

MATHEMATICA VERSION 6

<http://www.wolfram.com/products/mathematica/index.html>

Contact: Wolfram Research, Inc.

100 Trade Center Drive

Champaign, IL 61820-7237

217-398-0700

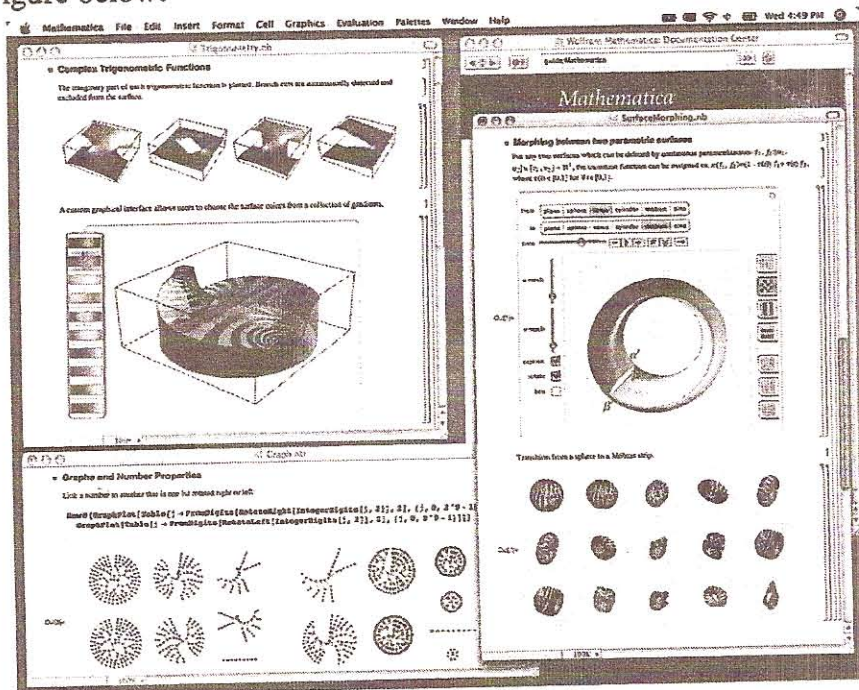
\$1,095 Academic price (\$139.95 Student version)

Most anyone with a long professional career related to mathematics would agree that *Mathematica* is the software package that has had the most overall impact on the discipline of mathematics over the last decade. Since its first release in 1988, *Mathematica* has pretty much defined how computing systems interact in the discipline of mathematics. Wolfram Research indicates that this newest version of *Mathematica* (Version 6) is in many ways a new and revolutionary product, extending well beyond a typical software upgrade. As a long-time user of *Mathematica* at the university level, I would agree. I found Version 6 to be quite impressive, and another significant step forward in technical computing for mathematics. This latest version includes many new features, particularly related to the dynamic interactivity of the package, with various supporting features to this interactivity, such as more adaptive data visualization strategies, enhanced data integration formats, load on demand curated data, symbolic interface construction, automated creation of interfaces, and various unifications of the program's graphics, text flowing, and input strategies. The program continues to run on a large variety of platforms, including Windows, Mac OS X, Linux, and numerous other systems. The Macintosh Version was reviewed here.

The core of the *Mathematica* program is still its symbolic processing language, which allows users to enter mathematical expressions and undertake extensive manipulation of those expressions. This language includes a wide range of grammatical features, including symbolic expressions, lists, functional operations, pattern matching, rules/transformations, definitions/assignments, logical tests, modularity, procedural programming, and various string manipulations. Mathematical functions are extensive as well, and include just about any common function that one might see in a mathematics textbook. A wide variety of input and output formats is also available, including numeric, graphical, text, image, and audio formats.

What *Mathematica* is probably best known for historically is the interactivity of the user with the program, operating in what are called "Mathematica Sessions". This aspect of *Mathematica* is well retained (and expanded) in Version 6, to allow the user a great deal of user control with

the program as well the capability to help "visualize" data, often providing a very aesthetic look at the data output. Finally, everything continues to be done within what are called "Mathematica Sessions" that are essentially on-screen notebooks, making the program look and operate somewhat like a word processing program and allowing multiple interactive windows. See Figure below.



