Maple 9

Getting Started Guide

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1 Introduction to Maple

Maple™ is an analytic computation system. It performs mathematical computations and manipulations for solving problems from various technical disciplines. Most significantly, Maple computes both numerical as well as symbolic solutions to mathematical expressions. This means that Maple performs computations on expressions that contain symbols, such as π or x, without performing numerical approximations. For example, Maple determines that the derivative of `sin(x)` is `cos(x)`, even when `x` has not been assigned a value. Maple provides exact solutions to many technical problems. In addition, Maple has visualization tools that contribute to the problem-solving process.

1.1 Installing Maple

For installation and licensing instructions, refer to the `Install.htm` file on your Maple CD.

1.2 Starting Maple

You can access the power of the Maple computation engine through a variety of user interfaces: the standard worksheet, the command-line version, the classic worksheet (not available on Macintosh®), and custom-built Maplet™ applications. The full Maple system is available through all of these interfaces. In this manual, any references to the graphical Maple interface refer to the standard worksheet interface. For more information on the various interface options, refer to the `?versions` help page.

To start the standard worksheet interface in Windows®:

- From the **Start** menu, select **Programs**, **Maple 9, Maple 9**. Alternatively, double-click the Maple 9 desktop icon.

To start the standard worksheet interface on a Macintosh computer:

- Double-click the Maple 9 application icon in the Finder.

To start the standard worksheet interface in UNIX® or Linux®:

- Enter the full path, for example, `/usr/local/maple/bin/xmaple`

  Alternatively,

1. Add your Maple 9 directory (for example, `/usr/local/maple/bin`) to your command search path.
2. Enter `xmaple`.

On all operating systems, the first Maple worksheet session opens with the *Introduction to Maple 9* page that points you to the New User's Tour, updates, and other introductory help pages. Subsequent worksheet sessions start with a new, blank worksheet.

1.3 The Maple Worksheet Window

The Maple worksheet window resembles that of a typical program. The main features are shown in Figure 1-A on page 3.

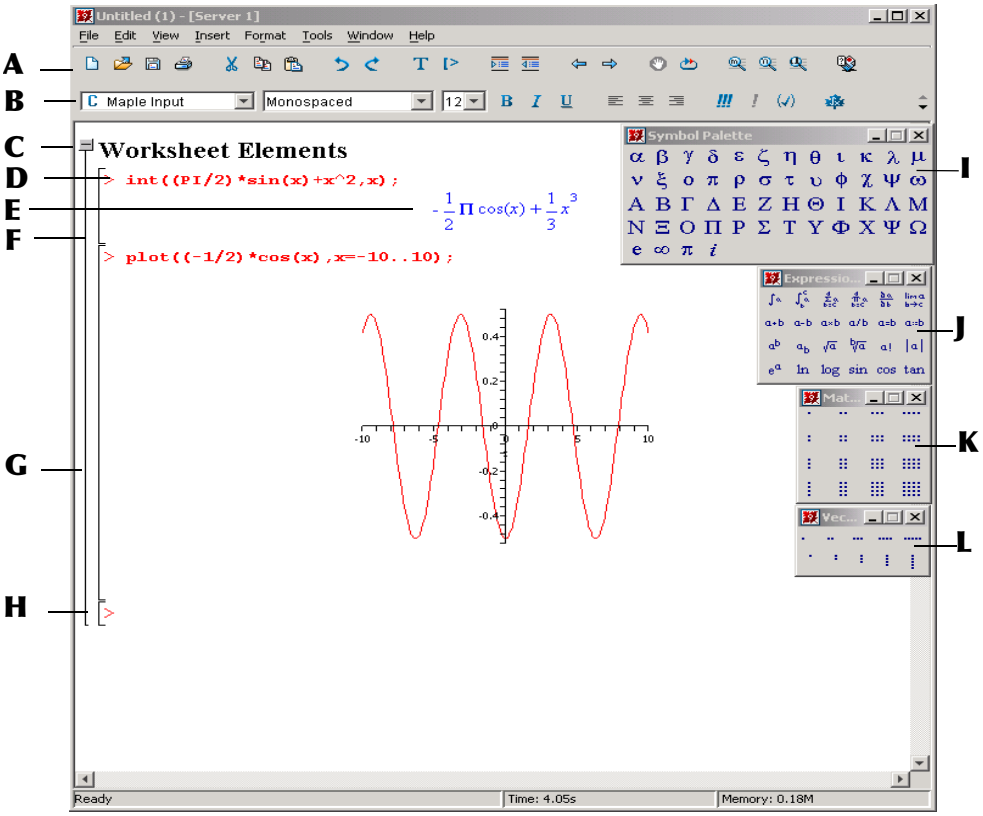

Figure 1-A Maple window features

Table 1: Maple Worksheet Interface

A **Toolbar**
A toolbar containing shortcut buttons.

B **Context bar**
A toolbar containing context-sensitive shortcut buttons. (The buttons change based on the cursor location or selection.) It can also contain a field for editing and entering text.

C **Section heading**
The name or title of a section.

D **Maple input**
A mathematical expression or command that Maple evaluates. By default, input commands are entered at the prompt, “>”, and are displayed in red type. The resulting output is displayed beneath.

Table 1: Maple Worksheet Interface

E	**Maple output** The result of an executed Maple input command. By default, Maple output is displayed in blue type in Standard Math Notation.
F	**Execution group** A set of Maple input with its corresponding output.
G	**Section range bracket** A line that encloses the elements of a section.
H	**Prompt** By default, the Maple prompt is a greater-than (**>**) symbol that indicates where to enter Maple input.
I	**Symbol palette** A collection of buttons for entering mathematical symbols in Maple.
J	**Expression palette** A collection of templates for entering mathematical expressions in Maple.
K	**Matrix palette** A collection of templates for entering matrices in Maple.
L	**Vector palette** A collection of templates for entering vectors in Maple.

1.4 Accessing Help Pages

The commands and features in Maple are documented in help pages. To view help pages, at the prompt, enter a question mark (?) followed by the name of the command or subject on which you want help. Do not enter any spaces. For example, to refer to the help page on natural logarithms, enter `?ln`. For information on different ways to access help, see *The Help System* on page 25.

1.5 Entering Expressions in Maple

To enter expressions at the prompt, use the keyboard, the palettes, or both. Using the keyboard is the most direct method, but the palettes enable you to enter a command without knowing its syntax.

