

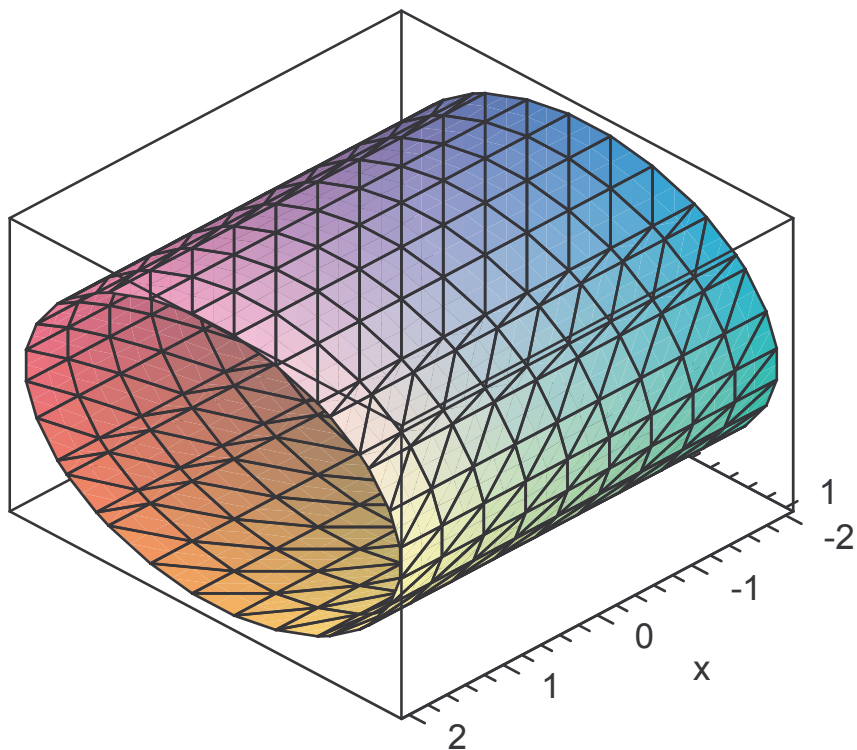
Intersecting Cylinders

A standard problem for three dimensional integration is to find the volume of two intersecting cylinders. One hard part of this problem is seeing the shape of the intersection. We take the cylinders

