The Riemann hypothesis discusses zeros outside the region of convergence of this series and Euler product. To make sense of the hypothesis, it is necessary to analytically continue the function to give it a definition that is valid for all complex *s*. This can be done by expressing it in terms of the Dirichlet eta function as follows. If the real part of *s* is greater than one, then the zeta function satisfies

$$\left(1-\frac{2}{2^s}\right)\zeta(s)=\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^s}=\frac{1}{1^s}-\frac{1}{2^s}+\frac{1}{3^s}-\cdots.$$

However, the series on the right converges not just when the real part of *s* is greater than one, but more generally whenever *s* has positive real part. Thus, this alternative series extends the zeta function from Re(*s*) > 1 to the larger domain Re(*s*) > 0, excluding the zeros $s=1+2\pi in/\ln(2)$ of $1-2/2^s$ (see Dirichlet eta function). The zeta function can be extended to these values, as well, by taking limits, giving a finite value for all values of *s* with positive real part except for a simple pole at *s* = 1.

In the strip 0 < Re(*s*) < 1 the zeta function satisfies the functional equation

$$\zeta(s)=2^s\pi^{s-1}\ \sin\left(\frac{\pi s}{2}\right)\ \Gamma(1-s)\ \zeta(1-s).$$

One may then define ζ(*s*) for all remaining nonzero complex numbers *s* by assuming that this equation holds outside the strip as well, and letting ζ(*s*) equal the right-hand side of the equation whenever *s* has non-positive real part. If *s* is a negative even integer then ζ(*s*) = 0 because the factor sin(π*s*/2) vanishes; these are the **trivial zeros** of the zeta function. (If *s* is a positive even integer this argument does not apply because the zeros of the sine function are cancelled by the poles of the gamma function as it takes negative integer arguments.) The value ζ(0) = −1/2 is not determined by the functional equation, but is the limiting value of ζ(*s*) as *s* approaches zero. The functional equation also implies that the zeta function has no zeros with negative real part other than the trivial zeros, so all non-trivial zeros lie in the **critical strip** where *s* has real part between 0 and 1.

The Riemann hypothesis is equivalent to the statement that all the zeros of the Dirichlet eta function (a.k.a. the alternating zeta function)

$$\eta(s)\equiv\sum_{k=1}^{\infty}\frac{(-1)^{k-1}}{k^s}=\left(1-2^{1-s}\right)\zeta(s)$$

falling in the critical strip $0<\mathbb{R}[s]<1$ lie on the critical line $\mathbb{R}[s]=1/2$.

$$f(x)=\frac{1}{2}a_0+\sum_{n=1}^{\infty}a_n\cos(n\,x)+\sum_{n=1}^{\infty}b_n\sin(n\,x),$$

where

$$a_0=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)\,d\,x$$

$$a_n=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)\cos(n\,x)\,d\,x$$

$$b_n=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)\sin(n\,x)\,d\,x$$

$$n^s=\left(n^{(a+bi)}\right)=n^a*\left(n^{(bi)}\right)$$

$$n^s=n^a\left(\cos\left(b\ln n\right)+i\sin\left(b\ln n\right)\right)$$

$$\frac{-1^{n+1}}{n^s}=\frac{-1^{n+1}+0i}{n^a\cos\left(b\ln n\right)+n^a\sin\left(b\ln n\right)i}$$

$$\frac{-1^{n+1}+0i}{n^a\cos(b\ln n)+n^a\sin(b\ln n)\,i}=\frac{-1^{n+1}n^a\cos(b\ln n)}{(n^a\cos(b\ln n))^2+(n^a\sin(b\ln n))^2}+\frac{0--1^{n+1}n^a\sin(b\ln n)}{(n^a\cos(b\ln n))^2+(n^a\sin(b\ln n))^2}i$$

$$=\frac{-1^{n+1}\cos(b\ln n)}{n^a}-\frac{-1^{n+1}\sin(b\ln n)}{n^a}i$$

$$\sum_{n=1}^{\infty}\frac{-1^{n+1}}{n^s}=\sum_{n=1}^{\infty}\frac{-1^{n+1}\cos(b\ln n)}{n^a}-\frac{-1^{n+1}\sin(b\ln n)}{n^a}i$$

