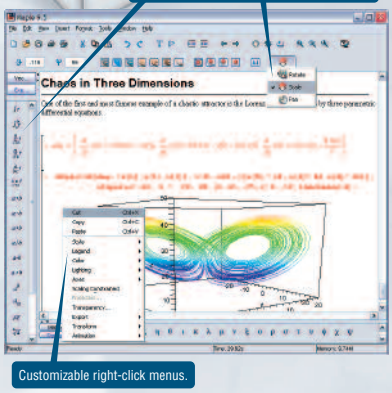
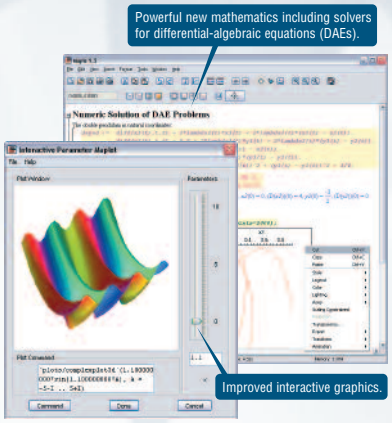
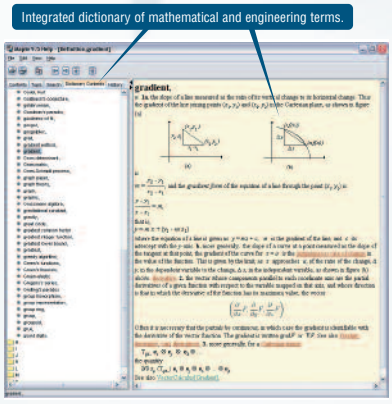
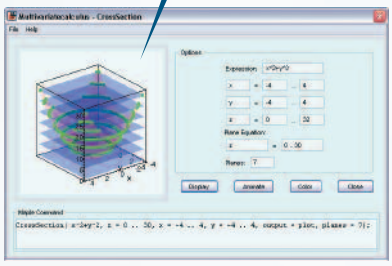
What's New in Maple™ 9.5









Rock Solid Numerics with World Class Symbolics

Continuing the tradition of providing standards-compliant algorithms that deliver maximum accuracy and powerful solvers, Maple 9.5 significantly expands the type and complexity of problems you can solve.

- The **Optimization** package is a powerful tool that extends Maple's numeric problem-solving capabilities.
  - Numeric methods for solutions of optimization problems.
  - Easy-to-use interactive Maplet™ assistant to set up and edit problems.
  - Arbitrary-precision solutions for maximum accuracy.
  - Solvers for linear, quadratic and nonlinear programs, including constrained and unconstrained problems.
  - Solvers for linear and nonlinear least-squares problems.
- Differential-algebraic equation (DAEs) solvers support advanced modeling applications.
- Improved ODE and PDE solvers extend Maple 9.5's lead in the technical software industry.
- Numerical performance improvements appear throughout the system. Using the latest technical advancements, Maple 9.5 is significantly faster than before.
- Many other additions, including improvements to the simplification, conversion, and combination of symbolic expressions; series expansions; and the mathematical function advisor mean Maple 9.5 can do more than ever before.

True Knowledge Management

Maple 9.5 contains new tools and an improved working environment to allow you to truly manage, manipulate and convey your knowledge, not just your calculation results.

- With the inclusion of a dictionary of mathematical and engineering terms and concepts, Maple 9.5 provides convenient access to important technical reference information.
  - Over 5,000 mathematical definitions.
  - Over 300 diagrams.
  - Fully integrated into the Help system.
  - Definitions can be accessed as help pages using an alphabetical listing in the Maple Help system, or through links in a worksheet or help pages.
  - Short definitions appear as pop-ups from inside other pages.
- Enhancements to plots improve interactive manipulation through sliders, scaling, panning, and an enhanced plot builder.
- New dockable palettes make expression entry easier.
- Easy-to-access interactive task assistants help with common tasks, such as unit conversion and solving ODEs.
- Improved command completion for easy navigation of the Maple command set.
- Mathematica® Notebook conversion and command translation saves time when migrating your work to Maple.
- OpenMaple™ allows access to Maple using C and now Java™ and Visual Basic® programs.
- Many new features offer advanced programmers greater convenience and programming tools, including debugging a running program.

Education

Maple 9.5 offers more tools to help educators effectively deliver course material, and to facilitate and increase students' understanding of mathematical and engineering concepts.