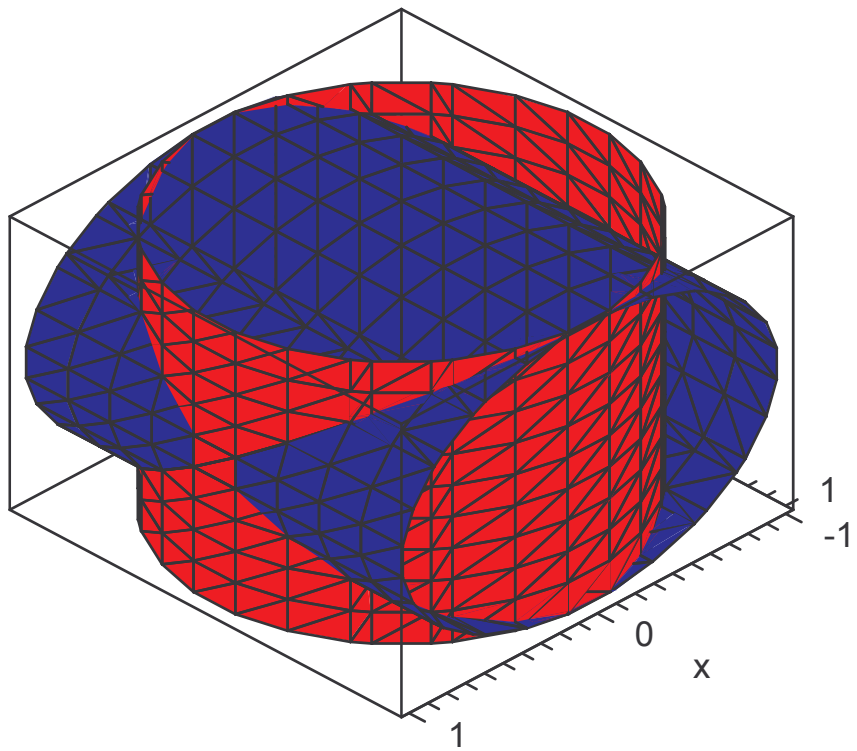
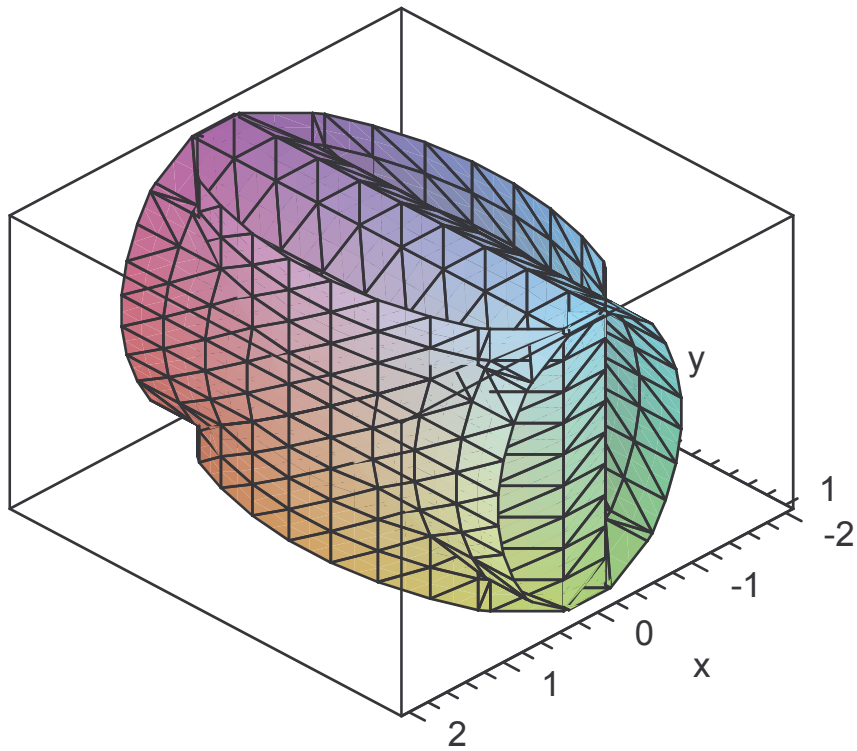
$$x^2 + y^2 = 1 \quad \text{and} \quad z^2 + y^2 = 1.$$

In an attempt to see the intersection, we first draw the two cylinders, one red and the other blue.

```
> with(plots):  
> implicitplot3d({ y^2 + z^2 =1},x=-2..2,y=-1..1,  
  z=-1..1,axes=boxed);
```



