

[Surface, level curves and limits.

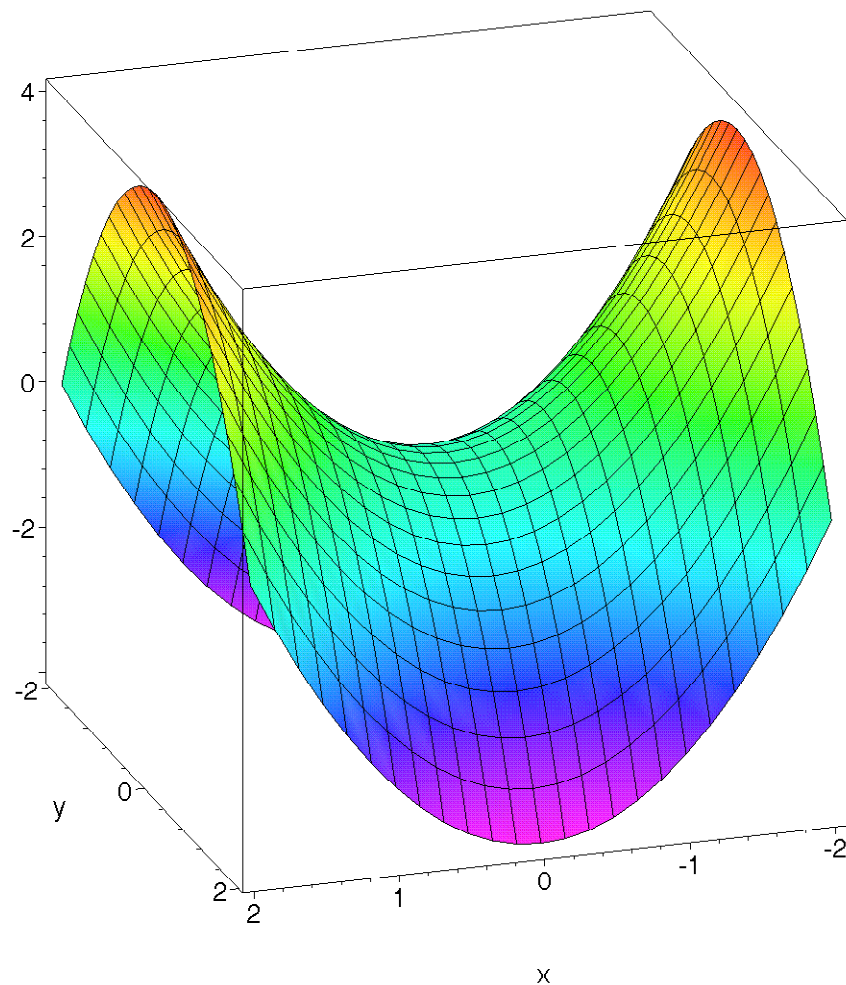
[>

[> **with(plots):**

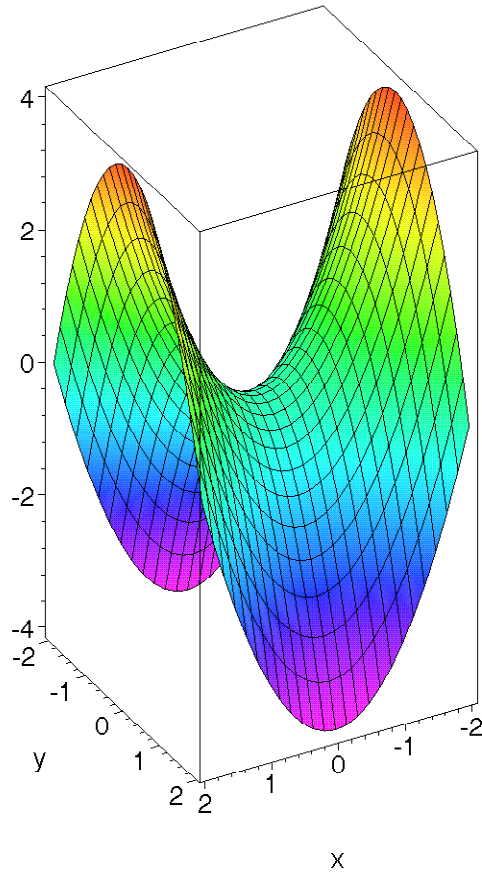
[> **f := (x,y) -> x^2 - y^2;**

$$f := (x, y) \rightarrow x^2 - y^2$$

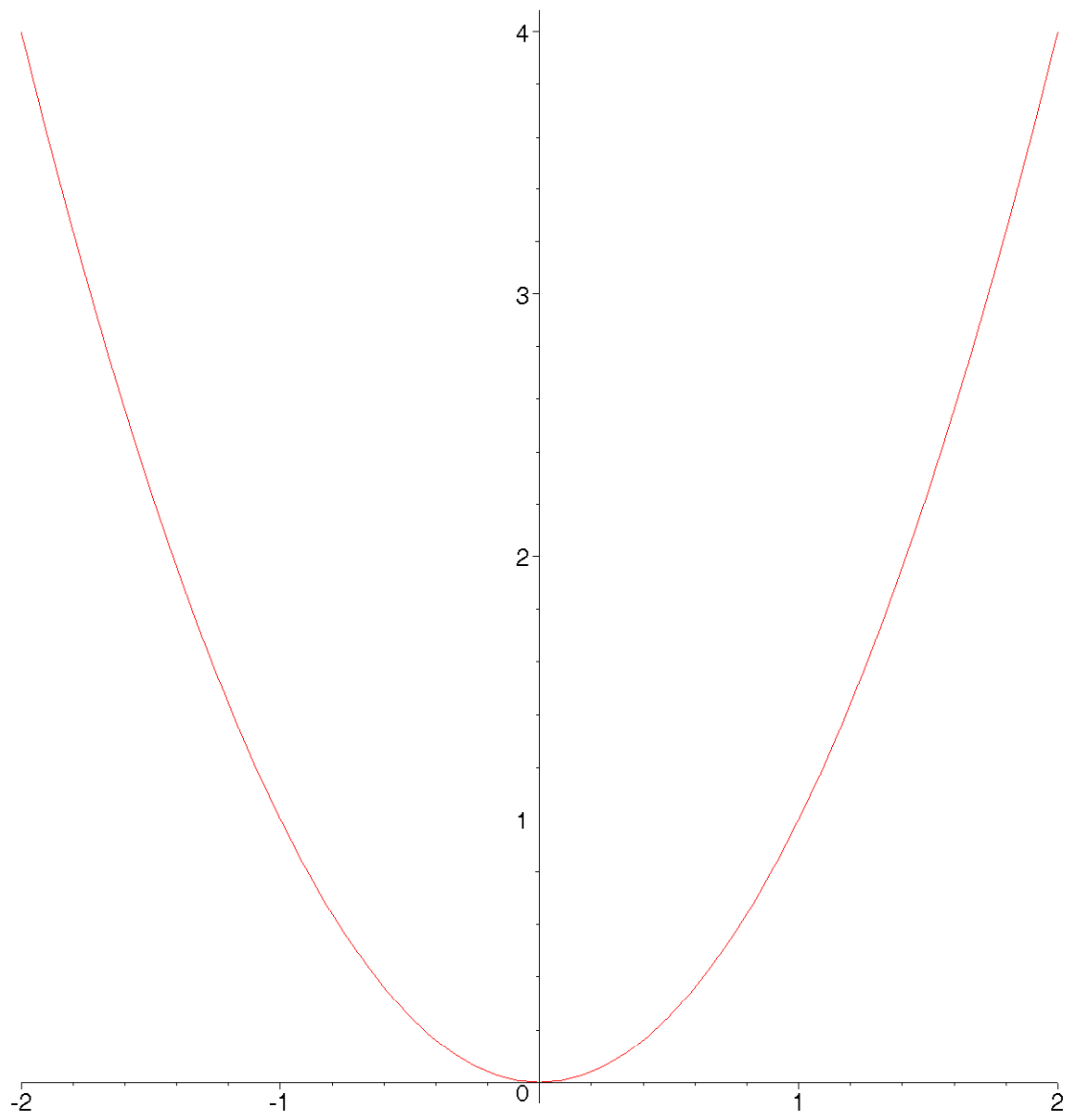
[> **plot3d(f(x,y), x=-2..2, y=-2..2, axes=BOX, shading=ZHUE);**



