WCACDF

PURPOSE
Compute the standard wrapped-up Cauchy cumulative distribution function.

DESCRIPTION
The standard wrapped-up Cauchy distribution has the following probability density function:

\[
f(x, p) = \frac{1 - p^2}{2\pi(1 + p^2 - 2p\cos(x))} \quad 0 \leq x < 2\pi
\]  

where \( p \) is a shape parameter.

The cumulative distribution function has the formula:

\[
F(x, p) = \frac{\arctan \left( \frac{\sin \left( \frac{\Delta}{2} \right) - p\sin \left( \frac{\Delta}{2} \right)}{-\cos \left( \frac{\Delta}{2} \right) + p\cos \left( \frac{\Delta}{2} \right)} \right) - \arctan \left( \frac{\sin \left( \frac{\Delta}{2} \right) + p\sin \left( \frac{\Delta}{2} \right)}{-\cos \left( \frac{\Delta}{2} \right) + p\cos \left( \frac{\Delta}{2} \right)} \right)}{2\pi} \quad 0 \leq x < \pi
\]  

For \( \pi < x < 2\pi \), the cdf is \( 1 - WCACDF(2\pi - x) \) where WCACDF is given by the formula above.

This distribution can be used as an alternative to the Von Mises distribution for symmetric, circular data.

SYNTAX
\[
\text{LET } <y> = \text{WCACDF}(<x>,<p>) \quad <\text{SUBSET/EXCEPT/FOR qualification}>
\]
where \(<x>\) is a number, parameter, or variable;
  \(<p>\) is a number, parameter, or variable in the range (0,1) that specifies the shape parameter;
  \(<y>\) is a variable or a parameter (depending on what \(<x>\) is) where the computed wrapped-up Cauchy cdf value is saved;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES
\[
\text{LET } A = \text{WCACDF}(3,0.5) \\
\text{LET } X2 = \text{WCACDF}(X1,P)
\]

NOTE
The general form of the wrapped-up Cauchy probability density function is:

\[
f(x, p, \mu) = \frac{1 - p^2}{2\pi(1 + p^2 - 2p\cos(x - \mu))} \quad 0 \leq x < 2\pi
\]

where \( \mu \) is a location parameter.

DEFAULT
None

SYNONYMS
None

RELATED COMMANDS
\begin{align*}
\text{WCAPDF} & = \text{Compute the wrapped-up Cauchy probability density function.} \\
\text{WCAPPF} & = \text{Compute the wrapped-up Cauchy percent point function.} \\
\text{CAUCDF} & = \text{Compute the Cauchy cumulative distribution function.} \\
\text{CAUPDF} & = \text{Compute the Cauchy probability density function.} \\
\text{CAUPPF} & = \text{Compute the Cauchy percent point function.} \\
\text{VONCDF} & = \text{Compute the normal cumulative distribution function.} \\
\text{VONPDF} & = \text{Compute the normal probability density function.} \\
\text{VONPPF} & = \text{Compute the normal percent point function.}
\end{align*}
REFERENCE


APPLICATIONS

Circular Distributions

IMPLEMENTATION DATE

95/10

PROGRAM

X1LABEL X
Y1LABEL PROBABILITY
LET TWOPI = 2*PI
.
MULTIPLT 2 2; MULTIPLT CORNER COORDINATES 0 0 100 100
LET P = 0.1
TITLE WRAPPED CAUCHY DISTRIBUTION - P = \^P
PLOT WCACDF(X,P) FOR X = 0 0.01 TWOPI
LET P = 0.5
TITLE WRAPPED CAUCHY DISTRIBUTION - P = \^P
PLOT WCACDF(X,P) FOR X = 0 0.01 TWOPI
LET P = 0.9
TITLE WRAPPED CAUCHY DISTRIBUTION - P = \^P
PLOT WCACDF(X,P) FOR X = 0 0.01 TWOPI
LET P = 0.0
TITLE WRAPPED CAUCHY DISTRIBUTION - P = \^P
YLIMITS 0 0.5
PLOT WCACDF(X,P) FOR X = 0 0.01 TWOPI
END OF MULTIPLT