

exp() — Exponentiation and logarithms
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Description

`exp(Z)` returns the elementwise exponentiation of Z . `exp()` returns real if Z is real and complex if Z is complex.

`ln(Z)` and `log(Z)` return the elementwise natural logarithm of Z . The functions are synonyms. `ln()` and `log()` return real if Z is real and complex if Z is complex.

`ln(x)`, x real, returns the natural logarithm of x or returns missing (`.`) if $x \leq 0$.

`ln(z)`, z complex, returns the complex natural logarithm of z . `Im(ln())` is chosen to be in the interval $(-pi, pi]$.

`log10(Z)` returns the elementwise log base 10 of Z . `log10()` returns real if Z is real and complex if Z is complex. `log10(Z)` is defined mathematically and operationally as `ln(Z)/ln(10)`.

`expm1(Z)` returns `exp(z) - 1` for every element z of real matrix Z . `expm1(z)` is more accurate than `exp(z) - 1` for small values of $|z|$.

`ln1p(Z)` and `log1p(Z)` return `log(1 + z)` for every element z of real matrix Z . The functions are synonyms. `ln1p(z)` is more accurate than `ln(1 + z)` for small values of $|z|$.

`ln1m(Z)` and `log1m(Z)` return `log(1 - z)` for every element z of real matrix Z . The functions are synonyms. `ln1m(z)` is more accurate than `ln(1 - z)` for small values of $|z|$.

Syntax

numeric matrix `exp(numeric matrix Z)`

numeric matrix `ln(numeric matrix Z)`

numeric matrix `log(numeric matrix Z)`

numeric matrix `log10(numeric matrix Z)`

numeric matrix `expm1(numeric matrix Z)`

numeric matrix `ln1p(numeric matrix Z)`

numeric matrix `log1p(numeric matrix Z)`

numeric matrix `ln1m(numeric matrix Z)`

numeric matrix `log1m(numeric matrix Z)`

Conformability

`exp(Z)`, `ln(Z)`, `log(Z)`, `log10(Z)`, `expm1(Z)`, `ln1p(Z)`, `log1p(Z)`, `ln1m(Z)`, `log1m(Z)`:

Z: $r \times c$
result: $r \times c$

Diagnostics

`exp(Z)` returns missing when $\text{Re}(Z) > 709$.

`ln(Z)`, `log(Z)`, and `log10(Z)` return missing when Z is real and $Z \leq 0$. In addition, the functions return missing (.) for real arguments when the result would be complex. For instance, `ln(-1) = .`, whereas `ln(-1+0i) = 3.14159265i`.

`expm1(Z)` returns missing when $Z > 709$.

`ln1p(z)` and `log1p(z)` return missing when $1 + z \leq 0$.

`ln1m(z)` and `log1m(z)` return missing when $1 - z \leq 0$.

Also see

[M-4] [Scalar](#) — Scalar mathematical functions