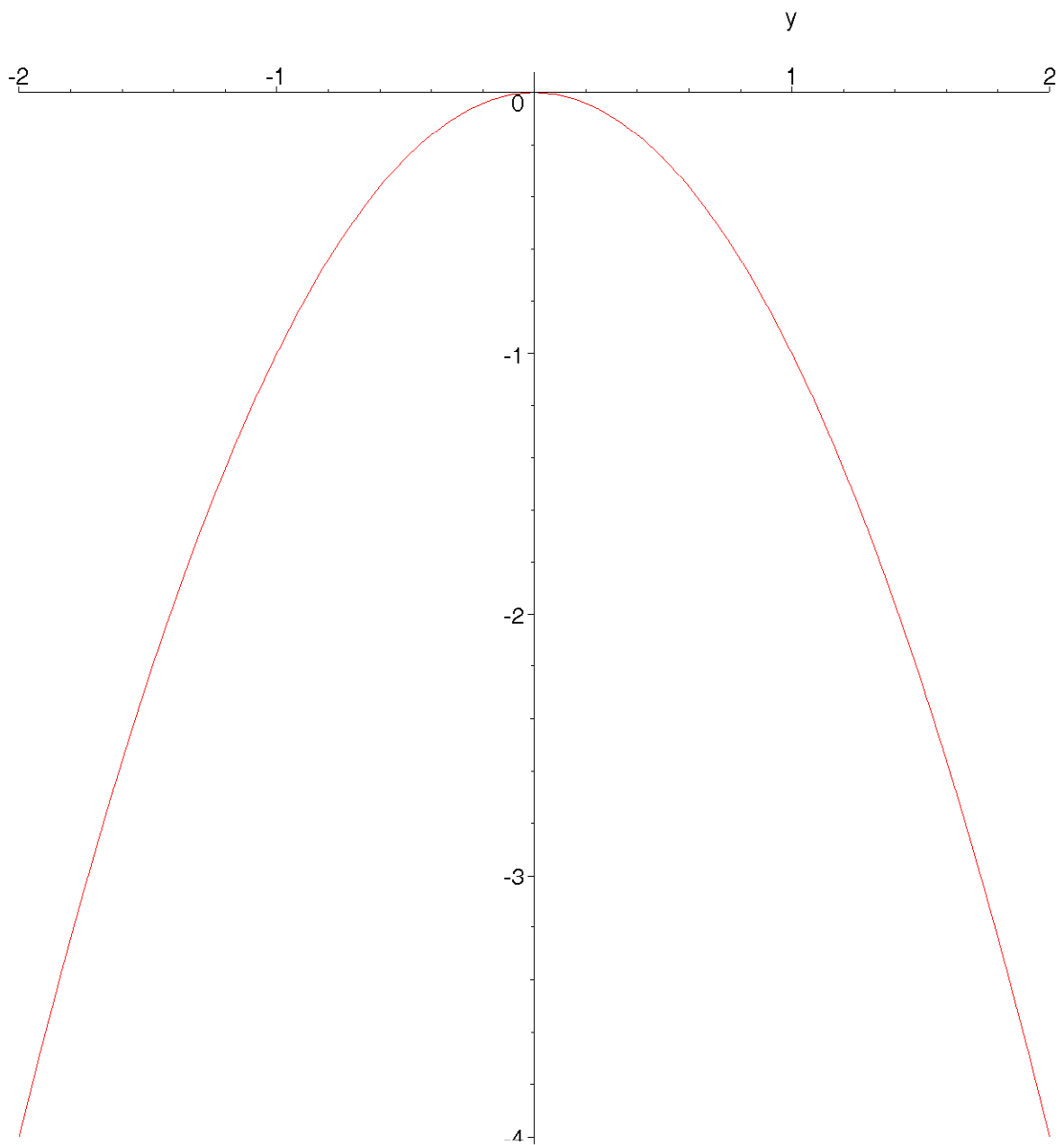
[> **plot3d(f(x,y), x=-2..2, y=-2..2, axes=BOX,
shading=ZHUE,scaling=constrained);**



