1\left(\beta+1,\,1;\,\beta+2;\,\frac{a+b\cot(c\,z)}{a-i\,b}\right)\right)$$

01.09.21.0175.01

$$\int \cot(c\,z)\sqrt{a+b\cot(c\,z)}\,dz = \frac{1}{c}\left(\sqrt{a+i\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a+i\,b}}\right)+\sqrt{a-i\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a-i\,b}}\right)-2\sqrt{a+b\cot(c\,z)}\right)$$

01.09.21.0176.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+b\cot(c\,z)}}\,dz = \frac{1}{c}\left(\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a+i\,b}}\right)}{\sqrt{a+i\,b}} + \frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a-i\,b}}\right)}{\sqrt{a-i\,b}}\right)$$

Involving $((a+b\cot(c\,z))^n)^{\beta}$

01.09.21.0177.01

$$\int ((a+b\cot(c\,z))^n)^{\beta}\,dz = -\frac{1}{2\left(a^2+b^2\right)c\,(n\,\beta+1)}\left((a+b\cot(c\,z))\,((a+b\cot(c\,z))^n)^{\beta}\left((b+i\,a)\,{}_2F_1\left(n\,\beta+1,\,1;\,n\,\beta+2;\,\frac{a+b\cot(c\,z)}{a+i\,b}\right)+(b-i\,a)\,{}_2F_1\left(n\,\beta+1,\,1;\,n\,\beta+2;\,\frac{a+b\cot(c\,z)}{a-i\,b}\right)\right)\right)$$

01.09.21.0178.01

$$\int \sqrt{(a+b\cot(c\,z))^3}\,dz = \left(\sqrt{(a+b\cot(c\,z))^3}\,\sin(c\,z)\left(\sqrt{a+i\,b}\;i\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a-i\,b}}\right)\sqrt{a+b\cot(c\,z)}\,\sin(c\,z)\,(a-i\,b)^2+\left(-i\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c\,z)}}{\sqrt{a+i\,b}}\right)\sqrt{a+b\cot(c\,z)}\,\sin(c\,z)\,(a+i\,b)^2-2\,b\,(b\cos(c\,z)+a\sin(c\,z))\sqrt{a+i\,b}\right)\sqrt{a-i\,b}\right)\right)\Big/\left(\sqrt{a-i\,b}\,\sqrt{a+i\,b}\,c\,(b\cos(c\,z)+a\sin(c\,z))^2\right)$$

01.09.21.0179.01

$$\int \frac{1}{\sqrt{(a+b\cot(c z))^3}}\,dz = \left((a+b\cot(c z))\left(i\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a-i b}}\right)\sqrt{a+b\cot(c z)}\,(a+i b)^{3/2}+\sqrt{a-i b}\left(2\sqrt{a+i b}\,b - i(a-i b)\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a+i b}}\right)\sqrt{a+b\cot(c z)}\right)\right)\right)\Big/\left((a-i b)^{3/2}(a+i b)^{3/2}\,c\sqrt{(a+b\cot(c z))^3}\right)$$

01.09.21.0180.01

$$\int \cot(c z)\left((a+b\cot(c z))^n\right)^\beta\,dz = \frac{1}{2\left(a^2+b^2\right)c\,(n\beta+1)}\left((a+b\cot(c z))\left((a+b\cot(c z))^n\right)^\beta\left((a-i b)\,{}_2F_1\left(n\beta+1,1;n\beta+2;\frac{a+b\cot(c z)}{a+i b}\right)+(a+i b)\,{}_2F_1\left(n\beta+1,1;n\beta+2;\frac{a+b\cot(c z)}{a-i b}\right)\right)\right)$$

01.09.21.0181.01

$$\int \cot(c z)\sqrt{(a+b\cot(c z))^3}\,dz = \frac{1}{3c\,(a+b\cot(c z))^{3/2}}\left(\sqrt{(a+b\cot(c z))^3}\left(3\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a+i b}}\right)(a+i b)^{3/2}+3(a-i b)^{3/2}\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a-i b}}\right)-2\sqrt{a+b\cot(c z)}\,(4a+b\cot(c z))\right)\right)$$

01.09.21.0182.01

$$\int \frac{\cot(c z)}{\sqrt{(a+b\cot(c z))^3}}\,dz = \frac{1}{c\sqrt{(a+b\cot(c z))^3}}\left(\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a+i b}}\right)(a+b\cot(c z))^{3/2}}{(a+i b)^{3/2}}+\frac{\tanh^{-1}\left(\frac{\sqrt{a+b\cot(c z)}}{\sqrt{a-i b}}\right)(a+b\cot(c z))^{3/2}}{(a-i b)^{3/2}}-\frac{2a\,(a+b\cot(c z))}{a^2+b^2}\right)$$

Involving $\left(a+b\cot^2(c z)\right)^\beta$

01.09.21.0183.01

$$\int \left(a+b\cot^2(c z)\right)^\beta\,dz = -\frac{\cot(c z)\left(b\cot^2(c z)+a\right)^\beta\left(\frac{b\cot^2(c z)}{a}+1\right)^{-\beta}}{c}F_1\left(\frac{1}{2};1,-\beta;\frac{3}{2};-\cot^2(c z),-\frac{b\cot^2(c z)}{a}\right)$$

01.09.21.0184.01

$$\int \sqrt{a+b\cot^2(c\,z)}\,dz = \left(i\sqrt{b\cot^2(c\,z)+a}\left(\sqrt{b}\,\log\left(\frac{4\,i\left(\left(b+\frac{i\sqrt{(-a-b+(a-b)\cos(2\,c\,z))\sec^4\left(\frac{c\,z}{2}\right)}\,\sqrt{b}}{\sqrt{2}}\right)\cot^2\left(\frac{c\,z}{2}\right)+2\,a-b\right)}{b^{3/2}}\right)-\right.\right.$$
$$\sqrt{b}\,\log\left(\sqrt{2}\,\sqrt{(-a-b+(a-b)\cos(2\,c\,z))\sec^4\left(\frac{c\,z}{2}\right)}-\frac{2\,i\left(b\tan^2\left(\frac{c\,z}{2}\right)+2\,a-b\right)}{\sqrt{b}}\right)-$$
$$\left.2\sqrt{b-a}\,\log\left(\frac{\cos^2\left(\frac{c\,z}{2}\right)\left(-i\,(a-b)\tan^2\left(\frac{c\,z}{2}\right)-i\,b+i\,a+\frac{\sqrt{b-a}\,\sqrt{(-a-b+(a-b)\cos(2\,c\,z))\sec^4\left(\frac{c\,z}{2}\right)}}{\sqrt{2}}\right)}{(b-a)^{3/2}}\right)\right)$$
$$\left.\sin(c\,z)\right)\Big/\left(c\,(\cos(c\,z)+1)\sqrt{\frac{2\,(a-b)\cos(2\,c\,z)-2\,(a+b)}{(\cos(c\,z)+1)^2}}\right)$$

01.09.21.0185.01

$$\int \frac{1}{\sqrt{a+b\cot^2(c\,z)}}\,dz = -\left(\sqrt{-a-b+(a-b)\cos(2\,c\,z)}\right.$$
$$\left(\log\left(-2\,(a-b)\sin^2(c\,z)\right)-\log\left(-a\sqrt{-a-b+(a-b)\cos(2\,c\,z)}+b\sqrt{-a-b+(a-b)\cos(2\,c\,z)}+\right.\right.$$
$$\left.\left.(a-b)\cos(2\,c\,z)\sqrt{-a-b+(a-b)\cos(2\,c\,z)}+\sqrt{2}\,\sqrt{(a-b)\sin^2(c\,z)}\,\sqrt{(a-b)^2\sin^2(2\,c\,z)}\right)\right)$$
$$\left.\sqrt{(a-b)^2\sin^2(2\,c\,z)}\,\tan(c\,z)\right)\Big/\left(2\sqrt{2}\,c\sqrt{b\cot^2(c\,z)+a}\,\left((a-b)\sin^2(c\,z)\right)^{3/2}\right)$$

01.09.21.0186.01

$$\int \cot(c\,z)\left(a+b\cot^2(c\,z)\right)^{\beta}\,dz ==$$
$$-\frac{(-a-b+(a-b)\cos(2\,c\,z))\left(b\cot^2(c\,z)+a\right)^{\beta}\csc^2(c\,z)}{4\,(a-b)\,c\,(\beta+1)}\,{}_2F_1\left(\beta+1,\,1;\,\beta+2;\,-\frac{(-a-b+(a-b)\cos(2\,c\,z))\csc^2(c\,z)}{2\,(a-b)}\right)$$

01.09.21.0187.01

$$\int \cot(c z) \sqrt{a + b \cot^2(c z)} \, dz = \frac{\sqrt{b \cot^2(c z) + a}}{2 c} \left(\frac{\sqrt{2} \sqrt{(a-b)^2 \sin^2(2 c z)}}{\sqrt{(a-b)\cos^2(c z)} \sqrt{-a-b+(a-b)\cos(2 c z)}} \tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)} \cot^2(c z) \sqrt{(a-b)^2 \sin^2(2 c z)}}{2\sqrt{2} \left((a-b)\cos^2(c z)\right)^{3/2}} \right) - 2 \right)$$

01.09.21.0188.01

$$\int \frac{\cot(c z)}{\sqrt{a + b \cot^2(c z)}} \, dz = -\left(\tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)} \cot^2(c z) \sqrt{(a-b)^2 \sin^2(2 c z)}}{2\sqrt{2} \left((a-b)\cos^2(c z)\right)^{3/2}} \right) \sqrt{-a-b+(a-b)\cos(2 c z)} \cot^2(c z) \sqrt{(a-b)^2 \sin^2(2 c z)} \right) \Big/ \left(2\sqrt{2}\, c \left((a-b)\cos^2(c z)\right)^{3/2} \sqrt{b \cot^2(c z) + a} \right)$$

Involving $\left(\left(a + b \cot^2(c z)\right)^n\right)^\beta$

01.09.21.0189.01

$$\int \left(\left(a + b \cot^2(c z)\right)^n\right)^\beta dz = -\frac{\cot(c z) \left(\left(b \cot^2(c z) + a\right)^n\right)^\beta \left(\frac{b \cot^2(c z)}{a} + 1\right)^{-n\beta}}{c} F_1\left(\frac{1}{2}; 1, -n\beta; \frac{3}{2}; -\cot^2(c z), -\frac{b \cot^2(c z)}{a}\right)$$

01.09.21.0190.01

$$\int \sqrt{\left(a + b \cot^2(c z)\right)^3} \, dz = \frac{1}{c} \left(\sqrt{\left(b \cot^2(c z) + a\right)^3} \sin(c z) \left(-\frac{b \cos(c z)}{a + b + (b-a)\cos(2 c z)} - \left(i (\cos(c z) + 1) \sqrt{-\frac{a + b + (b-a)\cos(2 c z)}{(\cos(c z) + 1)^2}} \left(4 \log\left(-\frac{1}{4\sqrt{b-a}} \left(\cos^2\left(\frac{c z}{2}\right) \left(-2 i (a-b) \tan^2\left(\frac{c z}{2}\right) - 2 i b + 2 i a + \sqrt{2} \sqrt{b-a} \sqrt{(-a-b+(a-b)\cos(2 c z)) \sec^4\left(\frac{c z}{2}\right)} \right)\right)\right) (a-b)^2 + \sqrt{b} \sqrt{b-a} (2b - 3a) \log\left(\sqrt{2} \sqrt{(-a-b+(a-b)\cos(2 c z)) \sec^4\left(\frac{c z}{2}\right)} - \frac{2 i \left(b \tan^2\left(\frac{c z}{2}\right) + 2a - b\right)}{\sqrt{b}} \right) + \sqrt{b} \sqrt{b-a} (3a - 2b) \log\left(\frac{1}{\sqrt{b}} \left(2\left(-2 i b + \sqrt{2} \sqrt{b} \sqrt{(-a-b+(a-b)\cos(2 c z)) \sec^4\left(\frac{c z}{2}\right)} \right) \cot^2\left(\frac{c z}{2}\right) - 8 i a + 4 i b \right) \right) \right) \sin^2(c z) \right) \Big/ \left(\sqrt{2} \sqrt{b-a} \left(a + b + (b-a)\cos(2 c z)\right)^2 \right) \right) \right)$$

01.09.21.0191.01

$$\int \frac{1}{\sqrt{\left(a + b \cot^2(c z)\right)^3}} \, dz = $$

$$\left(\csc^2(c z) \left(\frac{1}{\sqrt{(a-b)\sin^2(c z)}} \left(\sqrt{2} \, (-a - b + (a-b)\cos(2 c z))^{3/2} \csc(2 c z) \left(\log\left(-2 (a-b) \sin^2(c z)\right) - \log\left(-a \sqrt{-a - b + (a-b)\cos(2 c z)} + b \sqrt{-a - b + (a-b)\cos(2 c z)} + (a-b)\cos(2 c z) \sqrt{-a - b + (a-b)\cos(2 c z)} + \sqrt{2} \sqrt{(a-b)\sin^2(c z)} \sqrt{(a-b)^2 \sin^2(2 c z)}\right)\right) \sqrt{(a-b)^2 \sin^2(2 c z)}\right) - \frac{2 (a-b) b (-a - b + (a-b)\cos(2 c z)) \cot(c z)}{a}\right)\right) \Big/ \left(4 (a-b)^2 c \sqrt{\left(b \cot^2(c z) + a\right)^3}\right)$$

01.09.21.0192.01

$$\int \cot(c z) \left(\left(a + b \cot^2(c z)\right)^n\right)^\beta \, dz = $$

$$-\frac{(-a - b + (a-b)\cos(2 c z)) \left(\left(b \cot^2(c z) + a\right)^n\right)^\beta \csc^2(c z)}{4 (a-b) c (n \beta + 1)} \, {}_2F_1\left(n \beta + 1, 1; n \beta + 2; -\frac{(-a - b + (a-b)\cos(2 c z)) \csc^2(c z)}{2 (a-b)}\right)$$

01.09.21.0193.01

$$\int \cot(c z) \sqrt{\left(a + b \cot^2(c z)\right)^5} \, dz = $$

$$\frac{1}{c} \left(\sqrt{\left(b \cot^2(c z) + a\right)^5} \sin^5(c z) \left(\frac{\tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)} \cot^2(c z) \sqrt{(a-b)^2 \sin^2(2 c z)}}{2 \sqrt{2} \left((a-b)\cos^2(c z)\right)^{3/2}}\right) \csc^3(c z) \sec^2(c z) \left((a-b)^2 \sin^2(2 c z)\right)^{3/2}}{\sqrt{2} \sqrt{(a-b)\cos^2(c z)} \, (-a - b + (a-b)\cos(2 c z))^{5/2}} - \frac{4 \csc(c z) \left(3 b^2 \csc^4(c z) + 11 (a-b) b \csc^2(c z) + 23 (a-b)^2\right)}{15 (a + b + (b-a)\cos(2 c z))^2}\right)\right)$$

