Ploskve v prostoru

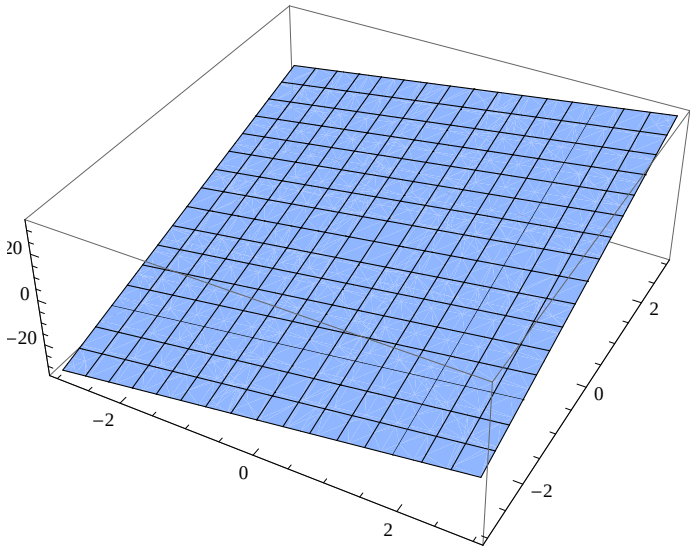
Osnovna ukaza za risanje ploskev v prostoru :

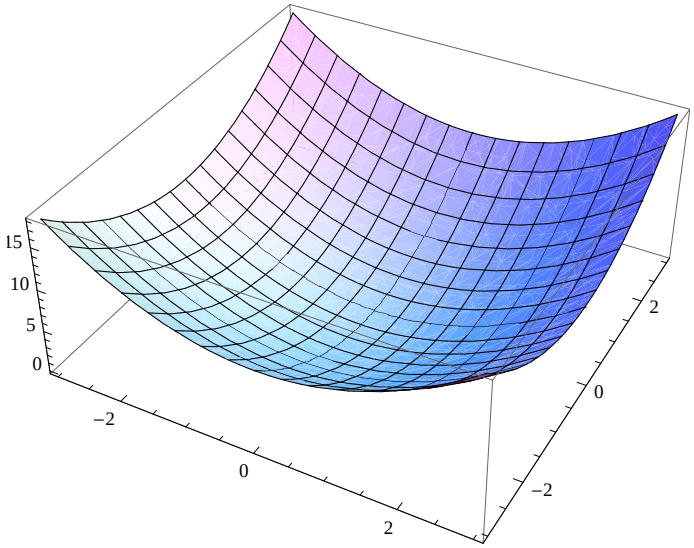
	ce je enacba ploskve ...	
Plot3D	eksplicitna	**z=f(x,y)**
ParametricPlot3D	parametrična	$\vec{r}$**={x(u,v),y(u,v),z(u,v)}**

