Package ‘lamW’

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Type Package
Title Lambert-W Function
Version 1.3.2
Date 2020-05-25
Description Implements both real-valued branches of the Lambert-W function, also known as the product logarithm, without the need for installing the entire GSL.
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URL https://bitbucket.org/aadler/lamw
BugReports https://bitbucket.org/aadler/lamw/issues
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Description

Implements both real-valued branches of the Lambert-W function, also known as the product logarithm, without the need for installing the entire GSL.

Details

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Author(s)

Avraham Adler <Avraham.Adler@gmail.com>

Description

The Lambert-W function is defined as the multivalued inverse of the function \( z = f(W) = W e^W \). The function has two branches. The principal branch is defined on the interval \([-1/e, \infty)\) and is always greater than -1. The second branch is defined on the interval \([-1/e, 0)\) and is always less than -1. The real-valued function is not defined for values less than \(-1/e\).

Usage

lambertW0(x)
lambertWm1(x)

Arguments

x vector of values
lambertW

Details

The Lambert-W function is defined for all real $x \geq -\frac{1}{e}$. It has two values in the interval $(-\frac{1}{e}, 0)$. The values strictly greater than -1 are assigned to the “principal” branch, also referred to as $W_0$, and the values strictly less than -1 are assigned to a secondary branch, referred to as $W_{-1}$. For non-negative $x$, only the principal branch exists as the other real-valued branch approaches negative infinity as $x$ approaches 0. The algorithms used to calculate the values predominantly follow those in the reference with some simplifications. There are many applications in which the Lambert-W function is useful, such as combinatorics, physics, and hydrology. The interested reader is directed to the references for more detail.

Value

Both functions return the appropriate values in the intervals for which they are defined. Outside of those intervals, they will return NaN, except that lambertW0(Inf) will return its limit Inf and lambertWm1(0) will return its limit -Inf.

Author(s)

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References


See Also

This package provides similar functionality to the Lambert functions in the gsl package without having to obtain or install the GSL.

Examples

```r
lambertW0(exp(1))  # Should equal 1, as 1 * exp(1) = e.
lambertW0(0)       # Should equal 0, as 0 * exp(0) = 0.
lambertW0(-exp(-1)) # Should equal -1.
lambertWm1(-exp(-1)) # Should also equal -1.
A <- -2 * exp(-2)
lambertWm1(A)      # Should equal -2
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