PEXPDF

PURPOSE
Compute the exponential power probability density function with shape parameters \( \alpha \) and \( \beta \).

DESCRIPTION
The exponential power distribution has the probability density function:

\[
f(x, \alpha, \beta) = \left( \frac{e^{\beta}}{\alpha \beta} \right) x^{\beta - 1} e^{-\left( \frac{x^\beta}{\alpha} \right)} e^{-e^{-\left( \frac{x^\beta}{\alpha} \right)}} \quad x \geq 0, \alpha > 0, \beta > 0 \tag{EQ Aux-255}
\]

where \( \alpha \) and \( \beta \) are the shape parameters. This distribution has been recommended for lifetime analysis when a U-shaped hazard function is desired. This corresponds to rapid failure once the product starts to wear out after a period of steady or even improving reliability. See the Smith and Bain paper listed in the Reference section below for details.

SYNTAX
LET <y> = PEXPDF(<x>,<alpha>,<beta>) <SUBSET/EXCEPT/FOR qualification>
where <x> is a non-negative variable, a number, or a parameter;
<y> is a variable or a parameter (depending on what <x> is) where the computed exponential power pdf value is saved;
<alpha> is a positive number or parameter that specifies the first shape parameter;
<beta> is a positive number or parameter that specifies the second shape parameter;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES
LET A = PEXPDF(3,1.5,0.8)
LET X2 = PEXPDF(X1,ALPHA,BETA)

NOTE 1
The general form of the exponential power probability density function is:

\[
f(x, \alpha, \beta, \mu) = \left( \frac{e^{\beta}}{\alpha \beta} \right) (x - \mu)^{\beta - 1} e^{-\left( \frac{x - \mu}{\alpha} \right)} e^{-e^{-\left( \frac{x - \mu}{\alpha} \right)}} \quad x \geq 0, \alpha > 0, \beta > 0 \tag{EQ Aux-256}
\]

where \( \mu \) is a positive location parameter. The case \( \beta = 1 \) is the truncated extreme value distribution.

NOTE 2
Johnson, Kotz, and Balakrishnan define this distribution with the reciprocal of the alpha parameter (i.e., simply substitute alpha with \( 1/\alpha \) in the pdf formula above). They also define a power exponential (or Subbotin) distribution. However, this distribution is distinct from the exponential power distribution defined here.

DEFAULT
None

SYNONYMS
None

RELATED COMMANDS
PEXCDF = Compute the exponential power cumulative distribution function.
PEXPPF = Compute the exponential power percent point function.
EWECDF = Compute the exponentiated Weibull cumulative distribution function.
EWEPDF = Compute the exponentiated Weibull probability density
WEICDF = Compute the Weibull cumulative distribution function.
WEIPDF = Compute the Weibull probability density function.
WEEPFF = Compute the Weibull percent point function.
EV1CDF = Compute the extreme value type 1 cumulative distribution function.
EV1PDF = Compute the extreme value type 1 probability density function.
EV1PPF = Compute the extreme value type 1 percent point function.
REFERENCE


APPLICATIONS

Reliability Analysis

IMPLEMENTATION DATE

96/1

PROGRAM

LET A = DATA 1 1 1 0.5 0.5 0.5 2 2 2
LET B = DATA 0.5 1 2 0.5 1 2 0.5 1 2

MULTIPLYOT 3 3; MULTIPLYOT CORNER COORDINATES 0 0 100 100
TITLE AUTOMATIC
TIC LABEL SIZE 3
LABEL SIZE 3
LOOP FOR K = 1 1 9
    LET A1 = A(K)
    LET B1 = B(K)
    X1LABEL ALPHA = ^A1
    X2LABEL BETA = ^B1
    PLOT PEXPDF(X,A1,B1) FOR X = 0.01 0.01 4
END OF LOOP
END OF MULTIPLYOT