

The maple Reporter™

The Newsletter from Maplesoft

Q1 2004

In This Issue:

- 1 **Cover Story**
MapleNet 2.0 Now Shipping!
- 2 **Happy New Year!**
In the News at Maplesoft
Maple™ 9 Japanese Edition Now Available
FREE Online Seminars
Shop at the Maplesoft Web Store
- 3 **MapleConnect™**
New MapleConnect Program
Offers Maple Users Commercial Opportunities
Maple Adoption Program™
- 4 **Maple Application Center™**
A Multitude of Maplet™ Applications
User Success Story
Developing Optical Zoom Lenses
- 6 **Tips & Techniques**
Maple 9 Student Package
Maple 9 Plots Package
- 10 **Book Reviews**
CalcLabs with Maple for Stewart's
Multivariable Calculus
CalcLabs with Maple for Stewart's
Single Variable Calculus
Maple Mastery I
- 11 **MSW™ 2004**
- 13 **Maple 9 Quick Reference**

mapleNET™

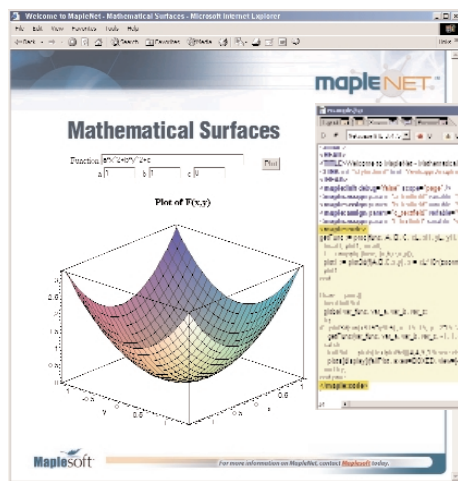
MapleNet 2.0 Now Shipping!

MapleNet 2.0, the latest release from Maplesoft of the web-based learning platform for mathematical courses, is now better than ever. With the addition of support for the use of JavaServer Pages (JSP) for content creation, a graphical user interface for publishing new content, and the integration of Maple 9, MapleNet is now the most powerful and flexible tool on the market for mathematical Web-based learning software.

attract the best and the greatest numbers of students.

"Our customers asked us for ways to do interactive mathematics over the Web, and the ability to access Maple remotely," says Darren McInyre, the Vice President of Business Development at Maplesoft.

"MapleNet was created in response to the demand for math anywhere, anytime. It provides the new tools they need to offer 'math on demand', while taking advantage of the established strength of the Maple system."



MapleNet is particularly flexible in the area of content creation. In MapleNet 2.0, interactive Web pages and learning objects can be created in three different ways.

- Authors familiar with Maple can write Maplet applications directly in Maple and then run them on MapleNet. Users can interact with the MapleNet Maplet application in the same way as if they had Maple installed locally.
- Authors familiar with Java™ can create Java-based applets.
- Authors familiar with the use of HTML tags and basic programming can write HTML pages with embedded MapleNet JSP tags which call out to the Maple engine.

MapleNet is a client/server system that allows instructors to create material that makes use of the Maple math engine, and share it with end users or students via the Web. The end user requires only a Java-enabled Web browser to interface with the material; he does not require a copy of Maple on his local machine.

MapleNet is used today by institutions worldwide for distance, continuing, professional, and other non-traditional forms of education and training. MapleNet offers innovative software components to make it easy for instructors to create and distribute electronic supplements and enhancements to courses. Students experience a rich interactive environment in which to explore difficult concepts. For administrators, MapleNet makes it possible to creatively develop new program offerings to expand the revenue base, to continue to improve the quality of the educational experience, and to offer high levels of innovation to

Version 2.0 also includes a new graphical user interface to make it easier to create and publish jar files. As well, MapleNet 2.0 uses Maple 9 for its math engine, and so MapleNet users have access to the latest and most powerful version of Maple available. In addition to enhanced mathematics functionality, Maple 9 includes visualization improvements that include the ability to have interactive plots inside MapleNet Web pages. In particular, 3-D plots can be rotated in real-time.

See MapleNet in action yourself by visiting the demo site at <http://maplenet.maplesoft.com>.

More information about MapleNet can be found at www.maplesoft.com/maplenet.



Jim Cooper P. ENG., President & CEO, Maplesoft

On behalf of the staff at Maplesoft, I would like to express our best wishes for 2004. We are looking forward to a very exciting year as we continue to build on the many significant achievements of the past year.

2003 will go down in Maplesoft history as one of major innovation and substantial increases in customer service. In addition to the great new features in Maple 9, it was also the year we introduced Maple T.A., and MapleNet. These new products have already made e-learning initiatives more effective and efficient. Our customer base for these new products continues to grow and we look forward to working with many more of you throughout 2004. We also introduced a wide range of new service offerings including the Maple

Adoption Program for student licenses, and the MapleConnect third party developer program. Both programs continue the tradition of supporting the active community that has developed around our technology.

So what's new for 2004? Plenty. One of our main focus areas will be applications. Having earned the reputation as developers of the best general platform for math computing, we will be working hard to deliver additional components that will make it easier for anyone to access the full potential of our products – whether you are a teacher, a student, a researcher or an engineer in industry. As our range of offerings grows, we will be introducing a much greater range of customer service options to ensure that your experience with Maplesoft products – from purchase to use – is as smooth as possible. Overall our goal is simple: best products and best experiences for our customers.

Many of you have taken the time over the years to help us better understand your needs and to improve our products and services to meet these needs. Your contribution has been invaluable as we embark on this exciting year. Thank you and we encourage you to continue to send us your comments and help us build the most energetic and enthusiastic user community in software. **Happy New Year!**

C. James Cooper P.Eng.
President and C.E.O.
Maplesoft



In the News at Maplesoft™

Maple 9 Japanese Edition Now Available

This past November marked the release of the Maple™ 9 Japanese Edition making Maple 9's user interface enhancements, countless new features and state of the art algorithms available to Japanese-speaking Maple users.

Maple 9 Japanese Edition offers a Japanese interface while possessing all of the same powerful features and programming capabilities for which Maple is famous. The improvements in Maple 9 focus on three areas: a more open and accessible infrastructure; a more versatile user interface; and continued innovation in mathematics education and analytical computation — the core strengths of the Maple product. The Maple 9 Japanese Edition features a Japanese Graphical User Interface (GUI), including menus and dialogs, and online help and search capabilities. The new edition also features a Japanese New User's Tour, a Getting Started guide, a Learning Guide and a Tip of the Day function.

For more information on the Maple 9 Japanese Edition, and to purchase in Japan, please contact Cybernet Systems directly at:



Cybernet Systems Co. Ltd.
Tokyo, Japan
Phone: +81 3 5978 2481
Fax: +81 3 5978 5440
Email: infomaps@cybernet.co.jp
Internet: www.cybernet.co.jp

Free Maple, Maple T.A., and MapleNet Online Seminars

Maplesoft continues to offer the public free, weekly seminars over the web. Those new to Maplesoft technologies can get an overview of Maple 9, Maple T.A., or MapleNet. Seasoned users can learn advanced techniques from a Maplesoft specialist, such as programming Maplet applications, creating Maple-graded questions in Maple T.A., and integrating Maple in the High School curriculum.

Participants can watch the seminars through their web browsers and listen to the dialogue through a teleconference. Maplesoft staff lead the live seminars, and participants can ask questions at any time.

To register for a seminar or view the schedule of upcoming events, visit <https://maplesoft.webex.com>.

To register for any of the seminars offered by Maplesoft:

1. Visit <https://maplesoft.webex.com>
2. Click on the seminar you wish to attend and click the "Enroll" link

Upon enrollment you will receive an e-mail invitation to the seminar that provides the URL and toll free conference phone number. When it is time for the seminar, click on that URL and dial the teleconference number.

For questions on any of the seminars or how to enroll, please contact applications@maplesoft.com.

