

# Symbolic Math Toolbox Quick Reference

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## Introduction

This appendix lists the Symbolic Math Toolbox functions that are available in the Student Version of MATLAB & Simulink. For complete information about any of these functions, use Help and select Reference from the **Symbolic Math Toolbox**.

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**Note** All of the functions listed in Symbolic Math Toolbox Reference are available in the Student Version of MATLAB & Simulink except `maple`, `mapleinit`, `mfun`, `mfunlist`, and `mhelp`.

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**Arithmetic Operations**

<code>+</code>	Addition
<code>-</code>	Subtraction
<code>*</code>	Multiplication
<code>.*</code>	Array multiplication
<code>/</code>	Right division
<code>./</code>	Array right division
<code>\</code>	Left division
<code>.\</code>	Array left division
<code>^</code>	Matrix or scalar raised to a power
<code>.^</code>	Array raised to a power
<code>'</code>	Complex conjugate transpose
<code>.'</code>	Real transpose

**Basic Operations**

<code>ccode</code>	C code representation of a symbolic expression
<code>conj</code>	Complex conjugate
<code>findsym</code>	Determine symbolic variables
<code>fortran</code>	Fortran representation of a symbolic expression
<code>imag</code>	Imaginary part of a complex number
<code>latex</code>	LaTeX representation of a symbolic expression
<code>pretty</code>	Pretty print a symbolic expression
<code>real</code>	Real part of an imaginary number
<code>sym</code>	Create symbolic object
<code>syms</code>	Shortcut for creating multiple symbolic objects

**Calculus**

<code>diff</code>	Differentiate
<code>int</code>	Integrate
<code>jacobi an</code>	Jacobian matrix
<code>limit</code>	Limit of an expression

**Calculus (Continued)**

<code>symsum</code>	Summation of series
<code>taylor</code>	Taylor series expansion

**Conversions**

<code>char</code>	Convert sym object to string
<code>double</code>	Convert symbolic matrix to double
<code>poly2sym</code>	Function calculator
<code>sym2poly</code>	Symbolic polynomial to coefficient vector

**Integral Transforms**

<code>fourier</code>	Fourier transform
<code>ifourier</code>	Inverse Fourier transform
<code>ilaplace</code>	Inverse Laplace transform
<code>iztrans</code>	Inverse z-transform
<code>laplace</code>	Laplace transform
<code>ztrans</code>	z-transform

**Linear Algebra**

<code>colspace</code>	Basis for column space
<code>det</code>	Determinant
<code>diag</code>	Create or extract diagonals
<code>eig</code>	Eigenvalues and eigenvectors
<code>expm</code>	Matrix exponential
<code>inv</code>	Matrix inverse
<code>jordan</code>	Jordan canonical form
<code>null</code>	Basis for null space
<code>poly</code>	Characteristic polynomial
<code>rank</code>	Matrix rank
<code>rref</code>	Reduced row echelon form
<code>svd</code>	Singular value decomposition
<code>tril</code>	Lower triangle
<code>triu</code>	Upper triangle

<b>Pedagogical and Graphical Applications</b>	
ezcontour	Contour plotter
ezcontourf	Filled contour plotter
ezmesh	Mesh plotter
ezmeshc	Combined mesh and contour plotter
ezplot	Function plotter
ezplot	Easy-to-use function plotter
ezplot3	3-D curve plotter
ezpolar	Polar coordinate plotter
ezsurf	Surface plotter
ezsurfz	Combined surface and contour plotter
funtool	Function calculator
rsums	Riemann sums
taylor tool	Taylor series calculator

<b>Simplification</b>	
collect	Collect common terms
expand	Expand polynomials and elementary functions
factor	Factor
horner	Nested polynomial representation
numden	Numerator and denominator
simplify	Search for shortest form
simplify	Simplification
subexpr	Rewrite in terms of subexpressions

<b>Solution of Equations</b>	
compose	Functional composition
dsolve	Solution of differential equations
finverse	Functional inverse
solve	Solution of algebraic equations

<b>Special Functions</b>	
cosint	Cosine integral, $ Ci(x) $
hypergeom	Generalized hypergeometric function
lambertw	Solution of $ \lambda(x)e^{\lambda(x)} = x $
sinint	Sine integral, $ Si(x) $
zeta	Riemann zeta function

<b>Variable Precision Arithmetic</b>	
digits	Set variable precision accuracy
vpa	Variable precision arithmetic