01.09.21.0194.01

$$\int \cot(c z)\sqrt{\left(a+b\cot^2(c z)\right)^3}\,dz == -\left(\sqrt{2}\sqrt{\left(b\cot^2(c z)+a\right)^3}\csc^2(2 c z)\left(12(a-b)\tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)}\cot^2(c z)\sqrt{(a-b)^2\sin^2(2 c z)}}{2\sqrt{2}\left((a-b)\cos^2(c z)\right)^{3/2}}\right)\cos^2(c z)\sqrt{(a-b)^2\sin^2(2 c z)}\sin^4(c z)+\sqrt{2}\sqrt{(a-b)\cos^2(c z)}\sqrt{-a-b+(a-b)\cos(2 c z)}(-2a+b+2(a-b)\cos(2 c z))\sin^2(2 c z)\right)\right)\Big/\left(3 c\sqrt{(a-b)\cos^2(c z)}(-a-b+(a-b)\cos(2 c z))^{3/2}\right)$$

01.09.21.0195.01

$$\int \frac{\cot(c z)}{\sqrt{\left(a+b\cot^2(c z)\right)^3}}\,dz == \left((a+b+(b-a)\cos(2 c z))\csc^2(c z)\left(4(b-a)\sqrt{(a-b)\cos^2(c z)}-\sqrt{2}\tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)}\cot^2(c z)\sqrt{(a-b)^2\sin^2(2 c z)}}{2\sqrt{2}\left((a-b)\cos^2(c z)\right)^{3/2}}\right)\sqrt{-a-b+(a-b)\cos(2 c z)}\csc^2(c z)\sqrt{(a-b)^2\sin^2(2 c z)}\right)\right)\Big/\left(8(a-b)^2 c\sqrt{(a-b)\cos^2(c z)}\sqrt{\left(b\cot^2(c z)+a\right)^3}\right)$$

01.09.21.0196.01

$$\int \frac{\cot(c z)}{\sqrt{\left(a+b\cot^2(c z)\right)^5}}\,dz == \left((-a-b+(a-b)\cos(2 c z))\csc^6(c z)\left(-4\sqrt{2}(-2a-b+2(a-b)\cos(2 c z))\tan^2(c z)\left((a-b)\cos^2(c z)\right)^{3/2}-3\tan^{-1}\left(\frac{\sqrt{-a-b+(a-b)\cos(2 c z)}\cot^2(c z)\sqrt{(a-b)^2\sin^2(2 c z)}}{2\sqrt{2}\left((a-b)\cos^2(c z)\right)^{3/2}}\right)(-a-b+(a-b)\cos(2 c z))^{3/2}\sqrt{(a-b)^2\sin^2(2 c z)}\right)\right)\Big/\left(24\sqrt{2}(a-b)^3 c\sqrt{(a-b)\cos^2(c z)}\sqrt{\left(b\cot^2(c z)+a\right)^5}\right)$$

Involving $\left(a+b\cot^{\frac{1}{2}}(c z)\right)^{\beta}$

01.09.21.0197.01

$$\int \left(a+b\cot^{\frac{1}{2}}(c z)\right)^{\beta} dz = \frac{1}{2\left(a^4+b^4\right) c\,(\beta+1)} \left(\left(a+b\cot^{\frac{1}{2}}(c z)\right)^{\beta+1} \left(i\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a+(-1)^{3/4} b}\right) a^3 + i\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a-(-1)^{3/4} b}\right) a^3 + \right.\right.$$

$$\sqrt[4]{-1}\; b\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a+(-1)^{3/4} b}\right) a^2 - \sqrt[4]{-1}\; b\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a-(-1)^{3/4} b}\right) a^2 +$$

$$b^2\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a+(-1)^{3/4} b}\right) a + b^2\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a-(-1)^{3/4} b}\right) a +$$

$$\left(-i\,a^3+(-1)^{3/4} b\,a^2+b^2 a-\sqrt[4]{-1}\; b^3\right) {}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a+\sqrt[4]{-1}\; b}\right) -$$

$$(-1)^{3/4} b^3\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a+(-1)^{3/4} b}\right) + \left(-i\,a^3-(-1)^{3/4} b\,a^2+b^2 a+\sqrt[4]{-1}\; b^3\right)$$

$$\left.\left.{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a-\sqrt[4]{-1}\; b}\right) + (-1)^{3/4} b^3\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c z)}{a-(-1)^{3/4} b}\right)\right)\right)$$

01.09.21.0198.01

$$\int \sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}\,dz = \left(\sqrt{a-\sqrt[4]{-1}\,b}\left(\sqrt{a+\sqrt[4]{-1}\,b}\left(\left(a+(-1)^{3/4}\,b\right)\sqrt{a-(-1)^{3/4}\,b}\;i\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\right)+\left(\sqrt[4]{-1}\,b+i\,a\right)\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\right)\right)-i\left(a+\sqrt[4]{-1}\,b\right)\sqrt{a-(-1)^{3/4}\,b}\,\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+\sqrt[4]{-1}\,b}}\right)\right)+\sqrt{a+\sqrt[4]{-1}\,b}\,\sqrt{a+(-1)^{3/4}\,b}\,\left((-1)^{3/4}\,b-i\,a\right)\sqrt{a-(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-\sqrt[4]{-1}\,b}}\right)\right)\Big/\left(\sqrt{a-\sqrt[4]{-1}\,b}\,\sqrt{a+\sqrt[4]{-1}\,b}\,\sqrt{a-(-1)^{3/4}\,b}\,\sqrt{a+(-1)^{3/4}\,b}\;c\right)$$

01.09.21.0199.01

$$\int \frac{1}{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}\,dz = \frac{1}{(a^4+b^4)\,c}\left(\sqrt{a+(-1)^{3/4} b}\; i \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a+(-1)^{3/4} b}}\right) a^3 + \sqrt{a-(-1)^{3/4} b}\; i \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a-(-1)^{3/4} b}}\right) a^3 + \right.$$

$$\sqrt[4]{-1}\, b \sqrt{a+(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a+(-1)^{3/4} b}}\right) a^2 - \sqrt[4]{-1}\, b \sqrt{a-(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a-(-1)^{3/4} b}}\right) a^2 +$$

$$b^2 \sqrt{a+(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a+(-1)^{3/4} b}}\right) a + b^2 \sqrt{a-(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a-(-1)^{3/4} b}}\right) a +$$

$$\sqrt{a+\sqrt[4]{-1}\, b}\; \left(-i a^3 + (-1)^{3/4} b a^2 + b^2 a - \sqrt[4]{-1}\, b^3\right) \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a+\sqrt[4]{-1}\, b}}\right) -$$

$$(-1)^{3/4} b^3 \sqrt{a+(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a+(-1)^{3/4} b}}\right) + \sqrt{a-\sqrt[4]{-1}\, b}\; \left(-i a^3 - (-1)^{3/4} b a^2 + b^2 a + \sqrt[4]{-1}\, b^3\right)$$

$$\left.\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a-\sqrt[4]{-1}\, b}}\right) + (-1)^{3/4} b^3 \sqrt{a-(-1)^{3/4} b}\; \tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c z)}}{\sqrt{a-(-1)^{3/4} b}}\right)\right)$$

01.09.21.0200.01

$$\int \cot(c\,z)\left(a+b\cot^{\frac{1}{2}}(c\,z)\right)^{\beta} dz = \frac{1}{2\left(a^4+b^4\right)c\,(\beta+1)}\Bigg(\left(a+b\cot^{\frac{1}{2}}(c\,z)\right)^{\beta+1}\Bigg({}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a+(-1)^{3/4}\,b}\right)a^3+{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a-(-1)^{3/4}\,b}\right)a^3-$$

$$(-1)^{3/4}\,b\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a+(-1)^{3/4}\,b}\right)a^2+(-1)^{3/4}\,b\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a-(-1)^{3/4}\,b}\right)a^2-$$

$$i\,b^2\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a+(-1)^{3/4}\,b}\right)a-i\,b^2\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a-(-1)^{3/4}\,b}\right)a+$$

$$\left(a^3-\sqrt[4]{-1}\,b\,a^2+b^2\,i\,a-(-1)^{3/4}\,b^3\right){}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a+\sqrt[4]{-1}\,b}\right)-$$

$$\sqrt[4]{-1}\,b^3\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a+(-1)^{3/4}\,b}\right)+\left(a^3+\sqrt[4]{-1}\,b\,a^2+b^2\,i\,a+(-1)^{3/4}\,b^3\right)$$

$${}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a-\sqrt[4]{-1}\,b}\right)+\sqrt[4]{-1}\,b^3\,{}_2F_1\left(\beta+1,1;\beta+2;\frac{a+b\cot^{\frac{1}{2}}(c\,z)}{a-(-1)^{3/4}\,b}\right)\Bigg)\Bigg)$$

01.09.21.0201.01

$$\int \cot(c\,z)\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}\,dz = \frac{1}{c}\Bigg(\sqrt{a-\sqrt[4]{-1}\,b}\,\tanh^{-1}\Bigg(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-\sqrt[4]{-1}\,b}}\Bigg)+ \Bigg(\Big(a+\sqrt[4]{-1}\,b\Big)\sqrt{a+(-1)^{3/4}\,b}\,\sqrt{a-(-1)^{3/4}\,b}\,\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}\,\tanh^{-1}\Bigg(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+\sqrt[4]{-1}\,b}}\Bigg)+ \sqrt{a+\sqrt[4]{-1}\,b}\Bigg(\sqrt{a+(-1)^{3/4}\,b}\,\Big(a-(-1)^{3/4}\,b\Big)\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}\,\tanh^{-1}\Bigg(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\Bigg)+\sqrt{a-(-1)^{3/4}\,b}\Bigg(\Big(a+(-1)^{3/4}\,b\Big)\tanh^{-1}\Bigg(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\Bigg)\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}-4\sqrt{a+(-1)^{3/4}\,b}\,\Big(a+b\cot^{\frac{1}{2}}(c\,z)\Big)\Bigg)\Bigg)\Bigg)\Bigg/ \Bigg(\sqrt{a+\sqrt[4]{-1}\,b}\,\sqrt{a-(-1)^{3/4}\,b}\,\sqrt{a+(-1)^{3/4}\,b}\,\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}\Bigg)\Bigg)$$

01.09.21.0202.01

$$\int \frac{\cot(c\,z)}{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}\,dz = \frac{1}{\left(a^4+b^4\right)c}\left(\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\right)a^3+\sqrt{a-(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\right)a^3-\right.$$

$$(-1)^{3/4}\,b\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\right)a^2+(-1)^{3/4}\,b\sqrt{a-(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\right)a^2-$$

$$i\,b^2\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\right)a-i\,b^2\sqrt{a-(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\right)a+$$

$$\sqrt{a+\sqrt[4]{-1}\,b}\,\left(a^3-\sqrt[4]{-1}\,b\,a^2+b^2\,i\,a-(-1)^{3/4}\,b^3\right)\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+\sqrt[4]{-1}\,b}}\right)-$$

$$\sqrt[4]{-1}\,b^3\sqrt{a+(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a+(-1)^{3/4}\,b}}\right)+\sqrt{a-\sqrt[4]{-1}\,b}\,\left(a^3+\sqrt[4]{-1}\,b\,a^2+b^2\,i\,a+(-1)^{3/4}\,b^3\right)$$

$$\left.\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-\sqrt[4]{-1}\,b}}\right)+\sqrt[4]{-1}\,b^3\sqrt{a-(-1)^{3/4}\,b}\,\tanh^{-1}\left(\frac{\sqrt{a+b\cot^{\frac{1}{2}}(c\,z)}}{\sqrt{a-(-1)^{3/4}\,b}}\right)\right)$$

01.09.21.0203.01

$$\int \frac{\cot(c\,z)}{\left(a+b\cot^{\frac{1}{2}}(c\,z)\right)^2}\,dz = -\frac{1}{2\left(a^4+b^4\right)^2 c}\left(\frac{4\left(a^4+b^4\right)a^3}{a+b\cot^{\frac{1}{2}}(c\,z)} - \sqrt{2}\,b\left(a^4-2b^2a^2-b^4\right)\log\left(-\cot(c\,z)+\sqrt{2}\cot^{\frac{1}{2}}(c\,z)-1\right)a + \sqrt{2}\,b\left(a^4-2b^2a^2-b^4\right)\log\left(\cot(c\,z)+\sqrt{2}\cot^{\frac{1}{2}}(c\,z)+1\right)a - 2b\left(-\sqrt{2}\,a^5-3ba^4-2\sqrt{2}\,b^2a^3+\sqrt{2}\,b^4a+b^5\right)\tan^{-1}\left(\sqrt{2}\cot^{\frac{1}{2}}(c\,z)+1\right) - 2b\left(\sqrt{2}\,a^5-3ba^4+2\sqrt{2}\,b^2a^3-\sqrt{2}\,b^4a+b^5\right)\tan^{-1}\left(1-\sqrt{2}\cot^{\frac{1}{2}}(c\,z)\right) - 4\left(a^6-3a^2b^4\right)\log\left(a+b\cot^{\frac{1}{2}}(c\,z)\right)+\left(a^6-3a^2b^4\right)\log\left(\cot^2(c\,z)+1\right)\right)$$

Involving functions of the direct function and a power function

Involving powers of the direct function and a power function

Involving powers of cot and power

Involving z^n and linear arguments

01.09.21.0204.01

$$\int z^n \cot^\nu(c\,z)\,dz = \frac{(-i)^\nu z^{n+1}}{n+1} + e^{2icvz}(-i)^\nu n!\sum_{j=0}^{n}\frac{(-1)^j(2icv)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\nu,\ldots,\nu;\nu+1,\ldots,\nu+1;e^{2icz}\right) + e^{2icz}(-i)^\nu\,\nu\,n!\sum_{j=0}^{n}\frac{(-1)^j(2ic)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+3}F_{j+2}\left(1,\ldots,1,\nu+1;2,\ldots,2;e^{2icz}\right) + e^{icvz}(-i)^\nu\binom{\nu}{\frac{\nu}{2}}n!\,(1-\nu \bmod 2)\sum_{j=0}^{n}\frac{(-1)^j(icv)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{\nu}{2},\ldots,\frac{\nu}{2},\nu;\frac{\nu}{2}+1,\ldots,\frac{\nu}{2}+1;e^{2icz}\right) + (-i)^\nu n!\sum_{s=1}^{\left\lfloor\frac{\nu-1}{2}\right\rfloor}\binom{\nu}{s}\left(e^{2icsz}\sum_{j=0}^{n}\frac{(-1)^j(2ics)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(s,\ldots,s,\nu;s+1,\ldots,s+1;e^{2icz}\right) + e^{2ic(\nu-s)z}\sum_{j=0}^{n}\frac{(-1)^j(2ic(\nu-s))^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\nu-s,\ldots,\nu-s,\nu;-s+\nu+1,\ldots,-s+\nu+1;e^{2icz}\right)\right)\,/;\,n\in\mathbb{N}\land\nu\in\mathbb{N}^+$$