Maple Updates Web Store to Expand Offerings and Enhance Online Shopping Experience

In early December, Maplesoft launched a new version of its Web store at <http://webstore.maplesoft.com>. The store, which first launched in early summer 2003, has been seeing steady climbs in traffic since its release, and has quickly become a viable purchasing option for many existing and new Maplesoft customers.

Based on demands from student users, the new version of the Web store now offers a downloadable purchase option for Maple 9 Student Edition. In addition to providing a more cost effective option for student users, students have commented that the immediate access to their purchase is of great benefit (yes, we all remember leaving those math assignments to the last minute).

In addition, the store has now implemented an Account management concept. Shoppers can set-up an Account in the store, which upon return visits can be used to view purchase history, manage shipping and billing addresses, and in general make the shopping experience easier and more efficient.

Visit <http://webstore.maplesoft.com> to take a tour today.



1. CREATE

Exclusive developer support and resources to transform your work into a commercial product.

2. SELL

No-cost Web-based sales and distribution reaching over 2.7 million users.

3. SUCCEED

Enjoy an attractive royalty rate and all the professional benefits of launching a commercial product.

New MapleConnect™ Program Offers Programmers Commercial Opportunities

Have you created high quality programs and materials based on a Maplesoft product? Have you ever thought there might be a market for them, but held back because it is too hard to promote, sell, and distribute a new product without quitting your day job?

Maplesoft has recently launched the MapleConnect Developer Program, which makes creating and selling your own Maple-related products much easier than ever before. The MapleConnect program offers technical and business resources to help developers to productize their intellectual property, and then provides a sales channel for the resulting product through the Maplesoft Web Store.

The overall spirit of MapleConnect is one of an 'open marketplace' for applications based on Maplesoft products. The developer decides what product to develop, its features, and its price. Maplesoft will provide resources to aid in turning the idea into a commercial-grade product, including tips and guidelines for technical, quality assurance, business, and marketing issues. Maplesoft will then handle sales of that product through its Web Store, with a revenue-sharing

model that heavily favors the developer. Essentially, the MapleConnect program provides a low-risk path to commercializing the developer's work.

The 'product' can be in a variety of formats. The main requirement is that it must run on top of, in conjunction with, or use an installed Maplesoft product. The user must have Maple, MapleNet, or Maple T.A. to use the MapleConnect product. Examples include, but are not limited to: worksheets, Maple packages, Maplet applications for Maple or MapleNet, Maple T.A. question banks, OpenMaple™ applications, pdf documents, and external tools (for example, to aid in writing Maple code).

During its initial pilot phase, the MapleConnect program has generated great interest from many developers and has already attracted applicants from a variety of fields including groundwater modeling, fuzzy sets, and econometrics.

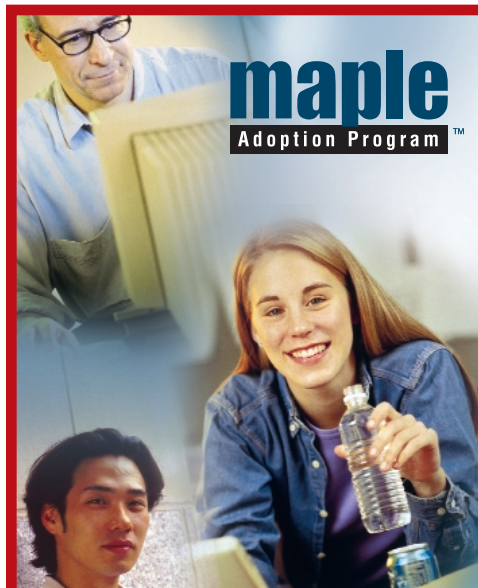
Douglas Harder, a Lecturer at the University of Waterloo and a participant in the pilot program, is developing a Fuzzy Sets package.

"It is extremely convenient to have a forum in which I can commercialize my packages," says Douglas Harder, *"Maplesoft already has access to my target market, so I can focus on design and implementation while MapleConnect deals with the sales and marketing."*

Dr. Jon Breslaw is the founder of Econotron Software, Inc. As part of the MapleConnect program, Dr. Breslaw has developed an OpenMaple application for econometrics. By combining the symbolic power of Maple with the programming language GAUSS, the Symbolic Tools application allows economists to solve optimization problems up to 10 times faster than before.

"The MapleConnect Program allows me to focus on development, instead of marketing, yet at the same time does not restrict my ability to promote and sell the product in other ways. It's a very attractive program," says Dr. Breslaw.

The MapleConnect program is now accepting applications. For more information, please visit <http://www.maplesoft.com/mapleconnect>.



Maple Adoption Program™

Designed to benefit both educators and students, the Maple Adoption Program makes it simpler for educators to incorporate the benefits of Maple into their courses, and makes learning and owning Maple easier for students.

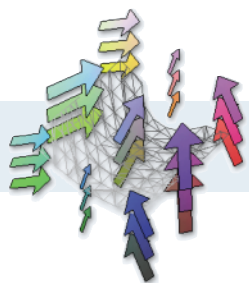
Sign up today!

Eligible instructors receive a Maple Adoption Kit including:

- Free Maple 9 Faculty Home Use copy
- Classroom Materials
- Discount on the Maple 9 Student Edition software for their students
- and much more...

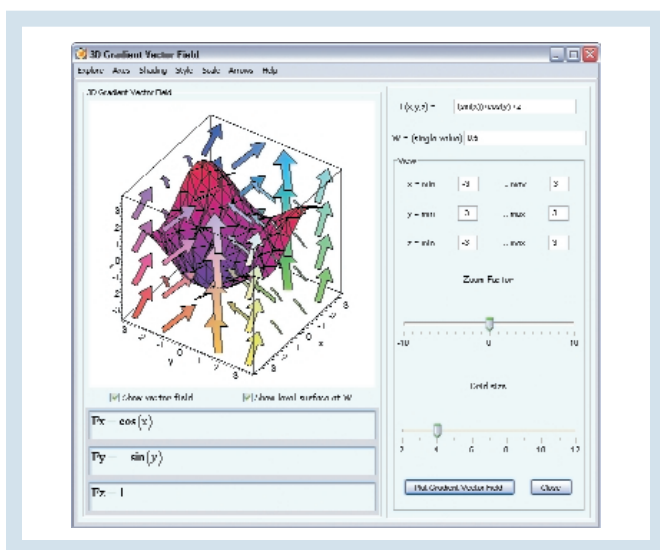
The Maple Adoption Program is a pilot program for instructors in Canada and the United States.

For more information on the benefits of the Maple Adoption Program, eligibility requirements, and the application procedure, please visit www.maplesoft.com/adoption.

