

Proposal for C2Y

WG14 Nxxxx

Title: Range bounds for math functions

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Proposal category: Technical

Reference Documents: C2Y draft N3854, Original issue: N3731

Motivation:

WG14 reflector message SC22WG14.34179 from Joseph Myers points out that the range bounds issue addressed by CFP's N3731 does not cover the same issue for complex functions. This paper addresses the issue for `cacos` (7.3.5.1), `casin` (7.3.5.2), `catan` (7.3.5.3), `cacosh` (7.3.6.1), `casinh` (7.3.6.2) and `catanh` (7.3.6.3) which we believe are all the missing functions that were not previously handled.

Proposed Changes:

Change 7.3.5.1 from:

Description

2 The `cacos` functions compute the complex arc cosine of z , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `cacos` functions return the complex arc cosine value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[0, \pi]$ along the real axis.

To:

Description

2 The `cacos` functions compute the branch of the complex arc cosine of z whose range is the strip unbounded along the imaginary axis and in the interval $[0, \pi]$ along the real axis, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `cacos` functions return the complex arc cosine of z .

4 NOTE The `cacos` functions, and similarly the `casin`, `catan`, `cacosh`, `casinh` and `catanh` functions, can return a value outside the specified branch for the computed mathematical function. Because the branch has boundary points with a coordinate that is not representable as a floating-point number, even correct rounding can yield values outside the branch boundary, depending on the return type and rounding direction.

Change 7.3.5.2 from:

Description

2 The `casin` functions compute the complex arc sine of z , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `casin` functions return the complex arc sine value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis.

To:

Description

2 The `casin` functions compute the branch of the complex arc sine of z whose range is the strip unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `casin` functions return the complex arc sine of z .

Change 7.3.5.3 from:

Description

2 The `catan` functions compute the complex arc tangent of z , with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

3 The `catan` functions return the complex arc tangent value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis.

To:

Description

2 The `catan` functions compute the branch of the complex arc tangent of z whose range is the strip unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis, with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

3 The `catan` functions return the complex arc tangent of z .

Change 7.3.6.1 from:

Description

2 The `cacosh` functions compute the complex arc hyperbolic cosine of z , with branch cuts at values less than 1 along the real axis.

Returns

3 The `cacosh` functions return the complex arc hyperbolic cosine value, in the range of a half-strip of non-negative values along the real axis and in the interval $[-i\pi, +i\pi]$ along the imaginary axis.

To:

Description

2 The `cacosh` functions compute the branch of the complex arc hyperbolic cosine of z whose range is a half-strip of non-negative values along the real axis and in the interval $[-i\pi, +i\pi]$ along the imaginary axis, with branch cuts at values less than 1 along the real axis.

Returns

3 The `cacosh` functions return the complex arc hyperbolic cosine of z .

Change 7.3.6.2 from:

Description

2 The `casinh` functions compute the complex arc hyperbolic sine of z , with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

3 The `casinh` functions return the complex arc hyperbolic sine value, in the range of a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis.

To:

Description

2 The `casinh` functions compute the branch of the complex arc hyperbolic sine of z whose range is a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis, with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

3 The `casinh` functions return the complex arc hyperbolic sine of z .

Change 7.3.6.3 from:

Description

2 The `catanh` functions compute the complex arc hyperbolic tangent of z , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `catanh` functions return the complex arc hyperbolic tangent value, in the range of a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis.

To:

Description

2 The `catanh` functions compute the branch of the complex arc hyperbolic tangent of z whose range is a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

3 The `catanh` functions return the complex arc hyperbolic tangent of z .