01.09.21.0205.01

$$\int z \cot^{\nu}(c z)\, dz = \frac{1}{2}(-i)^{\nu} z^2 - \frac{(-i)^{\nu} e^{2 i c \nu z}}{4 c^2 \nu^2}\left(2 i c \nu z\, {}_2F_1\left(\nu, \nu; \nu+1; e^{2 i c z}\right) - {}_3F_2\left(\nu, \nu, \nu; \nu+1, \nu+1; e^{2 i c z}\right)\right) - \frac{(-i)^{\nu} e^{2 i c z} \nu}{4 c^2}\left(2 i c z\, {}_3F_2\left(1, 1, \nu+1; 2, 2; e^{2 i c z}\right) - {}_4F_3\left(1, 1, 1, \nu+1; 2, 2, 2; e^{2 i c z}\right)\right) - \frac{(-i)^{\nu} e^{i c \nu z} (1 - \nu \bmod 2)}{c^2 \nu^2}\binom{\nu}{\frac{\nu}{2}}\left(i c \nu z\, {}_2F_1\left(\frac{\nu}{2}, \nu; \frac{\nu}{2}+1; e^{2 i c z}\right) - {}_3F_2\left(\frac{\nu}{2}, \frac{\nu}{2}, \nu; \frac{\nu}{2}+1, \frac{\nu}{2}+1; e^{2 i c z}\right)\right) - \frac{1}{4 c^2}(-i)^{\nu} \sum_{s=1}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s}\left(\frac{e^{2 i c s z}}{s^2}\left(2 i c s z\, {}_2F_1\left(s, \nu; s+1; e^{2 i c z}\right) - {}_3F_2\left(s, s, \nu; s+1, s+1; e^{2 i c z}\right)\right) - \frac{1}{(s-\nu)^2} e^{2 i c (\nu - s) z}\left(2 i c (s-\nu) z\, {}_2F_1\left(\nu, \nu-s; -s+\nu+1; e^{2 i c z}\right) + {}_3F_2\left(\nu, \nu-s, \nu-s; -s+\nu+1, -s+\nu+1; e^{2 i c z}\right)\right)\right) /; \nu \in \mathbb{N}^+$$

01.09.21.0206.01

$$\int z \cot^2(c z)\, dz = -\frac{z^2}{2} - \frac{\cot(c z) z}{c} + \frac{\log(\sin(c z))}{c^2}$$

01.09.21.0207.01

$$\int z \cot^3(c z)\, dz = \frac{i\left(i \cot(c z) + c z\left(i \csc^2(c z) + c z + 2 i \log\left(1 - e^{2 i c z}\right)\right) + \operatorname{Li}_2\left(e^{2 i c z}\right)\right)}{2 c^2}$$

01.09.21.0208.01

$$\int z \cot^4(c z)\, dz = -\frac{-3 c^2 z^2 + 2 c \cot(c z)\left(\csc^2(c z) - 4\right) z + \csc^2(c z) + 8 \log(\sin(c z))}{6 c^2}$$

01.09.21.0209.01

$$\int z \cot^5(c z)\, dz = -\frac{\cot(c z)\left(\csc^2(c z) - 10\right) + 3 c z\left(\csc^4(c z) - 4 \csc^2(c z) + 2 i c z - 4 \log\left(1 - e^{2 i c z}\right)\right) + 6 i \operatorname{Li}_2\left(e^{2 i c z}\right)}{12 c^2}$$

01.09.21.0210.01

$$\int z^2 \cot^2(c z)\, dz = -\frac{c z\left(c z (3 i + c z) + 3 c z \cot(c z) - 6 \log\left(1 - e^{2 i c z}\right)\right) + 3 i \operatorname{Li}_2\left(e^{2 i c z}\right)}{3 c^3}$$

01.09.21.0211.01

$$\int z^3 \cot^3(c z)\, dz = \frac{1}{64 c^4}\left(i\left(-16 c^4 z^4 + 32 c^3 i \csc^2(c z) z^3 + 64 c^3 i \log\left(1 - e^{-2 i c z}\right) z^3 - 96 c^2 z^2 + 96 c^2 i \cot(c z) z^2 - 96 c^2 \operatorname{Li}_2\left(e^{-2 i c z}\right) z^2 - 192 i c \log\left(1 - e^{2 i c z}\right) z + 96 c i \operatorname{Li}_3\left(e^{-2 i c z}\right) z + \pi^4 - 96 \operatorname{Li}_2\left(e^{2 i c z}\right) + 48 \operatorname{Li}_4\left(e^{-2 i c z}\right)\right)\right)$$

Involving functions of the direct function and exponential function

Involving powers of the direct function and exponential function

Involving exp

Involving $e^{b z}$

01.09.21.0212.01

$$\int e^{b z} \cot^{\nu}(c z)\, dz = \frac{e^{b z} \left(1-e^{2 i c z}\right)^{\nu} \left(1+e^{2 i c z}\right)^{-\nu} \cot^{\nu}(c z)}{b} F_1\left(-\frac{i b}{2 c}; -\nu, \nu; 1-\frac{i b}{2 c}; -e^{2 i c z}, e^{2 i c z}\right) /; b \neq 2 i c$$

01.09.21.0213.01

$$\int e^{2 i c z} \cot^{\nu}(c z)\, dz = -\frac{i\, 2^{-\nu-1} \left(1-e^{2 i c z}\right)^{\nu} \left(1+e^{2 i c z}\right) \cot^{\nu}(c z)}{c (\nu+1)}\, {}_2F_1\left(\nu+1, \nu; \nu+2; \frac{1}{2}\left(1+e^{2 i c z}\right)\right)$$

01.09.21.0214.01

$$\int e^{i c z} \cot^2(c z)\, dz = \frac{i}{c}\left(e^{i c z}\left(1-\frac{2}{-1+e^{2 i c z}}\right)+\log\left(-1+e^{i c z}\right)-\log\left(1+e^{i c z}\right)\right)$$

01.09.21.0215.01

$$\int e^{2 i c z} \cot^2(c z)\, dz = \frac{i\, e^{2 i c z}}{2 c}-\frac{2 i}{c\left(-1+e^{2 i c z}\right)}+\frac{2 i \log\left(-1+e^{2 i c z}\right)}{c}$$

01.09.21.0216.01

$$\int e^{2 i c z} \cot^4(c z)\, dz = -\frac{i\left(24 \log\left(-1+e^{2 i c z}\right)\left(-1+e^{2 i c z}\right)^3+93 e^{2 i c z}-63 e^{4 i c z}-9 e^{6 i c z}+3 e^{8 i c z}-40\right)}{6 c\left(-1+e^{2 i c z}\right)^3}$$

01.09.21.0217.01

$$\int e^{-2 i c z} \cot^4(c z)\, dz = -\frac{i}{6 c}\left(-\frac{8 e^{2 i c z}\left(9-12 e^{2 i c z}+5 e^{4 i c z}\right)}{\left(-1+e^{2 i c z}\right)^3}-3 e^{-2 i c z}-24 \log\left(-1+e^{-2 i c z}\right)\right)$$

Involving functions of the direct function, exponential and a power functions

Involving powers of the direct function, exponential and a power functions

Involving exp and power

Involving $z^n e^{b z}$

01.09.21.0218.01

$$\int z^n e^{b z} \cot^\nu(c z)\, dz = (-i)^\nu e^{(b+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} n!\,(1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{c\nu - i b}{2c}, \ldots, \frac{c\nu - i b}{2c}, \nu; \frac{c\nu - i b}{2c} + 1, \ldots, \frac{c\nu - i b}{2c} + 1; e^{2 i c z}\right) + (-i)^\nu n! \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \left(e^{(b+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-i b + 2 c s}{2c}, \ldots, \frac{-i b + 2 c s}{2c}, \nu; \frac{-i b + 2 c s}{2c} + 1, \ldots, \frac{-i b + 2 c s}{2c} + 1; e^{2 i c z}\right) + e^{(b+2 i c (\nu - s)) z} \sum_{j=0}^{n} \frac{(-1)^j (b + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-i b + 2 c (-s+\nu)}{2c}, \ldots, \frac{-i b + 2 c (-s+\nu)}{2c}, \nu; \frac{-i b + 2 c (-s+\nu)}{2c} + 1, \ldots, \frac{-i b + 2 c (-s+\nu)}{2c} + 1; e^{2 i c z}\right)\right) /; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

Involving functions of the direct function and trigonometric functions

Involving powers of the direct function and trigonometric functions

Involving sin

Involving $\sin(b z)$

01.09.21.0219.01

$$\int \sin(b z) \cot^\nu(c z)\, dz = -\frac{1}{2b}\left(e^{-i b z} \left(1 - e^{-2 i c z}\right)^\nu \left(1 + e^{-2 i c z}\right)^{-\nu} \left(F_1\left(\frac{b}{2c}; -\nu, \nu; \frac{b}{2c} + 1; -e^{-2 i c z}, e^{-2 i c z}\right) + e^{2 i b z} F_1\left(-\frac{b}{2c}; -\nu, \nu; 1 - \frac{b}{2c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right) \cot^\nu(c z)\right)$$

Involving powers of sin

Involving $\sin^m(b z)$

01.09.21.0220.01

$$\int \sin^m(b z)\cot^\nu(c z)\,dz = -\frac{2^{-m}\cot^{\nu+1}(c z)(1 - m \bmod 2)}{c(\nu+1)}\binom{m}{\frac{m}{2}}\,{}_2F_1\left(\frac{\nu+1}{2}, 1; \frac{\nu+3}{2}; -\cot^2(c z)\right) + \frac{1}{b}\left(2^{-m} i^{1-m}\left(1 - e^{-2 i c z}\right)^\nu \left(1 + e^{-2 i c z}\right)^{-\nu} \cot^\nu(c z)\right) \sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor} \frac{1}{2k-m}\left((-1)^k e^{-i b(m-2k)z}\binom{m}{k}\left(e^{2 i b(m-2k)z} F_1\left(-\frac{i b(m-2k)}{2 i c}; -\nu, \nu; 1 - \frac{i b(m-2k)}{2 i c}; -e^{-2 i c z}, e^{-2 i c z}\right) - (-1)^m F_1\left(\frac{i b(m-2k)}{2 i c}; -\nu, \nu; \frac{b i(m-2k)}{2 i c} + 1; -e^{-2 i c z}, e^{-2 i c z}\right)\right)\right) /; m \in \mathbb{N}^+$$

Involving cos

Involving cos(*b z*)

01.09.21.0221.01

$$\int \cos(b z)\cot^\nu(c z)\,dz = -\frac{1}{2b}\left(i e^{-i b z}\left(1 - e^{-2 i c z}\right)^\nu \left(1 + e^{-2 i c z}\right)^{-\nu} \left(e^{2 i b z} F_1\left(-\frac{i b}{2 i c}; -\nu, \nu; 1 - \frac{i b}{2 i c}; -e^{-2 i c z}, e^{-2 i c z}\right) - F_1\left(\frac{i b}{2 i c}; -\nu, \nu; 1 + \frac{i b}{2 i c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right)\cot^\nu(c z)\right)$$

Involving powers of cos

Involving $\cos^m(b z)$

01.09.21.0222.01

$$\int \cos^m(b z)\cot^\nu(c z)\,dz = \frac{1}{b}\left(\left(2^{-m} i\left(1 - e^{-2 i c z}\right)^\nu \left(1 + e^{-2 i c z}\right)^{-\nu} \cot^\nu(c z)\right) \sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor} \frac{1}{m-2k}\left(\left(e^{-i b(m-2k)z} F_1\left(\frac{b(m-2k)}{2c}; -\nu, \nu; \frac{b(m-2k)}{2c} + 1; -e^{-2 i c z}, e^{-2 i c z}\right) - e^{i b(m-2k)z} F_1\left(-\frac{b(m-2k)}{2c}; -\nu, \nu; 1 - \frac{b(m-2k)}{2c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right)\binom{m}{k}\right)\right) - \frac{2^{-m}\cot^{\nu+1}(c z)(1 - m \bmod 2)}{c(\nu+1)}\binom{m}{\frac{m}{2}}\,{}_2F_1\left(\frac{\nu+1}{2}, 1; \frac{\nu+3}{2}; -\cot^2(c z)\right) /; m \in \mathbb{N}^+$$

Involving functions of the direct function, trigonometric and a power functions

Involving powers of the direct function, trigonometric and a power functions

Involving sin and power

Involving $z^n \sin(a + b z) \cot^v(c z)$

01.09.21.0223.01

$$\int z^n \sin(a+bz)\cot^v(cz)\,dz = \frac{1}{2}(-i)^{v+1}\,n!\left(-e^{-ia+i(cv-b)z}\binom{v}{\frac{v}{2}}(1-v \bmod 2)\right.$$
$$\sum_{j=0}^{n}\frac{(-1)^j(-ib+icv)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{cv-b}{2c},\ldots,\frac{cv-b}{2c},v;\frac{cv-b}{2c}+1,\ldots,\frac{cv-b}{2c}+1;e^{2icz}\right)+e^{ia+i(b+cv)z}$$
$$\binom{v}{\frac{v}{2}}(1-v \bmod 2)\sum_{j=0}^{n}\frac{(-1)^j(ib+icv)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+cv}{2c},\ldots,\frac{b+cv}{2c},v;\frac{b+cv}{2c}+1,\ldots,\frac{b+cv}{2c}+1;e^{2icz}\right)-$$
$$\sum_{s=0}^{\left\lfloor\frac{v-1}{2}\right\rfloor}\binom{v}{s}\left(e^{-ia+i(2cs-b)z}\sum_{j=0}^{n}\frac{(-1)^j(-ib+2ics)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{2cs-b}{2c},\ldots,\frac{2cs-b}{2c},v;\frac{2cs-b}{2c}+1,\right.\right.$$
$$\left.\ldots,\frac{2cs-b}{2c}+1;e^{2icz}\right)+e^{-ia+i(2c(v-s)-b)z}\sum_{j=0}^{n}\frac{(-1)^j(-ib+2ic(v-s))^{-j-1}z^{n-j}}{(n-j)!}$$
$$\left.\left.{}_{j+2}F_{j+1}\left(\frac{2c(v-s)-b}{2c},\ldots,\frac{2c(v-s)-b}{2c},v;\frac{2c(v-s)-b}{2c}+1,\ldots,\frac{2c(v-s)-b}{2c}+1;e^{2icz}\right)\right)\right)+$$
$$\sum_{s=0}^{\left\lfloor\frac{v-1}{2}\right\rfloor}\binom{v}{s}\left(e^{ia+i(b+2cs)z}\sum_{j=0}^{n}\frac{(-1)^j(ib+2ics)^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2cs}{2c},\ldots,\frac{b+2cs}{2c},v;\frac{b+2cs}{2c}+1,\ldots,\right.\right.$$
$$\left.\frac{b+2cs}{2c}+1;e^{2icz}\right)+e^{ia+i(b+2c(v-s))z}\sum_{j=0}^{n}\frac{(-1)^j(ib+2ic(v-s))^{-j-1}z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2c(v-s)}{2c},\right.$$
$$\left.\left.\left.\ldots,\frac{b+2c(v-s)}{2c},v;\frac{b+2c(v-s)}{2c}+1,\ldots,\frac{b+2c(v-s)}{2c}+1;e^{2icz}\right)\right)\right)\;/;\;n\in\mathbb{N}\land v\in\mathbb{N}^+$$

