What is Mathcad?

Mathcad is the choice of professionals and academics around the world for technical calculations. Mathcad is as versatile and powerful as programming languages, yet it's easy to learn as a spreadsheet. Plus, it is fully wired to take advantage of the Internet and other applications you use every day.

Mathcad lets you type equations as you're used to seeing them, expanded fully on your screen. In a programming language, equations look something like this:

```
x=(-B+SQRT(B**2-4*A*C))/(2*A)
```

In a spreadsheet, equations go into cells looking something like this:

```
+(B1+SQRT(B1*B1-4*A1*C1))/(2*A1)
```

And that's assuming you can see them. Usually all you see is a number.

In Mathcad, the same equation looks the way you might see it on a blackboard or in a reference book. And there is no difficult syntax to learn; you simply point and click and your equations appear:

$$x := \frac{-b + \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a}$$

But Mathcad equations do much more than look good. You can use them to solve just about any math problem you can think of, symbolically or numerically. You can place text anywhere around them to document your work. You can show how they look with Mathcad's two and three dimensional plots. You can even illustrate your work with graphics taken from another Windows application.

Mathcad comes with its own on-line reference system called the Resource Center. It gives you access to many useful formulas, data values, reference material, and diagrams at the click of a button.

By combining text, graphics and equations in a single worksheet, Mathcad makes it easy to keep track of the most complex calculations. The document formatting and preparation features make it even easier, and by printing the worksheet exactly as it appears on the screen, Mathcad lets you make a permanent and accurate record of your work.

Mathcad features

Mathcad provides hundreds of operators and built-in functions for solving technical problems from the simple to the very complex. Mathcad can be used to perform numeric calculations or to find more general and precise symbolic solutions.

Advanced math functionality

- Handle real, imaginary, and complex numbers, as well as dimensional values
- Operators and built-in functions for manipulating numbers, vectors, and matrices
- Numeric systems solving and minimization
- Derivatives, integrals, summations, and products
- Trigonometric, hyperbolic, exponential, and Bessel functions
- Fast Fourier transforms and inverses

Pro

- Wavelet transform and inverse
- Symbolic calculations are "live": make a change, and Mathcad updates the symbolic result
- Symbolic solutions to individual equations or systems of equations
- Symbolic integration and differentiation, limits, and series
- Expand, simplify, and factor expressions
- Laplace, z, Fourier integral transforms and their inverses
- Inverse, transpose and determinant of a matrix, and eigenvalues and eigenvectors
- 20 operators to manipulate arrays, nested arrays and matrices, and 6 functions to find the size and scope of an array

Pro

- Advanced linear algebra functions, including Cholesky, QR, LU and SV decomposition

Pro

- 13 ordinary and partial differential equation solvers to solve ordinary differential equations, systems of differential equations, and boundary value problems (*rkfixed* also available in Mathcad 7 Standard)
- 64 statistical functions support standard and advanced methods of analysis, including parametric and non-parametric hypothesis testing, analysis of variance, and Monte Carlo techniques
- Compute the frequency distribution for histograms
- Curve fitting and surface interpolation
- Data smoothing functions are provided for smoothing time series with either a running median, a Gaussian kernel, or an adaptive linear least-squares method

Improved usability

- New Windows NT and 95 user interface and conventions, including context menus
- Easier equation entry and editing
- OLE2 client and server support
- OLE2 automation support using VBScript
- New ways to format regions.

Smart automatic unit conversion

- Automatically tracks and converts your units
- Complete SI unit system
- MKS, CGS, and U.S. customary units

New data input/output

- Move data in and out of Mathcad quickly
- Data filters for Excel files, MATLAB .mat files, ASCII and more

Pro

- Dedicated components for Excel, MATLAB, and Axum

Powerful functional programming (*Mathcad Professional only*)

- Procedural operators for building functional programs
- Define local variables, string variables, complex data structures, and nested arrays
- Looping, recursion, and conditional branching, with Return and Continue statements
- Run-time error-handling with On Error statement
- Program with live symbolic expressions

New MathConnex™ (*Mathcad Professional only*)

- Define and link drag-and-drop MathConnex components, including data input and output tables, Mathcad, Excel, MATLAB, and conditionals
- Integrate and manage data and computations between different applications
- Analyze and debug calculations
- ConnexScript™ math scripting language
- Script embedded OLE components using VBScript or JScript

Intelligent visualization tools

- Interactive 2D and 3D graphs, including X-Y, scatter, bar, polar, vector, contour, and parametric surface

