BESSJN

PURPOSE
Compute the Bessel function of the first kind and order v where v is a non-negative real number.

DESCRIPTION
The Bessel function of the first kind with order v (v is a non-negative real number) can be defined as:

$$J_v(x) = \left(\frac{x}{2}\right)^v \sum_{k=0}^{\infty} \frac{\left(\frac{-x^2}{4}\right)^k}{k!\,\Gamma(v+k+1)} \qquad \textbf{(EQ Aux-34)}$$

where Γ is the Gamma function and ! is the factorial function.

SYNTAX
LET <y2> = BESSJN(<y1>,<v>)   <SUBSET/EXCEPT/FOR qualification>
where <y1> is a number, variable or parameter;
> <y2> is a variable or a parameter (depending on what <y1> is) where the computed Bessel value is stored;
> <v> is a non-negative number, variable, or parameter that specifies the order of the Bessel function;

and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES
LET X2 = BESSJN(2,2)
LET A = BESSJN(X1,3)

NOTE 1
DATAPLOT uses the routine BESJ from the SLATEC Common Mathematical Library to compute this function. SLATEC is a large set of high quality, portable, public domain Fortran routines for various mathematical capabilities maintained by seven federal laboratories.

NOTE 2
Spherical Bessel functions can be defined for integer n by:

$$j_n(x) = \sqrt{\frac{\pi}{2x}}\; \text{BESSJN}(x, n) \qquad \textbf{(EQ Aux-35)}$$

where BESSJN is the Bessel function of the first kind and order N. The second program example shows an example of plotting spherical Bessel functions.

DEFAULT
None

SYNONYMS
None

RELATED COMMANDS
BESS0	=	Compute the Bessel function of the first kind and order 0.
BESS1	=	Compute the Bessel function of the first kind and order 1.
BESSYN	=	Compute the Bessel function of the second kind and order N.
BESSIN	=	Compute the modified Bessel function of order N.
BESSKN	=	Compute the modified Bessel function of the third kind and order N.

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

"Numerical Recipes: The Art of Scientific Computing (FORTRAN Version)," 2nd Edition, Press, Flannery, Teukolsky, and Vetterling. Cambridge University Press, 1992 (chapter 6).
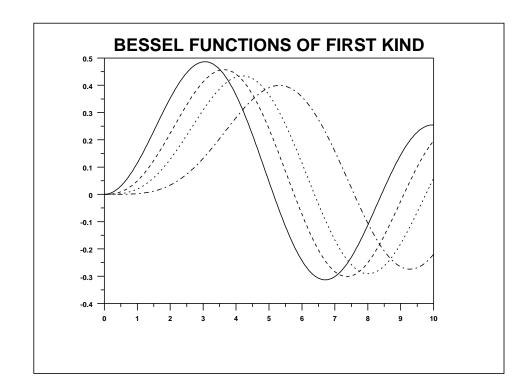
APPLICATIONS

     Special Functions

IMPLEMENTATION DATE

     94/9

PROGRAM 1

     TITLE BESSEL FUNCTIONS OF FIRST KIND
     LINE SOLID DASH DOT DASH2
     PLOT BESSJN(X,2) FOR X = 0 .05 10 AND
     PLOT BESSJN(X,2.5) FOR X = 0 .05 10 AND
     PLOT BESSJN(X,3) FOR X = 0 .05 10 AND
     PLOT BESSJN(X,4) FOR X = 0 .05 10

BESSEL FUNCTIONS OF FIRST KIND

PROGRAM 2

      TITLE SPHERICAL BESSEL FUNCTIONS (N = 2, 3, 4)
      LINE SOLID DASH DOT
      LET FACT = SQRT(PI/2)
      PLOT (FACT/SQRT(X))*BESSJN(X,2.5) FOR X = 0.01 .05 10 AND
      PLOT (FACT/SQRT(X))*BESSJN(X,3.5) FOR X = 0.01 .05 10 AND
      PLOT (FACT/SQRT(X))*BESSJN(X,4.5) FOR X = 0.01 .05 10