01.09.21.0224.01

$$\int z^n \sin(b z) \cot^\nu(c z) \, dz = \frac{1}{2} i^{-\nu-1} n! \Bigg(-e^{(-i b + i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (-i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{c\nu - b}{2c}, \ldots, \frac{c\nu - b}{2c}, \nu; \frac{c\nu - b}{2c} + 1, \ldots, \frac{c\nu - b}{2c} + 1; e^{2 i c z}\right) + e^{(i b + i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + c\nu}{2c}, \ldots, \frac{b + c\nu}{2c}, \nu; \frac{b + c\nu}{2c} + 1, \ldots, \frac{b + c\nu}{2c} + 1; e^{2 i c z}\right) - \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(-i b + 2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{2cs - b}{2c}, \ldots, \frac{2cs - b}{2c}, \nu; \frac{2cs - b}{2c} + 1, \ldots, \frac{2cs - b}{2c} + 1; e^{2 i c z}\right) + e^{(-i b + 2 i c (\nu - s)) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{2c(\nu - s) - b}{2c}, \ldots, \frac{2c(\nu - s) - b}{2c}, \nu; \frac{2c(\nu - s) - b}{2c} + 1, \ldots, \frac{2c(\nu - s) - b}{2c} + 1; e^{2 i c z}\right) \Bigg) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(i b + 2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + 2cs}{2c}, \ldots, \frac{b + 2cs}{2c}, \nu; \frac{b + 2cs}{2c} + 1, \ldots, \frac{b + 2cs}{2c} + 1; e^{2 i c z}\right) + e^{(i b + 2 i c (\nu - s)) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + 2c(\nu - s)}{2c}, \ldots, \frac{b + 2c(\nu - s)}{2c}, \nu; \frac{b + 2c(\nu - s)}{2c} + 1, \ldots, \frac{b + 2c(\nu - s)}{2c} + 1; e^{2 i c z}\right) \Bigg) \Bigg) \;/;\; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

Involving powers of sin and power

Involving $z^n \sin^m(b z) \cot^\nu(c z)$

01.09.21.0225.01

$$\int z^n \sin^m(b z) \cot^\nu(c z) \, dz = (-i)^\nu 2^{-m} \binom{m}{\frac{m}{2}} n! (1 - m \bmod 2) \Bigg(\frac{z^{n+1}}{(n+1)!} + e^{2 i c \nu z} \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}(\nu, \ldots, \nu; \nu + 1, \ldots, \nu + 1; e^{2 i c z}) + e^{2 i c z} \nu \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+3}F_{j+2}(1, \ldots, 1, \nu + 1; 2, \ldots, 2; e^{2 i c z}) + e^{i c \nu z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{\nu}{2}, \ldots, \frac{\nu}{2}, \nu; \frac{\nu}{2} + 1, \ldots, \frac{\nu}{2} + 1; e^{2 i c z}\right) +$$

$$\sum_{s=1}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \Bigg(e^{2 i c s z} \sum_{j=0}^{n} \frac{(-1)^j \, 2^{-j-1} \, (i c s)^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\big(s, \ldots, s, v; s+1, \ldots, s+1; e^{2 i c z}\big) +$$

$$e^{2 i c (v-s) z} \sum_{j=0}^{n} \frac{(-1)^j \, 2^{-j-1} \, (i c (v-s))^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\big(v-s, \ldots, v-s, v; -s+v+1, \ldots, -s+v+1; e^{2 i c z}\big) \Bigg) \Bigg) +$$

$$i^{-m-v} \, 2^{-m} \, n! \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} (-1)^k \binom{m}{k} \Bigg((-1)^m \, e^{(i c v - i b (m-2k)) z} \binom{v}{\frac{v}{2}} (1 - v \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j \, (i c v - i b (m-2k))^{-j-1} \, z^{n-j}}{(n-j)!}$$

$${}_{j+2}F_{j+1}\left(\frac{c v - b (m-2k)}{2c}, \ldots, \frac{c v - b (m-2k)}{2c}, v; \frac{c v - b (m-2k)}{2c} + 1, \ldots, \frac{c v - b (m-2k)}{2c} + 1; e^{2 i c z} \right) +$$

$$e^{(b i (m-2k) + i c v) z} \binom{v}{\frac{v}{2}} (1 - v \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j \, (b i (m-2k) + i c v)^{-j-1} \, z^{n-j}}{(n-j)!}$$

$${}_{j+2}F_{j+1}\left(\frac{b (m-2k) + c v}{2c}, \ldots, \frac{b (m-2k) + c v}{2c}, v; \frac{b (m-2k) + c v}{2c} + 1, \ldots, \frac{b (m-2k) + c v}{2c} + 1; e^{2 i c z} \right) +$$

$$(-1)^m \sum_{s=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \Bigg(e^{(2 i c s - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j \, (2 i c s - i b (m-2k))^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\Bigg(\frac{2 c s - b (m-2k)}{2c},$$

$$\ldots, \frac{2 c s - b (m-2k)}{2c}, v; \frac{2 c s - b (m-2k)}{2c} + 1, \ldots, \frac{2 c s - b (m-2k)}{2c} + 1; e^{2 i c z} \Bigg) +$$

$$e^{(2 i c (v-s) - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j \, (2 i c (v-s) - i b (m-2k))^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}$$

$$\Bigg(\frac{2 c (v-s) - b (m-2k)}{2c}, \ldots, \frac{2 c (v-s) - b (m-2k)}{2c}, v;$$

$$\frac{2 c (v-s) - b (m-2k)}{2c} + 1, \ldots, \frac{2 c (v-s) - b (m-2k)}{2c} + 1; e^{2 i c z} \Bigg) \Bigg) +$$

$$\sum_{s=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \Bigg(e^{(b i (m-2k) + 2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j \, (b i (m-2k) + 2 i c s)^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\Bigg(\frac{b (m-2k) + 2 c s}{2c},$$

$$\ldots, \frac{b (m-2k) + 2 c s}{2c}, v; \frac{b (m-2k) + 2 c s}{2c} + 1, \ldots, \frac{b (m-2k) + 2 c s}{2c} + 1; e^{2 i c z} \Bigg) +$$

$$e^{(b i (m-2k) + 2 c i (v-s)) z} \sum_{j=0}^{n} \frac{(-1)^j \, (b i (m-2k) + 2 c i (v-s))^{-j-1} \, z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}$$

$$\Bigg(\frac{b (m-2k) + 2 c (v-s)}{2c}, \ldots, \frac{b (m-2k) + 2 c (v-s)}{2c}, v; \frac{b (m-2k) + 2 c (v-s)}{2c} + 1,$$

$$\ldots, \frac{b (m-2k) + 2 c (v-s)}{2c} + 1; e^{2 i c z} \Bigg) \Bigg) \Bigg) \Bigg) /; n \in \mathbb{N} \land m \in \mathbb{N}^+ \land v \in \mathbb{N}^+$$

Involving cos and power

Involving $z^n \cos(a+b z)\cot^{\nu}(c z)$

01.09.21.0226.01

$$\int z^n \cos(a+b z)\cot^{\nu}(c z)\,dz = \frac{1}{2}(-i)^{\nu}\, n!\Bigg(e^{-i a + i (c\nu - b) z}\binom{\nu}{\frac{\nu}{2}}(1-\nu \bmod 2)\sum_{j=0}^{n}\frac{(-1)^j(-i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{c\nu-b}{2c},\ldots,\frac{c\nu-b}{2c},\nu;\frac{c\nu-b}{2c}+1,\ldots,\frac{c\nu-b}{2c}+1;e^{2icz}\right) + e^{i a + i (b + c\nu) z}\binom{\nu}{\frac{\nu}{2}}(1-\nu \bmod 2)\sum_{j=0}^{n}\frac{(-1)^j(i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+c\nu}{2c},\ldots,\frac{b+c\nu}{2c},\nu;\frac{b+c\nu}{2c}+1,\ldots,\frac{b+c\nu}{2c}+1;e^{2icz}\right) +$$

$$\sum_{s=0}^{\left\lfloor\frac{\nu-1}{2}\right\rfloor}\binom{\nu}{s}\Bigg(e^{-i a + i (2 c s - b) z}\sum_{j=0}^{n}\frac{(-1)^j(-i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{2cs-b}{2c},\ldots,\frac{2cs-b}{2c},\nu;\frac{2cs-b}{2c}+1,\ldots,\frac{2cs-b}{2c}+1;e^{2icz}\right) + e^{-i a + i (2c(\nu-s) - b) z}\sum_{j=0}^{n}\frac{(-1)^j(-i b + 2 i c(\nu-s))^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{2c(\nu-s)-b}{2c},\ldots,\frac{2c(\nu-s)-b}{2c},\nu;\frac{2c(\nu-s)-b}{2c}+1,\ldots,\frac{2c(\nu-s)-b}{2c}+1;e^{2icz}\right)\Bigg) +$$

$$\sum_{s=0}^{\left\lfloor\frac{\nu-1}{2}\right\rfloor}\binom{\nu}{s}\Bigg(e^{i a + i (b + 2 c s) z}\sum_{j=0}^{n}\frac{(-1)^j(i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2cs}{2c},\ldots,\frac{b+2cs}{2c},\nu;\frac{b+2cs}{2c}+1,\ldots,\frac{b+2cs}{2c}+1;e^{2icz}\right) + e^{i a + i (b + 2c(\nu-s)) z}\sum_{j=0}^{n}\frac{(-1)^j(i b + 2 i c(\nu-s))^{-j-1} z^{n-j}}{(n-j)!}\,{}_{j+2}F_{j+1}\left(\frac{b+2c(\nu-s)}{2c},\ldots,\frac{b+2c(\nu-s)}{2c},\nu;\frac{b+2c(\nu-s)}{2c}+1,\ldots,\frac{b+2c(\nu-s)}{2c}+1;e^{2icz}\right)\Bigg)\Bigg)\; /;\; n\in\mathbb{N}\land \nu\in\mathbb{N}^+$$

01.09.21.0227.01

$$\int z^n \cos(b z) \cot^\nu(c z)\, dz = \frac{1}{2} (-i)^\nu\, n! \left(e^{i (b+c\nu) z} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \right.$$

$${}_{j+2}F_{j+1}\left(\frac{b+c\nu}{2c}, \ldots, \frac{b+c\nu}{2c}, \nu; \frac{b+c\nu}{2c}+1, \ldots, \frac{b+c\nu}{2c}+1; e^{2icz}\right) + e^{i(c\nu-b)z} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2)$$

$$\sum_{j=0}^{n} \frac{(-1)^j (-i b + i c \nu)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(\frac{-b+c\nu}{2c}, \ldots, \frac{-b+c\nu}{2c}, \nu; \frac{-b+c\nu}{2c}+1, \ldots, \frac{-b+c\nu}{2c}+1; e^{2icz}\right) +$$

$$\sum_{s=0}^{\left\lfloor\frac{\nu-1}{2}\right\rfloor} \binom{\nu}{s} \left(e^{i(b+2cs)z} \sum_{j=0}^{n} \frac{(-1)^j (i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(\frac{b+2cs}{2c}, \ldots, \frac{b+2cs}{2c}, \nu; \frac{b+2cs}{2c}+1, \right.\right.$$

$$\left. \ldots, \frac{b+2cs}{2c}+1; e^{2icz}\right) + e^{i(b+2c(\nu-s))z} \sum_{j=0}^{n} \frac{(-1)^j (i b + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!}$$

$$\left.\left. {}_{j+2}F_{j+1}\left(\frac{b+2c(-s+\nu)}{2c}, \ldots, \frac{b+2c(-s+\nu)}{2c}, \nu; \frac{b+2c(-s+\nu)}{2c}+1, \ldots, \frac{b+2c(-s+\nu)}{2c}+1; e^{2icz}\right)\right)\right. +$$

$$\sum_{s=0}^{\left\lfloor\frac{\nu-1}{2}\right\rfloor} \binom{\nu}{s} \left(e^{i(2cs-b)z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(\frac{-b+2cs}{2c}, \ldots, \frac{-b+2cs}{2c}, \nu; \right.\right.$$

$$\left. \frac{-b+2cs}{2c}+1, \ldots, \frac{-b+2cs}{2c}+1; e^{2icz}\right) +$$

$$e^{i(2c(\nu-s)-b)z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + 2 i c (\nu-s))^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\left(\frac{-b+2c(-s+\nu)}{2c}, \ldots, \frac{-b+2c(-s+\nu)}{2c}, \right.$$

$$\left.\left.\left. \nu; \frac{-b+2c(-s+\nu)}{2c}+1, \ldots, \frac{-b+2c(-s+\nu)}{2c}+1; e^{2icz}\right)\right)\right) /; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

Involving powers of cos and power

Involving $z^n \cos^m(b z) \cot^\nu(c z)$

01.09.21.0228.01

$$\int z^n \cos^m(b z) \cot^\nu(c z)\, dz =$$

$$(-i)^\nu 2^{-m} \binom{m}{\frac{m}{2}} n! (1 - m \bmod 2) \left(\frac{z^{n+1}}{(n+1)!} + e^{2ic\nu z} \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c \nu)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}(\nu, \ldots, \nu; \nu+1, \ldots, \nu+1; e^{2icz}) + \right.$$

$$e^{2icz} \nu \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+3}F_{j+2}(1, \ldots, 1, \nu+1; 2, \ldots, 2; e^{2icz}) +$$

$$e^{i c v z} \binom{v}{\frac{v}{2}} (1 - v \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i c v)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{v}{2}, \ldots, \frac{v}{2}, v; \frac{v}{2}+1, \ldots, \frac{v}{2}+1; e^{2 i c z}\right) +$$

$$\sum_{s=1}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \left(e^{2 i c s z} \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c s)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}(s, \ldots, s, v; s+1, \ldots, s+1; e^{2 i c z}) + \right.$$

$$\left. e^{2 i c (v-s) z} \sum_{j=0}^{n} \frac{(-1)^j 2^{-j-1} (i c (v-s))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}(v-s, \ldots, v-s, v; -s+v+1, \ldots, -s+v+1; e^{2 i c z}) \right) \Bigg) +$$

$$i^{-v} 2^{-m} n! \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} \binom{m}{k} \left(e^{(i c v - i b (m-2k)) z} \binom{v}{\frac{v}{2}} (1 - v \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i c v - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \right.$$

$${}_{j+2}F_{j+1}\!\left(\frac{c v - b (m-2k)}{2c}, \ldots, \frac{c v - b (m-2k)}{2c}, v; \frac{c v - b (m-2k)}{2c}+1, \ldots, \frac{c v - b (m-2k)}{2c}+1; e^{2 i c z}\right) +$$

$$e^{(b i (m-2k) + i c v) z} \binom{v}{\frac{v}{2}} (1 - v \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (b i (m-2k) + i c v)^{-j-1} z^{n-j}}{(n-j)!}$$

$${}_{j+2}F_{j+1}\!\left(\frac{b (m-2k) + c v}{2c}, \ldots, \frac{b (m-2k) + c v}{2c}, v; \frac{b (m-2k) + c v}{2c}+1, \ldots, \frac{b (m-2k) + c v}{2c}+1; e^{2 i c z}\right) +$$

$$\sum_{s=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \left(e^{(2 i c s - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c s - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{2 c s - b (m-2k)}{2c}, \right.\right.$$

$$\left. \ldots, \frac{2 c s - b (m-2k)}{2c}, v; \frac{2 c s - b (m-2k)}{2c}+1, \ldots, \frac{2 c s - b (m-2k)}{2c}+1; e^{2 i c z}\right) +$$

$$e^{(2 i c (v-s) - i b (m-2k)) z} \sum_{j=0}^{n} \frac{(-1)^j (2 i c (v-s) - i b (m-2k))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}$$

$$\left(\frac{2 c (v-s) - b (m-2k)}{2c}, \ldots, \frac{2 c (v-s) - b (m-2k)}{2c}, v; \right.$$

$$\left. \left. \frac{2 c (v-s) - b (m-2k)}{2c}+1, \ldots, \frac{2 c (v-s) - b (m-2k)}{2c}+1; e^{2 i c z}\right)\right) +$$

$$\sum_{s=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{s} \left(e^{(b i (m-2k) + 2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (b i (m-2k) + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\!\left(\frac{b (m-2k) + 2 c s}{2c}, \right.\right.$$

$$\left. \ldots, \frac{b (m-2k) + 2 c s}{2c}, v; \frac{b (m-2k) + 2 c s}{2c}+1, \ldots, \frac{b (m-2k) + 2 c s}{2c}+1; e^{2 i c z}\right) +$$

$$e^{(b i (m-2k) + 2 c i (v-s)) z} \sum_{j=0}^{n} \frac{(-1)^j (b i (m-2k) + 2 c i (v-s))^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}$$

$$\left(\frac{b (m-2k) + 2 c (v-s)}{2c}, \ldots, \frac{b (m-2k) + 2 c (v-s)}{2c}, v; \frac{b (m-2k) + 2 c (v-s)}{2c}+1, \right.$$

$$b (m-2k) + 2 c (v-s) \quad \ldots))$$

Involving functions of the direct function, trigonometric and exponential functions