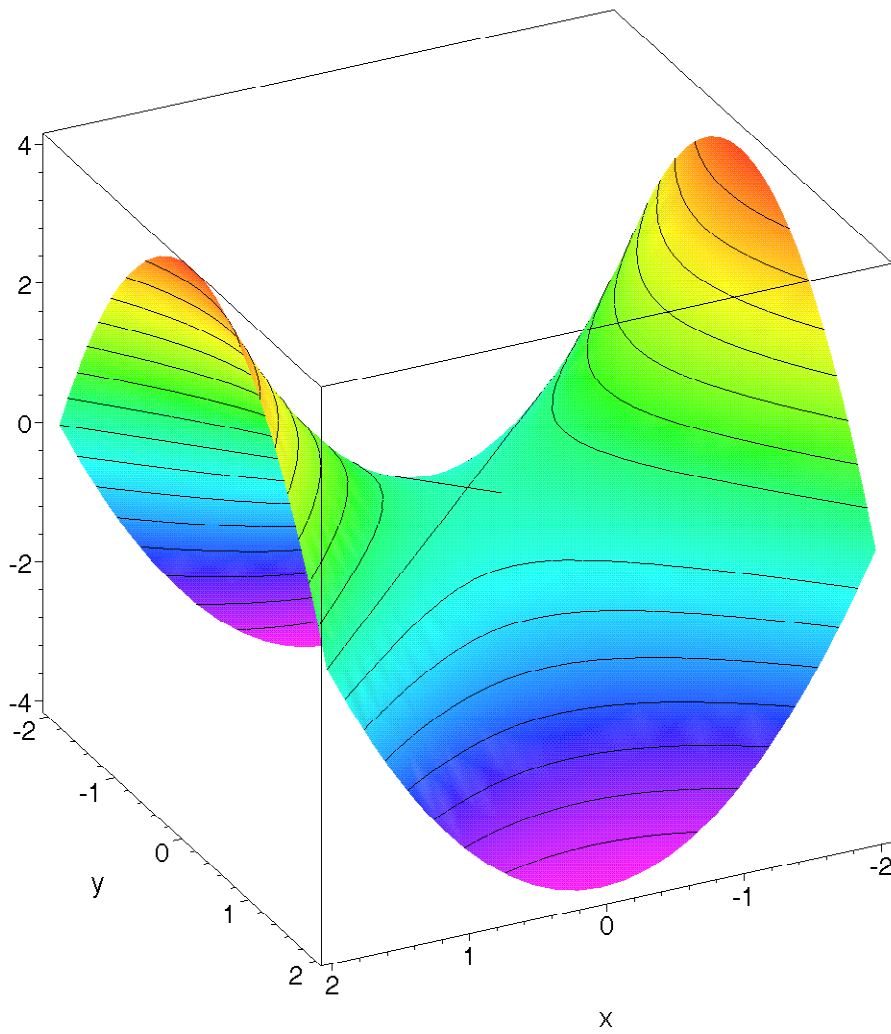
```
> plot(f(x,0),x=-2..2,scaling=constrained); # xz-plane cross section
```



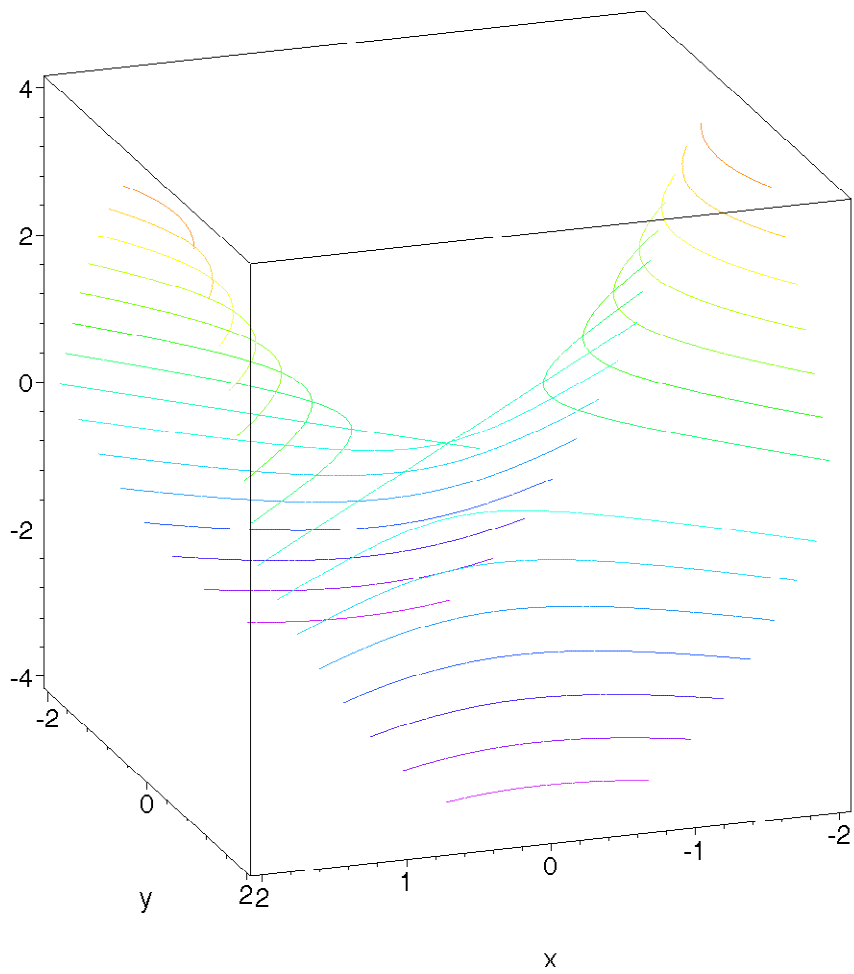
```
> plot(f(0,y),y=-2..2,scaling=constrained); # yz-plane cross  
section
```



```
> plot3d(f(x,y), x=-2..2, y=-2..2, axes=BOX, shading=ZHUE,  
style=patchcontour);
```



