

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

## 1 **Number**

2 TBD

## 3 **Title**

4 More mathematical functions.

## 5 **Submitted By**

6 J3

## 7 **Status**

8 For consideration.

## 9 **Basic Functionality**

10 More mathematical functions.

## 11 **Rationale**

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

## 16 **Estimated Impact**

17 Minor but tedious.

## 18 **Detailed Specification**

19 Provide ACOS, ASIN, ATAN, COSH, SINH, TAN and TANH for complex type. Provide inverse hyper-  
20 bolic functions, including for complex type.

21 The following also appear in applications, and have better round-off characteristics for  $x$  near zero when  
22 implemented directly rather than as written here:  $e^x - 1$ ,  $\log(x + 1)$ ,  $x - \log(x + 1)$ ,  $(x - \sin(x))/x^3$ ,  
23  $(1 - \cos(x))/x^2$ ,  $(\sinh(x) - x)/x^3$ ,  $(\cosh(x) - 1)/x^2$  and  $1/\Gamma(x + 1) - 1$ . The function  $x - 1 - \log(x)$   
24 has better round-off characteristics for  $x$  near one when implemented directly rather than as written  
25 here. These should be provided for both real and complex arguments. The first two are the ones most  
26 commonly found in applications.

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

## 29 **History**