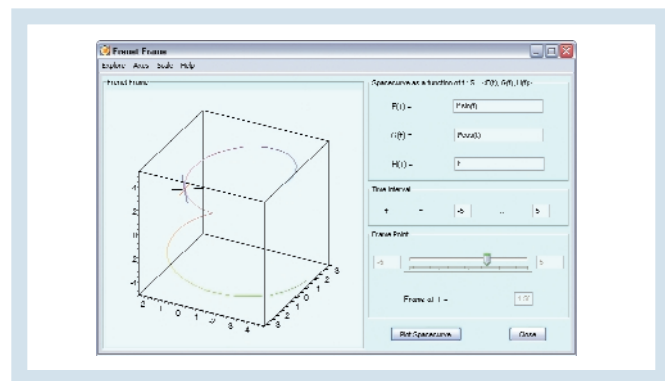


A Multitude of Maplet™ Applications

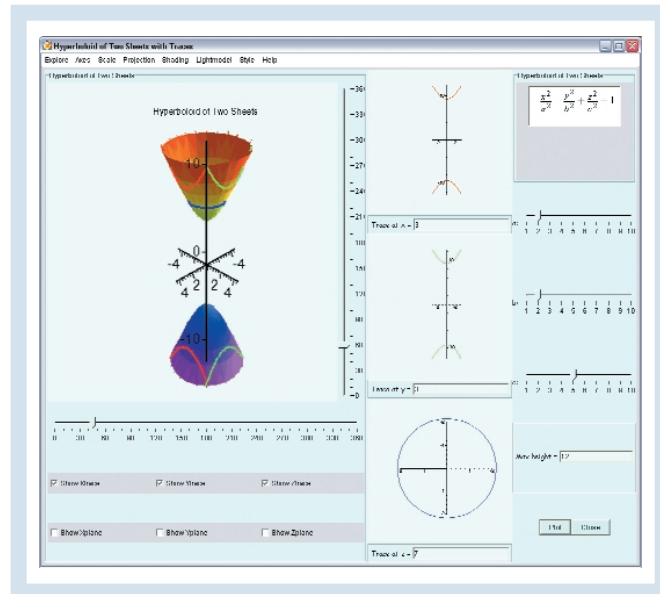
A swarm of Maplet applications has flooded the Application Center over the past few months courtesy of Joanna Ellis-Monaghan, Colin Kriwox, and Laura McLane of Saint Michael's College. The majority of the maplet applications submitted focus on concepts presented in a Vector Calculus course where topics include: 2-D/3-D Vector Fields, Families of Surfaces, Osculating Circles, Ellipsoid with Traces, Limited/Logistic/Exponential Growth and much more. These graphical interfaces add to the set of built-in tutors that Maple 9 currently offers for Precalculus, Calculus 1, and Linear Algebra.



The '3-D Gradient Vector Field' Maplet plots the 3-D gradient vector field along with the level surface where you have the option to display either or both of these surfaces at one time. The partial derivatives F_x , F_y , and F_z are also displayed in this window. The interface's menu bar has built-in several plotting options to manipulate the image to your liking.



The 'Frenet Frame' Maplet plots a parameterized space curve together with its Frenet Frame at time t . To identify each vector, the tangent is colored blue, the normal is colored black, and the binormal is colored red. The space curve has three coordinate functions of time: $F(t)$, $G(t)$, and $H(t)$. The endpoints of the desired time interval, t , are entered in the text boxes, and the time where the Frenet frame is computed is adjusted with the slider. The menu bar contains a Help menu that is fully equipped with instructions to assist students with using this interface.



The 'Hyperboloid of Two Sheets with Traces' Maplet plots a hyperboloid of two sheets together with traces and planes through the traces. Plots of the individual traces appear to the right of the hyperboloid plot where the parameters a , b , and c are chosen using the slider bars. The maximum height value determines how much of the hyperbola is shown. You have the option to display some or all of the traces and planes and adjust the overall surface.

Developing Optical Zoom Lenses Using Maple



Interview with Kazuo Tanaka
Chief D. Engineer
Canon Inc.

How did you start using Maple?

I was introduced to Maple about five or six years ago. I had completed my engineering education and I had been working in the field of optical research and development for many years. At the time, I was working with a team developing an optical zoom lens and I was responsible for some on the job training. I used Maple 4 for preparing the teaching material. I found it to be very convenient and efficient.

More recently, I have used Maple for producing presentation material, as well as the educational material for training other training specialists. I have used Mathematica® before, but I found Maple to be more user friendly. It is remarkable that we can rotate or change the direction of 3-D graphics so easily— by just using a mouse—and that we can easily output complicated calculations, sometimes using animations, in HTML format. The best thing is that I can adapt Maple so that it is most suitable for my purposes.

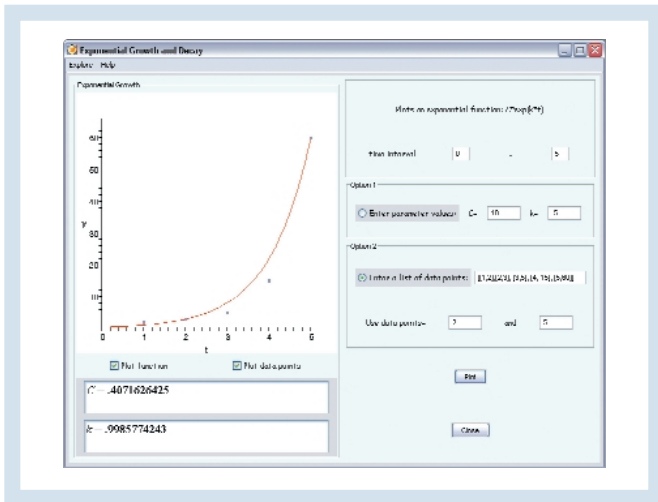
How would you describe “analytical computational software”?

If one chooses, analytical computational software can be used simply as a calculator, but its strength lies in the visualization of data. It enables you to analyze or evaluate formulas and data from diverse perspectives. It also functions as an interpreter so, for example, if you want to give a representation about undulation, you can do more than just draw a sine curve on a two-dimensional plane. You can move it along the temporal axis, modifying the results in real time. Undoubtedly, visualizing the results in this way helps in immediate comprehension. Maple has excellent drawing capacity and is not restricted to two-dimensional images.

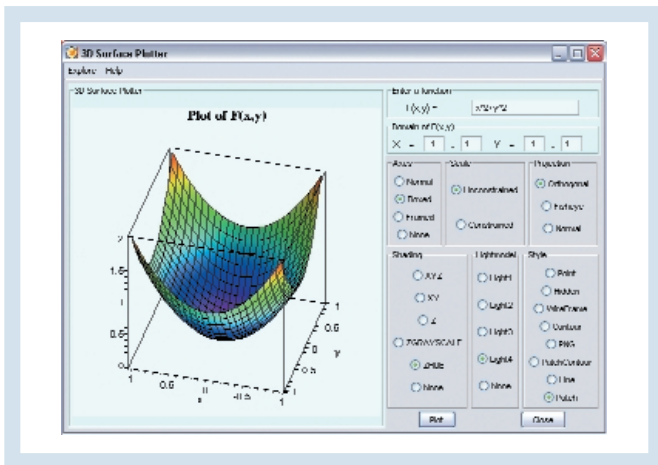
What features increase the effectiveness of your work?

Occasionally, there are times when you want exact evaluation. Whereas theoretical or inferential procedures require exact evaluation, such as calculating exact roots, for practical purposes, one more often prefers to round up pi at a certain digit, for example. Maple can be used in either way, evaluating exact roots, or, if you specify a floating decimal point, obtaining approximations instead. Another strength of Maple is that it can be linked with MATLAB®, in order to carry out very complicated engineering-specific calculations.

*This interview has been adapted from a Japanese translation. It was originally published in PC User Magazine, March 24, 2002, p. 2 (<http://www.sbpnet.jp/pcuser>) by Softbank Publishing Inc., Japan (<http://www.sbpnet.jp>).



The ‘Exponential Growth’ Maplet plots an exponential function of the form $f(t) = C \cdot \exp(k \cdot t)$. This maplet models unrestricted growth (if $k > 0$), or decay if $k < 0$), where the rate of growth is proportional to the amount present. This interface allows you to choose between two plotting options. Option 1 lets you directly enter the initial value C and the growth (or decay) constant k. Option 2 lets you enter a list of data points, and then choose two of the points (i.e. the 2nd and the 5th). The Maplet will then use these points to solve for C and k. The values of C and k appear below the plot.



In addition to the educational maplet applications submitted, the 3-D Surface Plotter Maplet allows you to easily apply various plotting options for automatic manipulation of the surface.

Learning concepts presented in a maplet interface allows students to focus on the mathematical concept that is being presented, instead of the Maple syntax required to accomplish the same task. For more information on these and other maplet applications, visit the Maple Application Center and select the Maplet subcategory found under Maple Tools.

The Maple 9 Student package contains the three subpackages *Precalculus*, *Calculus1*, and *LinearAlgebra*. The functionalities available in the *Calculus1* subpackage are summarized in Table 1.

Calculus1 provides two types of commands, visualization commands, and interactive commands that launch Maplet tutors. The visualization commands, listed in the middle column of Table 1, generate graphs related to the mathematical functionality stated in the leftmost column of Table 1. The commands listed in **green** font only draw graphs, whereas the commands listed in **blue** font provide both graphs and additional calculations and results. The `FunctionChart` command is unique in that it only draws a

graph, but is supported by five syntax-based commands (in black) that provide additional analytical results.