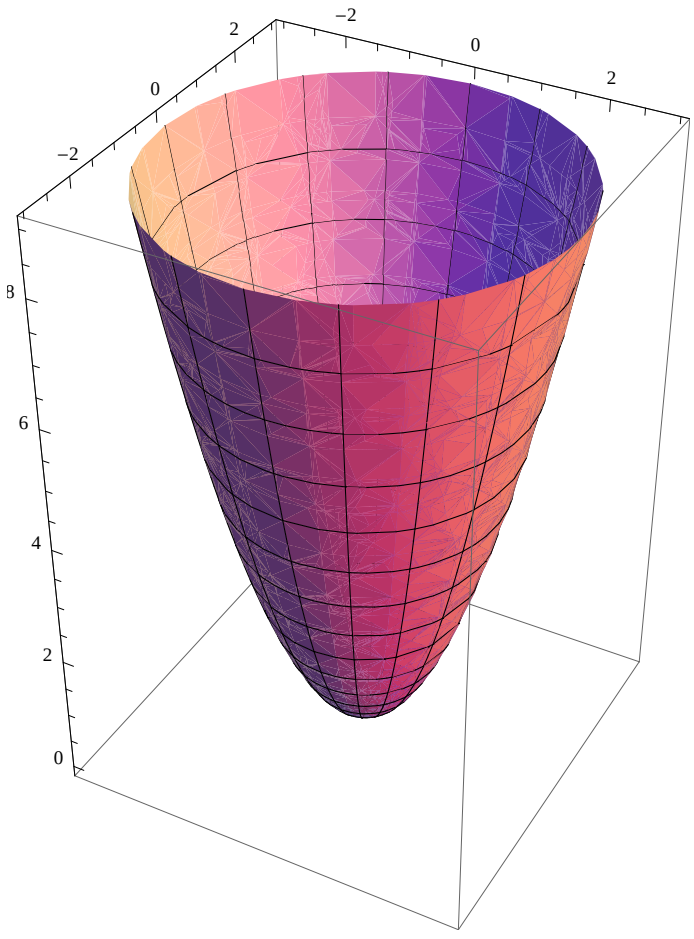
```
? Plot3D
? ParametricPlot3D
```

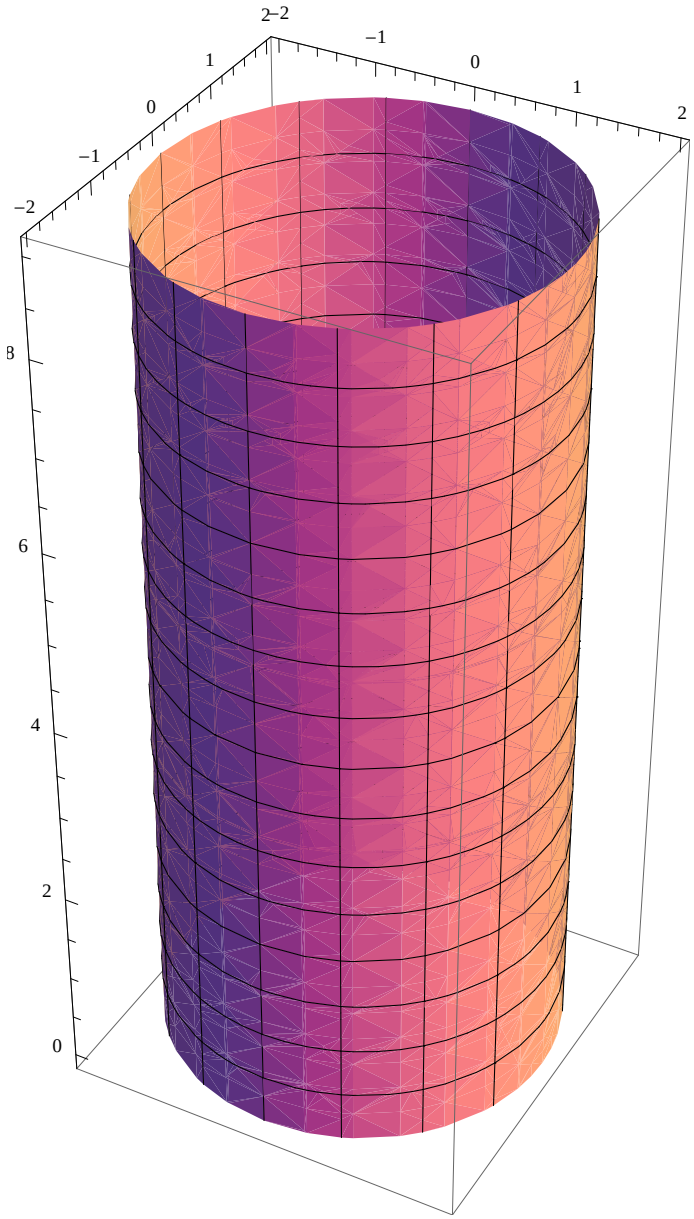
Primeri osnovnih geometrijskih oblik :
ravnina, paraboloid, valj, sfera