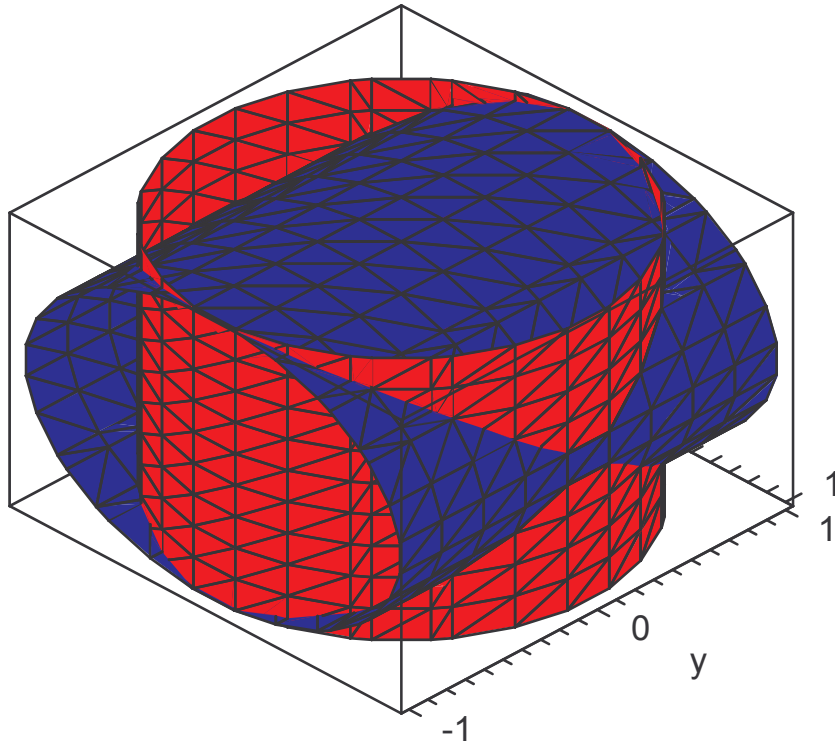
```
> implicitplot3d({x^2 + y^2 = 1,x^2 + z^2 = 1},x=-2..2,y=-1..1,  
  z=-1..1,axes=boxed);J:=implicitplot3d(x^2 + y^2 = 1,x=-1..1,y=-1.  
  .1,  
  z=-1..1,axes = boxed,color=RED):K:=implicitplot3d(x^2 + z^2 = 1,x=  
  -1..1,y=-1..1,  
  z=-1..1,axes = boxed,color=BLUE):display3d({J,K});
```



Look at that last graph and see if the following three pictures do not give visualization to the intersection. The first picture is from the perspective of standing in the first octant with the same

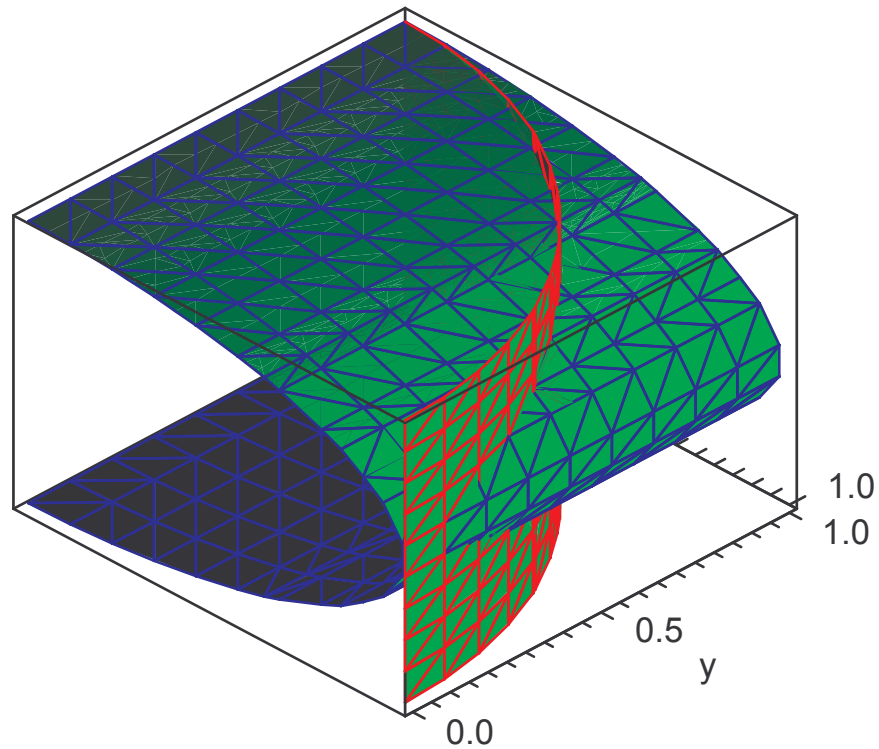
orientation as above..

```
> J:=implicitplot3d(x^2 + y^2 = 1,x=-1..1,y=-1..1,
z=-1..1,axes = boxed,orientation=[-45,45],color=RED):K:=
implicitplot3d(x^2 + z^2 = 1,x=-1..1,y=-1..1,
z=-1..1,axes = boxed,orientation=[-45,45],color=BLUE):display3d(
{J,K});
```