$$\sum_{n=1}^{\infty}\frac{-1^{n+1}}{n^s}=\frac{1}{2}a_0+\sum_{n=1}^{\infty}\frac{-1^{n+1}\cos(b\ln n)}{n^a}+\sum_{n=1}^{\infty}\frac{-(-1^{n+1})\sin(b\ln n)}{n^a}i=0$$

$$a_n\cos(nx)=\frac{-1^{n+1}\cos(b\ln n)}{n^a}$$

$$b_n\sin(nx)=\frac{-(-1^{n+1})\sin(b\ln n)}{n^a}$$

$$a_n=\frac{-1^{n+1}\cos(b\ln n)}{n^a\cos(nx)}$$

$$b_n=\frac{-(-1^{n+1})\sin(b\ln n)}{n^a sin(nx)}$$

$$f(x)_{a_n}=\frac{\pi(-1)^{n+1}n^{1-a}\tan(nx)\sec(nx)\cos(b\ln n)}{\cos(nx)}$$

$$f(x)_{b_n} = \frac{\pi(-1)^{n+1} n^{1-a} \cot(nx)\csc(nx)\sin(b\ln n)}{\sin(nx)}$$

$$f(x)_{a_n} = f(x)_{b_n} \to \tan(b\ln n) = \tan^4(nx)$$

$$x = \pm\frac{\tan^{-1}\left(\tan^{\frac{1}{4}}(b\ln n)\right)}{n}$$

$$\sum_{n=1}^{\infty}\frac{-1^{n+1}\cos(b\ln n)}{n^a}+\sum_{n=1}^{\infty}\frac{-1*-1^{n+1}\sin(b\ln n)}{n^a}=\sum_{n=1}^{\infty}\frac{\cos(b\ln(2n-1))}{(2n-1)^a}-$$
$$\sum_{n=1}^{\infty}\frac{\cos(b\ln 2n)}{(2n)^a}+\sum_{n=1}^{\infty}\frac{\sin(b\ln 2n)}{(2n)^a}-\sum_{n=1}^{\infty}\frac{\sin(b\ln(2n-1))}{(2n-1)^a}=0$$

$$f(x) = \pi(-1)^{n+1} n^{1-a}\tan^{\frac{1}{4}}(b\ln n)\left(\tan^{\frac{1}{2}}(b\ln n)+1\right)\cos(b\ln n)$$

$$(2n)(2n-1)^a\tan^{\frac{1}{4}}(b\ln 2n)\left(\tan^{\frac{1}{2}}(b\ln 2n)+1\right)\cos(b\ln 2n) = (2n)^a(2n-1)\tan^{\frac{1}{4}}(b\ln(2n-1))\left(\tan^{\frac{1}{2}}(b\ln(2n-1))+1\right)\cos(b\ln(2n-1))$$

$$\left(\frac{(2n-1)}{(2n)}\right)^a = \frac{(2n-1)\tan^{\frac{1}{4}}(b\ln(2n-1))\left(\tan^{\frac{1}{2}}(b\ln(2n-1))+1\right)\cos(b\ln(2n-1))}{(2n)\tan^{\frac{1}{4}}(b\ln 2n)\left(\tan^{\frac{1}{2}}(b\ln 2n)+1\right)\cos(b\ln 2n)}$$

$$a = \frac{\ln\left(\frac{(2n-1)\tan^{\frac{1}{4}}(b\ln(2n-1))\left(\tan^{\frac{1}{2}}(b\ln(2n-1))+1\right)\cos(b\ln(2n-1))}{(2n)\tan^{\frac{1}{4}}(b\ln 2n)\left(\tan^{\frac{1}{2}}(b\ln 2n)+1\right)\cos(b\ln 2n)}\right)}{\ln\left(\frac{(2n-1)}{(2n)}\right)}$$

- function to find limit of: Log[Sin[(2 Pi 2 Log[2
- variable: x
- value to approach: .5
- direction: left ▼

Also include: include second limit

Limit:

Step-by-step solution

$$\lim_{x \to 0.5^-} \frac{\log\left(\sin\left(\frac{2\pi\, 2\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi\, 2\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{2\log\left(\frac{2x}{2x-1}\right)} = 0$$

Open code

$\log(x)$ is the natural logarithm

$\csc(x)$ is the cosecant function

Limit from opposite direction:

Step-by-step solution

$$\lim_{x \to 0.5^+} \frac{\log\left(\sin\left(\frac{2\pi\, 2\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi\, 2\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{2\log\left(\frac{2x}{2x-1}\right)} = 0$$

