Graphics

Basic plotting functions

```
Plot[f, {x, x_min, x_max}]                plot f as a function of x from x_min to x_max
Plot[{f_1, f_2, ... }, {x, x_min, x_max}]  plot several functions together
```

```
In[1]:= Plot[{Sin[x], Sin[2x], Sin[3x]}, {x, 0, 2Pi}]
```

plot and overlay a list of functions

```
Out[1]= -Graphics-
```

Specifying "options" in Mathematica functions: each option has a definite name. As the last arguments to a function like Plot, you can include a sequence of rules of the form name->value

```
Plot[f, {x, x_min, x_max}, option->value]
                          plot, specifying a particular value for an option
```

Plot - the options Frame, FrameLabel and AxesLabel are modified

```
In[1]:= Plot[Sin[x^2], {x, 0, 3}, Frame -> True, FrameLabel ->"My First
Plot", AxesLabel -> {"x value",  "Sin[x^2]"} ]
```

Specific options can be set for each function and the defaults can be changed:

```
Options[function]
               give a list of the current default settings for all options

Options[function, option]
                          give the default setting for a particular option

SetOptions[function, option->value, ... ]                    reset defaults
```

```
In[1]:= Options[Plot, PlotRange]
```

default setting for the PlotRange

```
In[2]:= Options[Plot, AxesLabel -> {"x value",  "y value"} ]]
```

change default setting for the AxisLabel

Redraw plots

```
In[1]:=Plot[Sin[x^2], {x, 0, 3}]
In[2]:= Show[%,PlotRange -> {-1, 2}]
```

redraw line 1 changing options

Overlay plots

```
In[1]:=Plot[Sin[x^2], {x, 0, 3 Pi}]

In[2]:=Plot[Sin[2 x], {x, 0, 3 Pi}]

In[3]:=Plot[Sin[2 x], {x, 0, 3 Pi}]
……

In[33]:=Plot[Sin[Pi + x], {x, 0, 3 Pi}]

In[50]:= Show[%1,%2,%33]
```

Overlay plot line 1 2 and 33

Arrays of plots

```
In[51]:= Show[GraphicsArray[{{%1,%3}, {%2,%33}}]]
```

Plots from lists of data:

```
ListPlot[{y1, y2, ... }]                plot y1, y2, …at xvalues 1, 2, …
ListPlot[{{x1, y1}, {x2, y2}, ... }]    plot points (x1,y1), …
ListPlot[list, PlotJoined -> True]      join the points with lines
```

```
In[1]:= Table[{i^2, 4 i^2 + i^3}, {i, 10}]
         {{1, 5}, {4, 24}, {9, 63}, {16, 128}, {25, 225},
Out[1]=   {36, 360}, {49, 539}, {64, 768}, {81, 1053}, {100, 1400}}
```

generate a table

```
In[2]:= ListPlot[%]
```

Plot the points of the table

```
In[1]:= Table[{i^2, 4 i^2 + i^3}, {i, 10}]
         {{1, 5}, {4, 24}, {9, 63}, {16, 128}, {25, 225},
Out[1]=   {36, 360}, {49, 539}, {64, 768}, {81, 1053}, {100, 1400}}
```

generate a table

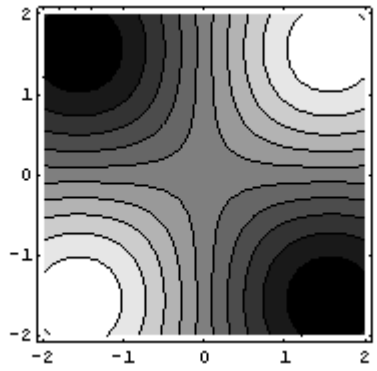
Plotting 3D

`ContourPlot[f, {x, `x_{min}`, `x_{max}`}, {y, `y_{min}`, `y_{max}`}]`
`make a contour plot of f as a function of x and y`

`DensityPlot[f, {x, `x_{min}`, `x_{max}`}, {y, `y_{min}`, `y_{max}`}]`
`make a density plot of f`

Contour Plot shows in 2 dimensions x,y the lines of constant values for f(x,y). The regions with lighter colour correspond to higher values of f.