Involving powers of the direct function, trigonometric and exponential functions

Involving sin and exp

Involving $e^{p z} \sin(a z) \operatorname{coh}^{\nu}(c z)$

01.09.21.0229.01

$$\int e^{p z} \sin(a z) \cot^{\nu}(c z)\, dz = \frac{1}{2} i \left(1 - e^{-2 i c z}\right)^{\nu} \left(1 + e^{-2 i c z}\right)^{-\nu} \cot^{\nu}(c z) \left(\frac{i e^{(-i a + p) z}}{a + i p} F_1\left(\frac{a + i p}{2 c}; -\nu, \nu; \frac{a + 2 c + i p}{2 c}; -e^{-2 i c z}, e^{-2 i c z}\right) - \frac{e^{(i a + p) z}}{i a + p} F_1\left(-\frac{a - i p}{2 c}; -\nu, \nu; 1 - \frac{a - i p}{2 c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right)$$

01.09.21.0230.01

$$\int e^{i a z} \sin(a z) \cot^{\nu}(c z)\, dz = -\frac{e^{2 i a z} \left(1 - e^{-2 i c z}\right)^{\nu} \cot^{\nu}(c z) \left(1 + e^{-2 i c z}\right)^{-\nu}}{4 a} F_1\left(-\frac{a}{c}; -\nu, \nu; 1 - \frac{a}{c}; -e^{-2 i c z}, e^{-2 i c z}\right) - \frac{i \cot^{\nu+1}(c z)}{2 c (\nu + 1)} \, {}_2F_1\left(\frac{\nu + 1}{2}, 1; \frac{\nu + 3}{2}; -\cot^2(c z)\right)$$

01.09.21.0231.01

$$\int e^{-i a z} \sin(a z) \cot^{\nu}(c z)\, dz = \frac{1}{4} \cot^{\nu}(c z) \left(\frac{2 i \cot(c z)}{\nu c + c} \, {}_2F_1\left(\frac{\nu + 1}{2}, 1; \frac{\nu + 3}{2}; -\cot^2(c z)\right) - \frac{e^{-2 i a z} \left(1 - e^{-2 i c z}\right)^{\nu} \left(1 + e^{-2 i c z}\right)^{-\nu}}{a} F_1\left(\frac{a}{c}; -\nu, \nu; \frac{a + c}{c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right)$$

Involving powers of sin and exp

Involving $e^{p z} \sin^{m}(a z) \cot^{\nu}(c z)$

01.09.21.0232.01

$$\int e^{p z} \sin^m(a z) \cot^{\nu}(c z)\, dz = \left(1 - e^{-2 i c z}\right)^{\nu} \left(1 + e^{-2 i c z}\right)^{-\nu} \cot^{\nu}(c z) (2 i)^{-m} \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} \binom{m}{k} (-1)^k \left(\frac{e^{(a i (m - 2 k) + p) z}}{a i (m - 2 k) + p} F_1\left(\frac{2 a k - a m + i p}{2 c}; -\nu, \nu; \frac{2 a k - a m + i p}{2 c} + 1; -e^{-2 i c z}, e^{-2 i c z}\right) + \frac{(-1)^m e^{(p - i a (m - 2 k)) z}}{p - i a (m - 2 k)} F_1\left(\frac{a (m - 2 k) + i p}{2 c}; -\nu, \nu; \frac{2 c - 2 a k + a m + i p}{2 c}; -e^{-2 i c z}, e^{-2 i c z}\right)\right) + \frac{1}{p} 2^{-m} e^{p z} \left(1 - e^{-2 i c z}\right)^{\nu} \left(1 + e^{-2 i c z}\right)^{-\nu} \binom{m}{\frac{m}{2}} \cot^{\nu}(c z) (1 - m \bmod 2) F_1\left(\frac{i p}{2 c}; -\nu, \nu; \frac{i p}{2 c} + 1; -e^{-2 i c z}, e^{-2 i c z}\right) /; m \in \mathbb{N}^+$$

Involving cos and exp

Involving $e^{p z} \cos(a z) \cot^{\nu}(c z)$

01.09.21.0233.01

$$\int e^{pz}\cos(az)\cot^{\nu}(cz)\,dz = \frac{1}{2}\left(1-e^{-2icz}\right)^{\nu}\left(1+e^{-2icz}\right)^{-\nu}\cot^{\nu}(cz) \left(\frac{i\,e^{(-ia+p)z}}{a+ip}F_1\left(\frac{a+ip}{2c};-\nu,\nu;\frac{a+2c+ip}{2c};-e^{-2icz},e^{-2icz}\right)+\frac{e^{(ia+p)z}}{ia+p}F_1\left(-\frac{a-ip}{2c};-\nu,\nu;1-\frac{a-ip}{2c};-e^{-2icz},e^{-2icz}\right)\right)$$

01.09.21.0234.01

$$\int e^{iaz}\cos(az)\cot^{\nu}(cz)\,dz = -\frac{i\,e^{2iaz}\left(1-e^{-2icz}\right)^{\nu}\left(1+e^{-2icz}\right)^{-\nu}\cot^{\nu}(cz)}{4a}F_1\left(-\frac{a}{c};-\nu,\nu;1-\frac{a}{c};-e^{-2icz},e^{-2icz}\right)- \frac{\cot^{\nu+1}(cz)}{2c(\nu+1)}\,{}_2F_1\left(\frac{\nu+1}{2},1;\frac{\nu+3}{2};-\cot^2(cz)\right)$$

01.09.21.0235.01

$$\int e^{-iaz}\cos(az)\cot^{\nu}(cz)\,dz = \frac{1}{4}\cot^{\nu}(cz) \left(\frac{i\,e^{-2iaz}\left(1-e^{-2icz}\right)^{\nu}\left(1+e^{-2icz}\right)^{-\nu}}{a}F_1\left(\frac{a}{c};-\nu,\nu;\frac{a+c}{c};-e^{-2icz},e^{-2icz}\right)-\frac{2\cot(cz)}{\nu c+c}\,{}_2F_1\left(\frac{\nu+1}{2},1;\frac{\nu+3}{2};-\cot^2(cz)\right)\right)$$

Involving powers of cos and exp

Involving $e^{pz}\cos^m(az)\cot^{\nu}(cz)$

01.09.21.0236.01

$$\int e^{pz}\cos^m(az)\cot^{\nu}(cz)\,dz = 2^{-m}\left(1-e^{-2icz}\right)^{\nu}\left(1+e^{-2icz}\right)^{-\nu}\cot^{\nu}(cz) \sum_{k=0}^{\left\lfloor\frac{m-1}{2}\right\rfloor}\binom{m}{k}\left(\frac{e^{(ai(m-2k)+p)z}}{ai(m-2k)+p}F_1\left(\frac{2ak-am+ip}{2c};-\nu,\nu;\frac{2ak-am+ip}{2c}+1;-e^{-2icz},e^{-2icz}\right)+ \frac{e^{(p-ia(m-2k))z}}{p-ia(m-2k)}F_1\left(\frac{a(m-2k)+ip}{2c};-\nu,\nu;\frac{2c-2ak+am+ip}{2c};-e^{-2icz},e^{-2icz}\right)\right)+ \frac{1}{p}2^{-m}e^{pz}\left(1-e^{-2icz}\right)^{\nu}\left(1+e^{-2icz}\right)^{-\nu}\binom{m}{\frac{m}{2}}\cot^{\nu}(cz)\,(1-m\bmod 2)\,F_1\left(\frac{ip}{2c};-\nu,\nu;\frac{ip}{2c}+1;-e^{-2icz},e^{-2icz}\right)\;/;\;m\in\mathbb{N}^+$$

Involving functions of the direct function, trigonometric, exponential and a power functions

Involving powers of the direct function, trigonometric, exponential and a power functions

Involving sin, exp and power

Involving $z^n e^{pz}\sin(a+bz)\cot^{\nu}(cz)$

01.09.21.0237.01

$$\int z^n e^{p z} \sin(a+b z) \cot^{\nu}(c z)\, dz = \frac{i}{2}(-i)^{\nu} n! \left(e^{(-i b+p+i c \nu) z - i a} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b-i p+c \nu}{2 c}, \ldots, \frac{-b-i p+c \nu}{2 c}, \nu; \frac{-b-i p+c \nu}{2 c}+1, \ldots, \frac{-b-i p+c \nu}{2 c}+1; e^{2 i c z} \right) - e^{i a+(i b+p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i b+p+i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b-i p+c \nu}{2 c}, \ldots, \frac{b-i p+c \nu}{2 c}, \nu; \frac{b-i p+c \nu}{2 c}+1, \ldots, \frac{b-i p+c \nu}{2 c}+1; e^{2 i c z} \right) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \left(e^{(-i b+p+2 i c s) z - i a} \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b-i p+2 c s}{2 c}, \ldots, \frac{-b-i p+2 c s}{2 c}, \nu; \frac{-b-i p+2 c s}{2 c}+1, \ldots, \frac{-b-i p+2 c s}{2 c}+1; e^{2 i c z} \right) + e^{(-i b+p+2 i c (\nu-s)) z - i a} \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+2 i c (\nu-s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b-i p+2 c (\nu-s)}{2 c}, \ldots, \frac{-b-i p+2 c (\nu-s)}{2 c}, \nu; \frac{-b-i p+2 c (\nu-s)}{2 c}+1, \ldots, \frac{-b-i p+2 c (\nu-s)}{2 c}+1; e^{2 i c z} \right) \right) - \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \left(e^{i a+(i b+p+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (i b+p+2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b-i p+2 c s}{2 c}, \ldots, \frac{b-i p+2 c s}{2 c}, \nu; \frac{b-i p+2 c s}{2 c}+1, \ldots, \frac{b-i p+2 c s}{2 c}+1; e^{2 i c z} \right) + e^{i a+(i b+p+2 i c (\nu-s)) z} \sum_{j=0}^{n} \frac{(-1)^j (i b+p+2 i c (\nu-s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b-i p+2 c (\nu-s)}{2 c}, \ldots, \frac{b-i p+2 c (\nu-s)}{2 c}, \nu; \frac{b-i p+2 c (\nu-s)}{2 c}+1, \ldots, \frac{b-i p+2 c (\nu-s)}{2 c}+1; e^{2 i c z} \right) \right) \right) /; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

01.09.21.0238.01

$$\int z^n e^{p z} \sin(b z) \cot^{\nu}(c z)\, dz = \frac{1}{2} (-i)^{\nu+1} n! \Bigg(-e^{(-i b+p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+i c \nu)^{-j-1} z^{n-j}}{(n-j)!}$$

$$_{j+2}F_{j+1}\left(\frac{-b-i p+c \nu}{2 c}, \ldots, \frac{-b-i p+c \nu}{2 c}, \nu; \frac{-b-i p+c \nu}{2 c}+1, \ldots, \frac{-b-i p+c \nu}{2 c}+1; e^{2 i c z}\right)+$$

$$e^{(i b+p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1-\nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i b+p+i c \nu)^{-j-1} z^{n-j}}{(n-j)!}$$

$$_{j+2}F_{j+1}\left(\frac{b-i p+c \nu}{2 c}, \ldots, \frac{b-i p+c \nu}{2 c}, \nu; \frac{b-i p+c \nu}{2 c}+1, \ldots, \frac{b-i p+c \nu}{2 c}+1; e^{2 i c z}\right)-$$

$$\sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(-i b+p+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{-b-i p+2 i c s}{2 c}, \ldots,$$

$$\frac{-b-i p+2 i c s}{2 c}, \nu; \frac{-b-i p+2 i c s}{2 c}+1, \ldots, \frac{-b-i p+2 i c s}{2 c}+1; e^{2 i c z}\Bigg)+$$

$$e^{(-i b+p+2 i c (\nu-s)) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b+p+2 i c (\nu-s))^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{-b-i p+2 c (\nu-s)}{2 c}, \ldots,$$

$$\frac{-b-i p+2 c (\nu-s)}{2 c}, \nu; \frac{-b-i p+2 c (\nu-s)}{2 c}+1, \ldots, \frac{-b-i p+2 c (\nu-s)}{2 c}+1; e^{2 i c z}\Bigg)\Bigg)+$$

$$\sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(i b+p+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (i b+p+2 i c s)^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{b-i p+2 c s}{2 c}, \ldots, \frac{b-i p+2 c s}{2 c},$$

$$\nu; \frac{b-i p+2 c s}{2 c}+1, \ldots, \frac{b-i p+2 c s}{2 c}+1; e^{2 i c z}\Bigg)+e^{(i b+p+2 i c (\nu-s)) z}$$

$$\sum_{j=0}^{n} \frac{(-1)^j (i b+p+2 i c (\nu-s))^{-j-1} z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{b-i p+2 c (\nu-s)}{2 c}, \ldots, \frac{b-i p+2 c (\nu-s)}{2 c},$$

$$\nu; \frac{b-i p+2 c (\nu-s)}{2 c}+1, \ldots, \frac{b-i p+2 c (\nu-s)}{2 c}+1; e^{2 i c z}\Bigg)\Bigg)\Bigg) /; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