The well-integrated and extensive features continue to make *Mathematica* one of the most popular and successful mathematics-related programs ever developed. As Wolfram Research advertises, Version 6 of the program has some significant innovations. The primary and most impressive innovation is the dynamic interactivity of the program, which expands its previous interactivity by use of strategies such as a "manipulate" command that creates dynamic interfaces for a single line of input. There is also a much more extensive and uniform range of control features, such as slider boxes, menus, buttons, etc. The manipulate command and the related control features essentially allow a user the ability to immediately make any computation or intermediate step in a sequence of mathematical analyses relatively interactive. Thus, it helps mathematicians (or related professionals) to fully explore each step in their analysis, to more fully understand the evolving sequence of mathematical steps. In my opinion, this interactivity closely supports how a mathematician or scientist "thinks through" an evolving mathematical

strategy. Numerous other new features in Version 6 support this more dynamic interactivity, such as more detailed and automated graphics and dataset presentations, the ability to create your own interactive "control features", enhanced strategies for handling external data, more automated aesthetics for graphical output, and more editing capability for the graphics, texts, and controls. In addition, Version 6 now has a feature called "Load-on-Demand Curated Data". This feature interfaces immediately over the Internet with extensive Wolfram datasets that are continually updated and stored at Wolfram, such as mathematical datasets on polyhedral geometry, graphs, knots, and lattices, and scientific datasets on chemical elements, nuclear isotopes, and astronomy. A variety of worldwide international datasets is also available, related to such areas as geography, economics, and international facts. In many ways, this new *Mathematica* approach for managing and interpreting mathematical data (by use of a "load on demand" utility integrated directly within the software) is quite impressive and really does have the potential to change how we think about and use data within the age of cyberspace.

Although, to a new user of *Mathematica*, this may all sound a bit complex and overwhelming, the typical college instructor will probably spend just an hour or two getting started. In fact, *Mathematica Version 6* represents a new developmental context for instructors who want to create and share interactive applications. *Mathematica* is now in many ways a software development tool that allows a user to easily create a mathematics-related simulation or illustration. The Wolfram Demonstrations Project, which is a website where such instructor-created applications are freely shared, already has more than 1300 such applications. This demonstration site is an impressive display of the utility of *Mathematica* for creating and sharing instructional applications (<http://demonstrations.wolfram.com/>).

The extensiveness of this program can seem a bit daunting, but the expansive functionality doesn't diminish its usability. The well-organized system of help features is probably the most comprehensive and polished of any software product on the market today, and includes extensive help buttons within the software itself as well as online help utilities, downloadable demonstration projects and lessons, various *Mathematica* guides, library archives, and even a *Mathematica* Journal which showcases the scientific and instructional uses of the software. Wolfram Research has also produced a large menu of *Mathematica* courses, mini-courses, short workshops, and seminars available to high-school, community college, and university instructors who would like to get a more focused orientation or training.

Mathematica rightfully retains its leadership in symbolic processing related to mathematics. I would be very hard pressed to find another program that would match its overall computing power and general innovation. *Mathematica* continues its long history of refinements and innovations of the last decade and, with this new version, continues to essentially define what can be done in the world of technical computing for mathematics. I would agree with the company's promotional materials that Version 6 really is a new product, with some impressive steps forward in technical and scientific computing.

Reviewed by Neal Grandgenett
University of Nebraska at Omaha

GEOGEBRA

<http://www.geogebra.org/cms/>
Florida Atlantic University
777 Glades Road, Math Department
Boca Raton, FL 33431
561-297-2485
Free software

One of the more interesting educational aspects of the Internet today is that it can help support various communities of learners who freely share ideas and resources related to a specific educational focus. A particularly interesting community of learners is one centered around a piece of interactive mathematics software called *GeoGebra*. This software was developed by Markus Hohenwarter in 2001 at the University of Salzburg and is now supported by Florida Atlantic University. A large community of *GeoGebra* users now contributes instructional ideas and materials to the *GeoGebra* website using an Internet Wiki, which is a type of website interface that allows users to freely add and edit webpage content. The *GeoGebra* software itself is a blend of basic geometry, algebra, and calculus tools that are displayed within a dual graphics and text window. The software can be freely downloaded from the *GeoGebra* website and runs on a variety of platforms, including Windows, Macintosh, Linux, and Unix.

While *GeoGebra* has a fairly simple set of interactive mathematics tools focused primarily on geometric constructions, it addresses some relatively foundational topics in geometry and algebra. For example, basic constructions involving points, vectors, segments, lines, and conic sections are quite easy to do, as well as graphical illustrations on a variety of functions and functional notations. A dual view of mathematical objects is used, with expressions in the geometry window often corresponding