The Maplet tutors listed in the rightmost column of Table 1 implement computations and related graphics in a syntax-free form, using buttons, and input-boxes instead of standard Maple syntax. Where appropriate, these tutors are listed opposite the syntax-based visualization commands that they parallel in function.

The three special rule-based tutors that single-step a student through the relevant calculations are listed in **red** in the rightmost column of Table 1.

Mathematical Functionality	Visualization Command	Interactive Command (Tutor)
Linear or cubic spline interpolation of equispaced points on a curve	PointInterpolation	
Reflect graph across $y = x$	InversePlot	InverseTutor
Illustrate Rolle's Theorem	RollesTheorem	
Stepwise (rule-based) evaluation of limits		LimitTutor
Implement definition of derivative	NewtonQuotient	TangentSecantTutor
Lines tangent to curves	Tangent	TangentTutor
Compare graphs of $f(x)$ and $f'(x)$	DerivativePlot	DerivativeTutor
Stepwise (rule-based) differentiation		DiffTutor
Sketching and analysis of curves	FunctionChart CriticalPoints ExtremePoints InflectionPoints Roots Asymptotes	CurveAnalysisTutor
Illustrate Mean Value theorem	MeanValueTheorem	MeanValueTheoremTutor
Taylor polynomials	TaylorApproximation	TaylorApproximationTutor
Newton iteration for root-finding	NewtonsMethod	NewtonsMethodTutor
Comparing graphs of $f(x)$ and its antiderivatives	AntiderivativePlot	AntiderivativePlotTutor
Defining the definite Riemann integral	RiemannSum	
Numeric approximation of integrals	ApproximateInt	ApproximateIntTutor
Stepwise (rule-based) evaluation of integrals		IntTutor
Average value of $f(x)$	FunctionAverage	FunctionAverageTutor
Arc length	ArcLength	ArcLengthTutor
Computing surface area for surface of revolution	SurfaceOfRevolution	SurfaceOfRevolutionTutor
Computing volume of solid of revolution	VolumeOfRevolution	VolumeOfRevolutionTutor

Table 1

Example 1: Definition of the Derivative

The *Newton Quotient* (or *Difference Quotient*) for the function $f(x)$ is the fraction

$$\frac{f(x+h) - f(x)}{(x+h) - x} = \frac{f(x+h) - f(x)}{h}$$

and represents the slope of the secant line between the points $(x, f(x))$ and $(x+h, f(x+h))$.

In the generic case, the Newton Quotient for the function $f(x)$ is generated in Maple via

```
> with(Student[Calculus1]):
  NewtonQuotient(f(x), x, h=h);
```

$$\frac{f(x+h) - f(x)}{h}$$

For the specific function

```
> f := exp(x);
```

$$f := e^x$$

at the specific point $x = a$, it would be

```
> NewtonQuotient(f, x=a, h=h);
```

$$\frac{e^{(a+h)} - e^a}{h}$$

With the numeric values $a = 1.0$ and $h = 0.1/10$, the Newton Quotient would evaluate to

```
> NewtonQuotient(f, 1.0, h=0.1);
2.858841960
```

The equation of the secant line so determined would be

```
> y = NewtonQuotient(f, 1.0,
  h=0.1, output=line);
y = 2.858841960 x - 0.140560132
```

A graph of the function and the secant line is obtained with

```
> NewtonQuotient(f, 1.0, h=0.1,
  output=plot);
```

An animation of a set of secant lines generated as h varies is created with

```
> NewtonQuotient(f, 1.0, h=0.1,
  output=animation);
```

The **TangentSecantTutor**, combining these functionalities, is launched with

```
> TangentSecantTutor(f, 1);
  Initializing Java runtime environment.
```

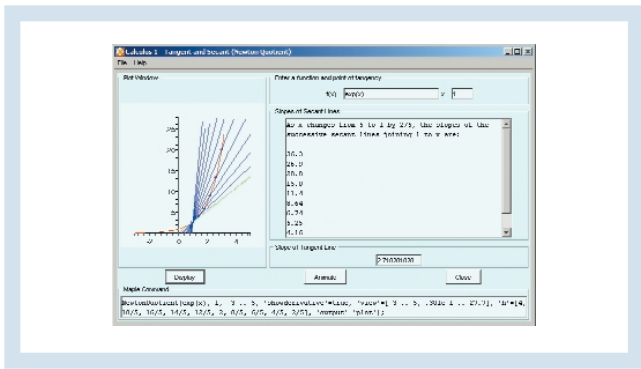


Figure 1.

and can be seen in Figure 1. On the left, a graph of $f(x) = e^x$ appears, along with ten secant lines (in blue) and one tangent line (in green). The secant lines connect the points $(1, e)$ and (x_k, e^{x_k}) , where $x_k = 1 + \frac{2k}{5}$, $k = 1, \dots, 10$. The values of the slopes of the secant lines appear as floating-point numbers in the large window to the right of the graph. The slope of the tangent line, namely, $e = 2.718281828$, appears in the window just below the window containing the function values. The button labeled **Animate** beneath the box displaying the slope of the tangent line converts the graph on the left to an animation of a single secant line approaching the tangent line. Finally, at the bottom of the Tutor, the syntax for generating the Newton Quotient via the **NewtonQuotient** command is displayed. This code can be copied and pasted back into the worksheet for experimentation from the command-line.

Example 2: Stepwise Integration

The **IntTutor**, launched with

> **IntTutor** (**exp** (**-x**) , **x**) ;

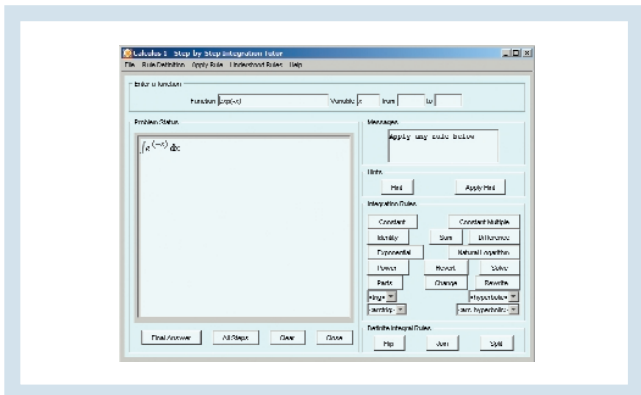


Figure 2.

appears in Figure 2. This is an interactive tutor, and requires that the user make specific choices of the actions Maple will impose on the given integral. Pressing the **Final Answer** button at the left end of the bottom row of buttons will cause Maple to display, in the *Problem Status* window of the Tutor, the final answer

$$-e^{-x}$$

Pressing the **All Steps** button to the right of the **Final Answer** button causes Maple to display, in the *Problem Status* window, the steps shown in Figure 3.

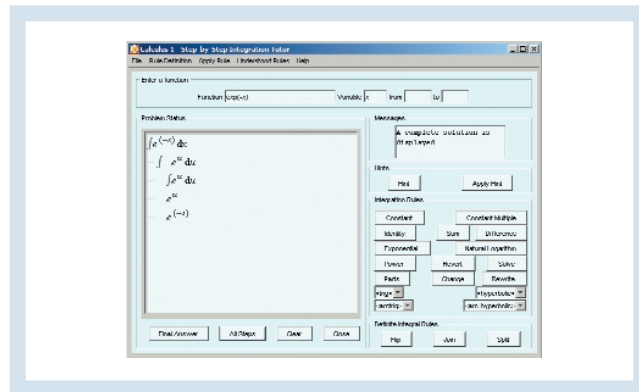


Figure 3.

Pressing the **Clear** button to the right of the **All Steps** button will clear the calculation from the *Problem Status* window. Pressing the **Hint** button in the *Hint* window will cause Maple to write to the *Message* window the hint

[change, u = -x, u] could be applied.