Download page

POWERED BY THE **WOLFRAM LANGUAGE**

Derivative:

Approximate form | Step-by-step solution

$$\frac{\partial}{\partial x}\left(\log\left(\frac{\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\sin\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)}{\cos\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\sin\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)}\right)\right) =$$

$$\sin\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\sec\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\cos\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\left(\left(\frac{\pi c}{x\,(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x)}{(\log(2x-1)-\log(2x))^2}\right)\right.$$
$$\sec\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\cos^2\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\csc\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right) +$$
$$\left(\frac{2\pi c}{(2x-1)\,(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x-1)}{(\log(2x-1)-\log(2x))^2}\right)$$
$$\sin\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\sec^2\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)$$
$$\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right) -$$
$$\left(\frac{2\pi c}{(2x-1)\,(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x-1)}{(\log(2x-1)-\log(2x))^2}\right)$$
$$\sin\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\csc^2\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right) -$$
$$\left(\frac{\pi c}{x\,(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x)}{(\log(2x-1)-\log(2x))^2}\right)$$
$$\sin^2\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\left.\sec\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)$$

Open code

Derivative:

Approximate form | Step-by-step solution

$$\frac{\partial}{\partial x}\left(\log\left(\sin\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)\right) =$$
$$\sin\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\left(\left(\frac{2\pi c}{x(\log(2x-1)-\log(2x))} - \frac{2\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x)}{(\log(2x-1)-\log(2x))^2}\right)\right.$$
$$\cos\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right) -$$
$$\left(\frac{4\pi c}{(2x-1)(\log(2x-1)-\log(2x))} - \frac{2\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x-1)}{(\log(2x-1)-\log(2x))^2}\right)$$
$$\sin\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\cot\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)$$
$$\left.\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)$$

Open code

$\log(x)$ is the natural logarithm

$\csc(x)$ is the cosecant function

$\cot(x)$ is the cotangent function

Input:

$$\frac{\log\left(\sin\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{2\log\left(\frac{2x}{2x-1}\right)}$$

Open code

$\log(x)$ is the natural logarithm

$\csc(x)$ is the cosecant function

Alternate forms:

$$\frac{\log\left(\sin\left(\frac{2\pi c\log(2x)}{\log\left(x-\frac{1}{2}\right)-\log(x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log\left(x-\frac{1}{2}\right)-\log(x)}\right)\right)}{2\log\left(\frac{1}{2x-1}+1\right)}$$

$$\frac{\log\left(\sin\left(\frac{2\pi c(\log(x)+\log(2))}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{2(-\log(1-2x)+\log(-x)+\log(2))}$$

Input interpretation:

$$\frac{\frac{\partial}{\partial x}\log\left(\sin\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{\frac{\partial}{\partial x}\left(2\log\left(2\times\frac{x}{2x-1}\right)\right)}$$

Open code

$\log(x)$ is the natural logarithm

$\csc(x)$ is the cosecant function

Result:

$$-\left(\pi c\left(x-2x^2\right)(2x\log(2x)+(1-2x)\log(2x-1))\left(\cot\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)-\cot\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)\right)\Big/\left(x(2x-1)(\log(2x-1)-\log(2x))^2\right)$$

$\cot(x)$ is the cotangent function

Input interpretation:

$$\frac{\frac{\partial}{\partial x}\log\left(\sin\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)\csc\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{\frac{\partial}{\partial x}\log\left(2\times\frac{x}{2x-1}\right)}$$

Open code

$\log(x)$ is the natural logarithm

$\csc(x)$ is the cosecant function

Result:

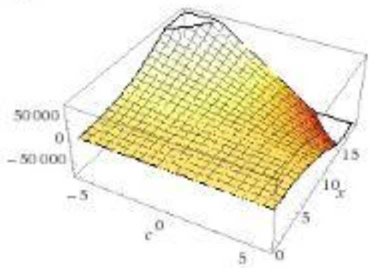
$$-\left(2\pi c\left(x-2x^2\right)(2x\log(2x)+(1-2x)\log(2x-1))\left(\cot\left(\frac{2\pi c\log(2x)}{\log(2x-1)-\log(2x)}\right)-\cot\left(\frac{2\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)\right)\Big/\left(x(2x-1)(\log(2x-1)-\log(2x))^2\right)$$