Involving powers of sin, exp and power

Involving $z^n e^{p z} \sin^m(b z) \cot^{\nu}(c z)$

01.09.21.0239.01

$$\int z^n e^{p z} \sin^m(b z) \cot^\nu(c z)\, dz = 2^{-m} \binom{m}{\frac{m}{2}} (1 - m \bmod 2) (-i)^\nu n! \Bigg(e^{(p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{c\nu - i p}{2c}, \ldots, \frac{c\nu - i p}{2c}, \nu; \frac{c\nu - i p}{2c} + 1, \ldots, \frac{c\nu - i p}{2c} + 1; e^{2 i c z}\right) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(p+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (p + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{2cs - i p}{2c}, \ldots, \frac{2cs - i p}{2c}, \nu; \frac{2cs - i p}{2c} + 1, \ldots, \frac{2cs - i p}{2c} + 1; e^{2 i c z}\right) + e^{(p+2 c i (\nu - s)) z} \sum_{j=0}^{n} \frac{(-1)^j (p + 2 c i (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{2c(\nu-s) - i p}{2c}, \ldots, \frac{2c(\nu-s) - i p}{2c}, \nu; \frac{2c(\nu-s) - i p}{2c} + 1, \ldots, \frac{2c(\nu-s) - i p}{2c} + 1; e^{2 i c z}\right)\Bigg)\Bigg) +$$

$$(-i)^\nu i^{-m} 2^{-m} n! \sum_{k=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} (-1)^k \binom{m}{k} \Bigg(e^{(b i (m-2k)+p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (b i (m-2k) + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b(m-2k) - i p + c\nu}{2c}, \ldots, \frac{b(m-2k) - i p + c\nu}{2c}, \nu; \frac{b(m-2k) - i p + c\nu}{2c} + 1, \ldots, \frac{b(m-2k) - i p + c\nu}{2c} + 1; e^{2 i c z}\right) + (-1)^m \Bigg(e^{(-i b (m-2k)+p+i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (-i b (m-2k) + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b(m-2k) - i p + c\nu}{2c}, \ldots, \frac{-b(m-2k) - i p + c\nu}{2c}, \nu; \frac{-b(m-2k) - i p + c\nu}{2c} + 1, \ldots, \frac{-b(m-2k) - i p + c\nu}{2c} + 1; e^{2 i c z}\right) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \Bigg(e^{(-i b (m-2k)+p+2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b (m-2k) + p + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b(m-2k) - i p + 2cs}{2c}, \ldots, \frac{-b(m-2k) - i p + 2cs}{2c}, \nu; \frac{-b(m-2k) - i p + 2cs}{2c} + 1, \ldots, \frac{-b(m-2k) - i p + 2cs}{2c} + 1; e^{2 i c z}\right) + e^{(-i b (m-2k)+p+2 c i (\nu-s)) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b (m-2k) + p + 2 c i (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b(m-2k) - i p + 2c(\nu-s)}{2c}, \ldots, \frac{-b(m-2k) - i p + 2c(\nu-s)}{2c}, \nu;\right.$$

$$\frac{-b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c}+1,\,\ldots,\,\frac{-b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c}+1;\,e^{2\,i\,c\,z}\Bigg)\Bigg)\Bigg)+$$

$$\sum_{s=0}^{\left\lfloor\frac{v-1}{2}\right\rfloor}\binom{v}{s}\Bigg(e^{(b\,i\,(m-2\,k)+p+2\,i\,c\,s)\,z}\sum_{j=0}^{n}\frac{(-1)^j\,(b\,i\,(m-2\,k)+p+2\,i\,c\,s)^{-j-1}\,z^{n-j}}{(n-j)\,!}\,{}_{j+2}F_{j+1}$$

$$\Bigg(\frac{b\,(m-2\,k)-i\,p+2\,c\,s}{2\,c},\,\ldots,\,\frac{b\,(m-2\,k)-i\,p+2\,c\,s}{2\,c},\,v;\,\frac{b\,(m-2\,k)-i\,p+2\,c\,s}{2\,c}+1,$$

$$\ldots,\,\frac{b\,(m-2\,k)-i\,p+2\,c\,s}{2\,c}+1;\,e^{2\,i\,c\,z}\Bigg)+e^{(b\,i\,(m-2\,k)+p+2\,c\,i\,(v-s))\,z}$$

$$\sum_{j=0}^{n}\frac{(-1)^j\,(b\,i\,(m-2\,k)+p+2\,c\,i\,(v-s))^{-j-1}\,z^{n-j}}{(n-j)\,!}\,{}_{j+2}F_{j+1}\Bigg(\frac{b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c},$$

$$\ldots,\,\frac{b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c},\,v;\,\frac{b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c}+1,\,\ldots,$$

$$\frac{b\,(m-2\,k)-i\,p+2\,c\,(v-s)}{2\,c}+1;\,e^{2\,i\,c\,z}\Bigg)\Bigg)\Bigg)\,/;\,n\in\mathbb{N}\bigwedge m\in\mathbb{N}^+\bigwedge v\in\mathbb{N}^+$$

Involving cos, exp and power

Involving $z^n\,e^{p\,z}\cos(a+b\,z)\cot^v(c\,z)$

01.09.21.0240.01

$$\int z^n e^{p z} \cos(a + b z) \cot^{\nu}(c z)\, dz = \frac{1}{2} (-i)^{\nu} n! \left(e^{(-i b + p + i c \nu) z - i a} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (-i b + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p + c \nu}{2 c}, \ldots, \frac{-b - i p + c \nu}{2 c}, \nu; \frac{-b - i p + c \nu}{2 c} + 1, \ldots, \frac{-b - i p + c \nu}{2 c} + 1; e^{2 i c z} \right) + e^{i a + (i b + p + i c \nu) z} \binom{\nu}{\frac{\nu}{2}} (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (i b + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p + c \nu}{2 c}, \ldots, \frac{b - i p + c \nu}{2 c}, \nu; \frac{b - i p + c \nu}{2 c} + 1, \ldots, \frac{b - i p + c \nu}{2 c} + 1; e^{2 i c z} \right) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \left(e^{(-i b + p + 2 i c s) z - i a} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c s}{2 c}, \ldots, \frac{-b - i p + 2 c s}{2 c}, \nu; \frac{-b - i p + 2 c s}{2 c} + 1, \ldots, \frac{-b - i p + 2 c s}{2 c} + 1; e^{2 i c z} \right) + e^{(-i b + p + 2 i c (\nu - s)) z - i a} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{-b - i p + 2 c (\nu - s)}{2 c}, \ldots, \frac{-b - i p + 2 c (\nu - s)}{2 c}, \nu; \frac{-b - i p + 2 c (\nu - s)}{2 c} + 1, \ldots, \frac{-b - i p + 2 c (\nu - s)}{2 c} + 1; e^{2 i c z} \right) \right) + \sum_{s=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{s} \left(e^{i a + (i b + p + 2 i c s) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p + 2 i c s)^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p + 2 c s}{2 c}, \ldots, \frac{b - i p + 2 c s}{2 c}, \nu; \frac{b - i p + 2 c s}{2 c} + 1, \ldots, \frac{b - i p + 2 c s}{2 c} + 1; e^{2 i c z} \right) + e^{i a + (i b + p + 2 i c (\nu - s)) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p + 2 i c (\nu - s))^{-j-1} z^{n-j}}{(n-j)!} {}_{j+2}F_{j+1}\left(\frac{b - i p + 2 c (\nu - s)}{2 c}, \ldots, \frac{b - i p + 2 c (\nu - s)}{2 c}, \nu; \frac{b - i p + 2 c (\nu - s)}{2 c} + 1, \ldots, \frac{b - i p + 2 c (\nu - s)}{2 c} + 1; e^{2 i c z} \right) \right) \right) /;\ n \in \mathbb{N} \bigwedge \nu \in \mathbb{N}^+$$

01.09.21.0241.01

$$\int z^n e^{p z} \cos(b z) \cot^\nu(c z) \, dz = \frac{1}{2} (-i)^\nu \binom{\nu}{\frac{\nu}{2}} n! (1 - \nu \bmod 2) \left(e^{(-i b+p+i c \nu) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - i p + c \nu}{2 c}, \ldots, \frac{-b - i p + c \nu}{2 c}, \nu; \frac{-b - i p + c \nu}{2 c} + 1, \ldots, \frac{-b - i p + c \nu}{2 c} + 1; e^{2 i c z} \right) + e^{(i b+p+i c \nu) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b - i p + c \nu}{2 c}, \ldots, \frac{b - i p + c \nu}{2 c}, \nu; \frac{b - i p + c \nu}{2 c} + 1, \ldots, \frac{b - i p + c \nu}{2 c} + 1; e^{2 i c z} \right) \right) + \frac{1}{2} (-i)^\nu n! \sum_{i=0}^{\left\lfloor \frac{\nu-1}{2} \right\rfloor} \binom{\nu}{i} \left(e^{(-i b+2 i c i+p) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b + 2 i c i + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b + 2 c i - i p}{2 c}, \ldots, \frac{-b + 2 c i - i p}{2 c}, \nu; \frac{-b + 2 c i - i p}{2 c} + 1, \ldots, \frac{-b + 2 c i - i p}{2 c} + 1; e^{2 i c z} \right) + e^{(i b+2 i c i+p) z} \sum_{j=0}^{n} \frac{(-1)^j (i b + 2 i c i + p)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b + 2 c i - i p}{2 c}, \ldots, \frac{b + 2 c i - i p}{2 c}, \nu; \frac{b + 2 c i - i p}{2 c} + 1, \ldots, \frac{b + 2 c i - i p}{2 c} + 1; e^{2 i c z} \right) + e^{(-i b-2 i c i+p+2 i c \nu) z} \sum_{j=0}^{n} \frac{(-1)^j (-i b - 2 i c i + p + 2 i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{-b - 2 c i - i p + 2 c \nu}{2 c}, \ldots, \frac{-b - 2 c i - i p + 2 c \nu}{2 c}, \nu; \frac{-b - 2 c i - i p + 2 c \nu}{2 c} + 1, \ldots, \frac{-b - 2 c i - i p + 2 c \nu}{2 c} + 1; e^{2 i c z} \right) + e^{(i b-2 i c i+p+2 i c \nu) z} \sum_{j=0}^{n} \frac{(-1)^j (i b - 2 i c i + p + 2 i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{b - 2 c i - i p + 2 c \nu}{2 c}, \ldots, \frac{b - 2 c i - i p + 2 c \nu}{2 c}, \nu; \frac{b - 2 c i - i p + 2 c \nu}{2 c} + 1, \ldots, \frac{b - 2 c i - i p + 2 c \nu}{2 c} + 1; e^{2 i c z} \right) \right) /; n \in \mathbb{N} \land \nu \in \mathbb{N}^+$$

Involving powers of cos, exp and power

Involving $z^n e^{p z} \cos^m(b z) \cot^\nu(c z)$

01.09.21.0242.01

$$\int z^n e^{p z} \cos^m(b z) \cot^\nu(c z) \, dz = i^{-\nu} 2^{-m} e^{(p+i c \nu) z} \binom{m}{\frac{m}{2}} \binom{\nu}{\frac{\nu}{2}} n! (1 - m \bmod 2) (1 - \nu \bmod 2) \sum_{j=0}^{n} \frac{(-1)^j (p + i c \nu)^{-j-1} z^{n-j}}{(n-j)!} \, {}_{j+2}F_{j+1}\left(\frac{c \nu - i p}{2 c}, \ldots, \frac{c \nu - i p}{2 c}, \nu; \frac{c \nu - i p}{2 c} + 1, \ldots, \frac{c \nu - i p}{2 c} + 1; e^{2 i c z} \right) + i^{-\nu} 2^{-m} \binom{\nu}{\frac{\nu}{2}} n!$$

$$(1 - v \bmod 2) \sum_{s=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} \binom{m}{s} \Bigg(e^{(p - i\, b\,(m-2s) + i\, c\, v)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (p - i\, b\,(m-2s) + i\, c\, v)^{-j-1}\, z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{-i\, p - b\,(m-2s) + c\, v}{2c},$$

$$\ldots, \frac{-i\, p - b\,(m-2s) + c\, v}{2c}, v; \frac{-i\, p - b\,(m-2s) + c\, v}{2c} + 1, \ldots, \frac{-i\, p - b\,(m-2s) + c\, v}{2c} + 1; e^{2 i c z}\Bigg) +$$

$$e^{(p + b\, i\,(m-2s) + i\, c\, v)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (p + b\, i\,(m-2s) + i\, c\, v)^{-j-1}\, z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{-i\, p + b\,(m-2s) + c\, v}{2c}, \ldots,$$

$$\frac{-i\, p + b\,(m-2s) + c\, v}{2c}, v; \frac{-i\, p + b\,(m-2s) + c\, v}{2c} + 1, \ldots, \frac{-i\, p + b\,(m-2s) + c\, v}{2c} + 1; e^{2 i c z}\Bigg)\Bigg) +$$

$$i^{-v}\, 2^{-m} \binom{m}{\frac{m}{2}}\, n!\, (1 - m \bmod 2) \sum_{i=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \binom{v}{i} \Bigg(e^{(2 i c i + p)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (2\, i\, c\, i + p)^{-j-1}\, z^{n-j}}{(n-j)!}$$

$${}_{j+2}F_{j+1}\Bigg(\frac{2 c i - i\, p}{2c}, \ldots, \frac{2 c i - i\, p}{2c}, v; \frac{2 c i - i\, p}{2c} + 1, \ldots, \frac{2 c i - i\, p}{2c} + 1; e^{2 i c z}\Bigg) +$$

$$e^{(-2 i c i + p + 2 i c v)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (-2\, i\, c\, i + p + 2\, i\, c\, v)^{-j-1}\, z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{-2 c i - i\, p + 2 c v}{2c}, \ldots,$$

$$\frac{-2 c i - i\, p + 2 c v}{2c}, v; \frac{-2 c i - i\, p + 2 c v}{2c} + 1, \ldots, \frac{-2 c i - i\, p + 2 c v}{2c} + 1; e^{2 i c z}\Bigg)\Bigg) + i^{-v}\, 2^{-m}\, n!$$

$$\sum_{i=0}^{\left\lfloor \frac{v-1}{2} \right\rfloor} \sum_{s=0}^{\left\lfloor \frac{m-1}{2} \right\rfloor} \binom{m}{s} \binom{v}{i} \Bigg(e^{(2 i c i + i b m + p - 2 i b s)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (2\, i\, c\, i + i\, b\, m + p - 2\, i\, b\, s)^{-j-1}\, z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{2 c i + b m - i\, p - 2 b s}{2c},$$

$$\ldots, \frac{2 c i + b m - i\, p - 2 b s}{2c}, v; \frac{2 c i + b m - i\, p - 2 b s}{2c} + 1, \ldots, \frac{2 c i + b m - i\, p - 2 b s}{2c} + 1; e^{2 i c z}\Bigg) +$$

$$e^{(2 i c i - i b m + p + 2 i b s)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (2\, i\, c\, i - i\, b\, m + p + 2\, i\, b\, s)^{-j-1}\, z^{n-j}}{(n-j)!}\, {}_{j+2}F_{j+1}\Bigg(\frac{2 c i - b m - i\, p + 2 b s}{2c},$$

$$\ldots, \frac{2 c i - b m - i\, p + 2 b s}{2c}, v; \frac{2 c i - b m - i\, p + 2 b s}{2c} + 1, \ldots, \frac{2 c i - b m - i\, p + 2 b s}{2c} + 1; e^{2 i c z}\Bigg) +$$

$$e^{(-2 i c i + i b m + p - 2 i b s + 2 i c v)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (-2\, i\, c\, i + i\, b\, m + p - 2\, i\, b\, s + 2\, i\, c\, v)^{-j-1}\, z^{n-j}}{(n-j)!}$$

$${}_{j+2}F_{j+1}\Bigg(\frac{-2 c i + b m - i\, p - 2 b s + 2 c v}{2c}, \ldots, \frac{-2 c i + b m - i\, p - 2 b s + 2 c v}{2c}, v;$$

$$\frac{-2 c i + b m - i\, p - 2 b s + 2 c v}{2c} + 1, \ldots, \frac{-2 c i + b m - i\, p - 2 b s + 2 c v}{2c} + 1; e^{2 i c z}\Bigg) +$$

$$e^{(-2 i c i - i b m + p + 2 i b s + 2 i c v)\, z} \sum_{j=0}^{n} \frac{(-1)^j\, (-2\, i\, c\, i - i\, b\, m + p + 2\, i\, b\, s + 2\, i\, c\, v)^{-j-1}\, z^{n-j}}{(n-j)!}$$

$$ {}_{j+2}F_{j+1}\left(\frac{-2ci-bm-i p+2bs+2cv}{2c}, \ldots, \frac{-2ci-bm-i p+2bs+2cv}{2c}, v; \frac{-2ci-bm-i p+2bs+2cv}{2c}+1, \ldots, \frac{-2ci-bm-i p+2bs+2cv}{2c}+1; e^{2icz}\right)\right) /; n \in \mathbb{N} \land m \in \mathbb{N}^+ \land v \in \mathbb{N}^+ $$