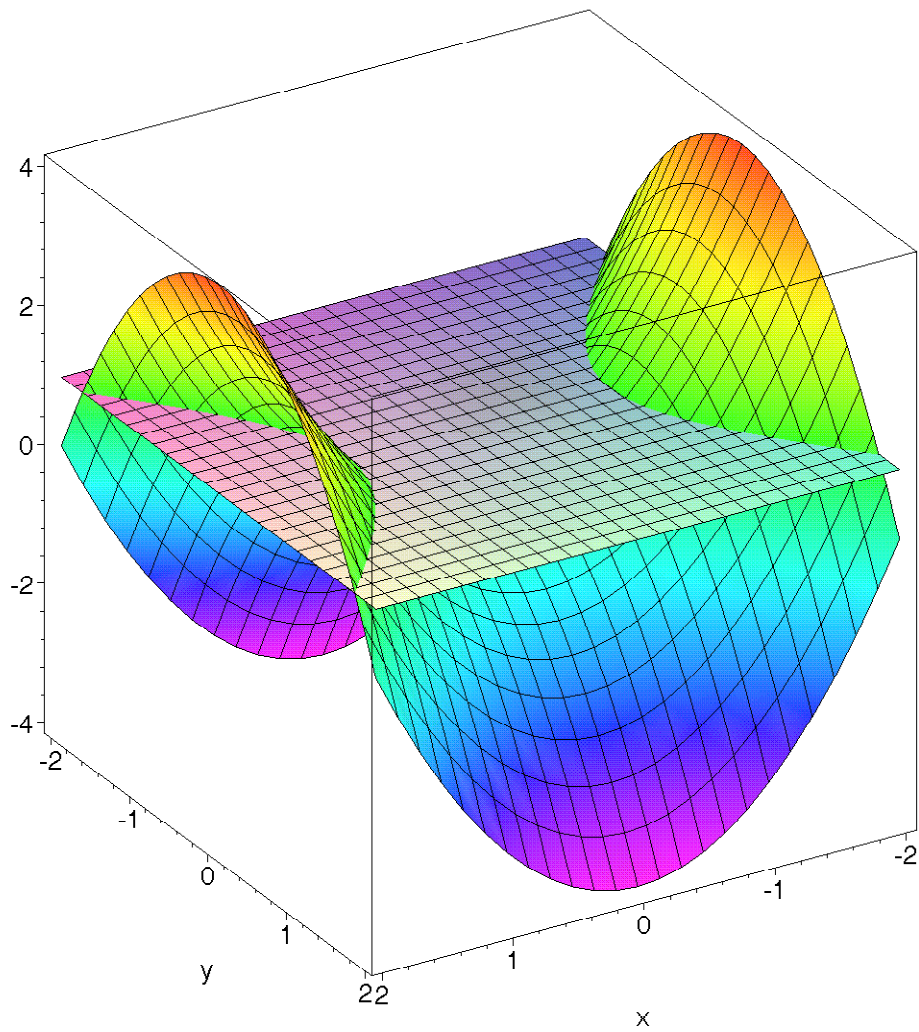
```
> plot3d(f(x,y), x=-2..2, y=-2..2, axes=BOX, shading=ZHUE,  
style=contour); #right click on the graph to change these option
```



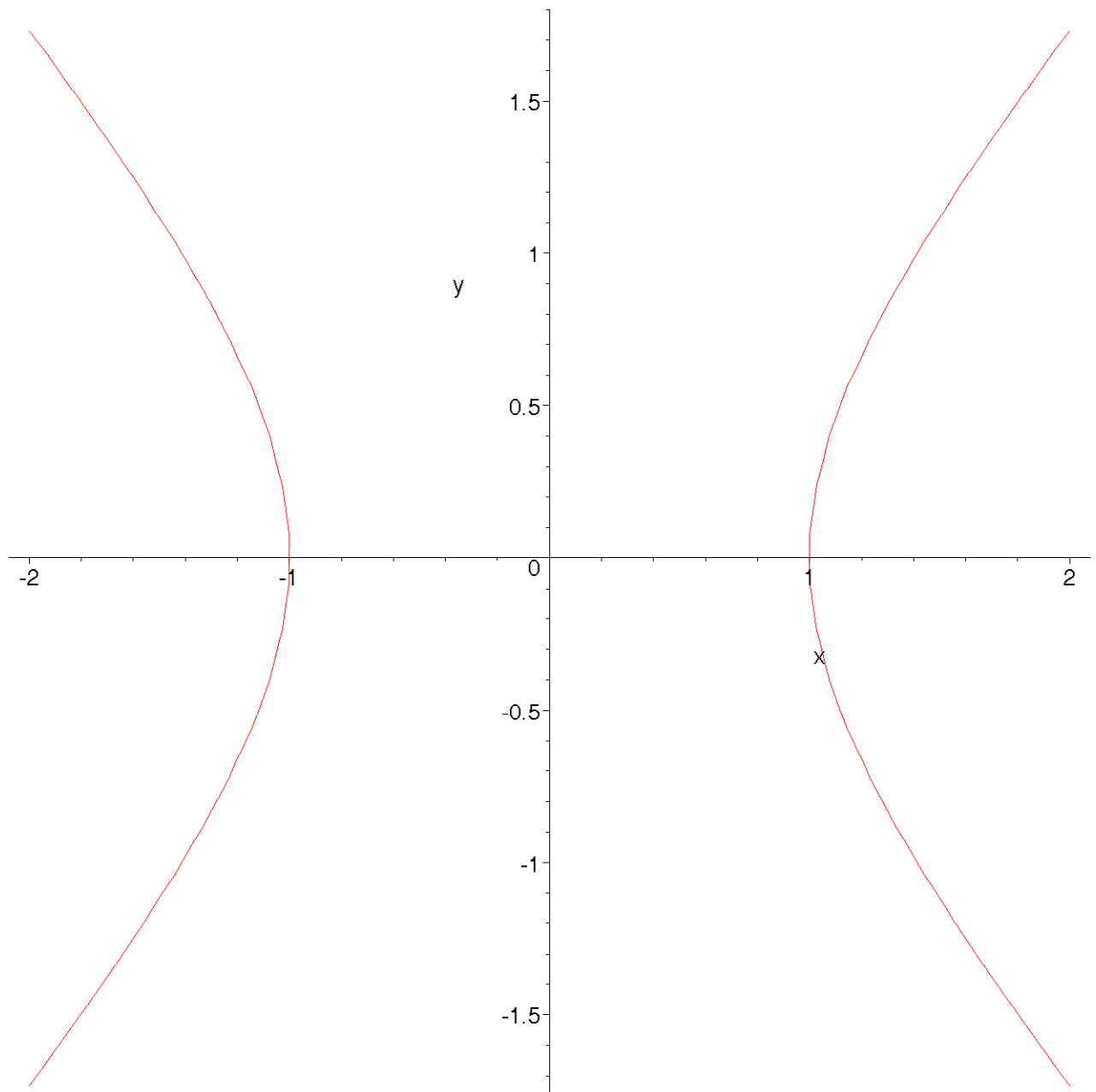
```

> p1:=plot3d(1,x=-2..2,y=-2..2): # The plane z=1
> g:=plot3d(f(x,y), x=-2..2, y=-2..2, axes=BOX, shading=ZHUE,
style=patch): # the original graph
> display({p1,g});

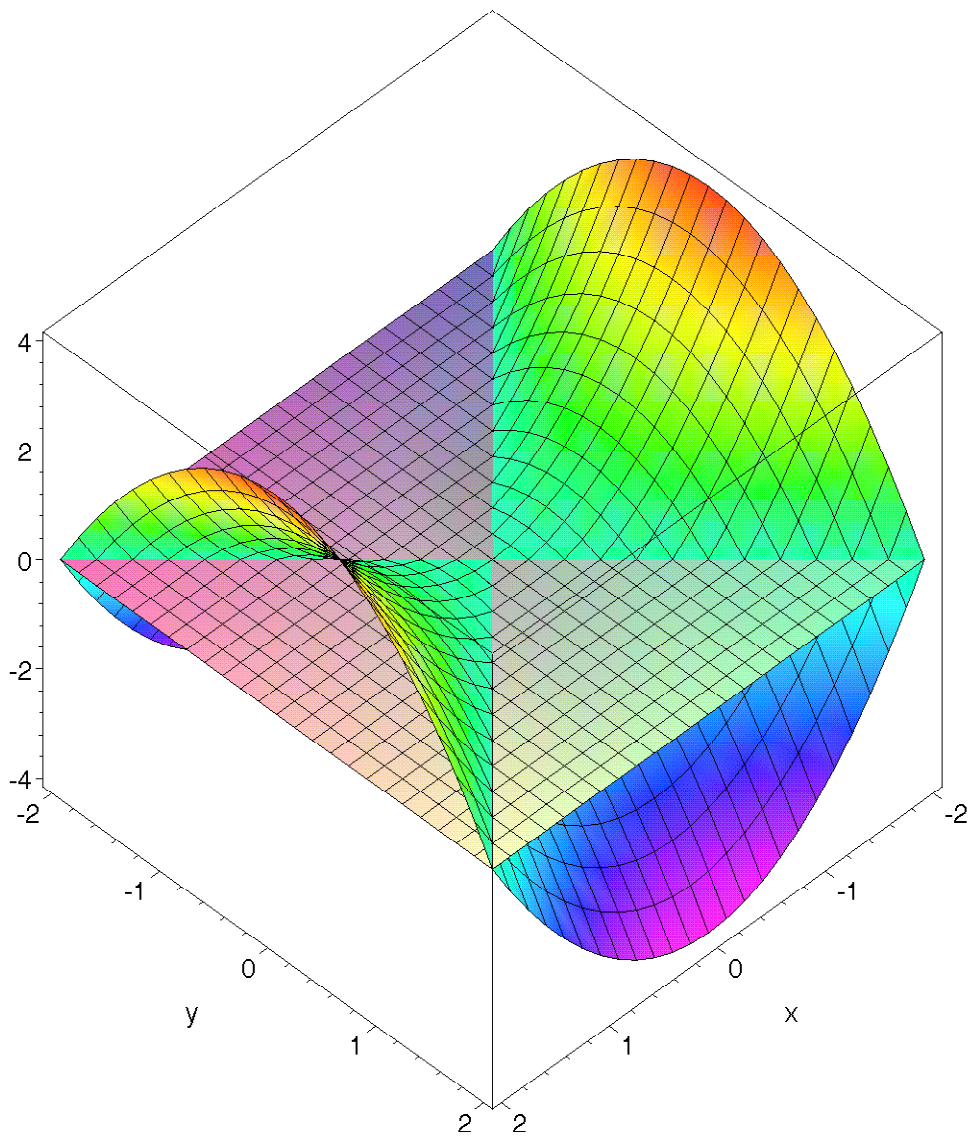
```