There are two types of input display. Use **Maple Notation** to display input as Maple syntax. Maple Notation is the default. Use **Standard Math Notation** to display input in typeset notation as it appears in a textbook.

These examples step you through entering and evaluating $\int_0^{\pi} \sin(x)dx$ in various ways.

To enter and evaluate the integral in Standard Math Notation by using the palettes:

1. Display the palettes, if necessary. From the **View** menu, select **Palette**, then **Show All**. The Symbol, Expression, Matrix, and Vector palettes are displayed.
2. If required, change the input to Standard Math Notation. (If there is a question mark (?) after the prompt, the input is already set to Standard Math Notation.) If there is no ?, at the prompt, right-click. (For Macintosh, if you are using a single-button mouse, command-click.) A context-sensitive menu is displayed. Select **Standard Math**.
3. On the **Expression** palette, click  . The integral symbol appears, and the question mark placeholder is selected.
4. On the **Expression** palette, click  . The function *sin* appears, with another placeholder.
5. Enter x (on the keyboard), and press TAB to go to the next placeholder.
6. Repeat step 5.
7. Enter 0 (zero), and press TAB.
8. On the **Symbol** palette, click  . (It is in the bottom row.)
9. Press ENTER. Maple inserts the integral in Standard Math Notation, and then evaluates the integral.

Your worksheet should resemble that shown in Figure 1-B on page 6.

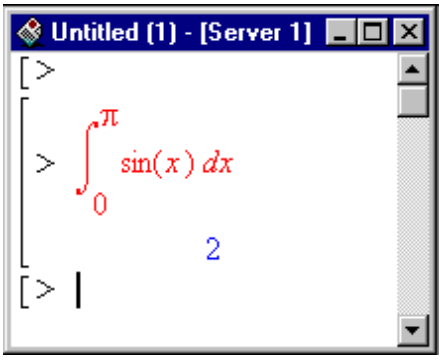

Figure 1-B Integral input in Standard Math Notation

The next example shows you how you can use the palettes to enter the expression and learn the Maple command syntax at the same time.

To enter and evaluate the integral in Maple Notation by using the palettes:

1. On the **Expression** palette, click $\int_a^b$. The integration command `int` appears, and the %? placeholder is selected.
2. On the **Expression** palette, click sin. The mathematical function *sin* appears, with another placeholder.
3. Enter `x` (on the keyboard), and press TAB to go to the next placeholder.
4. Repeat step 5.
5. Enter `0` (zero), and press TAB.
6. On the **Symbol** palette, click π. (It is in the bottom row.)
7. Press ENTER. Maple inserts the integral in Maple Notation, and then evaluates the integral.

   Note: Maple appends a semicolon to the end of the command. This signifies the end of the statement.

Your worksheet should resemble that shown in Figure 1-C.

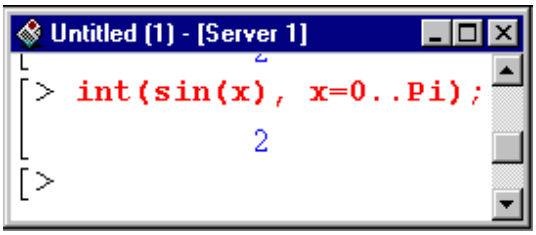

Figure 1-C Integral input in Maple Notation

Now that you know the correct notation, you can enter the expression at the prompt. For more information on entering expressions, see the examples in the next chapter and refer to `?worksheet,expressions,entering` (*Enter Expressions in Maple*). For more information on using palettes, refer to `?worksheet,expressions,palettes` (*Overview of Palettes*).

For the rest of this guide, it is assumed that you are entering expressions in Maple Notation.

2 Solving a Problem

This chapter presents a mathematical problem with its solution. The discussion of the problem and its solution introduces you to key features of the Maple program.

> ***Note:*** When entering Maple commands, keep in mind that they are case-sensitive.

2.1 Scenario

A skier has made her way to the top of a mountain. She wants to take the steepest path down, which she can find by performing the calculations outlined in this chapter. Start by opening a new worksheet for this problem.

To open a new worksheet:

- From the **File** menu, select **New**.

2.2 Commands in Packages

Some of the commands used in the discussion are found in packages whereas the *top-level* commands are not. A *package* is a group of routines related to a particular area of mathematics. You can always access commands in packages by using the long form, that is, specifying both package and function name: `package_name[function_name](...)`, but to be able to use the short form, that is, specify only the function name, use the `with` command first.

To access commands in the `plots` package:

- At the prompt, enter the following and press ENTER.
  `with(plots);`

After executing the command, Maple lists any warnings, followed by all of the commands that are included in the package. For the `plots` package, a warning indicates that the name of one of the commands in the package, `changecoords`, is the same as that of a top-level command. After executing the `with` command, the name `changecoords` refers to the package command `plots[changecoords]` instead of the top-level `changecoords` command. To use the top-level command[1], you must first clear the Maple internal memory using the `restart` command. For more information, refer to the `?restart` help page.

For other methods of accessing commands in packages, refer to Chapter 4, "Maple Structure and Packages," in the *Maple Learning Guide*. For a list of all the packages in Maple, refer to `?index,packages` (*Index of descriptions for packages of library functions*).

2.3 Math and Visualization

Use mathematical and visualization commands to determine basic properties of the hill. For more information on any of the commands used here, enter a question mark, followed by the name of the command. For example, to find help on the exponential command, enter `?exp` *(The Expontential Function)*.

Suppose that the height at a point `(x,y)` of the hill is given by `f`, in thousands of feet.

$$f = \frac{3}{(1+x^2+y^2)\left(\frac{1}{4}+\frac{(x+1)^2}{2}+\frac{(y+2)^2}{2}\right)}$$

To enter the expression in Maple:

- At the prompt, enter the following and press ENTER:
  `f := 3/(1+x^2+y^2)/(1/4+1/2*(x+1)^2+1/2*(y+2)^2);`

1. For more information about using a top-level command in this context, refer to the `?with` (*with*) help page.

The expression for the shape of the hill is assigned to the name `f` by means of the assignment operator ":=" so that it can be referred to in subsequent calculations. For more information about assignments, refer to `?assignment` (*The assignment statement*). For more information about names, refer to `?names` (*Names*).

