Graphing in Maple

Here we give a selection of maple commands involved with Maple's graphics package.

2-D Graphics

If we type

$[> \ plot(sin(x), x = 0..\ 2 * Pi);$

then maple will give a graph of the function $\sin x$ on $[0, 2\pi]$ If we type

$[> \ plot([sin(x), cos(x)], x = 0..\ 2 * Pi);$

then maple will give two graphs superimposed, the function $\sin x$ and $\cos x$ on $[0, 2\pi]$
If we type

$[> \ plot([2 - t^2, t - t^3, t = -2..2]);$

then maple will us a plot of the parametric equations

$$x = 2 - t^2, \quad y = t - t^3.$$

If we wish to make the graph larger or smaller, left click your mouse arrow in the middle of the picture and maple will put a box around it. Then you can make the box as large or as small as you wish. There are several options that we will discuss. To be able to get this list, if we type

$[> \ ?plot;$

Maple will take us to a help menu where all sorts of information can be found including options (see the bottom for **See Also**).

Common Options

axes

Specifies the type of axes, one of FRAME, BOXED, NORMAL and NONE.

Example

$[> \ plot(sin(x), x = 0..2 * Pi, axes = BOXED);$

axesfont

Specifies the [family,style,size], where family is one of TIMES, COURIER, HELVETICA and SYMBOL. For TIMES, style may be one from ROMAN, BOLD, ITALIC or BOLDITALIC, For HELVETICA and COURIER style may be omitted or select of of BOLD, OBLIQUE or BOLDOBLIQUE. SYMBOL doesn't accept a style option. The final value, size, is the point size to be used.

Example

$[> \ plot(sin(x), x = 0..2 * Pi, axesfont = [TIMES, ITALICS, 16]);$

color

Allows the user to specify the color of the curves to be plotted. The spelling "colour" may also be used. For details, see it plot,color. .

Example

$[> \ plot(sin(x), x = 0..2 * Pi, color = blue);$

filled

If the filled option is set to true, the area between the curve and the x-axis is given a solid color. This option is valid only with the following commands: *plot, contourplot, implicitplot, listcontplot, polarplot*, and *semilogplot*.

Example

$[> \ plot(sin(x), x = 0..2 * Pi, color = blue, filled = true);$

font

Same as **axesfont** except for text objects in the plot.

labels = [x,y]

This option specifies labels for the axes. The values of x and y must be strings. The default

labels are the names of the variables in the original function to be plotted, if any.
Example

$[> \ plot(sin(x), x = 0..2 * Pi, color = blue, filled = true, labels = [t, T]);$

legend=s

A legend for a plot can be specified by either a string or a list of strings. When more than one curve is being plotted then they must be specified as a list (and not a set) and there must be a legend for each curve where the ith curve is associated with the ith legend.
Example

$[> \ plot([sin(x), cos(x)], x = 0..2 * Pi, color = [red, blue], legend = [''sin(x)'', ''cos(x)'']);$

linestyle=n

Controls the dash pattern used to render lines in the plot. The linestyle can be specified as either an integer between 1 and 4, or a name from the following list: SOLID, DOT, DASH, DASHDOT.
Example

$[> \ plot([sin(x), cos(x)], x = 0..2 * Pi, color = [red, blue], linestyle = [1, 2]);$

style=s

The interpolation style must be one of LINE, POINT, PATCH, or PATCHNOGRID. The default is LINE. POINT style plots points only, LINE interpolates between the points, PATCH uses the patch style for plots containing polygons, and PATCHNOGRID is the PATCH style without the grid lines.

symbol=s

Symbol for points in the plot, where the value s is one of BOX, CROSS, CIRCLE, POINT, and DIAMOND. Note: If the style is set to POINT, the default symbol is plot device specific.

symbolsize=n

The size (in points) of a symbol used in plotting can be given by a positive integer. This does not affect the symbol POINT. The default symbol size is 10.
Example