Pressing the **Apply Hint** button in the *Hint* window will cause Maple to update the *Problem Status* window with the line

$$= \int -e^{-u} du$$

Pressing the **Hint** button again would suggest the **Constant Multiple** button in the *Integration Rules* window be pressed. If this is done, the *Problem Status* window will be updated with the line

$$- \int e^{-u} du$$

Pressing the **Exponential** button in the *Integration Rules* window would cause Maple to evaluate the indefinite integral, and update the *Problem Status* window with the line

$$-e^{-u}$$

Pressing the **Revert** button in the *Integration Rules* window will cause Maple to restore the original variable x , so that the *Problem Status* window will be updated with the line

$$-e^{-x}$$

The three interactive tutors, namely, **LimitTutor**, **DiffTutor**, and **IntTutor**, allow students to practice the specific skills that underly a by-hands approach to the relevant manipulations. As such, they function as intelligent tutors for students as they learn the rules and procedures for evaluating limits, derivatives, and integrals.

The remaining tutors allow students to experience aspects of calculus in a syntax-free form, so that they can explore its concepts without the burden of learning a great deal of syntax.

TIPS
&
TECHNIQUES

For more useful Tips & Techniques, visit
www.maplesoft.com/reporter.

The interactive **smartplot** was introduced prior to Maple 9. The Maple 9 plots package now has an additional interactive plot-builder, giving two different functionalities for drawing Maple graphs without encountering the syntax of the plotting commands.

Interactive Plotting

Smartplots

A Maple **smartplot** of $\sin(x)$ can be launched from the keyboard with the syntax

```
> smartplot(sin(x));
```

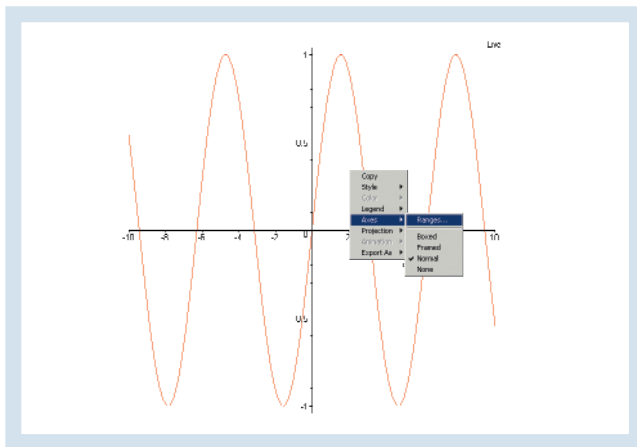


Figure 1.

Properties such as the domain can be altered interactively by opposite-clicking on the graph and using the pop-up menu, as seen in Figure 1. This leads to the dialog box shown in Figure 2.

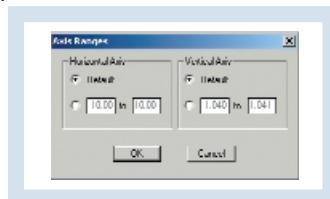


Figure 2.

Another feature of the **smartplot** is illustrated by the following. Execute the input

```
> cos(x);
cos(x)
```

then select the output. Drag the selected output and drop it onto the **smartplot** of $\sin(x)$. A graph of $\cos(x)$ will be superimposed on the graph of $\sin(x)$.

Graphs can be removed from the **smartplot** by selecting and dragging. If dropped to a prompt $[>]$, the corresponding input for this curve will be written. If dropped into a text region, the input for the curve will appear as in-line math. If dropped to the side of the smartplot, the code for the curve will disappear.

Alternatively, the **smartplot** can be launched from the pop-up context menu. For example, execute the following command.

```
> cos(x)^2-sin(x)^2;
cos(x)^2 - sin(x)^2
```

Place the cursor in the blue output and opposite-click on the selection. Choose **Plots** in the pop-up menu, and then **2-D Plot**, as shown in Figure 3. This will launch a **smartplot** of the expression in which the cursor was placed.

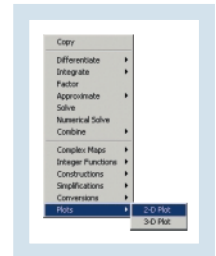


Figure 3.

Interactive Plot-Builder

In addition to the smartplot, Maple has an interactive plot-builder that, provided the *plots* package has been loaded via

```
> with(plots):
Warning, the name changecoords has been redefined
```

can be launched with the **interactive** command, as shown by the following.

```
> interactive(sin(x));
Initializing Java runtime environment.
```

The window that opens (See Figure 4) gives access to all the graphics properties via the GUI interface shown in Figure 5.

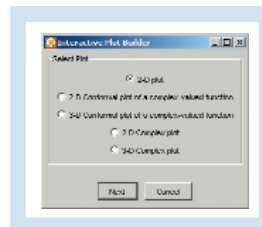


Figure 4.

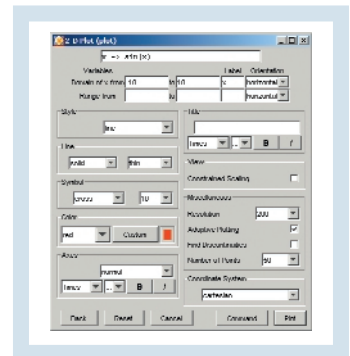


Figure 5.

Alternatively, the plot-builder can be launched interactively, via the pop-up context menu. For example, execute the command

```
> cos(x)^2-sin(x)^2;
cos(x)^2 - sin(x)^2
```

then place the cursor in the blue output (for Maple 9's standard interface) or in a complete selection of the blue output (for Maple 9's classic interface). Opposite-click to obtain the pop-up context menu shown in Figure 6. Select **Plots**, and **Plot Builder**. The interactive plot-builder will launch.

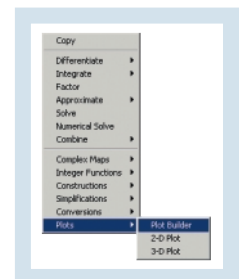


Figure 6.

Plotting Several Functions Simultaneously

In Maple V, Release 4, the `plot` command was modified to accept lists of functions so that properties of each function could be applied by listing them within the single command. For example, to plot a graph containing $\sin(x)$ and $\cos(x)$, each with different colors and line-weights, (see Figure 7), the following syntax was made to work.

```
> plot([sin(x),cos(x)], x=0..2*Pi,
color=[black,red], thickness=[3,5],
scaling=constrained, title="Figure 7");
```

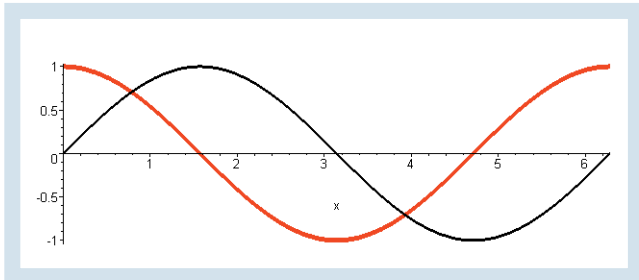


Figure 7.

In Maple 9, the `plot3d`, `implicitplot`, and `implicitplot3d` commands were similarly modified.

Hence, it is now possible to draw two surfaces, each with different properties, with one call to `plot3d`, as illustrated in Figure 8.

```
> plot3d([1-x-y, 2-x-y], x=0..1,y=0..1,
color=[red,blue], style=[patch,wireframe],
axes=box, tickmarks=[2,2,2], labels=[x,y,z],
title="Figure 8");
```

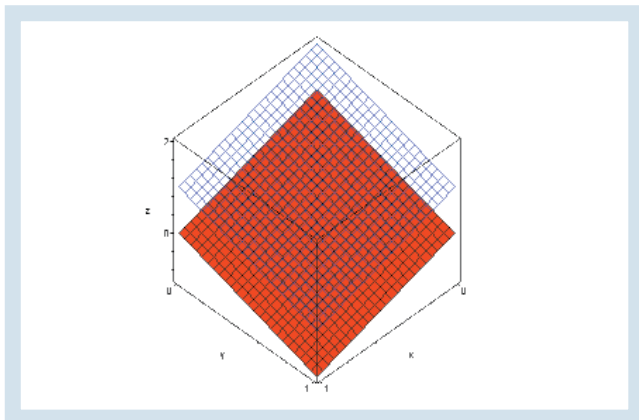


Figure 8.