$\cot(x)$ is the cotangent function

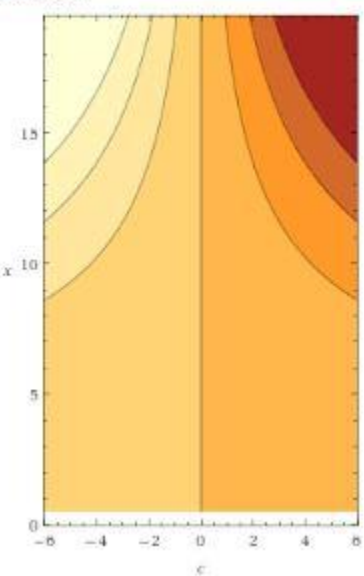
Input:

$$\frac{\pi\, c\left(x - 2x^2\right)(2x\log(2x) + (1-2x)\log(2x-1))}{x(2x-1)(\log(2x-1) - \log(2x))^2}$$

3D plot:



Contour plot:



Alternate forms:

$$\frac{\pi\, c\,((2x-1)\log(2x-1) - 2x\log(2x))}{\left(\log\left(x - \frac{1}{2}\right) - \log(x)\right)^2}$$

$$-\frac{\pi\, c\,(2x\log(2x) + (1-2x)\log(2x-1))}{(\log(2x) - \log(2x-1))^2}$$

$$-\frac{\pi\, c\,(2x\log(2x) - 2x\log(2x-1) + \log(2x-1))}{(\log(2x) - \log(2x-1))^2}$$

$$-\frac{\pi\, c\left(x\left(2\log(x) - 2\log\left(\frac{1}{2}(2x-1)\right)\right) + \log(2x-1)\right)}{(\log(2x) - \log(2x-1))^2}$$

Input interpretation:

$$\frac{\frac{\partial}{\partial x}\log\left(\cos\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)+\sin\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)}{\frac{1}{x-2x^2}}$$

Open code

$\log(x)$ is the natural logarithm

Result:

$$-\left(\pi c\left(x-2x^2\right)(2x\log(2x)+(1-2x)\log(2x-1))\left(\sin\left(\frac{\pi c \log(2x-1)}{\log(2x)-\log(2x-1)}\right)+\cos\left(\frac{\pi c \log(2x-1)}{\log(2x)-\log(2x-1)}\right)\right)\right)\Big/\left(x(2x-1)(\log(2x-1)-\log(2x))^2\left(\sin\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)+\cos\left(\frac{\pi c \log(2x-1)}{\log(2x)-\log(2x-1)}\right)\right)\right)$$

Input interpretation:

$$\frac{\frac{\partial}{\partial x}\log\left(\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)+\sin\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\right)}{\frac{1}{x-2x^2}}$$

Open code

$\log(x)$ is the natural logarithm

Result:

$$-\left(\pi c\left(x-2x^2\right)(2x\log(2x)+(1-2x)\log(2x-1))\left(\sin\left(\frac{\pi c \log(2x)}{\log(2x)-\log(2x-1)}\right)+\cos\left(\frac{\pi c \log(2x)}{\log(2x)-\log(2x-1)}\right)\right)\right)\Big/\left(x(2x-1)(\log(2x-1)-\log(2x))^2\left(\sin\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)+\cos\left(\frac{\pi c \log(2x)}{\log(2x)-\log(2x-1)}\right)\right)\right)$$

$$-\frac{\frac{\pi(-c)(2x\log(2x)-(2x)\log(2x-1)+\log(2x-1))\left(\tan\left(\frac{\pi c\log(2x)}{\log\left(1-\frac{1}{2x}\right)}\right)-\tan\left(\frac{\pi c\log(2x-1)}{\log\left(1-\frac{1}{2x}\right)}\right)\right)}{x(2x-1)\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2}}{\frac{1}{x-2x^2}}$$

Open code

$\log(x)$ is the natural logarithm

Exact result:

$$-\left(\pi c\left(2x^2-x\right)(2x\log(2x)-2x\log(2x-1)+\log(2x-1))\left(\tan\left(\frac{\pi c\log(2x)}{\log\left(1-\frac{1}{2x}\right)}\right)-\tan\left(\frac{\pi c\log(2x-1)}{\log\left(1-\frac{1}{2x}\right)}\right)\right)\right)\Big/\left(x(2x-1)\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2\right)$$