Definite integration

For the direct function itself

01.09.21.0009.01

$$ \int_0^{\frac{\pi}{4}} t \cot(t)\, dt = \frac{1}{16}\left(8C + i\pi^2 + 4\pi \log(1-i)\right) $$

Involving the direct function

01.09.21.0010.01

$$ \int_0^{\frac{\pi}{2}} \cot^n(t)\, dt = \frac{\pi}{2} \sec\left(\frac{n\pi}{2}\right) /; |\mathrm{Re}(n)| < 1 $$

01.09.21.0250.01

$$ \int_0^z \left(\cot(t) - \frac{1}{t}\right)(z-t)^n\, dt = (\log(\sin(z)) - \log(z))\, z^n - \left(\sum_{j=0}^{n-1} \frac{(-1)^{n-j}\binom{n}{j}}{n-j}\right) z^n - \frac{i\, n\, z^{n+1}}{n+1} + \sum_{j=0}^{n-1} \binom{n}{j} (-2i)^{j-n} (n-j)!\, z^j\, \mathrm{Li}_{-j+n+1}(1) - \sum_{j=0}^{n-1} (-1)^{n-j} \binom{n}{j} z^j \sum_{k=0}^{n-j} \binom{n-j}{k} k!\, (2i)^{-k} z^{-j-k+n}\, \mathrm{Li}_{k+1}\left(e^{-2iz}\right) /; n \in \mathbb{N} $$

01.09.21.0251.01

$$ \int_0^w \left(\cot(a\,t) - \frac{1}{a\,t}\right)(z-t)^n\, dt = \frac{z^n}{a}\left(-\frac{i(-1)^n a\, w^{n+1} z^{-n}}{n+1} - 2i\pi\left\lfloor \frac{3}{4} - \frac{\arg(a\,w)}{2\pi}\right\rfloor - \log(-2i) - \log(a\,w) - \sum_{k=0}^{n-1} \frac{1}{k+1}\binom{n}{k}\left(-\frac{w}{z}\right)^k \left(a\, i\, w + \frac{k\,w - n\,w}{k\,z + z}\right) + \sum_{k=1}^{n} (2i\,a\,z)^{-k} \binom{n}{k} k!\, \mathrm{Li}_{k+1}(1) - \sum_{k=0}^{n}\left(-\frac{w}{z}\right)^k \binom{n}{k} \sum_{j=0}^{k} (-2i\,a\,w)^{-j} \binom{k}{j} j!\, \mathrm{Li}_{j+1}\left(e^{2iaw}\right)\right) /; n \in \mathbb{N} $$

01.09.21.0252.01

$$\text{Integrate}\left[\frac{(z-t)^n}{a\,t},\,\{t,\,0,\,p\},\,\text{GenerateConditions}\to\text{False}\right]+\text{Integrate}\left[(z-t)^n\left(\cot(a\,t)-\frac{1}{a\,t}\right),\,\{t,\,0,\,p\},\,\text{GenerateConditions}\to\text{False}\right]=\frac{z^n}{a}\left(-\frac{i\,a\,p}{n+1}\left(-\frac{p}{z}\right)^n-2\,i\,\pi\left\lfloor\frac{3}{4}-\frac{\arg(a\,p)}{2\,\pi}\right\rfloor-\log(-2\,i)+\log(p)-\log(a\,p)-i\,a\,p\sum_{k=0}^{n-1}\frac{1}{k+1}\binom{n}{k}\left(-\frac{p}{z}\right)^k+\sum_{k=1}^{n}(2\,i\,a\,z)^{-k}\binom{n}{k}k!\,\text{Li}_{k+1}(1)-\sum_{k=0}^{n}\left(-\frac{p}{z}\right)^k\binom{n}{k}\sum_{j=0}^{k}(-2\,i\,a\,p)^{-j}\binom{k}{j}j!\,\text{Li}_{j+1}\left(e^{2\,i\,a\,p}\right)\right)\,/;\,n\in\mathbb{N}$$

Involving related functions

01.09.21.0011.01

$$\int_0^{\frac{\pi}{4}}\log(\cot(t))\,dt=C$$

Summation

Finite summation

01.09.23.0001.01

$$\sum_{k=1}^{n-1}\cot^2\left(\frac{\pi\,k}{n}\right)=\frac{(n-1)\,(n-2)}{3}\,/;\,n\in\mathbb{N}^+$$

01.09.23.0002.01

$$\sum_{k=1}^{n}\cot^2\left(\frac{\pi\,(2\,k-1)}{4\,n}\right)=2\,n^2-n\,/;\,n\in\mathbb{N}^+$$

01.09.23.0003.02

$$\sum_{k=0}^{n-1}\cot^2\left(\frac{\pi\,k}{n}+z\right)=\cot^2(n\,z)\,n^2+n^2-n\,/;\,n\in\mathbb{N}^+$$

01.09.23.0004.01

$$\sum_{k=1}^{n-1}\cot^4\left(\frac{\pi\,k}{n}\right)=\frac{1}{45}\,(n-1)\,(n-2)\left(n^2+3\,n-13\right)/;\,n\in\mathbb{N}^+$$

01.09.23.0005.01

$$\sum_{k=1}^{n-1}\cot^{2\,m}\left(\frac{\pi\,k}{n}\right)=n\,(-1)^m-n\,(-1)^m\,2^{2\,m}\sum_{l_0=0}^{m}\cdots\sum_{l_{2\,m}=0}^{m}\delta_{\sum_{r=0}^{2\,m}l_r-m}\,n^{2\,l_0-1}\prod_{r=0}^{2\,m}\frac{B_{2\,l_r}}{(2\,l_r)!}\,/;\,n\in\mathbb{N}^+\bigwedge m\in\mathbb{N}^+$$

01.09.23.0006.01

$$\sum_{k=1}^{n-1}(-1)^k\cot^{2\,m}\left(\frac{\pi\,k}{n}\right)=(-1)^m\,n\,2^{2\,m+1}\sum_{l_0=0}^{m}\cdots\sum_{l_{2\,\nu}=0}^{m}\delta_{\sum_{r=0}^{2\,m}l_r-m}\,n^{2\,l_0-1}\prod_{r=0}^{2\,m}\frac{B_{2\,l_r}}{(2\,l_r)!}\,/;\,n\in\mathbb{N}^+\bigwedge m\in\mathbb{N}^+$$

01.09.23.0007.01

$$\sum_{k=1}^{n-1}\cot\left(\frac{k\,\pi}{n}\right)\cot\left(\frac{k\,m\,\pi}{n}\right)=4\,n\sum_{k=1}^{n-1}\left(\frac{k}{n}-\left\lfloor\frac{k}{n}\right\rfloor-\frac{1}{2}\right)\left(\frac{k\,m}{n}-\left\lfloor\frac{k\,m}{n}\right\rfloor-\frac{1}{2}\right)/;\,m-1\in\mathbb{N}^+\bigwedge n-1\in\mathbb{N}^+\bigwedge\gcd(m,\,n)=1$$

01.09.23.0008.01

$$n\sum_{k=1}^{m-1}\cot\left(\frac{\pi\,n\,k}{m}\right)\cot\left(\frac{\pi\,k}{m}\right)+m\sum_{k=1}^{n-1}\cot\left(\frac{\pi\,m\,k}{n}\right)\cot\left(\frac{\pi\,k}{n}\right)=\frac{1}{3}\left(m^2+n^2+1\right)-n\,m\;/;\;m\in\mathbb{N}^+\land n\in\mathbb{N}^+\land\gcd(n,m)=1$$

01.09.23.0009.01

$$\sum_{k=0}^{n-1}(-1)^k\cot\left(\frac{(2\,k+1)\,\pi}{4\,n}\right)=n\;/;\;n\in\mathbb{N}$$

01.09.23.0010.01

$$\sum_{k=0}^{2\,n-1}(-1)^k\cot\left(\frac{(2\,k+1)\,\pi}{8\,n}\right)=2\,n\;/;\;n\in\mathbb{N}$$

01.09.23.0011.01

$$\sum_{k=1}^{n}\cot^4\left(\frac{k\,\pi}{2\,n+1}\right)=\frac{1}{45}\,n\,(2\,n-1)\left(4\,n^2+10\,n-9\right)\;/;\;n\in\mathbb{N}$$

01.09.23.0012.01

$$\sum_{k=1}^{\left\lfloor\frac{n-1}{2}\right\rfloor}\cot^2\left(\frac{k\,\pi}{n}\right)=\frac{1}{6}\,(n-1)\,(n-2)\;/;\;n\in\mathbb{N}^+$$

01.09.23.0013.01

$$\frac{1}{p}\sum_{k=1}^{p-1}\cot\left(\frac{k\,q\,\pi}{p}\right)\cot\left(\frac{\pi\,k}{p}+z\right)+\frac{1}{q}\sum_{k=1}^{q-1}\cot\left(\frac{k\,p\,\pi}{q}\right)\cot\left(\frac{\pi\,k}{q}+z\right)=\frac{\csc^2(z)}{p\,q}-\cot(p\,z)\cot(q\,z)-1\;/;$$
$$p\in\mathbb{N}^+\land q\in\mathbb{N}^+\land\mathrm{GCD}(p,q)=1$$

S. Fukuhara: New Trigonometric Identities and Generalized Dedekind Sums Tokyo Journal of Mathematics 26, 1-14 (2003)

Infinite summation

01.09.23.0014.01

$$\sum_{k=1}^{\infty}\frac{1}{k^3}\cot\left(\frac{1}{2}\,k\,\pi\left(1+\sqrt{5}\right)\right)=-\frac{\pi^3}{45\sqrt{5}}$$

Products

Finite products

01.09.24.0001.01

$$\prod_{k=1}^{n-1}\cot\left(\frac{k\,\pi}{n}\right)=-\frac{(-1)^n}{n}\sin\left(\frac{n\,\pi}{2}\right)\;/;\;n\in\mathbb{N}^+$$

Representations through more general functions

Through hypergeometric functions

01.09.26.0008.01

$$\cot(z) = \frac{2}{z}\,{}_3F_2\left(1, -\frac{z}{\pi}, \frac{z}{\pi}; 1-\frac{z}{\pi}, \frac{z}{\pi}+1; 1\right) - \frac{1}{z}$$

Brychkov Yu.A. (2005)

Through other functions

Involving Jacobi functions

01.09.26.0001.01

$$\cot(z) == \operatorname{cs}(z \mid 0)$$

01.09.26.0002.01

$$\cot(z) == i\, \operatorname{ns}(i\, z \mid 1)$$

01.09.26.0003.01

$$\cot(z) == \operatorname{sc}\left(\frac{\pi}{2} - z \,\middle|\, 0\right)$$

01.09.26.0004.01

$$\cot(z) == -i\, \operatorname{sn}\left(\frac{\pi\, i}{2} - i\, z \,\middle|\, 1\right)$$

Involving Mathieu functions

01.09.26.0005.01

$$\cot\left(\sqrt{a}\, z\right) == \frac{\operatorname{Ce}(a, 0, z)}{\operatorname{Se}(a, 0, z)}$$

01.09.26.0006.01

$$\cot\left(\sqrt{a}\, z\right) == -\frac{\operatorname{Se}_z(a, 0, z)}{\operatorname{Ce}_z(a, 0, z)}$$

Involving some elliptic-type functions

01.09.26.0007.01

$$\cot(z) == \frac{\sqrt{-z^2}}{z} \sqrt{\frac{2}{3}} \sqrt{1 - \wp\left(-\sqrt{\frac{2}{3}}\, z; 3, 1\right)} \;/;\; z \notin \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$$

Representations through equivalent functions

With inverse function

01.09.27.0001.01

$$\cot\left(\cot^{-1}(z)\right) == z$$

01.09.27.0002.01

$$\cot\left(n \cot^{-1}(z)\right) == \frac{i\, ((z-i)^n + (z+i)^n)}{(z+i)^n - (z-i)^n} \;/;\; n \in \mathbb{N}^+$$

01.09.27.0003.02

$$\cot^{-1}(\cot(z)) == z \;/;\; -\frac{\pi}{2} < \operatorname{Re}(z) < \frac{\pi}{2} \bigvee \operatorname{Re}(z) == -\frac{\pi}{2} \bigwedge \operatorname{Im}(z) < 0 \bigvee \operatorname{Re}(z) == \frac{\pi}{2} \bigwedge \operatorname{Im}(z) \geq 0$$

01.09.27.0085.01

$$\cot^{-1}(\cot(z)) == z + \pi \;/;\; -\frac{3\pi}{2} < \mathrm{Re}(z) < -\frac{\pi}{2} \bigvee \mathrm{Re}(z) == -\frac{3\pi}{2} \bigwedge \mathrm{Im}(z) < 0 \bigvee \mathrm{Re}(z) == -\frac{\pi}{2} \bigwedge \mathrm{Im}(z) \geq 0$$

01.09.27.0086.01

$$\cot^{-1}(\cot(z)) == z - \pi \;/;\; \frac{\pi}{2} < \mathrm{Re}(z) < \frac{3\pi}{2} \bigvee \mathrm{Re}(z) == \frac{\pi}{2} \bigwedge \mathrm{Im}(z) < 0 \bigvee \mathrm{Re}(z) == \frac{3\pi}{2} \bigwedge \mathrm{Im}(z) \geq 0$$

01.09.27.0087.01

$$\cot^{-1}(\cot(z)) == z - \pi k \;/;\; \left(k\pi - \frac{\pi}{2} < \mathrm{Re}(z) < \pi k + \frac{\pi}{2} \bigvee \mathrm{Re}(z) == k\pi - \frac{\pi}{2} \bigwedge \mathrm{Im}(z) < 0 \bigvee \mathrm{Re}(z) == \pi k + \frac{\pi}{2} \bigwedge \mathrm{Im}(z) \geq 0\right) \bigwedge k \in \mathbb{Z}$$

01.09.27.0004.01

$$\cot^{-1}(\cot(z)) == z + \pi \left\lfloor \frac{1}{2} - \frac{\mathrm{Re}(z)}{\pi} \right\rfloor - \frac{1}{2}\pi \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} + \frac{1}{2} \right\rfloor + \left\lfloor -\frac{\mathrm{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor}\right) \theta(-\mathrm{Im}(z)) \;/;\; \frac{z}{\pi} - \frac{1}{2} \notin \mathbb{Z}$$

01.09.27.0088.01

$$\cot^{-1}(\cot(z)) == \begin{cases} z - \pi \left\lfloor \frac{2\,\mathrm{Re}(z) - \pi}{2\pi} \right\rfloor & \frac{2\,\mathrm{Re}(z) + \pi}{2\pi} \in \mathbb{Z} \bigwedge \mathrm{Im}(z) \geq 0 \\ z - \pi \left\lfloor \frac{2\,\mathrm{Re}(z) + \pi}{2\pi} \right\rfloor & \text{True} \end{cases}$$

With related functions

Involving exp

01.09.27.0005.01

$$\cot(z) == \frac{i\left(e^{iz} + e^{-iz}\right)}{e^{iz} - e^{-iz}}$$

01.09.27.0006.01

$$\cot(z) == \frac{2i}{e^{2iz} - 1} + i$$

Involving sin

01.09.27.0007.01

$$\cot(z) == \frac{\sin\left(\frac{\pi}{2} - z\right)}{\sin(z)}$$

01.09.27.0008.01

$$\cot(z) == \frac{\sin\left(\frac{\pi}{2} + z\right)}{\sin(z)}$$

01.09.27.0009.01

$$\cot(z) == \frac{\sqrt{-z^2}}{z} \frac{\sqrt{\sin^2(z) - 1}}{\sin(z)} \;/;\; 0 < \mathrm{Re}(z) < \pi$$

