PNRCDF

PURPOSE
Compute the standard power-normal cumulative distribution function.

DESCRIPTION
The standard power-normal distribution has the following probability density function:

\[ f(x, \sigma, p) = \left( \frac{p}{\sigma} \right) \phi \left( \frac{x}{\sigma} \right) \Phi \left( \frac{x}{\sigma} \right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \]  

(EQ Aux-270)

where \( \sigma \) is the shape parameter, \( p \) is the power parameter, and \( \Phi \) and \( \phi \) are the cumulative distribution function and the probability density function for the standard normal distribution respectively.

The cumulative distribution is the area under the curve from negative infinity to \( x \) (i.e., the integral of the above function). It has the formula:

\[ F(x, \sigma, p) = 1 - \Phi \left( \frac{x}{\sigma} \right)^{p} \quad \sigma > 0, p > 0 \]  

(EQ Aux-271)

If \( p \) is 1, this distribution reduces to the normal distribution.

SYNTAX
LET <y2> = PNRCDF(<y1>,<p>,<s>) <SUBSET/EXCEPT/FOR qualification>
where <y1> is a non-negative number, parameter, or variable;
<p> is a positive number, parameter, or variable that specifies the power parameter;
<s> is an optional positive number, parameter, or variable that specifies the shape parameter;
<y2> is a variable or a parameter (depending on what <y1> is) where the computed power-normal cdf value is stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

If the <s> parameter is omitted, it defaults to 1.

EXAMPLES
LET A = PNRCDF(3,2,1)
LET X2 = PNRCDF(X1,POW,SD)
LET X2 = PNRCDF(X1,1,0.5)

NOTE
The general power-normal distribution has the following probability density function:

\[ f(x, \mu, \sigma, p) = \left( \frac{p}{\sigma} \right) \phi \left( \frac{x - \mu}{\sigma} \right) \Phi \left( \frac{x - \mu}{\sigma} \right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \]  

(EQ Aux-272)

where \( \mu \) is the location parameter, \( \sigma \) is the shape parameter and \( p \) is the power parameter. The cumulative distribution function has the formula:

\[ F(x, \mu, \sigma, p) = 1 - \Phi \left( \frac{x - \mu}{\sigma} \right)^{p} \quad \sigma > 0, p > 0 \]  

(EQ Aux-273)

DEFAULT
None

SYNONYMS
None

RELATED COMMANDS
PNRPDF = Compute the power-normal probability density function.
PNRPFF = Compute the power-normal percent point function.
PLNCDF = Compute the power-lognormal cumulative distribution function.
PLNPDF = Compute the power-lognormal probability density function.
PLNPCD = Compute the power-lognormal percent point function.
NORCDF = Compute the normal cumulative distribution function.
NORPDF = Compute the normal probability density function.
NORPPF = Compute the normal percent point function.

REFERENCE

APPLICATIONS
Reliability

IMPLEMENTATION DATE
95/5

PROGRAM
X1LABEL CDF'S; TITLE SIZE 2
YLIMITS 0 1; MAJOR YTIC MARK NUMBER 6
TITLE SD=1, P=10000, 3000, 1000, 300, 100, 50, 20, 5, 1, 0.5, 0.2 0.1
PLOT PNRCDF(X,10000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,3000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,1000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,300,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,100,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,50,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,20,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,5,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,1,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.5,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.2,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.1,1) FOR X = -5 .05 5