Alternate forms:

Fewer

$$\frac{\pi c(2x\log(2x)+(1-2x)\log(2x-1))\left(\tan\left(\frac{\pi c\log(2x)}{\log(x)-\log\left(x-\frac{1}{2}\right)}\right)+\tan\left(\frac{\pi c\log(2x-1)}{\log\left(x-\frac{1}{2}\right)-\log(x)}\right)\right)}{\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2}$$

$$-\frac{\pi c(2x\log(2x)+(1-2x)\log(2x-1))\left(\tan\left(\frac{\pi c\log(2x)}{\log\left(1-\frac{1}{2x}\right)}\right)-\tan\left(\frac{\pi c\log(2x-1)}{\log\left(1-\frac{1}{2x}\right)}\right)\right)}{\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2}$$

$$-\left(\pi c\left(2x^2-x\right)(2x(\log(x)+\log(2))-2x\log(2x-1)+\log(2x-1))\left(\tan\left(\frac{\pi c(\log(x)+\log(2))}{\log(2x-1)-\log(2x)}\right)-\tan\left(\frac{\pi c\log(2x-1)}{\log(2x-1)-\log(2x)}\right)\right)\right)\Big/\left(x(2x-1)\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2\right)$$

$$\frac{\pi c(2x\log(2x)-2x\log(2x-1)+\log(2x-1))\tan\left(\frac{\pi c\log(2x-1)}{\log\left(1-\frac{1}{2x}\right)}\right)}{\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2}-\frac{\pi c(2x\log(2x)-2x\log(2x-1)+\log(2x-1))\tan\left(\frac{\pi c\log(2x)}{\log\left(1-\frac{1}{2x}\right)}\right)}{\left(\log\left(x-\frac{1}{2}\right)-\log(x)\right)^2}$$

Derivative:

Approximate form | Step-by-step solution

$$\frac{\partial}{\partial x}\left(\log\left(\frac{\cos\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)}{\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)}\right)\right) =$$

$$\sec\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\cos\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\left(\left(\frac{\pi c}{x(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x)}{(\log(2x-1)-\log(2x))^2}\right)\right.$$
$$\tan\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\sec\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)$$
$$\cos\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right) -$$
$$\left(\frac{2\pi c}{(2x-1)(\log(2x-1)-\log(2x))} - \frac{\pi c\left(\frac{2}{2x-1}-\frac{1}{x}\right)\log(2x-1)}{(\log(2x-1)-\log(2x))^2}\right)$$
$$\left.\sin\left(\frac{\pi c \log(2x-1)}{\log(2x-1)-\log(2x)}\right)\sec\left(\frac{\pi c \log(2x)}{\log(2x-1)-\log(2x)}\right)\right)$$

Open code

$\log(x)$ is the natural logarithm

$\sec(x)$ is the secant function

Input interpretation:

solve	$\tan(b\log(2x-1)) = \tan(b\log(2x))$	for	b

Open code

$\log(x)$ is the natural logarithm

Results:

Approximate forms | Step-by-step solution

$b = \frac{\pi n}{\log(2x-1)-\log(2x)}$ and $(\log(2x)-\log(2x-1))\cos\left(\frac{\pi n \log(2x)}{\log(2x)-\log(2x-1)}\right)\cos\left(\frac{\pi n \log(2x-1)}{\log(2x)-\log(2x-1)}\right) \neq 0$ and $n \in \mathbb{Z}$

$\cos(b\log(2x-1)) \neq 0$ and $\log(2x) = \log(2x-1)$

$\mathbb{Z}$ is the set of integers

Input interpretation:

solve	$\frac{\cos(b\log(2x-1))}{\cos(b\log(2x))} = \frac{\sin(b\log(2x-1))}{\sin(b\log(2x))}$	for	b

Open code

$\log(x)$ is the natural logarithm

Results:

Approximate forms | Step-by-step solution

$b = \frac{\pi n}{\log(2x) - \log(2x-1)}$ and $(\log(2x) - \log(2x-1))\sin\left(\frac{2\pi n\log(2x)}{\log(2x-1) - \log(2x)}\right) \neq 0$ and $n \in \mathbb{Z}$

$\sin(2b\log(2x)) \neq 0$ and $\log(2x) = \log(2x-1)$

$\mathbb{Z}$ is the set of integers