Subject: More mathematical functions
From: Van Snyder
Reference: 03-258r1, section 2.4.4.3

# Number

TBD

# Title

More mathematical functions.

# Submitted By

J3

# Status

For consideration.

# Basic Functionality

More mathematical functions.

# Rationale

Mathematical functions for complex type are occasionally needed. The only ones that are available for complex type are ABS, COS, EXP, LOG and SIN. The other mathematical functions that are provided for real type are useful in practice for complex type as well. Inverse hyperbolic functions and other functions are useful.

# Estimated Impact

Minor but tedious.

# Detailed Specification

Provide ACOS, ASIN, ATAN, COSH, SINH, TAN and TANH for complex type. Provide inverse hyperbolic functions, including for complex type.

The following also appear in applications, and have better round-off characteristics for $x$ near zero when implemented directly rather than as written here: $e^x - 1$, $\log(x+1)$, $x - \log(x+1)$, $(x - \sin(x))/x^3$, $(1 - \cos(x)/x^2$, $(\sinh(x) - x)/x^3$, $(\cosh(x) - 1)/x^2$ and $1/\Gamma(x+1) - 1$. The function $x - 1 - \log(x)$ has better round-off characteristics for $x$ near one when implemented directly rather than as written here. These should be provided for both real and complex arguments. The first two are the ones most commonly found in applications.

A few other functions are useful, especially $\Gamma(x)$, $\mathrm{erf}(x)$, $\mathrm{erfc}(x)$ and $\exp(x^2)\,\mathrm{erfc}(x)$. These are sufficiently difficult to do well for complex arguments that the standard should not require it.

# History