- The **Student[MultivariateCalculus]** package assists with the teaching and learning of multivariate calculus.
  - Interactive tutors use Maplet technology to provide effective environments in which to explore complex concepts in multivariate calculus. For example:
    - Integral approximation
    - Taylor approximation
    - Directional derivatives
  - Curriculum-specific visualization routines improve students' comprehension in key topics. For example:
    - Taylor approximation
    - Change of variables
    - Center of mass
    - Gradient
    - Jacobian
    - Surface area
- The expanded **Tools** menu provides easy access to 40 interactive tutors, which guide you through mathematical explorations in precalculus, calculus, multivariate calculus and linear algebra.
- The **Student[Precalculus]** package now includes more functions for visual explorations of topics in greater depth.

New features of Maple 9.5 on reverse...

New Features of Maple 9.5

This list includes just some of the many new features in Maple 9.5.

Mathematical Computations

Differential Equations

Exact Solutions

- New algorithms for solving Riccati type ODEs, second order linear ODEs of Mathieu type, polynomial solutions for nonlinear ODEs and systems of ODEs, linear and nonlinear PDEs and systems of PDEs
- New methods for initial value ODE problems, and piecewise ODEs
- Hypergeometric solutions free of integrals for linear ODEs
- Efficiency improvements for difficult first order Abel type ODE problems

Numeric Solutions

- Three new numerical solution methods for Differential Algebraic ODE initial value problems (DAEs), both stiff and non-stiff
- Maplet assistant extended to allow interactive solving of DAE problems
- Optimization option for large or complex systems can increase calculation speed by up to 30 times
- New implicit option for the stiff IVP solver is useful for large, dense ODE systems

Differential Equation Tools

- Seven new commands, some based on original algorithms, were added to DEtools
- PDEtools now includes a command for computing traveling wave solutions
- Method for using algebraic triangular techniques were added to diffalg package

New Packages

Optimization

- Numeric methods for solutions of optimization problems
- Easy-to-use interactive Maplet assistant
- Arbitrary-precision solutions
- Solvers for linear, quadratic and nonlinear programs, including constrained and unconstrained problems
- Solvers for linear and nonlinear least-squares problems

Logic

- The Logic package is a collection of commands for manipulating and transforming expressions using two-valued Boolean logic
- Simplify logical expressions, test two expressions for equivalence, convert logical expressions to algebraic expressions modulo 2, and perform a variety of other logical operations

RootFinding

- The RootFinding package enhances Maple's ability to compute and locate roots numerically
- Computes zeros of analytic functions and solutions of two or more bivariate polynomials

Enhanced Packages

Groebner

- Now includes two algorithms to compute the reduced Groebner basis of a toric ideal

LREtools

- Determine necessary conditions for the solution of a linear recurrence equation to be analytic, in terms of the initial values
- Finds all d'Alembertian solutions of a linear recurrence equation
- Determine if it is possible to construct a desingularizable operator with polynomial coefficients for the linear recurrence, and compute it if it exists

QDifferenceEquations

- Sum the solutions of a q-shift operator using the method of accurate q-summations
- Compute a series solution of a linear q-difference equation
- Extend a series solutions of a linear q-difference equation to a higher degree
- Finds all q-hypergeometric solutions of a given linear q-difference equation

SolveTools

- Extended to include functions to solve inequalities
- Linear inequalities with respect to one variable
- Linear univariate and multivariate systems of inequalities

SumTools

- Functionality involving sums of hypergeometric type sums has been extended

General

Symbolic Calculations

- Enhancements have been made to many top-level routines for symbolic calculations and manipulations, including the functions for:
  - Integration
  - Summation
  - Simplification
  - Combinations
  - Series expansions
  - Conversions
- Function decomposition routines performs rational function decomposition on overdetermined systems in the presence of parameters
- The FunctionAdvisor command has been enhanced regarding the computation of non-trivial specializations of mathematical functions for particular values of their parameters

Efficiency Improvements

- Significant improvements have been made in the efficiency and accuracy of the routines that calculate elliptic and Jacobi functions
- Maple 9.5 has more efficient computation of the quotient of sparse polynomials
- Conversions between D and diff notation for derivatives are now much faster
- Numeric linear algebra calculations on Windows®, Macintosh® and Linux® use state-of-the art routines optimized for each platform

Education

Dictionary

- Over 5,000 mathematical and engineering terms and definitions are fully incorporated into the Help system
- Includes over 300 figures to clearly explain the concepts
- Definitions can be accessed as help pages using an alphabetical listing in the Maple Help system, or through links in a worksheet or help page
- Short definitions are conveniently displayed as pop-ups