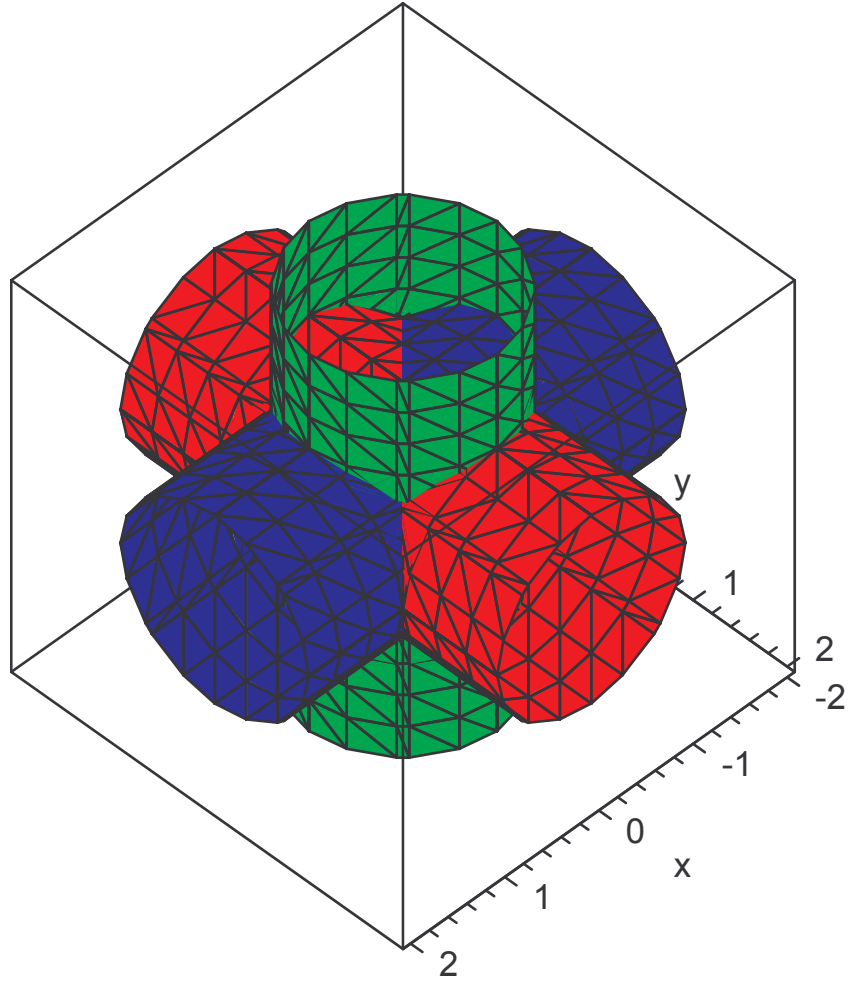


In the above view you are looking down into the red part of the intersection. Next, we look from the first quadrant, but near to the x axis.

```
> J:=implicitplot3d(x^2 + y^2 = 1,x=0..1,y=0..1,
z=-1..1,axes = boxed,orientation=[-45,45],color=RED,style=hidden,
light=[50,25,0,1,0]):K:=implicitplot3d(x^2 + z^2 = 1,x=0..1,y=0.
.1,
z=-1..1,axes = boxed,orientation=[-45,45],color=BLUE,style=hidden,
light=[50,25,0,1,0]):display3d({J,K});
```



```
> with(plots):  
  A := implicitplot3d(1=(x^2+z^2), x=-2..2, y=-2..2, z=-2..2, grid=  
    [13,13,13],axes=boxed,color = red):  
> B := implicitplot3d(1=(x^2+y^2), x=-2..2, y=-2..2, z=-2..2, grid=  
    [13,13,13],axes=boxed,color = green):  
>  
> C := implicitplot3d(1=(z^2+y^2), x=-2..2, y=-2..2, z=-2..2, grid=  
    [13,13,13],axes=boxed,color = blue):  
> display3d({A, B, C});
```



>