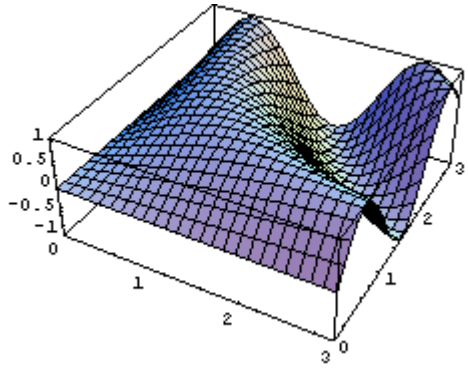
```
In[1]:= ContourPlot[Sin[x] Sin[y], {x, -2, 2}, {y, -2, 2}]
```



Three-dimensional surface plot of a function

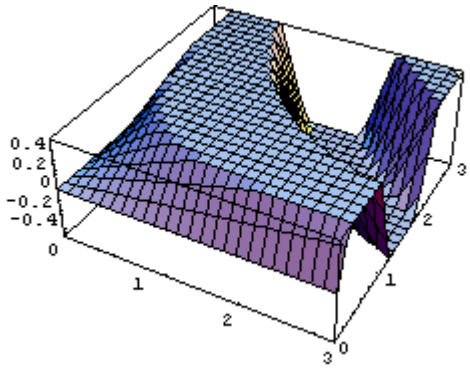
`Plot3D[f, {x, `x_{min}`, `x_{max}`}, {y, `y_{min}`, `y_{max}`}]`
`make a three-dimensional plot of f as a function of the variables x and y`

```
In[1]:= Plot3D[Sin[x y], {x, 0, 3}, {y, 0, 3}]
```



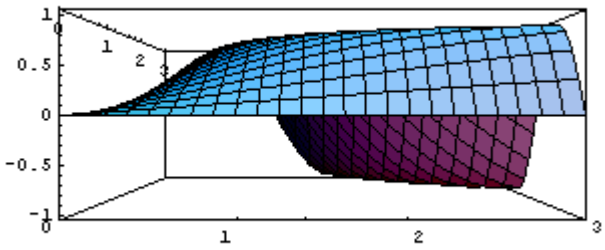
```
In[2]:= Show[%, PlotRange -> {-0.5, 0.5}]
```

redraw with changed option for the z range



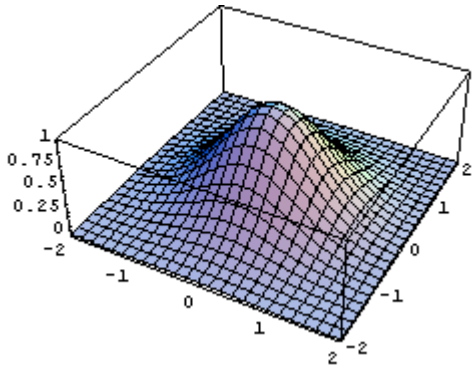

```
In[3]:= Show[%1, ViewPoint -> {0, -2, 0}]
```

change the view



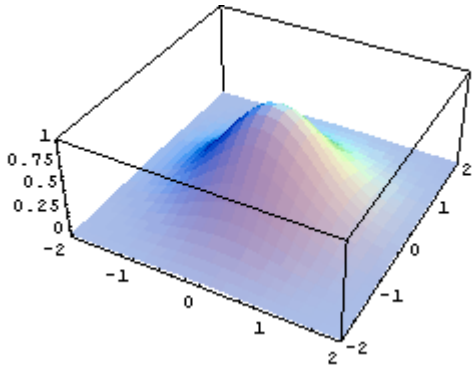

```
In[4]:= g = Plot3D[Exp[-(x^2+y^2)], {x, -2, 2}, {y, -2, 2}]
```

another example




```
In[5]:= Show[g, Mesh -> False]
```

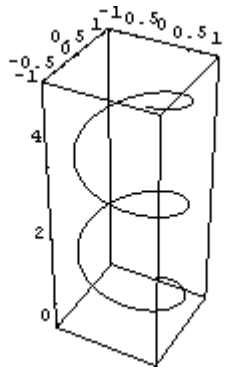
change the grid



Parametric Plots

```
In[6]:= ParametricPlot3D[{Sin[t], Cos[t], t/3}, {t, 0, 15}]
```

helical curve




```
In[7]:= ParametricPlot3D[{Cos[t] Cos[u], Sin[t] Cos[u], Sin[u]},
{t, 0, 2Pi}, {u, -Pi/2, Pi/2}]
```

sphere