An example of two curves drawn implicitly with one call to `implicitplot`, but each having different properties, is shown in Figure 9.

```
> implicitplot([x^2+y^2=1, x-y=1/2], x=-1..1,
y=-1..1, color=[black,red], thickness=[1,3],
scaling=constrained, title="Figure 9");
```

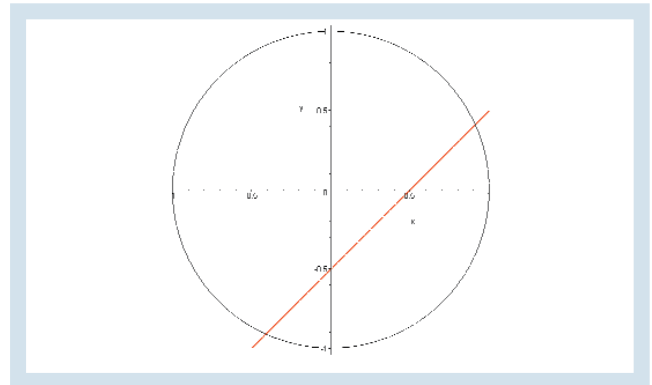


Figure 9.

An example of two surfaces drawn implicitly with one call to `implicitplot3d`, but each having different properties, is shown in Figure 10.

```
> implicitplot3d([z^2=x^2+y^2, x+y+z=1],
x=-2..2,y=-2..2,z=0..2, color=[red,blue],
style=[patch,wireframe], axes=box,
grid=[20,20,20], title="Figure 10");
```

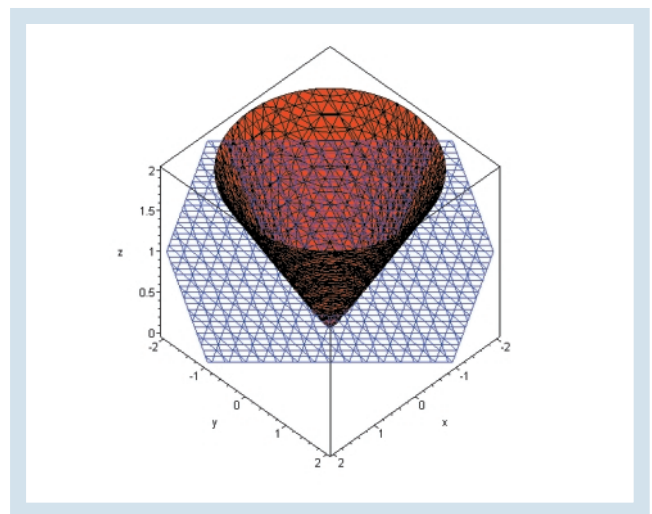


Figure 10.

An alternative in each of these cases would be the creation of separate plots that are combined with the `display` command. An example of this method is illustrated below, and results in Figure 11.

```
> p1 := plot(sin(x), x=0..2*Pi, color=black):
p2 := plot(cos(x), x=0..2*Pi, color=red):
display([p1,p2], scaling=constrained,
title="Figure 11");
```

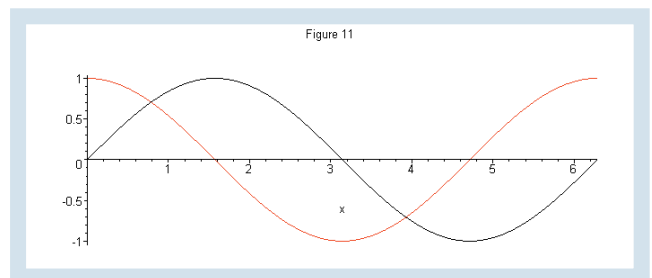
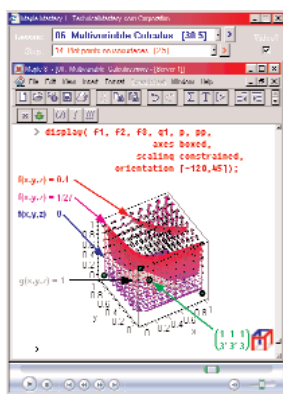
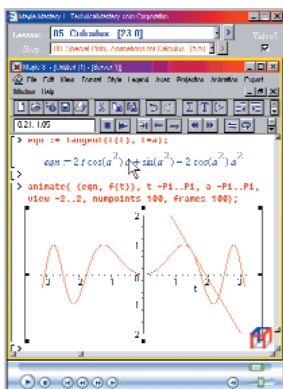


Figure 11.

Book Reviews



Maple Mastery I

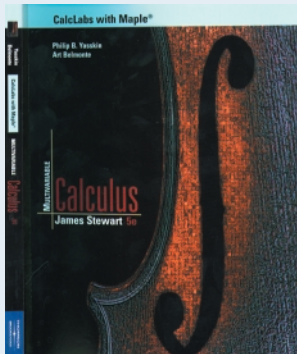
by **TechnicalMastery.com Corp.** (www.TechnicalMastery.com)

Maple Mastery I uses self-paced video lessons to teach viewers how to use Maple to solve mathematical problems. The lessons cover the use of Maple for topics in Calculus I-IV, Differential Equations, Linear Algebra, and Solving Systems of Equations. Classical examples are used throughout to reinforce and leverage the mathematical background of the viewer. Emphasis is placed on visualizing problems and their solutions.

Maple worksheets are included so viewers can reinforce the lessons by executing the Maple commands while watching the videos, and so they can review the material separately later. The course material is compatible with Maple 6 through Maple 9.

While helpful to anyone who wishes to learn Maple, Maple Mastery I is particularly useful for students and their instructors. Too often when tutorials try to teach Maple and mathematics at the same time, the students end up learning neither very well. The philosophy behind Maple Mastery I is that students master the Maple they need in a just-in-time fashion by obtaining the necessary Maple knowledge from the relevant video lesson(s), and only then carry out their own mathematical investigations with their new-found Maple fluency. This approach also saves their instructors from having to take time away from teaching the actual course material in order to teach Maple.

Maple Mastery I is part of the MapleConnect program. This product will be available for sale through the Maplesoft Web Store in late February, 2004. For demos and enquires about site licenses, visit www.TechnicalMastery.com.

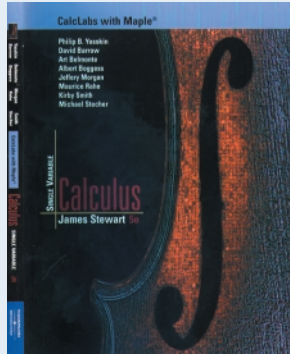


CalcLabs with Maple for Stewart's Multivariable Calculus, 5e

by **Philip B. Yasskin and Art Belmonte.** Brooks/Cole, ISBN 0-534-39361-6

The latest edition of CalcLabs with Maple for Stewart's Multivariable Calculus is designed to help students learn the topics presented in a multivariable calculus course by utilizing the power of Maple. A Maple

package called VecCalc accompanies this manual where all of the included routines run successfully in Maple 8 and the beta release of Maple 9. This lab manual can be used with most texts on multivariable calculus, however it is designed to accompany select chapters from Calculus, Fifth Edition or Calculus, Early Transcendentals, Fifth Edition by James Stewart. This manual starts off by describing how to enter standard vector calculus computations in Maple and advances to multivariate calculus problems. Topics in this manual include: the geometry of R² and R³, applications using tangent planes and directional derivatives, computing line and surface integrals, major theorems of vector analysis, and more. This manual is designed for a lab setting since homework and assignments are included throughout.



