

NAME

qpsi – Quadruple-precision psi(x)

SYNOPSIS

Fortran (77, 90, 95, HPF):

```
f77 [ flags ] file(s) ... -L/usr/local/lib -lgjl
```

```
REAL*16 FUNCTION qpsi(x)
```

```
REAL*16 x
```

C (K&R, 89, 99), C++ (98):

```
cc [ flags ] -I/usr/local/include file(s) ... -L/usr/local/lib -lgjl
```

Use

```
#include <gampsi.h>
```

to get this prototype:

```
fortran_quadruple_precision qpsi(const fortran_quadruple_precision * x_);
```

NB: The definition of C/C++ data types **fortran_**xxx, and the mapping of Fortran external names to C/C++ external names, is handled by the C/C++ header file. That way, the same function or subroutine name can be used in C, C++, and Fortran code, independent of compiler conventions for mangling of external names in these programming languages.

Last code modification: 04-Aug-2000

DESCRIPTION

Compute and return the value of the psi(x) function for quadruple-precision x.

The psi(x) function is the logarithmic derivative of the Gamma(x) function:

$$\text{psi}(x) = d/dx (\text{Gamma}(x)) / \text{Gamma}(x) = d/dx (\ln \text{Gamma}(x))$$

This code correctly handles the case where x is NaN, for which psi(NaN) is a NaN, and the case where x is sufficiently large and positive, or takes one of the integer values 0, -1, -2, -3, ..., for which psi(x) = +Infinity, a special value in IEEE 754 arithmetic.

This code is derived from code given by

W. J. Cody

Algorithm 715: SPECFUN --- A Portable FORTRAN

Package of Special Function Routines and Test Drivers

ACM Trans. Math. Software 19(1) 22--32, March 1993.

but has been augmented for support of IEEE 754 arithmetic, and extended with a new rational Pade approximation for psi(x) with x in [1,2], and new algorithms for argument reduction.

SEE ALSO

dgamma(3), **dpsi(3)**, **dpsiln(3)**, **gamma(3)**, **psi(3)**, **psiln(3)**, **qgamma(3)**, **qpsiln(3)**.

AUTHORS

The algorithms and code are described in detail in the paper

Algorithm xxx: Quadruple-Precision Gamma(x) and psi(x) Functions for Real Arguments

in ACM Transactions on Mathematical Software, Volume ??, Number ??, Pages ???--??? and ???--???, 2001, by

Nelson H. F. Beebe

Center for Scientific Computing

University of Utah

Department of Mathematics, 110 LCB

155 S 1400 E RM 233

Salt Lake City, UT 84112-0090

Tel: +1 801 581 5254

FAX: +1 801 581 4148

Email: beebe@math.utah.edu, beebe@acm.org, beebe@computer.org

WWW URL: <http://www.math.utah.edu/~beebe>

and

James S. Ball
University of Utah
Department of Physics
Salt Lake City, UT 84112-0830
USA
Tel: +1 801 581 8397
FAX: +1 801 581 6256
Email: ball@physics.utah.edu
WWW URL: <http://www.physics.utah.edu/people/faculty/ball.html>