01.09.27.0010.01

$$\cot(z) == \frac{\sqrt{1 - \sin^2(z)}}{\sin(z)} \;/;\; |\mathrm{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0011.01

$$\cot(z) = \frac{\sqrt{1-\sin^2(z)}}{\sin(z)} (-1)^{\left\lfloor \frac{1}{2} - \frac{\operatorname{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor + \left\lfloor \frac{1}{2} - \frac{\operatorname{Re}(z)}{\pi} \right\rfloor}\right) \theta(\operatorname{Im}(z))\right)$$

01.09.27.0012.01

$$\cot^2(z) = \frac{1-\sin^2(z)}{\sin^2(z)}$$

Involving cos

01.09.27.0013.01

$$\cot(z) = \frac{\cos(z)}{\cos\left(\frac{\pi}{2} - z\right)}$$

01.09.27.0014.01

$$\cot(z) = -\frac{\cos(z)}{\cos\left(\frac{\pi}{2} + z\right)}$$

01.09.27.0015.01

$$\cot(z) = \frac{\sqrt{-z^2}}{z} \frac{\cos(z)}{\sqrt{\cos^2(z) - 1}} \;/;\; |\operatorname{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0016.01

$$\cot(z) = \frac{\sqrt{z^2}}{z} \frac{\cos(z)}{\sqrt{1 - \cos^2(z)}} \;/;\; |\operatorname{Re}(z)| < \pi$$

01.09.27.0017.01

$$\cot(z) = \frac{\cos(z)}{\sqrt{1 - \cos^2(z)}} \;/;\; 0 < \operatorname{Re}(z) < \pi$$

01.09.27.0018.01

$$\cot(z) = \frac{\cos(z)}{\sqrt{1 - \cos^2(z)}} (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} \right\rfloor} \left(1 - \left((-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} \right\rfloor} + 1\right) \theta(-\operatorname{Im}(z))\right)$$

01.09.27.0019.01

$$\cot^2(z) = \frac{\cos^2(z)}{1 - \cos^2(z)}$$

Involving tan

01.09.27.0020.01

$$\cot(z) = \tan\left(\frac{\pi}{2} - z\right)$$

01.09.27.0021.01

$$\cot(z) = -\tan\left(z + \frac{\pi}{2}\right)$$

01.09.27.0022.01

$$\cot(z) = -\tan\left(z - \frac{\pi}{2}\right)$$

01.09.27.0023.01

$$\cot(z) == \frac{1}{\tan(z)}$$

01.09.27.0024.01

$$\cot(z) == \frac{1 - \tan^2\left(\frac{z}{2}\right)}{2 \tan\left(\frac{z}{2}\right)}$$

01.09.27.0025.01

$$\cot\left(\frac{\pi}{2} + z\right) == -\tan(z)$$

01.09.27.0026.01

$$\cot\left(\frac{\pi}{2} - z\right) == \tan(z)$$

01.09.27.0027.01

$$\cot(z) == \tan(z) + \frac{2}{\tan(2\, z)}$$

Involving csc

01.09.27.0028.01

$$\cot(z) == \frac{\csc(z)}{\csc\left(\frac{\pi}{2} - z\right)}$$

01.09.27.0029.01

$$\cot(z) == \frac{\csc(z)}{\csc\left(\frac{\pi}{2} + z\right)}$$

01.09.27.0030.01

$$\cot(z) == e^{i z} \csc(z) - i$$

01.09.27.0031.01

$$\cot(z) == e^{-i z} \csc(z) + i$$

01.09.27.0032.01

$$\cot(z) == \frac{\sqrt{-z^2}}{z} \sqrt{1 - \csc^2(z)} \;/;\; \operatorname{Im}(z) \neq 0$$

01.09.27.0033.01

$$\cot(z) == \sqrt{\csc^2(z) - 1} \;/;\; 0 < \operatorname{Re}(z) < \frac{\pi}{2}$$

01.09.27.0034.01

$$\cot(z) == z \sqrt{\frac{1}{z^2}} \sqrt{\csc^2(z) - 1} \;/;\; |\operatorname{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0035.01

$$\cot(z) == \sqrt{\csc^2(z) - 1}\, (-1)^{\left\lfloor \frac{2 \operatorname{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} \right\rfloor}\right) \theta(\operatorname{Im}(z))\right) \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} + \frac{1}{2} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor}\right) \theta(-\operatorname{Im}(z))\right)$$

01.09.27.0036.01

$$\cot^2(z) == \csc^2(z) - 1$$

Involving sec

01.09.27.0037.01

$$\cot(z) = \frac{\sec\left(\frac{\pi}{2} - z\right)}{\sec(z)}$$

01.09.27.0038.01

$$\cot(z) = -\frac{\sec\left(\frac{\pi}{2} + z\right)}{\sec(z)}$$

01.09.27.0039.01

$$\cot(z) = e^{i z} \sec\left(\frac{\pi}{2} - z\right) - i$$

01.09.27.0040.01

$$\cot(z) = e^{-i z} \sec\left(\frac{\pi}{2} - z\right) + i$$

01.09.27.0041.01

$$\cot(z) = \frac{\sqrt{-z^2}}{z} \frac{1}{\sqrt{1 - \sec^2(z)}} \;/;\; \mathrm{Im}(z) \neq 0$$

01.09.27.0042.01

$$\cot(z) = \frac{1}{\sqrt{\sec^2(z) - 1}} \;/;\; 0 < \mathrm{Re}(z) < \frac{\pi}{2}$$

01.09.27.0043.01

$$\cot(z) = \frac{\sqrt{z^2}}{z} \frac{1}{\sqrt{\sec^2(z) - 1}} \;/;\; |\mathrm{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0044.01

$$\cot(z) = \frac{1}{\sqrt{\sec^2(z) - 1}} (-1)^{\left\lfloor \frac{2\,\mathrm{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\mathrm{Re}(z)}{\pi} \right\rfloor}\right) \theta(-\mathrm{Im}(z))\right) \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} + \frac{1}{2} \right\rfloor + \left\lfloor -\frac{\mathrm{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor}\right) \theta(\mathrm{Im}(z))\right)$$

01.09.27.0045.01

$$\cot^2(z) = \frac{1}{\sec^2(z) - 1}$$

01.09.27.0046.01

$$\cot^2(z) = \sec^2\left(\frac{\pi}{2} - z\right) - 1$$

Involving sinh

01.09.27.0047.01

$$\cot(z) = \frac{\sinh\left(\frac{i\pi}{2} - i z\right)}{\sinh(i z)}$$

01.09.27.0048.01

$$\cot(z) = \frac{\sinh\left(\frac{i\pi}{2} + i z\right)}{\sinh(i z)}$$

01.09.27.0049.01

$$\cot(z) = \frac{i\sqrt{\sinh^2(i z) + 1}}{\sinh(i z)} \;/;\; |\mathrm{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0050.01

$$\cot(z) = \frac{i\sqrt{1 + \sinh^2(i z)}}{\sinh(i z)} (-1)^{\left\lfloor \frac{1}{2} - \frac{\mathrm{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor + \left\lfloor \frac{1}{2} - \frac{\mathrm{Re}(z)}{\pi} \right\rfloor}\right) \theta(\mathrm{Im}(z))\right)$$

01.09.27.0051.01

$$\cot^2(z) = -\frac{\sinh^2(i z) + 1}{\sinh^2(i z)}$$

Involving cosh

01.09.27.0052.01

$$\cot(z) = \frac{\cosh(i z)}{\cosh\left(\frac{i\pi}{2} - i z\right)}$$

01.09.27.0053.01

$$\cot(z) = -\frac{\cosh(i z)}{\cosh\left(\frac{i\pi}{2} + i z\right)}$$

01.09.27.0054.01

$$\cot(z) = \frac{\sqrt{-z^2}}{z} \frac{\cosh(i z)}{\sqrt{\cosh^2(i z) - 1}} \;/;\; |\mathrm{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0055.01

$$\cot(z) = \frac{\sqrt{z^2}}{z} \frac{\cosh(i z)}{\sqrt{1 - \cosh^2(i z)}} \;/;\; |\mathrm{Re}(z)| < \pi$$

01.09.27.0056.01

$$\cot(z) = \frac{\cosh(i z)}{\sqrt{1 - \cosh^2(i z)}} \;/;\; 0 < \mathrm{Re}(z) < \pi$$

01.09.27.0057.01

$$\cot(z) = -\frac{\cosh(i z)}{\sqrt{1 - \cosh^2(i z)}} (-1)^{\left\lfloor -\frac{\mathrm{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\mathrm{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\mathrm{Re}(z)}{\pi} \right\rfloor}\right) \theta(\mathrm{Im}(z))\right)$$

01.09.27.0058.01

$$\cot^2(z) = \frac{\cosh^2(i z)}{1 - \cosh^2(i z)}$$

Involving tanh

01.09.27.0059.01

$$\cot(z) = -i \tanh\left(\frac{\pi i}{2} - i z\right)$$

01.09.27.0060.01

$$\cot(z) = i \tanh\left(\frac{\pi i}{2} + i z\right)$$

01.09.27.0061.01

$$\cot(z) = \frac{i}{\tanh(i z)}$$

Involving coth

01.09.27.0062.01

$$\cot(z) = i \coth(i z)$$

01.09.27.0063.01

$$\cot(i z) = -i \coth(z)$$

Involving csch

01.09.27.0064.01

$$\cot(z) = \frac{\operatorname{csch}(i z)}{\operatorname{csch}\left(\frac{\pi i}{2} - i z\right)}$$

01.09.27.0065.01

$$\cot(z) = \frac{\operatorname{csch}(i z)}{\operatorname{csch}\left(\frac{\pi i}{2} + i z\right)}$$

01.09.27.0066.01

$$\cot(z) = i e^{i z} \operatorname{csch}(i z) - i$$

01.09.27.0067.01

$$\cot(z) = i e^{-i z} \operatorname{csch}(i z) + i$$

01.09.27.0068.01

$$\cot(z) = \frac{\sqrt{-z^2}}{z} \sqrt{1 + \operatorname{csch}^2(i z)} \;/;\; \operatorname{Im}(z) \neq 0$$

01.09.27.0069.01

$$\cot(z) = \sqrt{-\operatorname{csch}^2(i z) - 1} \;/;\; 0 < \operatorname{Re}(z) < \frac{\pi}{2}$$

01.09.27.0070.01

$$\cot(z) = z \sqrt{\frac{1}{z^2}} \sqrt{\operatorname{csch}^2(i z) - 1} \;/;\; |\operatorname{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0071.01

$$\cot(z) = \sqrt{-\operatorname{csch}^2(i z) - 1} \, (-1)^{\left\lfloor \frac{2 \operatorname{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} \right\rfloor}\right) \theta(\operatorname{Im}(z))\right) \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} + \frac{1}{2} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor}\right) \theta(-\operatorname{Im}(z))\right)$$

01.09.27.0072.01

$$\cot^2(z) = -\operatorname{csch}^2(i z) - 1$$

Involving sech

01.09.27.0073.01

$$\cot(z) = \frac{\operatorname{sech}\left(\frac{\pi i}{2} - i z\right)}{\operatorname{sech}(i z)}$$

01.09.27.0074.01

$$\cot(z) = -\frac{\operatorname{sech}\left(\frac{\pi i}{2} + i z\right)}{\operatorname{sech}(i z)}$$

01.09.27.0075.01

$$\cot(z) = e^{i z} \operatorname{sech}\left(\frac{\pi i}{2} - i z\right) - i$$

01.09.27.0076.01

$$\cot(z) = e^{-i z} \operatorname{sech}\left(\frac{\pi i}{2} - i z\right) + i$$

01.09.27.0077.01

$$\cot(z) = \frac{\sqrt{-z^2}}{z} \frac{1}{\sqrt{1 - \operatorname{sech}^2(i z)}} \;/;\; \operatorname{Im}(z) \neq 0$$

01.09.27.0078.01

$$\cot(z) = \frac{1}{\sqrt{\operatorname{sech}^2(i z) - 1}} \;/;\; 0 < \operatorname{Re}(z) < \frac{\pi}{2}$$

01.09.27.0079.01

$$\cot(z) = \frac{\sqrt{z^2}}{z} \frac{1}{\sqrt{\operatorname{sech}^2(i z) - 1}} \;/;\; |\operatorname{Re}(z)| < \frac{\pi}{2}$$

01.09.27.0080.01

$$\cot(z) = \frac{1}{\sqrt{\operatorname{sech}^2(i z) - 1}} (-1)^{\left\lfloor \frac{2 \operatorname{Re}(z)}{\pi} \right\rfloor} \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} \right\rfloor}\right) \theta(-\operatorname{Im}(z))\right) \left(1 - \left(1 + (-1)^{\left\lfloor \frac{\operatorname{Re}(z)}{\pi} + \frac{1}{2} \right\rfloor + \left\lfloor -\frac{\operatorname{Re}(z)}{\pi} - \frac{1}{2} \right\rfloor}\right) \theta(\operatorname{Im}(z))\right)$$

01.09.27.0081.01

$$\cot^2(z) = \frac{1}{\operatorname{sech}^2(i z) - 1}$$

01.09.27.0082.01

$$\cot^2(z) = \operatorname{sech}^2\left(\frac{\pi i}{2} - i z\right) - 1$$

Involving trigonometric and hyperbolic functions

01.09.27.0083.01

$$\cot(z) = \frac{\cos(z)}{\sin(z)}$$

01.09.27.0084.01

$$\cot(z) + \tan(z) = 2 \csc(2 z)$$

Inequalities

01.09.29.0001.01

$\cot(x) < \frac{1}{x} /; 0 < x < \pi \land x \in \mathbb{R}$

Zeros

01.09.30.0001.01

$\cot(z) == 0 /; z == \pi\left(k + \frac{1}{2}\right) \bigwedge k \in \mathbb{Z}$

Theorems

Hilbert cotangent transformation

$$\hat{f}(y) == \frac{1}{2\pi}\int_0^{2\pi} f(x)\cot\left(\frac{y-x}{2}\right) dx \Leftrightarrow f(x) == \frac{1}{2\pi}\int_0^{2\pi} \hat{f}(y)\cot\left(\frac{y-x}{2}\right) dy + \int_0^{2\pi} f(x)\, dx.$$

Poisson formula

The value $f\left(r\, e^{i\phi}\right)$ of an analytic function $f(z)$ can be expressed through the values of $f(z)$ along the circle $r\, e^{i\vartheta}$ by

$$f\left(r\, e^{i\phi}\right) == f(0) - \frac{i}{2\pi}\mathcal{P}\int_0^{2\pi} f\left(r\, e^{i\vartheta}\right)\cot\left(\frac{\vartheta-\phi}{2}\right) d\vartheta.$$

Other information

Value properties

01.09.33.0001.01

$(x \in \mathbb{Q} \bigwedge \cot(x^\circ) \in \mathbb{Q}) \Rightarrow \cot(x) == 0 \lor \cot(x) == -1 \lor \cot(x) == 1$

History

– E. Gunter (1620) used the notation "cotangent"
– J. Keill (1726)
– L. Euler (1748)

The function cot is encountered often in mathematics and the natural sciences.

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