CalcLabs with Maple for Stewart's Single Variable Calculus, 5e

by **Philip B. Yasskin, David Barrow, Art Belmonte, Albert Boggess, Jeffrey Morgan, Maurice Rahe, Kirby Smith, and Michael Stecher.** Brooks/Cole, ISBN 0-534-39370-5

CalcLabs with Maple for Stewart's Single Variable Calculus is a lab manual designed to accompany Calculus, Fifth Edition by James Stewart. Students will

gain superior insight and understanding of the topics presented in a first year calculus course by spending at least an hour a week in a lab setting working through the numerous examples and exercises presented throughout this manual. At the onset, this manual begins by introducing some of the essential Maple commands that any novice Maple user should know. From here, the manual proceeds into analyzing single variable calculus concepts by entering the topics in Maple. The latter part of the manual switches focus by providing an introduction to Maple programming and offering some helpful trouble-shooting tips.



MSW 2004

Maple Summer Workshop™

July 11th - 14th | Wilfrid Laurier University | Waterloo, Ontario, Canada

Advanced Program Highlights

Maple Tutorials

Maple Programming I

Michael Monagan

Department of Mathematics and Statistics
Simon Fraser University

This tutorial provides an introduction to writing Maple procedures. Participants will learn basic procedural programming, if-then-else constructions, loops, recursion, parameter checking, printing output, and simple tools for finding bugs.

During the hands-on portion, participants will write simple programs including a program to solve a non-linear equation and a program to animate the complex roots of a function in a parameter.

Assumes knowledge of Maple syntax.

Maple Programming II

Michael Monagan

Department of Mathematics and Statistics
Simon Fraser University

Maple programmers who want to make their programs more effective, efficient, and professional, will benefit from this advanced, hands-on session. Topics include rectangular hash tables, the PLOT data structure, efficient loop constructions, and modules. Participants will write programs including a recursive program to generate a plot of a "broccoli fractal" and a module for doing arithmetic in a finite field.

Assumes knowledge of Maple programming.

Programming Maplets I

Jason Schattman

Content Team
Maplesoft

Participants will be introduced to the

development of custom user interfaces for Maple, using the Maplets package. Basic techniques will be practiced, by building several maplets from scratch with the instructor. Participants will also learn some advanced features by enhancing a pre-existing maplet that the instructor will provide.

Assumes knowledge of Maple syntax.

Programming Maplets II

Jason Schattman

Content Team
Maplesoft

This is an advanced session for participants who want to build on their existing maplets knowledge. Participants will learn how to create maplets that flow among multiple windows and communicate with Maple procedures.

Assumes knowledge of Maple programming and maplets programming.

Maple T.A. I

Louise Krmpotic

Technical Product Manager and Manager,
Web Development
Maplesoft

This session will consist of an introduction to Maple T.A. through a demonstration, followed by a hands-on component on creating a variety of question and assignment types.

No previous knowledge is assumed, though a basic familiarity with Maple would be beneficial.

Maple T.A. II

Louise Krmpotic

Technical Product Manager and Manager,
Web Development
Maplesoft



This tutorial is for participants who want to go beyond the basics of Maple T.A. Advanced areas of Maple T.A. will be explored including creating mastery assignments, writing question bank scripts, and harnessing more of the power of Maple.

Basic knowledge of Maple is expected.

Maple in Mathematics Education

Robert J. Lopez

Manager, Content Team
Maplesoft

A tutorial on creating Maple-based learning experiences in: precalculus, calculus, linear algebra, differential equations, and the physical applications of mathematics. Using materials from actual course curricula, participants will learn how to build in-class demonstrations, conduct mathematical explorations, write a self-explanatory worksheet, construct multi-layered animations, and implement a variety of insightful plots.

Maple Packages: Creation and Distribution

James McCarron

Senior Developer, Mathematical Software
Maplesoft

Participants will learn how to create a modern, module-based Maple package, consisting of code,

help pages, and example worksheets. The latest programming techniques will be used in implementing the packages. The instructor will also demonstrate how such a package can be efficiently packaged and distributed to other users.

The target audience for this tutorial includes instructors wishing to provide specific Maple programs for students and colleagues, as well as Toolbox authors within the MapleConnect program.

Maple in the Physical Sciences

Robert Corless

Department of Applied Mathematics
University of Western Ontario

This tutorial will introduce physical and engineering applications in Maple. Topics will include: important mathematical functionality for modeling and simulation, visualization, and numerical solutions. Examples will be drawn from a wide range of application areas including physics and engineering.

Maple and ODEs

Edgardo Cheb-Terrab

Team Lead, Mathematical Software
Maplesoft

Allan Wittkopf

Intermediate Developer, Mathematical Software
Maplesoft

Tutorial participants will tour the numeric and symbolic facilities for solving ODEs in Maple, with an emphasis on the advanced features of these solvers. This tutorial will provide an in-depth look at the available algorithms, options, and supporting facilities in the DE tools package.

The hands-on component of this tutorial will allow participants to explore Maple's ODE functionality by solving some real problems both numerically and symbolically.

The target audience of this tutorial includes any Maple user with an interest in ODEs. Assumes a basic familiarity with Maple.



Invited Speakers

Douglas B. Meade

Department of Mathematics
University of South Carolina

Maple and Its Role in the Development of a Mathematician

Hiroshi Komatsugawa

Chitose Institute of Science & Technology

E-learning Systems for Mathematics

Lawrence F. Shampine

Department of Mathematics
Southern Methodist University

Symbolic and Numerical Methods for ODEs

Paul Thagard

Department of Philosophy
University of Waterloo

Minds and Mathematics

Visit www.maplesoft.com/msw/program/speakers.shtml to read invited speaker biographies.

Contributed Sessions

Workshop attendees selected through a formal call for presentations, will present their work to MSW peers. Examples of contributed session titles for MSW 2004 include:

Discourse with Maple: Teaching Maple in an Interactive Classroom

Michael McCabe, University of Portsmouth

Maple in Disguise: Intuitive Math Tools Using MapleNet

Bert G. Wachsmuth, Seton Hall University

Essentials of PDEs in Mathematical Physics Using Maple 9

Yutaka Abe, Hokkaido Automotive Engineering College

Integrating Maple into the Freshman Engineering Program

George D. Catalano, State University of New York at Binghamton

Generating Efficient Equations for Dynamic Simulation of Electromechanical Multibody Systems Using Maple, Subsystem Models, and Linear Graph Theory

Chad Schmitke and **John McPhee**, University of Waterloo

Least-Squares Fitting of Data from the Physical Sciences

David M. Harrison and **Solomon R.C. Douglas**,
University of Toronto

Computer Mathematics with Maple: Numerical Analysis with Symbolic Computation

Johannes Grotendorst, Research Centre Jülich

Cryptography Using Chebyshev Polynomials

Gree Fee and **Michael Monagan**, Simon Fraser University

For an up-to-date list of contributed session titles, visit www.maplesoft.com/msw/program/contributed.shtml.



For More Information

Visit www.maplesoft.com/msw for details on conference registration, accommodations, program updates...and more!

MSW Mailing List

To join the MSW e-mail list, to request an MSW poster, or for general inquiries, contact mswinfo@maplesoft.com. Individuals requesting MSW posters should provide a mailing address.

When Using Maple, Remember...

Command	Description
Ending Maple Commands	Commands must end in semicolons to display results or colons to suppress display of results.
ENTER vs. SHIFT+ENTER	Press ENTER to end the command to Maple press SHIFT+ENTER to continue the command on the next line.
Context-sensitive Menus	Context-sensitive menus provide shortcuts for many operations. Right-click (ctrl-click on Mac) output, plots and other objects to see a selection of available operations.
Maple Syntax vs. Standard Math	Use Maple Notation to display input as Maple syntax (e.g. diff(x^2,x)) and Standard Math Notation to display expressions in typeset notation (e.g. $\frac{d}{dx} x^2$).
Palettes	Palettes can be used for expression creation in input and text regions. See the View>Palette menu. Palettes can be used in Maple syntax mode and Standard Notation.
Referring to Previous Result	Use % to refer to the previously executed result. Similarly, use %0, %99 for the second and third last results.
Case Sensitivity	Maple is case sensitive. Diff and diff are different commands.
Converting Symbolic to Numeric	To convert a fraction to a decimal approximation, use evalf() (e.g. evalf(2/3)).
Using Package Function Short Names	Many functions are organized inside packages. Package functions can be accessed through the long name (e.g. linearAlgebra[Determinant](M)) or by first using the with command (e.g. with(package_name);) and then using the short name (e.g. with(linearAlgebra); Determinant(M)).
Getting Help	To access the help system, type ?topic or start the Help Navigator from the Help menu.