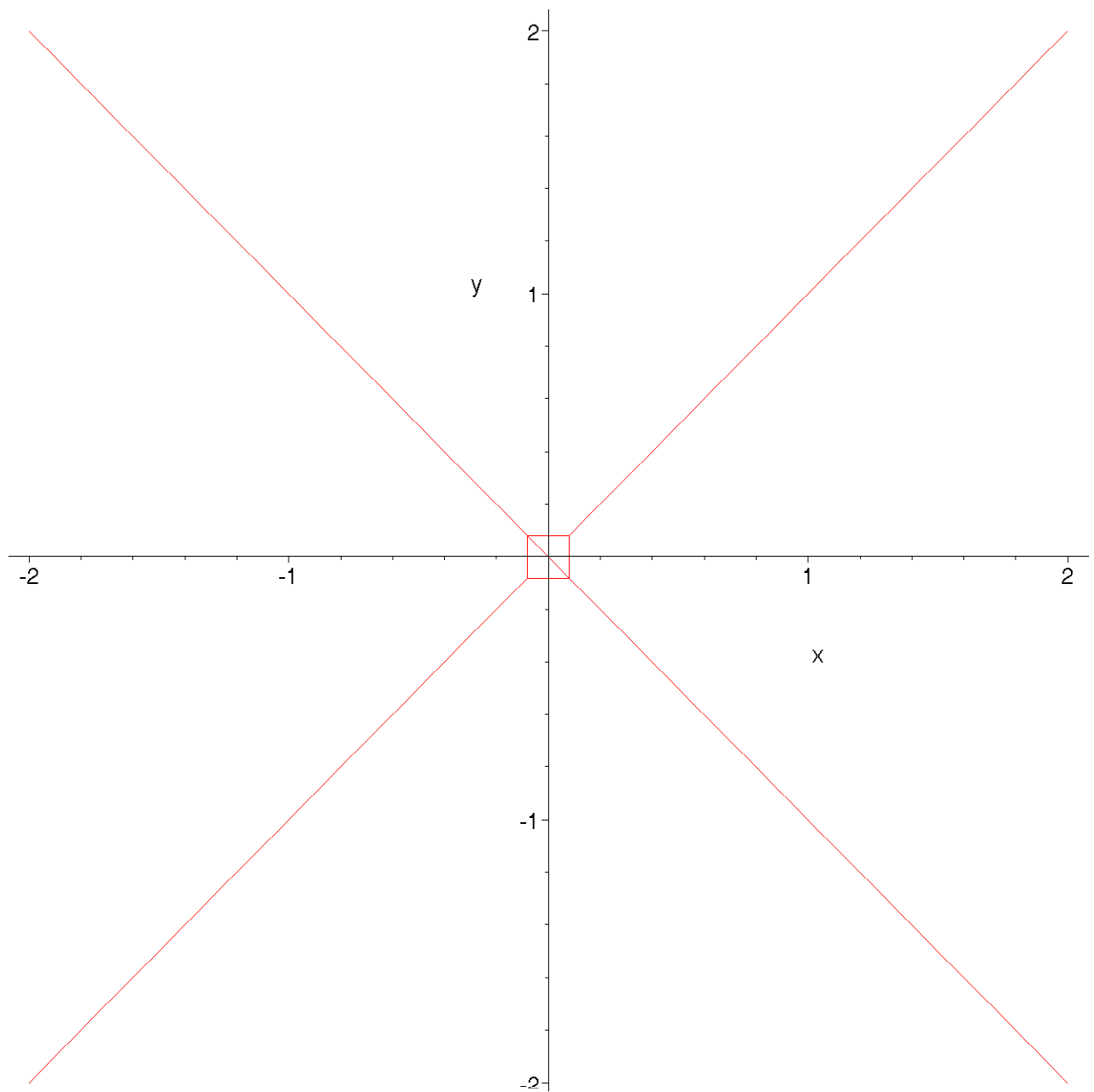
```
> implicitplot(f(x,y)=1,x=-2..2,y=-2..2); # The level curve f = 1.  
Relate to the above graph
```