- Trace and zoom, animation, image viewing
- 2D QuickPlot

Extensive formatting and preparation

- Technical spell checker
- Document templates, style sheets, and region formatting
- Include equations in text and highlight equations
- Page setup control and print preview

Innovative Web integration

- Browse "live" math and HTML from within Mathcad seamlessly, using Microsoft Internet Explorer (included for free with Mathcad 7)
- MAPI-based e-mail support
- Define hyperlinks locally or to the Web
- Join the Collaboratory™, a free Internet forum serving the world-wide Mathcad community

Complete extensibility

Pro - Set up your own function libraries

Pro - User-definable math notation

Pro - Create your own functions using C or C++ programming language

Pro - Extend functionality with discipline-specific add-on packs

- Access more 2D and 3D graph and plot types through a hotlink to Axum

New electronic content and guidance

- 300 QuickSheets covering standard analyses and tasks
- Technical reference tables and guide to practical statistics
- Guide to problem solving in Mathcad, excerpted from *The Mathcad Treasury*

Pro - Guide to programming in Mathcad, excerpted from *The Mathcad Treasury*

- Regularly updated Web Library of Mathcad worksheets and Electronic Books
- On-line help, tutorial, search-by-subject index, context-sensitive help, *User's Guide*, and free technical support

How to use this User's Guide

This *User's Guide* is organized into the following parts:

Getting Started
This section contains a quick introduction to Mathcad's features and workspace, including on-line resources and on the Internet for getting more out of Mathcad. Be sure to read this section if you are a new Mathcad user.

Editing and Worksheet Features
This section describes how to edit equations and worksheets. It leads you through the basic features of the Mathcad document-style interface. This section covers editing and formatting equations and text, as well as opening, editing, saving, and printing Mathcad worksheets and templates.

Computational Features
This section describes how Mathcad interprets equations and explains Mathcad's computational features: units of measurement, complex numbers, matrices, built-in functions, equation-solving, programming and so on. This section also describes how to do symbolic calculations.

Graphics Features
This section describes how to create and format a variety of two and three dimensional plots. It also describes how to import graphics into Mathcad and how to create an animation clip of anything in your worksheet.

The *User's Guide* ends with some useful reference appendices and a comprehensive index.

As far as possible, the topics in this manual are described independently of each other. This means that once you are familiar with the basic workings of the program, you can just select a topic of interest and read about it.

If you're trying to learn by reproducing screenshots from this *User's Guide*, keep in mind that some of them may be difficult to recreate because they contain equations other than those displayed, because default plot formats and numerical formats are not always used, because they involve random number generation, or because they use data files not available to you.

Notations and conventions

This *User's Guide* uses the following notations and conventions:

Italics represent scalar variable names, function names, and error messages.

`Bold Courier` represents keys you should type.

■ Filled squares indicate steps you should follow.

Bold represents a menu command. It is also used to denote vector and matrix valued variables.

An arrow such as that in "**Change Defaults⇒Text**" indicates a pull-right menu command.

Function keys and other special keys are enclosed in brackets. For example, [↑], [↓], [←], and [→] are the arrow keys on the keyboard. [**F1**], [**F2**], etc., are function keys; [**BkSp**] is the Backspace key for backspacing over characters; [**Delete**] is the Delete key for deleting characters to the right; and [**Tab**] is the Tab key.

[**Ctrl**], [**Shift**], and [**Alt**] are the Control, Shift, and Alt keys. When two keys are shown together, for example, [**Ctrl**]**V**, press and hold down the first key, and then press the second key.

The symbol [↵] and [**Enter**] refer to the same key.

When this *User's Guide* shows spaces in an equation, you need not type the spaces. Mathcad automatically spaces the equation correctly.

A Mathcad window takes on a variety of appearances depending on how you've configured the Math Palette, other operator palettes, the Toolbar, and the Format Bar. To maximize available space, nearly all screenshots in this *User's Guide* are taken with these elements hidden.

Pro

This *User's Guide* applies to Mathcad Professional and Mathcad Standard, as well as certain specialized editions of Mathcad. If you're not using Mathcad Professional, certain features described in this *User's Guide* will not be available to you. The word "***Pro***" appears:

- In the page margin, as it does above, whenever a section in a chapter describes a feature or a function that is unique to Mathcad Professional.
- In the page footer, whenever all features described in that chapter are unique to Mathcad Professional.