Common Mathematical Functions and Constants

Mathematical Functions and Constants	Maple Functions and Constants	Example
sum, difference, product, quotient, power	$x^y, x^y, \frac{1}{x}, \frac{1}{x^y}$	
square root, n th root	$\sqrt{x}, \sqrt[n]{x}$	
absolute value, x	abs	
binomial coefficient	binomial	
factorial, n!	!	
exponential, e ^x	exp	
natural logarithm	ln	
logarithm base 10	log10	
logarithm base b	log[b]	
trigonometric functions (in radians)	sin, cos, tan, csc, sec, cot	
inverse trig functions	arcsin, arccos, arctan, arctanh, arccsc, arcsec, arccot	
hyperbolic functions	sinh, cosh, tanh, coth, sech, csch	
inverse hyperbolic functions	arsinh, arccosh, artanh, arccsch, arcsech, arcoth	
Bessel functions	Bessel, BesselJ, BesselY	
computation modulo m	mod, modp, modq	
logical operators	and, or, not, xor, implies, logical	
π	Pi	
e	exp(1)	
infinity	infinity	
Catalan number	Catalan	
Euler's constant	gamma	

Maplesoft Product Information

For more information on Maplesoft products, see www.maplesoft.com.
 The Maple Application Center™ (www.maplesoft.com) contains over 1500 Maple applications to view or download.
 The Maple Student Center™ (www.maple-tutorials.com) provides educational material and Maple resources to assist students.

Maple Packages

Maple packages are collections of related functions. Below is a sampling of the 84 Maple packages available to users. For a full listing, see ?maplepackage.

Package Name	Description
CodeGeneration	Translate Maple code to C, Fortran, Java™, MATLAB®, and Visual Basic®
combinat	Combinatorial functions
construct	Combinatorial structures
CurveFitting	Functions that support curve-fitting
DEtools	Tools for differential equations
Gaussint	Gaussian integrals
geometry	Euclidean geometry
DiscreteTransforms	Functions to compute transforms of discrete data, including Fourier transforms
Groebner	Groebner bases
inttrans	Integral transforms
LinearAlgebra	Over 100 functions for constructing, solving, and programming topics in linear algebra
LinearFunctionalSystems	Construct solutions of linear functional systems of equations
ListTools	Tools for manipulating lists
Maplets	Create graphical interfaces to Maple functions
MathML	Import and export Maple expressions as MathML
Math	MATLAB link
numapprox	Numerical approximation
PDEtools	Partial differential equation tools
plots	Graphics package
plottools	Basic graphical objects
PolynomialTools	Functions to perform basic manipulations of polynomials
RandomTools	Tools for working with random objects
RationalNormalForms	Construct minimal representation and decomposition of hypergeometric terms
ReadDomain	Environment that provides a real number context
ScientificConstants	Values of over 13,000 constants commonly used in chemistry and physics
ScientificErrorAnalysis	Construct quantities with errors and propagate errors through calculations
Spread	Programmatic access to spreadsheet data
stats	Statistics
Student[CalculusI]	Step through differentiation, integration, and limit problems or visualize concepts presented in a first year calculus course
Student[CalculusII]	Tools for study lines, polynomials, linear inequalities, and more
Student[LinearAlgebra]	Tutorials to step through Gaussian elimination and Gauss-Jordan reduction method or visualize concepts presented in a first year linear algebra course
SumTools	Indefinite and definite sums
Units	Convert among 750+ units
VectorCalculus	Perform multivariate and vector calculus operations on objects

Defining Variables, Functions and Procedures

Command	Description	Example
:=	Assignment operator	$x := 5;$
>	Function definition	$f := x \rightarrow x^2;$
proc	Procedure definition	$p := proc(a,b) a^2+b^2 end proc;$

Expression Manipulation

Command	Description	Example
factor	Factor polynomials	$> \text{factor}(8x^2-24x+24);$
expand	Expand expressions	$> \text{expand}(x+1)^3;$
normal	Put expressions into normal form	$> \text{normal}((x^2-y^2)/(x-y)^3);$
simplify	Simplify expressions	$> \text{simplify}(x^4/(x^2+5));$
numer, denom	Extract numerator or denominator	$> \text{numer}(a/b);$ $> \text{denom}(a/b);$
rhs, lhs	Extract right/left-hand side of equation	$> \text{rhs}(x=y);$ $> \text{lhs}(x=y);$
eval	Evaluate expressions at a point	$> \text{eval}(x^3-2x^2-7x+5, x=3);$

Solving Equations

Command	Description	Example
solve	Solve equations	$> \text{solve}(x^2-2x+1, x);$
fsolve	Solve for numeric solutions	$> \text{fsolve}(\tan(\sin(x))=4, x);$
dsolve	Solve differential equations	$> \text{dsolve}(\text{diff}(y(x), x) = y(x)^2(x)^2xy(x));$

Calculus

Command	Description	Example
diff	Differentiate	$> \text{diff}(x^2+x^4-3*x^2+x);$
int	Integrate	$> \text{int}(\sin(x), x);$
limit	Find limit	$> \text{limit}(\sin(x)/x, x=0);$
Student[PreCalculus][...]	Package of Maple tutors for PreCalculus	$> \text{with}(\text{Student}[\text{PreCalculus}]);$ $> \text{Functions}[\text{LogFactor}](x^3+3*x^2*x-3);$ $> \text{MeanValueTheorem}(\sin(x), 1..5);$

Linear Algebra

Command	Description	Example
Matrix	Define matrix	$> \text{Matrix}([1,2], [3,4]);$ $> \llcorner 1, 2 \rceil, \llcorner 3, 4 \gg;$
Vector	Define a column vector	$> \text{Vector}([1,2,3]);$
	Define a row vector	$> \llcorner 1, 2, 3 \gg;$
*	Matrix multiplication	$> M1 \cdot M2;$
.	Scalar multiplication	$> a \cdot M;$
^(+)	Matrix inverse	$> M^(-1);$
LinearAlgebra[...]	Package of linear algebra commands	$> \text{with}(\text{LinearAlgebra});$ $> \text{Determinant}(M);$
Student[LinearAlgebra][...]	Package of linear algebra commands, visualization routines and Maple tutors	$> \text{with}(\text{Student}[\text{LinearAlgebra}]);$

Plotting

Command	Description	Example
plot	2-D plot	$> \text{plot}(\sin(x), x=0..2*Pi);$
plot3d	3-D plot	$> \text{plot3d}(\sin(x)*y, x=0..1, y=0..1);$
plots[...]	Package of plotting routines	$> \text{plots}[\text{contourplot}](\sin(x*y), x=-3..3, y=-3..3);$

Control Flow

Command	Description	Example
for...do	Loop construct	$> \text{for } i \text{ from } 2 \text{ to } 10 \text{ do } f(i) \text{ end do};$
if...then	Conditional statement	$> \text{if } n < 0 \text{ then } a/n \text{ else } 0 \text{ end if};$
map	Apply a function to each element of an expression	$> \text{map}(x \rightarrow x^2, [a,b,c]);$
seq	Create a sequence	$> \text{seq}(8*x, x=1..5);$

Some of the described functionality may not be available in previous versions of Maple.



L 519.747.2373 | F 519.747.5284 | US 6 Canada 800.267.6583 | info@maplesoft.com | www.maplesoft.com | www.mapleapps.com | www.maplestudents.com
 © Maplesoft, a division of Waterloo Maple Inc. 2014. Maplesoft, Maple, Maple T.A., MapleNet, Maple, OpenMaple, Maple Application Center, MapleConnect, Maple Adoption Program and Maple Summer Workshop are trademarks of Waterloo Maple Inc. All other trademarks are property of their respective owners.