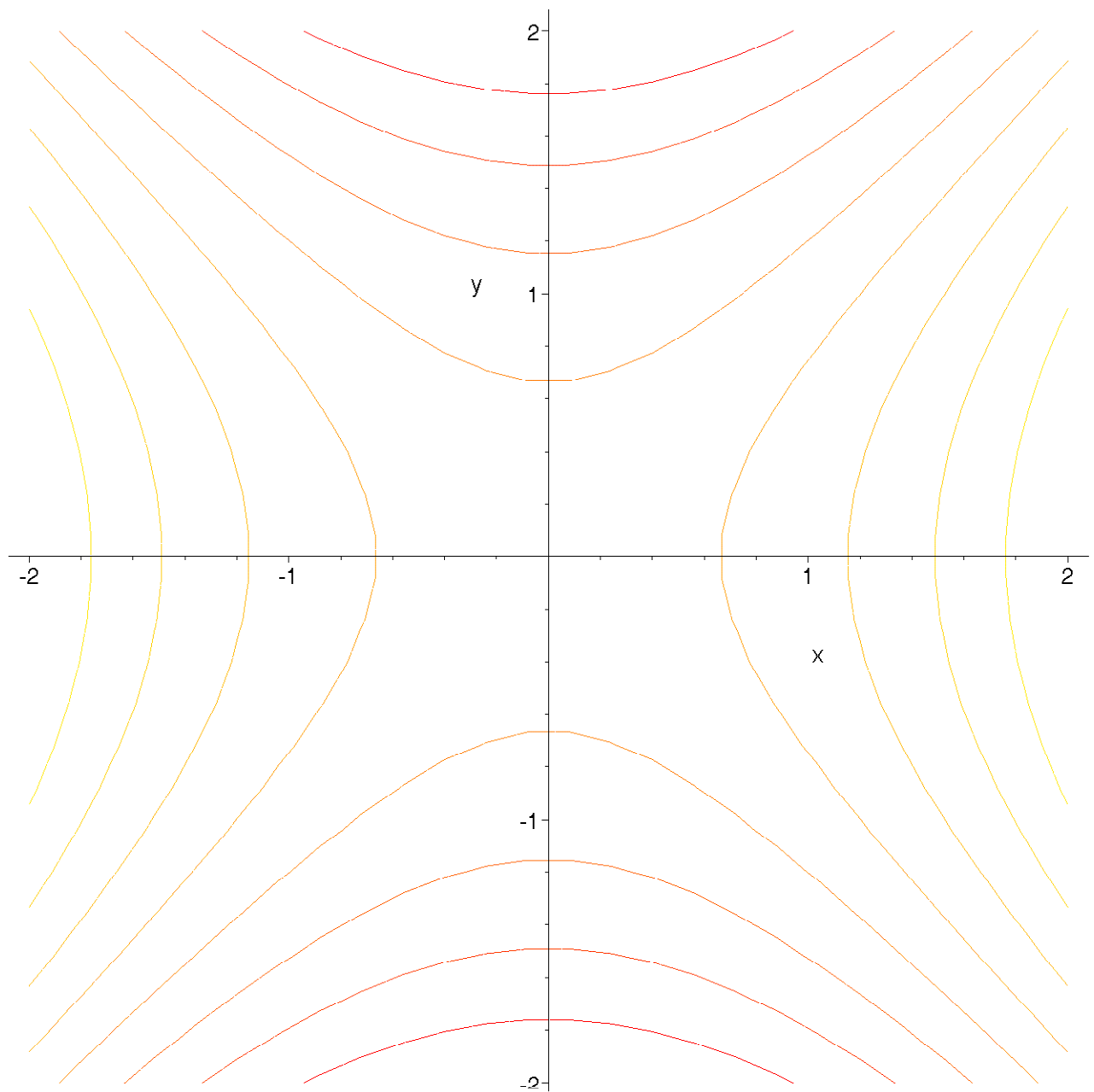
```
[ > p0:=plot3d(0,x=-2..2,y=-2..2):  
[ > display({p0,g});
```

```
> implicitplot(f(x,y)=0,x=-2..2,y=-2..2); # The level curve  $f = 0$ .  
Relate to the above graph
```