Plotting the Hill

Before solving the problem, it is helpful to get an idea of the appearance of the hill (and an idea of the answer).

To plot the expression:

1. Right-click the output of the expression (for Macintosh, command-click). The context-sensitive menu is displayed.
2. Select **Plots**, **3-D Plot**, then **x,y**. Maple inserts the plot into the worksheet.

   Note: The content of context-sensitive menus varies depending on the cursor location or selected expression. For more information, refer to `?worksheet,expressions,manipulatecsm` (*Use Context-Sensitive Menus to Manipulate Expressions*).

To add axes:

1. Right-click the plot (for Macintosh, command-click).
2. Select **Axes**, then **Boxed**.

To modify the axis ranges:

1. Right-click the plot (for Macintosh, command-click), select **Axes**, then **Range**.
2. In the **Axis Ranges** dialog:
   a) Under **X** axis, click the button beside the range boxes. Enter a range of –4 to 3.
   b) Similarly, under the **Y** axis, enter a range of –4 to 3.
   c) Click **OK**.

The visualization tools in Maple enable you to see the surface from more than one angle.

To rotate the surface:

1. Click the plot to select it.
2. Place the pointer on the plot.
3. Drag the plot in any direction. The surface rotates.

Depending on how you rotated the plot, it may look similar to Figure 2-A.

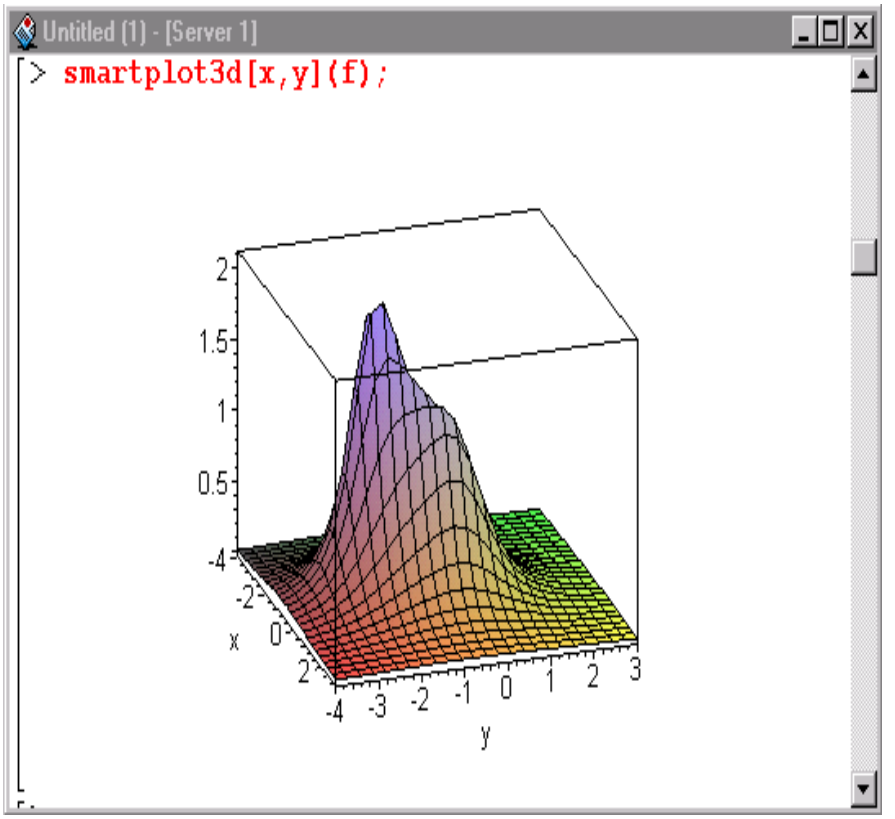

Figure 2-A Plot of the hill

While you can look at the surface and guess what the highest point (peak) is, you can obtain a more precise answer by using calculus.

Finding the Maximum Point of the Surface

Determine the location of the top of the hill by taking partial derivatives, setting them to `0`, and solving for `x` and `y`.

To find the partial derivative of `f` with respect to `x`:

- At the prompt, enter the following and press ENTER.
  ```
  fx := diff(f,x);
  ```

To find the partial derivative of `f` with respect to `y`:

- At the prompt, enter the following and press ENTER.
  ```
  fy := diff(f,y);
  ```

Since you are interested in the real-valued solution, use the `fsolve` command instead of the more general `solve` command. For more information, refer to the `?fsolve` (*fsolve*) and `?solve` (*solve*) help pages.

To solve the system of equations `{fx=0, fy=0}`:

- At the prompt, enter the following and press ENTER.
  ```
  top_xy := fsolve({fx=0,fy=0},{x,y},{x=-3..0,y=-3..0});
  ```

The numerical result `{x = –.9026100199, y = -1.805220040}` is an approximation of the x- and y-values of the peak.

> ***Note:*** Sets do not preserve order, so you may instead obtain the equivalent set: `{y = –1.805220040, x = –.9026100199}`.

Finding the Skier's Starting Point

Assume that the skier does not start at the peak but slightly to the side. To approximate this location, add a small factor, say `0.05`, to the `x-` and `y-`values of the highest point. Assign the peak values to the variables `x` and `y` and then add the small factor.

To assign the values to the variables:

- At the prompt, enter the following and press ENTER.
  ```
  assign(%);
  ```

The ditto operator (%) refers to the result of the previous computation. For more information, refer to `?%` (*The ditto operators*).

To define the starting `x-` and `y-`values, `x1` and `y1`, respectively:

- At the prompt, enter the following and press ENTER.
  ```
  x1:=x+0.05;
  y1:=y+0.05;
  ```

The names `x` and `y` have values assigned to them. To use `x` and `y` as variables in the following calculations, they must be first unassigned. For more information on unassigning, refer to the `?uneval` (*Unevaluated expressions*) help page.

To unassign `x` and `y`:

- At the prompt, enter the following and press ENTER.
  ```
  x:='x';
  y:='y';
  ```

To find the z-coordinate of the starting point:

- Evaluate the function representing the hill at the x- and y-values representing the starting point (x1,y1). At the prompt, enter the following and press ENTER.
  `z1:=eval(f,{x=x1,y=y1});`

The numerical result {x1 =-.8526100199 , y1 = -1.755220040, z1 = 2.145631453} is an approximation of the skier's starting point.

