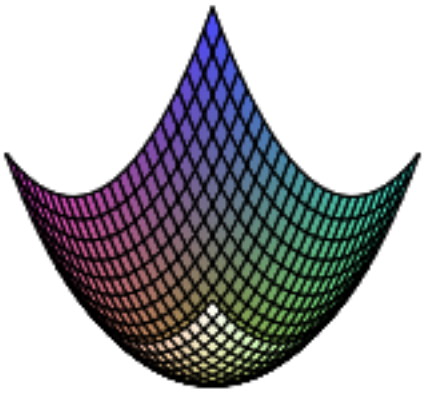
Notebook 13: Vectors and Geometry of Space

Cylinders and Quadratic Surfaces

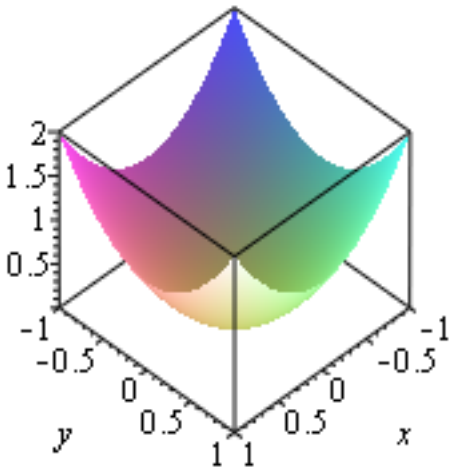
Plotting in three dimensions is very similar to plotting in two dimensions. The basic command is *plot3d*

> $plot3d(x^2+y^2, x=-1..1, y=-1..1)$



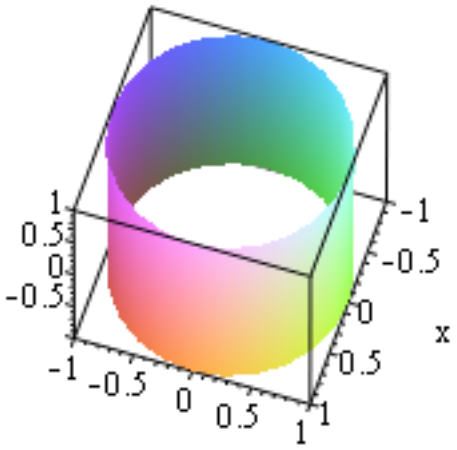
Optional arguments to control the axes and the appearance of the surface will improve readability of a 3-D graph.

> $plot3d(x^2+y^2, x=-1..1, y=-1..1, axes=boxed, style=patchnogrid)$



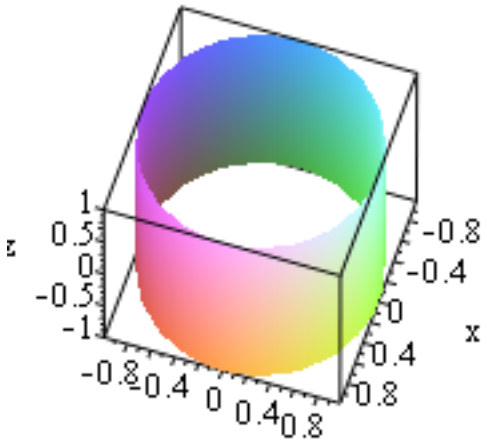
The *plot3d* command will also plot parametric functions in three dimensions, but the syntax is changed slightly from the 2-D case.

```
> plot3d( [cos(t), sin(t), z], t = 0 ..2 π, z = -1 ..1, axes = boxed, style = patchnogrid, orientation = [ 18,
      31 ] )
```



The *implicitplot3d* in the *plots* command will plot implicit functions in three dimensions. The variable ranges must be given in the order *x y z* so that Maple will orient the graph correctly.

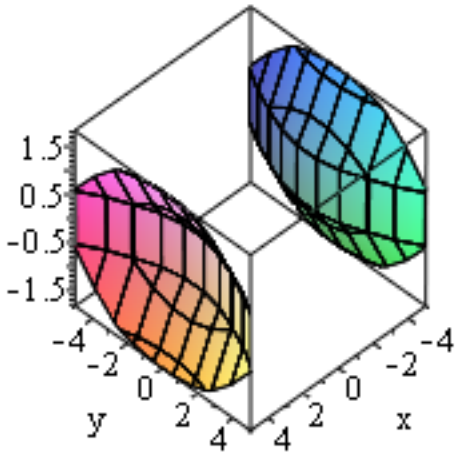
```
> plots[ implicitplot3d ]( x^2 + y^2 = 1, x = -1 ..1, y = -1 ..1, z = -1 ..1, axes = boxed, style = patchnogrid,
      orientation = [ 18, 31 ] )
```



The argument *orientation* = [θ, ϕ] dictates at what angle to display the graph initially.

Often, some experimentation will be needed in order to produce a satisfactory graph. Take for example the following equation

```
> eqn := x^2/9 - 1 = y^2/16 + z^2/2 :
  plots[implicitplot3d](eqn, x = -5..5, y = -5..5, z = -5..5, axes = boxed)
```



In addition to the ranges being changed, the argument *grid* = [*m*, *n*, *k*] can be used to smooth out a rough graph. The numbers *m*, *n*, and *k* dictate how many points are to be plotted in the *x*, *y*, and *z* direction respectively.

```
> plots[implicitplot3d](eqn, x = -20..20, y = -32..32, z = -10..10, axes = boxed, orientation = [-60, 60],
      grid = [30, 30, 30], style = patchcontour)
```