

**matrix** — Matrix functions

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[M-5] Manual entry Function

Purpose

Characteristics

<b>trace()</b>	trace()	trace of matrix
<b>det()</b>	det() dettriangular()	determinant determinant of triangular matrix
<b>norm()</b>	norm()	matrix and vector norms
<b>cond()</b>	cond()	matrix condition number
<b>rank()</b>	rank()	rank of matrix

Cholesky decomposition, solvers, & inverters

<b>cholesky()</b>	cholesky()	Cholesky square-root decomposition $A = GG'$
<b>cholsolve()</b>	cholsolve()	solve $AX = B$ for $X$
<b>cholinv()</b>	cholinv()	inverse of pos. def. symmetric matrix
<b>invsym()</b>	invsym()	real symmetric matrix inversion

LU decomposition, solvers, & inverters

<b>lud()</b>	lud()	LU decomposition $A = PLU$
<b>lusolve()</b>	lusolve()	solve $AX = B$ for $X$
<b>luinv()</b>	luinv()	inverse of square matrix

## QR decomposition, solvers, &amp; inverters

<b>qrd()</b>	qrd() qrdp() hqrd() hqrdp() hqrdmultq() hqrdmultq1t() hqrdq() hqrdq1() hqrdr() hqrdr1()	QR decomposition $A = QR$ QR decomposition $A = QRP'$ QR decomposition $A = f(H)R_1$ QR decomposition $A = f(H, \tau)R_1P'$ return $QX$ or $Q'X$ , $Q = f(H, \tau)$ return $Q'_1X$ , $Q_1 = f(H, \tau)$ return $Q = f(H, \tau)$ return $Q_1 = f(H, \tau)$ return $R$ return $R_1$
<b>qrsolve()</b>	qrsolve()	solve $AX = B$ for $X$
<b>qrinv()</b>	qrinv()	generalized inverse of matrix

## Hessenberg decomposition &amp; generalized Hessenberg decomposition

<b>hessenbergd()</b>	hessenbergd()	Hessenberg decomposition $T = Q'XQ$
<b>ghessenbergd()</b>	ghessenbergd()	gen. Hessenberg decomp. $T = Q'XQ$

## Schur decomposition &amp; generalized Schur decomposition

<b>schurd()</b>	schurd() schurdgroupby()	Schur decomposition $T = U'AV$ ; $R = U'BA$ Schur decomp. with grouping of results
<b>gschurd()</b>	gschurd() gschurdgroupby()	gen. Schur decomposition $T = U'AV$ ; $R = U'BA$ gen. Schur decomp. with grouping of results

## Singular value decomposition, solvers, &amp; inverters

<b>svd()</b>	svd() svdsv()	singular value decomposition $A = UDV'$ singular values $s$
<b>fullsvd()</b>	fullsvd() fullsdiag()	singular value decomposition $A = USV'$ convert $s$ to $S$
<b>svsolve()</b>	svsolve()	solve $AX = B$ for $X$
<b>pinv()</b>	pinv()	Moore–Penrose pseudoinverse

## Triangular solvers

<b>solverlower()</b>	<code>solverlower()</code>	solve $AX = B$ for $X$ , $A$ lower triangular
	<code>solverupper()</code>	solve $AX = B$ for $X$ , $A$ upper triangular

## Eigensystems, powers, &amp; transcendental

<b>eigensystem()</b>	<code>eigensystem()</code>	right eigenvectors and eigenvalues
	<code>eigenvalues()</code>	eigenvalues
	<code>lefteigensystem()</code>	left eigenvectors and eigenvalues
	<code>symeigensystem()</code>	eigenvectors/eigenvalues of symmetric matrix
	<code>symeigenvalues()</code>	eigenvalues of symmetric matrix
<b>eigensystemselect()</b>	<code>eigensystemselect*()</code>	selected eigenvectors/eigenvalues etc.
<b>geigensystem()</b>	<code>geigensystem()</code>	generalized eigenvectors/eigenvalues etc.
<b>matpowersym()</b>	<code>matpowersym()</code>	powers of symmetric matrix
<b>matexpsym()</b>	<code>matexpsym()</code>	exponentiation of symmetric matrix
	<code>matlogsym()</code>	logarithm of symmetric matrix

## Equilibration

<b>_equilrc()</b>	<code>_equilrc()</code>	row/column equilibration
	<code>_equilr()</code>	row equilibration
	<code>_equilc()</code>	column equilibration
	<code>_perhapsequilrc()</code>	row/column equilibration if necessary
	<code>_perhapsequilr()</code>	row equilibration if necessary
	<code>_perhapsequilc()</code>	column equilibration if necessary
	<code>rowscalefactors()</code>	row-scaling factors for equilibration
	<code>colscalefactors()</code>	column-scaling factors for equilibration

## LAPACK

<b>lapack()</b>	<code>LA_*</code>	LAPACK linear-algebra functions
	<code>_flopfin()</code>	convert matrix order from row major to column major
	<code>_flopout()</code>	convert matrix order from column major to row major

## Description

The above functions are what most people would call mathematical matrix functions.

## Remarks and examples

For other mathematical functions, see

- |                                    |                                  |
|------------------------------------|----------------------------------|
| <a href="#">[M-4] scalar</a>       | Scalar mathematical functions    |
| <a href="#">[M-4] mathematical</a> | Important mathematical functions |

## Also see

- [\[M-4\] intro](#) — Categorical guide to Mata functions