Finding the Path Down

Before you find the path, take a look at the level curves of the hill to get an idea of the skier's path.

To plot the level curves:

- The contourplot command (in the plots package) with five contours suggests an interesting shape, as shown in Figure 2-B. At the prompt, enter the following command and press ENTER.
  `contourplot(f, x=–2..1, y=–3..1, contours=5, filled=true);`

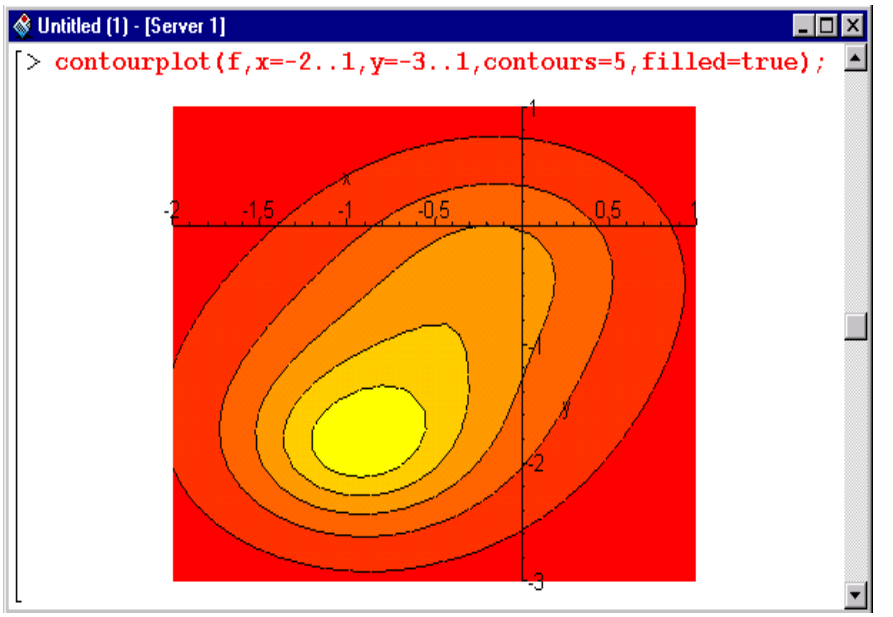

Figure 2-B Level curves of the hill

2.4 Using a For Loop—Finding the Path

Next, construct and plot the path on the surface of the hill that the skier should take. The negative of the gradient ($-\nabla f(x,y)$ or `-grad(f(x,y))` in the Maple language), gives the `x` and `y` components of the direction of steepest descent. At each point `(x,y,z)` on the surface, the skier must travel in the direction of $-\nabla f(x,y)$, while staying on the surface. Since $-\nabla f(x,y)$ changes from point to point, you can break the process into steps, building an approximation of the path of steepest descent. If the step size is too large, the path may leave the surface of the hill. If the step size is too small, you derive no benefit from the increased number of calculations.

Performing the Initialization

Assume that the skier is currently at the starting point (`x1,y1,z1`). Use a timestep of 0.1 and find 25 points along the path. Use the arrays `point3d` and `route3d` to store the values of the computed points and the direction taken, respectively. To simplify the calculation of the points and route, define vector representations of the expressions for the hill and the derivatives with respect to both `x` and `y`.

To define vector representations of the expressions:

- At the prompt, enter the following and press ENTER.

```
g:=eval(f,{x=P[1],y=P[2]});
gx:=eval(fx,{x=P[1],y=P[2]});
gy:=eval(fy,{x=P[1],y=P[2]});
```

To declare the arrays for storing the values at each timestep:

- At the prompt, enter the following and press ENTER.

```
point3d:=Array(1..25);
route3d:=Array(1..25);
```

To define the initialization:

- At the prompt, enter the following and press ENTER.

```
timestep:=0.1;
point3d[1]:=<x1,y1,z1>;
```

  Note: The notation `<x1,y1,z1>` defines a Vector while P[i] accesses the i^{th} element of the list P. For more information about Vectors, refer to `?Vector` (*Vector - construct a Vector*). For more information about lists, refer to `?lists` (*Sets and Lists*).

Specifying the For Loop

To obtain the additional 24 points, use a `for` loop. A `for` loop repeatedly executes a sequence of Maple commands entered between the `do` and `end do` commands of the loop, that is, in the loop body. It executes the commands as the value of a numeric variable, called an index, varies from its specified initial value to its specified final value. The value of the index is incremented after each execution of the commands in the body of the loop. The iteration stops when the value of the index is greater than the specified final value. For information on other programming structures in Maple, refer to the *Maple Introductory Programming Guide*.

To start the `for` loop:

- At the prompt, enter the following and press SHIFT+ENTER.
```
for i from 1 to 24 do
```

  Note: If you press ENTER, Maple returns the message: "Warning, premature end of input, use <Shift> + <Enter> to avoid this message". The `for` statement is not complete. You must use SHIFT+ENTER to go to the next line.

The body of the `for` loop comprises the next commands. These commands find the skier's position at the end of each time step.

To construct the 3-D normalized negative of the gradient vectors:

- On the next line, enter the following and press SHIFT+ENTER.
```
route3d[i] := LinearAlgebra[Normalize](eval(<-gx,-gy,0>,
P=point3d[i]));
```

To find the next point in the skier's path:

- On the next line, enter the following and press SHIFT+ENTER.
```
point3d[i+1] :=
eval(<P[1],P[2],g>,P=point3d[i]+timestep*route3d[i]);
```

To complete the `for` loop:

- On the next line, enter the following and press ENTER. Remember to end the line with a colon to suppress the output.
```
end do:
```

This command ends the `for` loop. After you press ENTER, the five commands in the loop body are repeated 24 times. At the end of each iteration, the value of `i` is increased by 1. That is, for the first iteration, the value of `i` is its initial value 1, for the second 2, and so on. For the last iteration the value of `i` is 24. Maple exits at the end of the 24th iteration once `i` is set to 25 (since 25 is outside of the bounds of the loop).

To graph the path, you must convert the points representing the path of the skier, which are stored in the `point3d` array, to a list.

To convert the `point3d` array to a list:

- At the prompt, enter the following and press ENTER.
  ```
  listpoints3d := [seq( convert( point3d[i], list ), i=1..25 )]:
  ```

You will use these lists in the next section.