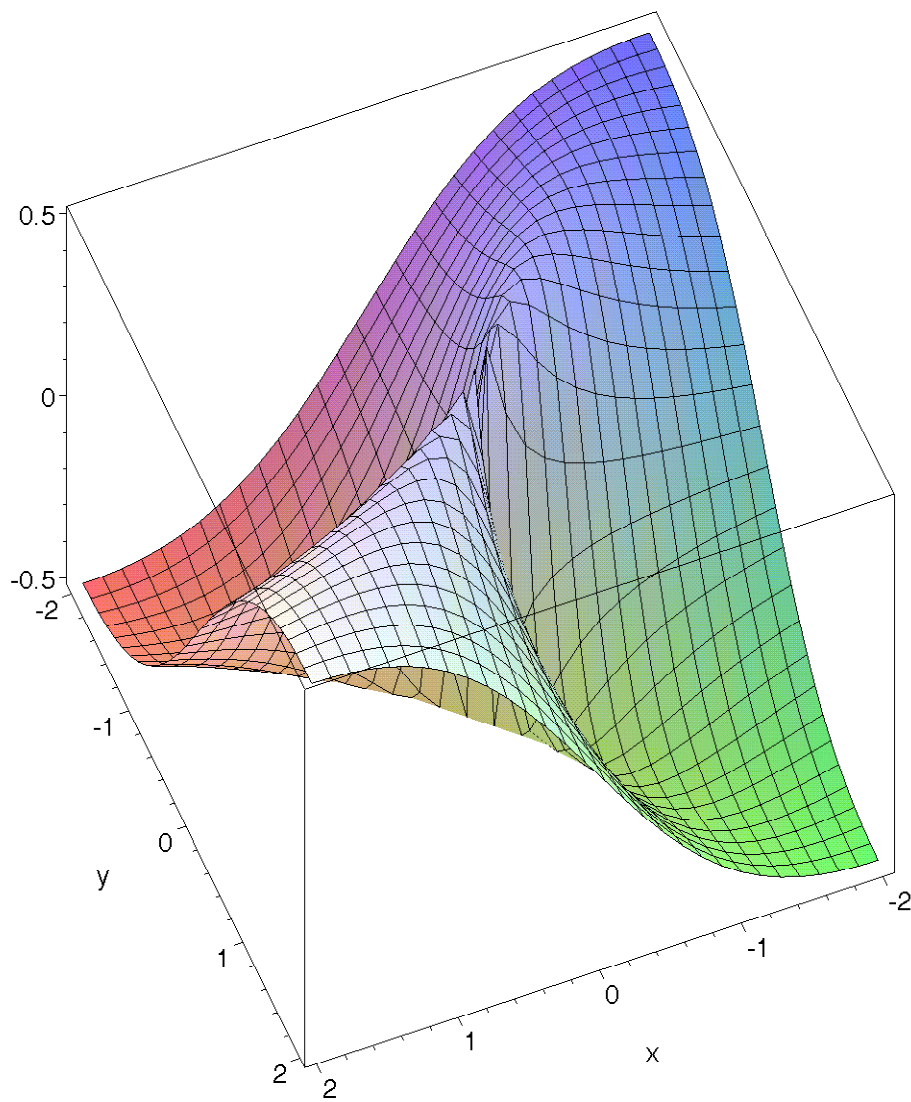


```
> contourplot(f(x,y), x=-2..2, y=-2..2, scaling=constrained);  
#level curves
```

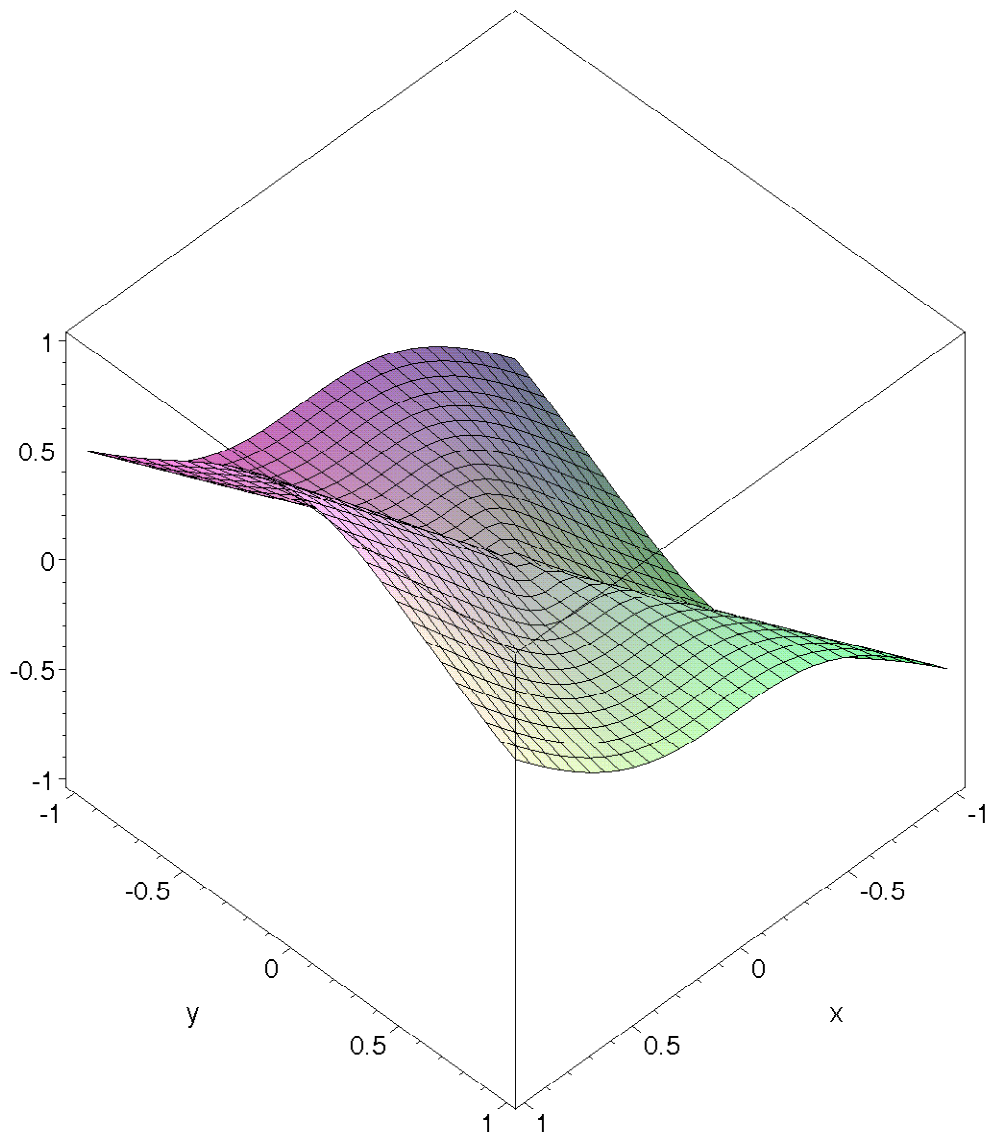


Surfaces with possible discontinuities.

