

Package ‘lamW’

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Type Package

Title Lambert-W Function

Version 1.3.0

Date 2017-04-24

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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Depends R (>= 3.0.2)

Imports Rcpp, RcppParallel (>= 4.3.20)

LinkingTo Rcpp, RcppParallel (>= 4.3.20)

SystemRequirements GNU make

Suggests testthat

NeedsCompilation yes

URL <https://bitbucket.org/aadler/lamw>

BugReports <https://bitbucket.org/aadler/lamw/issues>

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R topics documented:

lamW-package	2
lambertW	2

Index	4
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 lamW-package

Lambert-W Function

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Details

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 lambertW

Lambert-W Function

Description

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

Usage

```
lambertW0(x)
lambertWm1(x)
```

Arguments

x vector of values

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

- Corless, R. M., Gonnet, G. H., Hare, D. E., Jeffrey, D. J., Knuth, D. E. 1996 "On the Lambert W function", *Advances in Computational Mathematics*, **5**, 329–359, Springer
- Veberic, D. 2012 "Lambert W function for applications in physics", *Computer Physics Communications*, **183**(12), 2622–2628.

See Also

This package provides similar functionality to the [Lambert](#) functions in the `gsl` package without having to obtain or install the GSL.

Examples

```
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
```

Index

*Topic **NumericalMathematics**

lambertW, [2](#)

lamW-package, [2](#)

*Topic **package**

lamW-package, [2](#)

Lambert, [3](#)

lambertW, [2](#)

lambertW0 (lambertW), [2](#)

lambertWm1 (lambertW), [2](#)

lamW (lamW-package), [2](#)

lamW-package, [2](#)