2.5 Visualization Revisited

The visualization tools in Maple enable you to create different kinds of two- and three-dimensional plots in a number of coordinate systems. In addition, you can plot more than one element on a single set of axes. First assign the individual plots to names, then plot them together by using the `display` command.

To plot the hill and assign it to the name `mountain`:

- At the prompt, enter the following and press ENTER. Remember to end the line with a colon to suppress the output.
  ```
  mountain := plot3d(f, x=–3..3, y=–4..4, axes=boxed):
  ```

To plot the set of points on the path as a straight line and assign it to `path3d`:

- At the prompt, enter the following and press ENTER.
  ```
  path3d := pointplot3d(listpoints3d, style=line, color=red):
  ```

To plot the starting point of the skier and assign it to `skier`:

- At the prompt, enter the following and press ENTER.
  ```
  skier := pointplot3d(convert(point3d[1],list), symbol=cross,
  symbolsize=50,color=yellow):
  ```

To view all three elements at once:

- At the prompt, enter the following and press ENTER.
  ```
  display(mountain, skier, path3d);
  ```

To rotate the surface of the plot to see the path:

1. Click the plot to select it.
2. Place the pointer on the plot.
3. Drag the plot in any direction. The surface rotates.

Your plot should look similar to that shown in Figure 2-C. For a list of all the different types of plots, refer to `?plots` (*Introduction to the plots package*). For overview information on plots, refer to `?worksheet,plotinterface` (*Overview of Plotting*). For information on different plot options, refer to `?plot,options` *(plot[options])* and `?plot3d,option` *(plot3d[option]*).

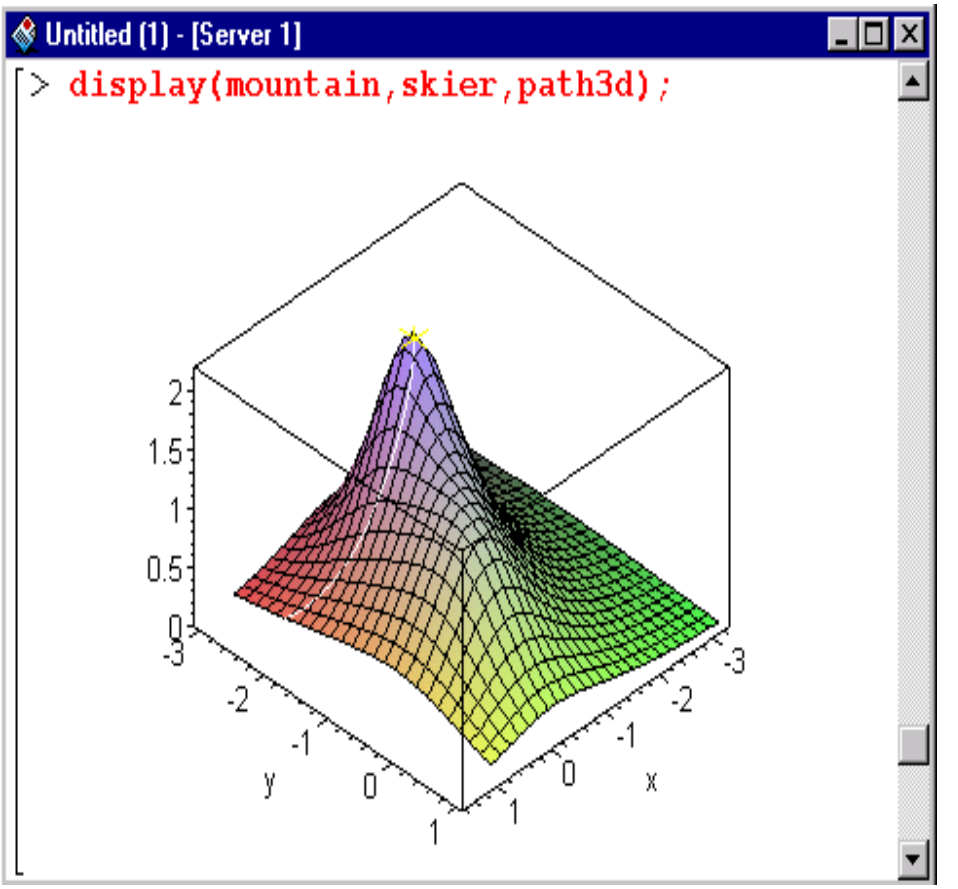

Figure 2-C The skier's starting position, the path, and the hill

Similarly, you can display a contour plot with the skier's path.

2.6 Documenting Your Work

You can document the steps you take to solve a problem by adding some text to your worksheet. You can then format the text by using predefined styles, or defining and using custom styles. In addition, you can insert formatted mathematics in your text.

Adding Text

Add a title and text to your worksheet to describe the problem that you are solving. You can also add text in other locations in the worksheet to describe how you are solving the problem.

To add a title to your worksheet:

1. Insert a new execution group at the top of the worksheet: place the insertion point on the top line, and from the **Insert** menu, select **Execution Group**, then **Before Cursor**.
2. Click  (or from the **Insert** menu, select **Text**) to add text rather than a Maple command.
3. From the styles drop-down box on the left side of the context bar, select **Title**.
4. Enter the following text as the title of the worksheet.
   `The Skier's Path`
5. Insert another execution group after the title. From the **Insert** menu, select **Text**.
6. From the styles drop-down box, select **Author**. Enter your name.

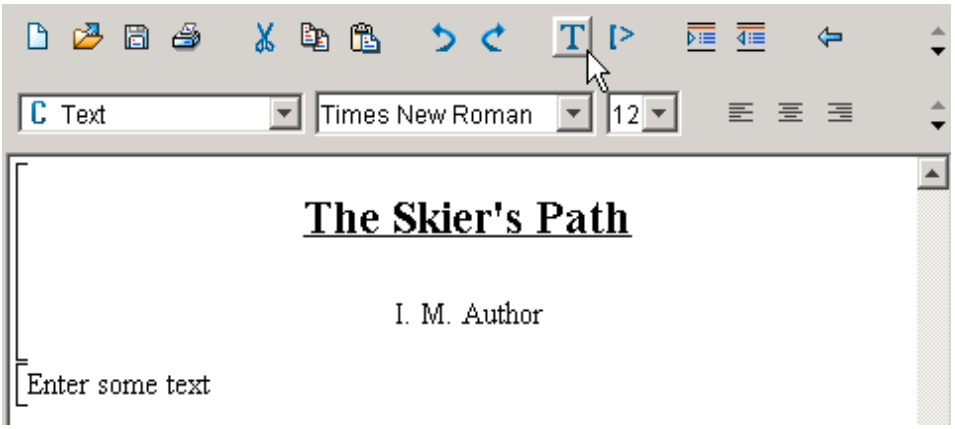

Figure 2-D Worksheet with a title; context bar for text

It is possible to redefine the styles (alignment, font, underlining, and so on). For more information, refer to `?worksheet,documenting,styles` (*Overview of Maple Text Styles*).