Student[MultivariateCalculus]

- The Student[MultivariateCalculus] package will assist with the teaching and learning of multivariate calculus
- Interactive routines use Maplet technology to assist you to work through the standard problems of multivariate calculus in a visually directed manner
- Visualization routines are provide to aid in the understanding of concepts including Taylor approximation, change of variables, center of mass, gradient, Jacobian, surface area, and more

Student Packages

- Student package tutors are now easily accessible from the Tools menu
- Most interactive tutors now include an option to see the equivalent Maple command
- Student[Precalculus] now includes more functions for visual explorations of topics in greater depth, including a routine to explore lines

Graphical User Interface

Usability

- Maple 9.5 adds the ability to dock your palettes to the edges of your workspace
- Improved palettes use meaningful placeholder names. Expressions can be dragged from the palette into the workspace
- Improved command completion facilities automatically display the full command when a unique completion is detected
- The Tools menu provides quick access to the Maple Assistants, such as the Unit Converter, Plot Builder and ODE Analyzer, and to the Maple Tutors associated with the Student packages, including Linear Algebra and Multivariate Calculus
- The Options dialog has been redesigned to allow easier and more consistent access to the settings, and control over more items

Document Formatting

- You can emphasize information in your worksheets by using the Text Highlight feature
- Maple 9.5 allows you to include superscript and subscript characters in your worksheets
- You can now easily control the number of displayed terms of an expression and digits of a number. A threshold can be set at which elision is invoked as well as the number of leading and trailing terms or digits
- Two new types of hyperlinks are supported: a link to a definition contained in the math dictionary and a link to a Maplet

Graphics

- The Interactive Plot Builder has been expanded to allow easier creation of a greater variety of plots
- The Plot Builder now supports plotting multiple expressions simultaneously, and allowing interactive adding of expressions to be plotted
- Animations can be created using the Plot Builder
- Plots created with slider controls for parameters permit a plot to be adjusted interactively
- Maple 9.5 provides slider control for viewing individual frames of an animated plot
- Oscillate control allows you to play animations backward and forward
- Point-probe cursor makes is easy to identify the coordinates of a particular point on a 2-D plot
- Scale and pan 2-D and 3-D plots and animations

Programming and Connectivity

OpenMaple™

- OpenMaple allows access to Maple using C and now Java and Visual Basic programs

Maple Library Archive

- All components of a Maple library can now be saved in a single file
- Other types of files can be saved inside the archive for convenient sharing of related materials

Debugging

- A program that is already running can be debugged by clicking on a Debug button inside the worksheet
- If a computation cannot be interrupted, you are now given the option of restarting the math engine

MapleNet™

- Maplet applications created in Maple 9.5 can easily be deployed to MapleNet

New Packages and Functions

Mathematica® Conversion Tools

- Automatically convert Mathematica notebooks to Maple worksheets
- Translate commands from Mathematica's syntax to Maple syntax
- Maplet assistant makes translating commands and documents easy

Context Menus

- The new context menu package provides new easy-to-use tools to control and customize Maple context-sensitive menus
- Replace the default context menu, add new entries to the existing context menu, or alter the criteria under which entries are displayed in a menu

Cache

- This package contains function to manipulate a new cache data structure. A cache table allows both permanent and temporary storage inside the same data structure
- Used as a remember table, the important items can be stored permanently while temporary items can be replaced to avoid wasting memory

Package Unloading

- The unwith command allows you to reverse the effects of a with for module-based packages

Modules and Operators

- Modules can now be applied to objects
- Modules can control how they are printed
- Routines can be defined that will run when a module is loaded or unloaded
- The list of overloadable operators has been extended to include list construction, set construction, function application, and index application
- Overloaded operators and functions can be controlled by the argument type

Enhanced Packages and Functions

Code Generation

- The new CodeGeneration[Save] command allows user-contributed language definitions to be saved in a Maple archive more easily

Inert Representation

- The ToInert command for converting to an inert representation of a Maple object has been extended to allow for finer control over which objects to convert

Partial Fraction Decomposition

- Partial fraction decomposition now has a convenient programmer interface

Polynomial Tools

- Four more tools have been added for calculating Taylor shift distances, shiftless decompositions, greatest factorial factorizations and gcd-free bases

String Tools

- Includes a function for seeding the random string generator

Note: Not all features are available on all machine configurations.

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