CBESSY

PURPOSE

Compute the real or complex component of the Bessel function of the second kind and order v for a complex argument where v is a non-negative real number.

DESCRIPTION

The definition of Bessel functions of the second kind with order v (v is a non-negative real number) is:

$$Y_v(x) = \frac{J_v(x)\cos(\pi v) - J_{-v}(x)}{\sin(\pi v)} \qquad \textbf{(EQ Aux-62)}$$

where J_v is the Bessel function of the first kind. See the documentation for the BESSJN commands for details on this function.

The order is restricted to values between 0 and 100.

SYNTAX 1

LET <y2> = CBESSYR(<r1>,<i1>,<v>) <SUBSET/EXCEPT/FOR qualification>
where <r1> is the real component of a number, variable or parameter;
<i1> is the complex component of a number, variable or parameter;
<v> is a non-negative number, variable, or parameter that specifies the order of the Bessel function;
<y2> is a variable or a parameter (depending on what <r1> and <i1> are) where the computed Bessel value is stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

This syntax computes the real component.

SYNTAX 2

LET <y2> = CBESSYI(<r1>,<i1>,<v>) <SUBSET/EXCEPT/FOR qualification>
where <r1> is the real component of a number, variable or parameter;
<i1> is the complex component of a number, variable or parameter;
<v> is a non-negative number, variable, or parameter that specifies the order of the Bessel function;
<y2> is a variable or a parameter (depending on what <r1> and <i1> are) where the computed Bessel value is stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

This syntax computes the real component.

EXAMPLES

```
LET XR = CBESSYR(2,2,1)
LET XC = CBESSYI(2,2,1)
LET AR = CBESSYR(XR,XC,ORDER)
LET AC = CBESSYI(XR,XC,ORDER)
```

NOTE 1

DATAPLOT uses the routine BESYCF from the BESPAK library. This library was written by David Sagin (Sookne), Computer Center, Tel Aviv University.

NOTE 2

DATAPLOT does not calculate this function for negative orders. However, the following relation can be used:

Y(-v)(z) = COS(v*PI)*Y(v)(z) - SIN(v*PI)*J(v)(z)

where z is a complex number and J(v) is the Bessel function of the first kind. The functions CBESSJR, CBESSJI, CBESSYR, and CBESSYI can be used to compute the relevant Bessel functions.

Although DATAPLOT does not allow negative orders, negative orders can be calculated with the following relation:

$$Y_{-v}(z) = \cos(\pi v)\, Y_v(z) - \sin(v\pi)\, J_v(z) \qquad \textbf{(EQ Aux-63)}$$

where z is a complex number and J_v is the Bessel function of the first kind. The functions CBESSJR, CBESSJI, CBESSYR, and CBESSYI can be used to compute the relevant Bessel functions.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

BESSYN	=	Compute the Bessel function of the second kind, order N, and real argument.
CBESSJR	=	Compute the real component of the Bessel function of the first kind, order N, and complex argument.
CBESSJI	=	Compute the complex component of the Bessel function of the first kind, order N, and complex argument.
CBESSIR	=	Compute the real component of the modified Bessel function of order N and complex argument.
CBESSII	=	Compute the complex component of the modified Bessel function of order N and complex argument.
CBESSKR	=	Compute the real component of the modified Bessel function of the third kind, order N, and complex argument.
CBESSKI	=	Compute the complex component of the modified Bessel function of the third kind, order N, and complex argument.

REFERENCE

"Handbook of Mathematical Functions, Applied Mathematics Series, Vol. 55," Abramowitz and Stegun, National Bureau of Standards, 1964 (pages 355-433).

"Note on Backward Recurrence Algorithms," Olver and Sookne, Mathematics of Computation, Volume 26, October 1972.

"Recurrence Techniques for the Calculation of Bessel Functions," Goldstein and Thaler, Mathematics of Computation, Volume 13, April 1959.

"Bessel Functions of Complex Argument and Integer Order," Sookne, Journal of Research of the National Bureau of Standards, Series B, Volume 77A, July-December, 1973.

APPLICATIONS

Special Functions

IMPLEMENTATION DATE

94/10

PROGRAM

```
LET XR = SEQUENCE .1 .1 5
LET XC = .1 .1 5
LET ORDER = 2
LET YR = CBESSYR(XR,XC,ORDER)
LET YI = CBESSYI(XR,XC,ORDER)
PRINT XR XC YR YI
```