To add a text description to the worksheet:

1. Place the insertion point on the first input command (the `with` command).
2. From the **Insert** menu, select **Execution Group**, then **Before Cursor**. A new prompt appears.
3. Click T (or from the **Insert** menu, select **Text**) to add text.
4. Enter the following sentences.
   ```
   A skier has made her way to the top of a mountain. She wants to
   take the steepest path down, which she can find by performing
   the calculations outlined in this worksheet.
   ```

To add formatted math to the text:

1. To add another paragraph and a blank line to the worksheet, press ENTER twice.
2. Enter the following text.
   ```
   Suppose that the height at a point (x,y) of the hill is given by
   f=3/(1+x^2+y^2)/(1/4+1/2*(x+1)^2+1/2*(y+2)^2), in thousands of
   feet.
   ```
3. Highlight the equation.
4. From the **Format** menu, select **Convert to**, then **Standard Math**. The equation appears in standard math notation.

Your worksheet should resemble that shown in Figure 2-E.

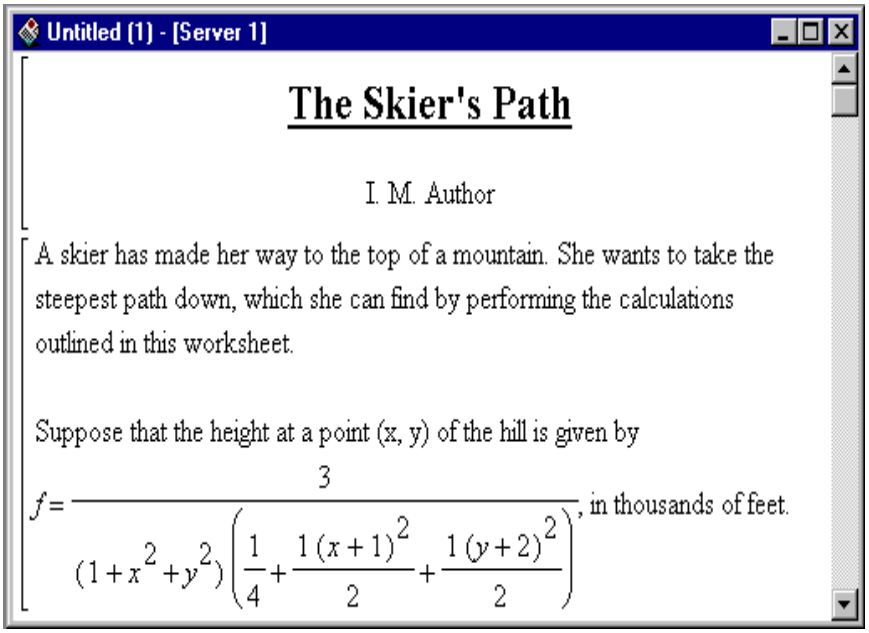

Figure 2-E Text description with formatted math

Structuring the Worksheet with Sections

You can add sections to your worksheet to group various elements. When you enclose elements in a section (or indent them), Maple automatically inserts a place for a section title.

To add and title a section:

1. Select the first two paragraphs in the worksheet. (They begin with “A skier …” and end with “… in thousands of feet.”)
2. Click (Indent) on the toolbar. A large range bracket topped by a little square appears to the left of the two paragraphs you selected.
3. Click to the right of the box, and enter the title of the section.
   `Problem Description`

Compare your worksheet to Figure 2-F on page 22. You can continue to document each step in the problem. For more information about sections, refer

to `?worksheet,documenting,structuring2` (*Structure Worksheets with Sections*).

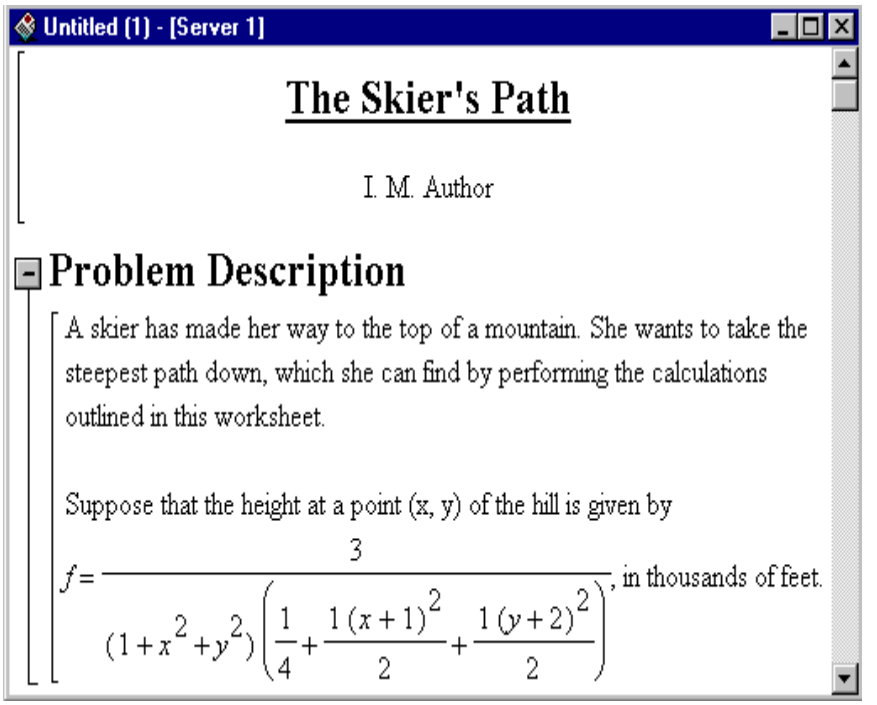

Figure 2-F Worksheet with a titled section

Adding Numbers

If you plan to print your worksheet, you may find it useful to add page numbers to the bottom of the page.