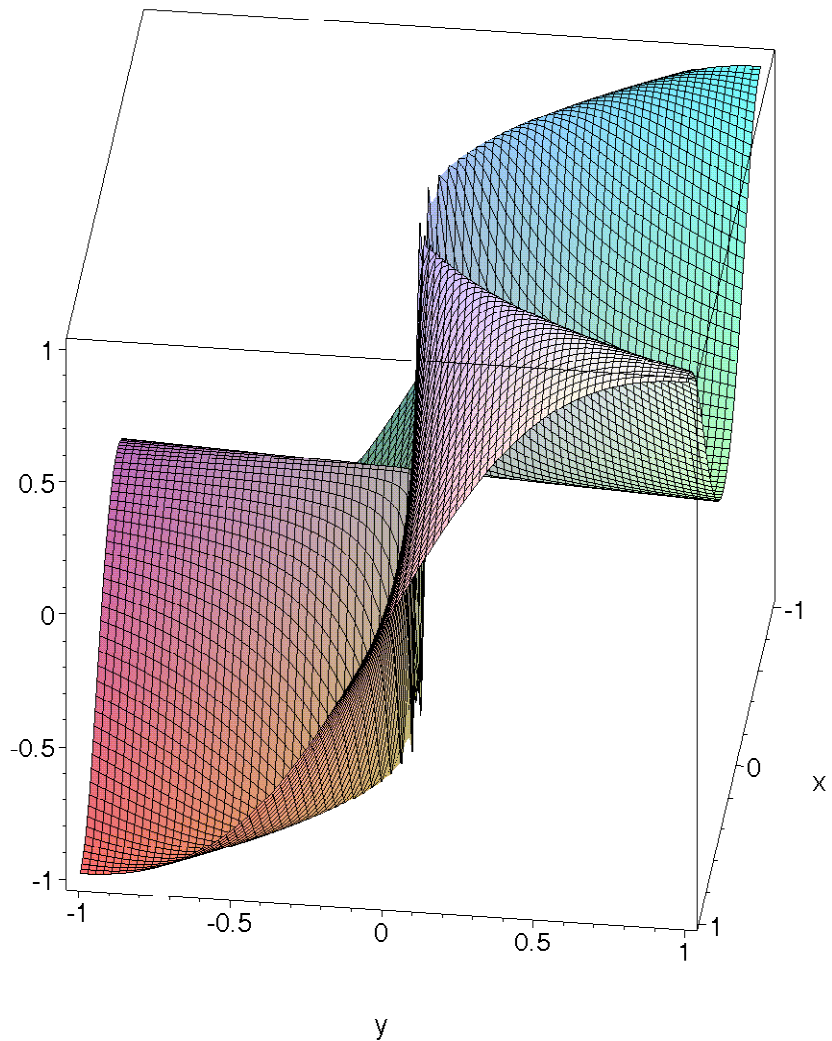
```
> plot3d(x*y/(x^2 + y^2),x=-2..2,y=-2..2,grid=[30,30],axes=boxed);  
#change the grid values to get a finer grid
```



```
> plot3d(x^3/(x^2 + y^2),x=-1..1,y=-1..1,grid=[30,30],axes=boxed);  
# the limit as (x,y) -> (0,0) exists.
```



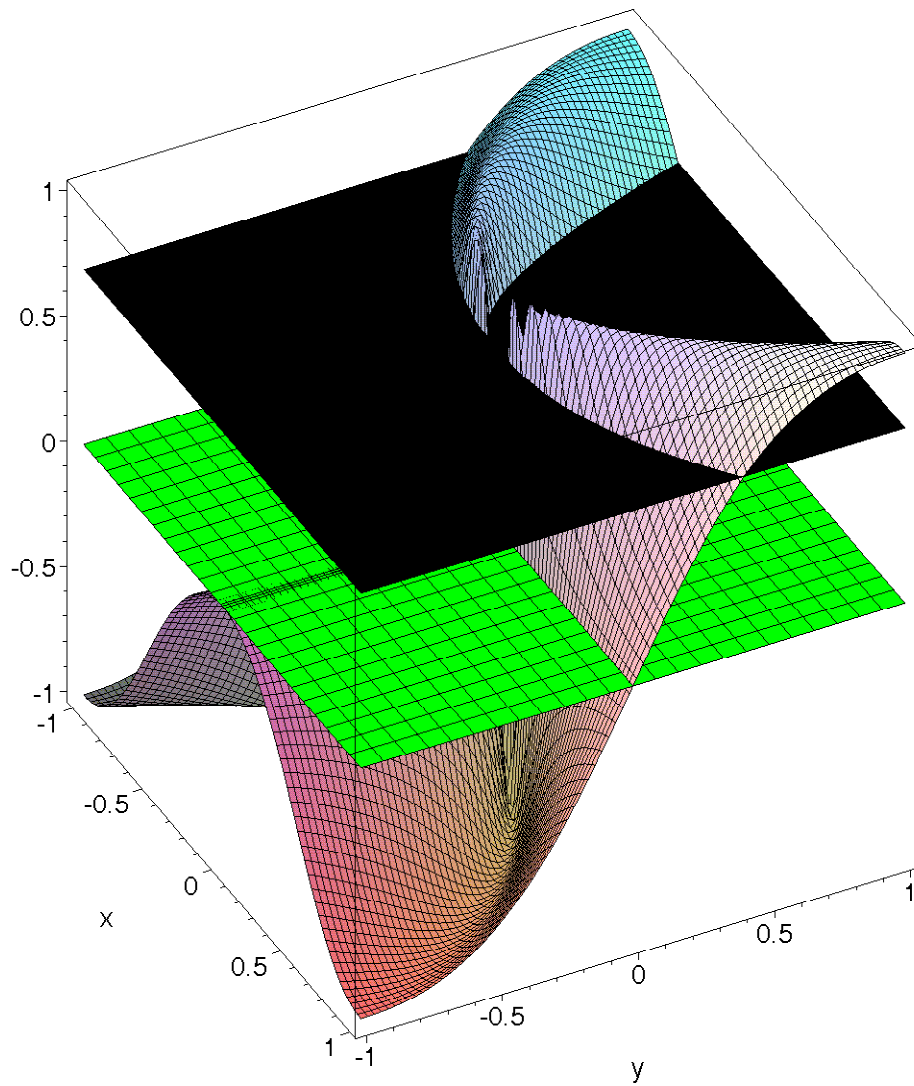
```
> plot3d(2*x^2*y/(x^4 +  
y^2), x=-1..1, y=-1..1, grid=[80, 80], axes=boxed);
```



```

> G:=plot3d(2*x^2*y/(x^4 +
y^2),x=-1..1,y=-1..1,grid=[80,80],axes=boxed):
> p3:=plot3d(0.7,x=-1..1,y=-1..1,color=black,axes=boxed):
> p4:=plot3d(0,x=-1..1,y=-1..1,color=green,axes=boxed):
> display({p3,p4,G}); #think what happens as you walk towards the
origin along the different cross-section

```



```
> contourplot(2*x^2*y/(x^4 + y^2),x=-1..1,y=-1..1,grid=[80,80]);  
#Note that all the contours approach (0,0)
```