$[>\ \ plot([sin(x), cos(x)], x = 0..\ 2 * Pi, style = [POINT, LINE],$
$symbol = [DIAMOND], symbolsize = 16);$
Example
$[>\ \ plot([sin(x), cos(x)], x = 0..\ 2 * Pi, style = POINT,$
$symbol = [CROSS, CIRCLE], symbolsize = 16);$

thickness=n
This option specifies the thickness of lines in the plot. The thickness n must be a non-negative integer. The default thickness is 0.

tickmarks=[m, n]
This option specifies that a reasonable number of points no less than m and n should be marked along the x-axis and y-axis, respectively. Both m and n must be either a positive integer or the name 'default'. If tick marks are desired along only one axis, use xtickmarks or ytickmarks instead.

title=t
The title for the plot. The value t must be a character string. The default is no title. You can create multi-line titles for standard plots. Use the characters
n in the character string to denote the start of a new title line.

titlefont=l
Font for the title of the plot, specified in the same manner as font.
Example
$[>\ \ plot(sin(x), x = 0..\ 2 * Pi, tickmarks = [3, 2], title = "y = sin(x)Curve");$

view=[xmin..xmax, ymin..ymax]
This option indicates the minimum and maximum coordinates of the curve to be displayed on the screen. The default is the entire curve.
Example
$[>\ \ plot(tan(x), x = 0..\ 2 * Pi, view = [0..2 * Pi, -5..5]);$

3-D Graphics

If we type

$[> \ plot3d((x^2-y^2)/(x^2+y^2), x=-1..1, y=-1..1);$

then maple will give a 3d graph of the function $z = \frac{x^2-y^2}{x^2+y^2}$ on $[-1,1] \times [-1,1]$. A really nice feature is if we left click on the picture and hold it down, we get real time rotation. many of the options are similar and can be viewed using

Example

$[> \ ?plot3d;$

2-D Animation

Maple also has an animation feature in its graphics package. However, we need to call in the entire plots package. To do this we use the Maple command

$[> \ with(plots) :$

If we type

$[> \ animate(exp(-(x+t)^2, x=-10..10, t=0..5, frames=50);$

we will get the initial profile at $t = 0$ on $[-10, 10]$ and we can evolve the picture from $t = 0$ to $t = 5$ and there will be a total of 50 snap shots. We can also have animated parametric plots

Example

$[> \ animate([r*cos(t), r*sin(t), t=0..5], r=0..1, frames=50);$

In both examples, once we execute the maple command, we need to left click on the picture. At that point, at the top of the screen you will find tape recorder type controls. These can be used to go forward, backward. You can single step through the frames etc. We can also animate in 3d. The following is an example. Please note the *with(plots)* command still need to be used.

Example

$[> \ with(plots);$

$[> \ (animate3d(cos(t*x)*sin(t*y), x=-Pi..Pi, y=-Pi..Pi, t=1..2, color=cos(x*y));$

Problems

1. Graph the functions $y = x$ and $y = \cos x$ and determine where they intersect. You will need to use last weeks material.

2. Graph the functions $y = \sin x$, $y = \sin 2x$ and $y = \sin 3x$ on the interval $[0, 2\pi]$ with three different colors. To get a list of the colors you can type the maple command *?plot,color;*. Use the legend command here.

3. Animate the function

$$y = \text{sech}(\text{x} - \text{t}) + 2\,\text{sech}(\text{x}/2 - \text{t}/2).$$

Plot this on $[-40, 40]$ for $t = -30..30$ using 100 frames. What happens in the graph?

4. Plot the 3D graph of $z = sqrt(4 - x^2 - y^2)$ on $[-2, 2] \times [-2, 2]$ using 100, 500 and 1000 points. What is the primary difference in the three graphs?

5. Animate the 3D graph of $z = 10 - t \tan^{-1}\left(x^2 + y^2\right)$ on $[-3, 3] \times [-3, 3]$ for $t = ..30$. Explain what happens?