To add page numbers (centered at the bottom of the page):

1. From the **Format** menu, select **Page Numbers**.
2. In the **Page Number** dialog:
   a) Select the **Show Page Numbers** check box.
   b) Under **Vertical location**, leave the default selection at **Bottom**.
   c) Under **Horizontal location**, click **Center**.
   d) Click **OK**.

For more information about the page number options, refer to `?worksheet,documenting,pagenumbers` (*Page Numbers*).

To save your worksheet:

- From the **File** menu, select **Save**. If you have not saved it previously, you are prompted for a file location and name that ends with `.mw` (for Maple worksheet). The **Save As Maple 8 Worksheet(.mws)** option exists for cases where the worksheet also needs to be read by older releases of Maple; it creates a worksheet in the `.mws` format.

  Note: Maple worksheets use an `.mw` file extension. Previous releases of Maple created worksheets as `.mws` files. The two formats are different, but Maple can open and run both file types. Older worksheets may not behave exactly as they do in the version in which they were created because improvements to the system sometimes result in different forms of responses.

2.7 Exporting to HTML

You can export your worksheet as an HTML file. (Maple worksheets can also be exported to HTML with MathML, LaTeX, Maple text, Plain text, Rich Text Format (RTF), Maplet applications, and Maple Input. For more information, refer to `?worksheet,managing,export` (*Export a Worksheet*).)

To export a worksheet as HTML:

1. Open the worksheet to export.
2. From the **File** menu, select **Export As**. The **Export As** dialog opens.
3. Specify **HTML** as the file type.
4. Specify a path and folder for the file.
5. Enter a filename.
6. Click **Export**. The **HTML Options** dialog opens.
7. In the **Image Subdirectory** field, enter the pathname for the directory where the exported images are to be saved. Each image is saved in its own GIF file. All image directories are relative to the document. The default directory is **images**, and it is located under the same directory that was selected for the HTML document.
8. To export the worksheet as an HTML document with frames, select the **Use Frames** check box. If you prefer that the links be at the top of the page, separated by a horizontal rule, clear the **Use Frames** check box.
9. You can export mathematical expressions in various forms. Select **GIF** images, **MathML1.0, MathML2.0,** or **MathML2.0 with WebEQ**™.
10. Click **OK**.

The HTML file is created. You can then open it in your Web browser.

For more information on how to export worksheets to HTML, refer to `?worksheet,managing,exportHTML` (*Export as HTML or HTML with MathML*). For information on how Maple translates the worksheet to HTML, refer to `?worksheet,managing,exporttoHTML` (*Translation of Maple Worksheets to HTML or HTML with MathML*).

3 Getting More Information

This guide is a brief introduction to the Maple program. Maple has many other features, such as spreadsheets, a Microsoft® Excel link, and a MATLAB® link. To learn more, you can use the Maple help system, read the Maple manuals, and access other online resources.

3.1 The Help System[1]

The Maple program provides a custom help system consisting of almost 4000 reference pages. The help system is a convenient resource for determining the syntax of Maple commands and for learning about the features of the Maple program.

Maple Help Pages

The Maple help system opens in a separate window. The window has two panes. The left pane contains the Help Navigator, while the right pane displays the help page. Most help pages in the Maple program are command reference pages, such as the one shown in Figure 3-A on page 26.

1. This manual describes the standard worksheet interface help system. For information about the classic worksheet interface help system, refer to the `?worksheet/reference/HelpGuide` help page.

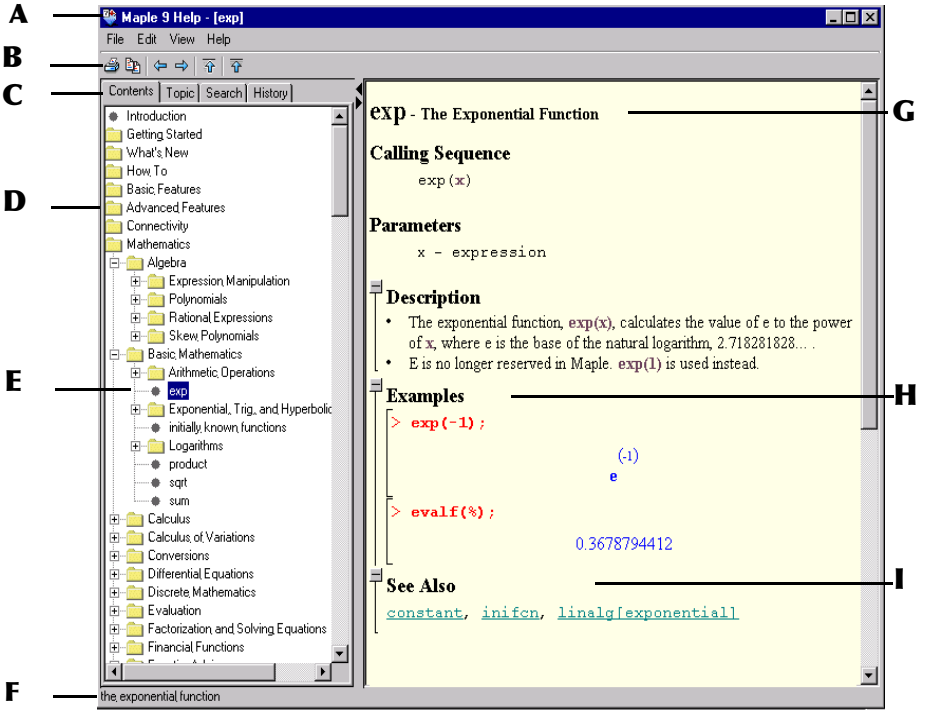

Figure 3-A Sample Help page

Table 2: Help System

A **Help Page Name**

Help page name in square brackets.

B **Toolbar**

A toolbar containing shortcut buttons: Print an active worksheet, copy selection to clipboard, go back or forward in hyperlink history, go to the parent help page, or view the introduction to Maple help page.

C **Help Navigator Tabs**

Contents displays a structured list of all topics in the help system.
Topic reveals a list of matching topics.
Search reveals a list of topics based on keyword frequency.
History reveals the last ten help pages visited.

D **Topic folders**

A folder icon indicates that a topic can be expanded into subtopics.

