**factorial() — Factorial and gamma function**

## Description

**factorial(R)** returns the elementwise factorial of *R*.

**lnfactorial(R)** returns the elementwise \( \ln(\text{factorial}(R)) \), calculated differently. Very large values of *R* may be evaluated.

**lngamma(Z)**, for *Z* real, returns the elementwise real result \( \ln(\text{abs}(\text{gamma}(Z))) \), but calculated differently. **lngamma(Z)**, for *Z* complex, returns the elementwise \( \ln(\text{gamma}(Z)) \), calculated differently. Thus, \( \text{lngamma}(-2.5) = -0.056244 \), whereas \( \text{lngamma}(-2.5+0i) = -0.056244 + 3.1416i \). In both cases, very large values of *Z* may be evaluated.

**gamma(Z)** returns \( \exp(\text{lngamma}(Z)) \) for complex arguments and \( \text{Re}(\exp(\text{lngamma}(\text{C}(Z)))) \) for real arguments. Thus **gamma()** can correctly calculate, say, **gamma(-2.5)** even for real arguments.

**digamma(R)** returns the derivative of **lngamma()** for *R* > 0, sometimes called the psi function. **digamma()** requires a real argument.

**trigamma(R)** returns the second derivative of **lngamma()** for *R* > 0. **trigamma()** requires a real argument.

## Syntax

```plaintext
real matrix factorial(real matrix R)
real matrix lnfactorial(real matrix R)
numeric matrix lngamma(numeric matrix Z)
numeric matrix gamma(numeric matrix Z)
real matrix digamma(real matrix R)
real matrix trigamma(real matrix R)
```

## Conformability

All functions return a matrix of the same dimension as input, containing element-by-element calculated results.
Diagnostics

factorial() returns missing for noninteger arguments, negative arguments, and arguments > 167.

lnfactorial() returns missing for noninteger arguments, negative arguments, and arguments > 1e+305.

lngamma() returns missing for 0, negative integer arguments, negative arguments ≤ −2,147,483,648, and arguments > 1e+305.

gamma() returns missing for real arguments > 171 and for negative integer arguments.

digamma() returns missing for 0 and negative integer arguments and for arguments < −10,000,000.

trigamma() returns missing for 0 and negative integer arguments and for arguments < −10,000,000.

Also see

[M-4] scalar — Scalar mathematical functions

[M-4] statistical — Statistical functions