E **Bullet**

Click a topic preceded by a bullet to open the corresponding help page.

Table 2: Help System

F **Description**
Brief description of help page.

G **Help Page Title**
Help page name and a brief description.

H **Examples**
Sample uses of the Maple command. To copy all the examples, from the **Edit** menu in the Help window, select **Copy Examples**. You can then paste the examples into a worksheet and execute them.

I **See Also**
Hyperlinks to related topics.

Getting Help

The Maple program provides many ways of accessing the information in the help system.

- The `?topic_name` help command in a worksheet displays the help page of a specified command or topic in the Help system.
- **Table of Contents** in the worksheet **Help** menu opens the Help system with the **Contents** tab active in the Help Navigator.
- **Topic Index** in the worksheet **Help** menu opens the Help system with the **Topic** tab active in the Help Navigator.
- **Search** in the worksheet **Help** menu opens the Help system with the **Search** tab active in the Help Navigator.
- The worksheet toolbar also contains a Help icon  to activate the Help system.

Help command If you know, or can guess, the name of a help page, you can access it by using the `?topic_name` help command. It is the most direct method of obtaining help. To use the help command, at the prompt, enter a question mark followed by the command or topic for which you want help and press ENTER. Note that you are not required to terminate a help command with a semicolon or a colon. For more information, refer to `?help` (*help*).

Help Navigator The Help Navigator contains four tabs: **Contents**, **Topic**, **Search**, and **History**. Intermediate search results are displayed in the Help Navigator pane.

- A folder icon indicates that a topic can be expanded into subtopics.
- Clicking a topic preceded by a bullet displays the associated help page.

- **Contents** displays a structured list of all topics in the help system. For more information, refer to `?worksheet,reference,browse` (*Using the Table of Contents in the Help Navigator*).
- **Topic** searches reveal a list of matching topics displayed alphabetically as you enter the letters of the search topic word. Topic searches are not case-sensitive. To search on a topic name, click the **Topic** tab in the Help Navigator. Enter your **Topic** word. For more information, refer to `?worksheet,help,topicsearch` (*Perform a Topic Search*).
- **Search** reveals a list of topics based on keyword frequency. With this search, you can search on more than one word. However, the results may include pages that contain only one of the words listed in the search, and not all of them. Searches are not case-sensitive. To display a list of topics based on keyword frequency, click the **Search** tab in the Help Navigator. Enter your word(s) and press ENTER. For more information, refer to `?worksheet,help,fulltextsearch` (*Perform a Search*).
- **History** lists the last ten help pages visited, which can include pages from previous Maple sessions. Note that these pages are included only if available based on **libname**.

For additional information about the Help system, refer to `?worksheet,reference,HelpGuide` (*Using Help*).

3.2 Manual Set

The Maple software comes with the following manuals.

Title	Content
Maple 9 Getting Started Guide	This guide contains an introduction to the graphical user interface and a tutorial that outlines using Maple to solve mathematical problems and create technical documents. It also contains additional information for new users about the help system, New User's Tour, example worksheets, and Maplesoft™ Web site.
Maple 9 Learning Guide	This guide explains how Maple and the Maple language work. It describes the most important commands and uses them to solve technical problems. User hints for Maplet applications are also described in this guide.

Title	Content
Maple 9 Introductory Programming Guide[1]	This guide introduces the basic Maple programming concepts, such as expressions, data structures, looping and decision mechanisms, procedures, input and output, debugging, and the Maplet User Interface Customization System.
Maple 9 Advanced Programming Guide[1]	This guide extends the basic Maple programming concepts to more advanced topics, such as modules, input and output, numerical programming, graphics programming, and compiled code.

1. The Student Edition does not include the *Maple 9 Introductory Programming Guide* and the *Maple 9 Advanced Programming Guide*. These programming guides can be purchased from school and specialty bookstores or directly from Maplesoft.

3.3 Tutorials

Maple provides three tutorials that can be accessed from the **New User** submenu of the **Help** menu: **Full Tour**, **Quick Tour**, and **Basic How To**.

- When you select the **Full Tour** menu item, the **New User's Tour** opens. This tour is a set of interactive worksheets that you can use to learn about the Maple program. The worksheets present commands that every user should know. The tour covers many areas of the Maple program, such as the worksheet environment, numerical calculations, algebraic computations, graphics, calculus, differential equations, linear algebra, finance and statistics, programming, and the Maple help system. The **New User's Tour** is easy to follow and a single topic takes approximately 15 minutes to complete.
- When you select the **Quick Tour** menu item, the **Quick New User's Tour** worksheet opens. This worksheet is a subset of the **Full Tour**. You can execute the worksheet or simply glance at the content. The tour takes approximately 10 minutes to complete.
- When you select the **Basic How To** menu item, the **How to Perform Basic Tasks** worksheet opens. This worksheet serves as a review of common commands and guidelines for using the Maple program. You may choose to return to this reference in future Maple program sessions.

To access the tutorials:

- From the **Help** menu, select **New User** and then **Full Tour, Quick Tour**, or **Basic How To**. Each tutorial is an active worksheet and as such opens in a worksheet window.

3.4 Example Worksheets

The example worksheets (about 100) contain examples from the Maple programming language and from many different areas of mathematics, such as algebra, geometry, discrete mathematics, integration, integral transforms, differential equations, general symbolics, general numerics, and mathematical visualization.

To see the contents of the set of example worksheets:

- At the prompt, enter `?examples,index` and press ENTER.

3.5 Web Sites

The Maplesoft Web site has, among other things, information on products, support, and services.

To visit the Maplesoft Web site:

- In your Web browser, enter this URL: `www.maplesoft.com`, or
- From the **Help** menu in your Maple 9 worksheet, select **Maple on the Web**, and **Product and Company Info**.

The Maple Application Center™ includes a forum for sharing solutions, demonstrations of Maple PowerTools, and an online tutorial.

To visit the Maple Application Center Web site:

- In your Web browser, enter this URL: `www.mapleapps.com`, or
- From the **Help** menu in your Maple 9 worksheet, select **Maple on the Web,** and **Maple Application Center.**

The Student Center includes course help, Maple tutorials, and Maple graphics.

To visit the Student Center Web site:

- In your Web browser, enter this URL: `www.maple4students.com`, or
- From the **Help** menu in your Maple 9 worksheet, select **Maple on the Web**, and **Student Center**.

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