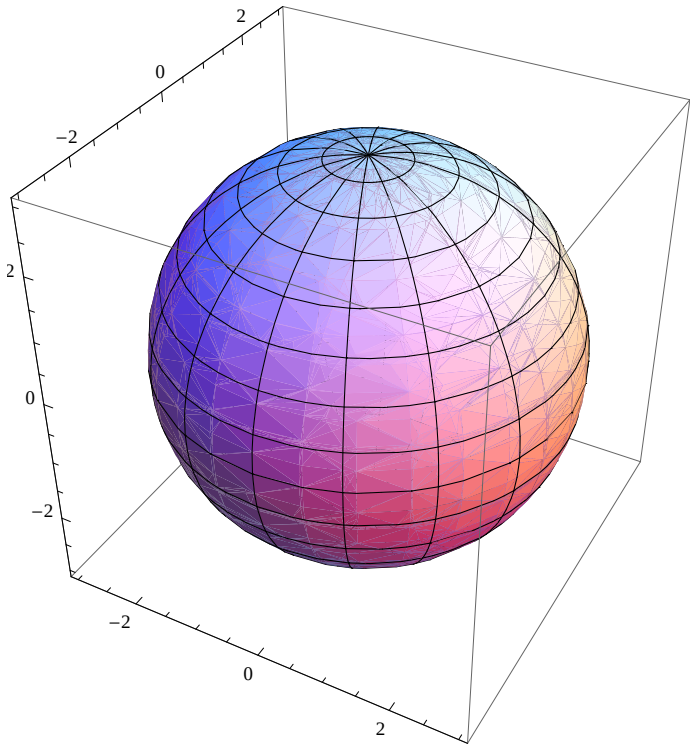
```
ravnina = Plot3D[4 x + 7 y, {x, -3, 3}, {y, -3, 3}]
paraboloid = Plot3D[x^2 + y^2, {x, -3, 3}, {y, -3, 3}]
paraboloid = ParametricPlot3D[{ρ Cos[φ], ρ Sin [φ], ρ^2}, {φ, 0, 2 π}, {ρ, 0, 3}]
valj = ParametricPlot3D[{2 Cos[φ], 2 Sin [φ], z}, {φ, 0, 2 π}, {z, 0, 9}]
sfera =
 ParametricPlot3D[{3 Cos[θ] Cos[φ], 3 Cos[θ] Sin[φ], 3 Sin[θ]}, {φ, 0, 2 π}, {θ, -π / 2, π / 2}]
```




15
10
5
0
−2
0
2
2
0
−2


2
0
−2
−2
0
2
8
6
4
2
0


2
1
0
−1
−2
−2
−1
0
1
2
8
6
4
2
0

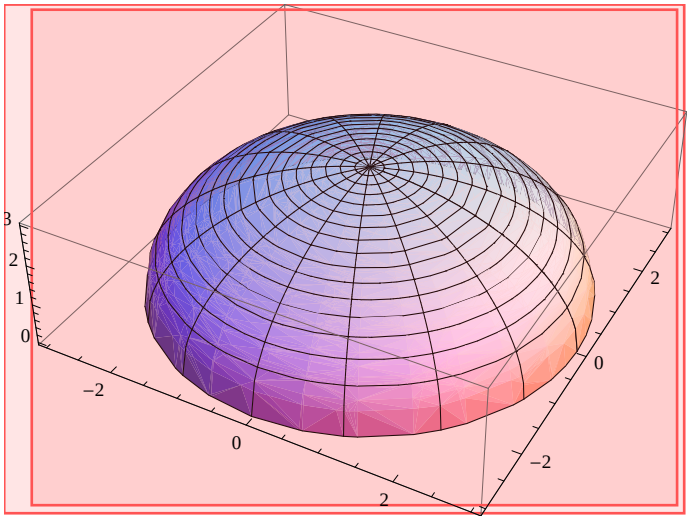


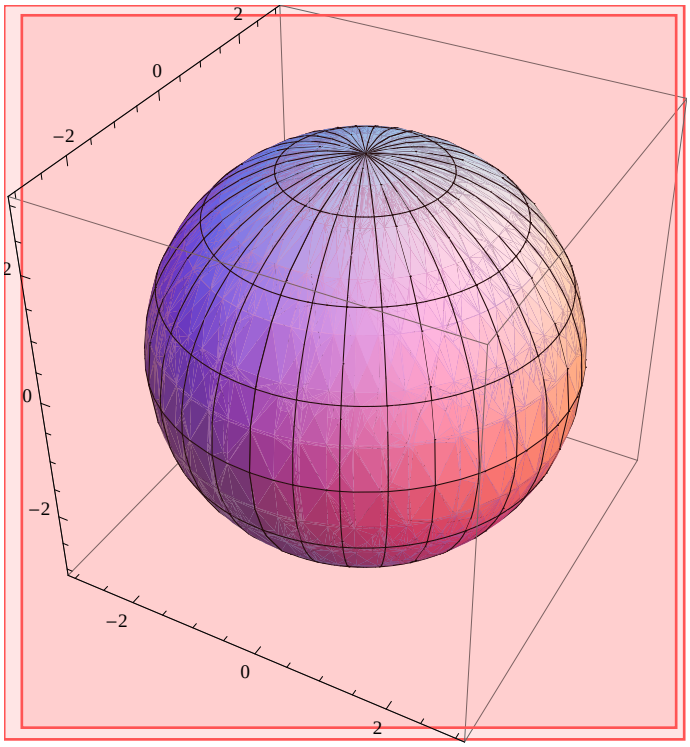
Veliko ploskev se najbolj naravno parametrizira, ▪e za parametra izberemo cilindri▪ni koordinati (ρ,φ), oziroma sferi▪ni (φ,θ). Za risanje takih ploskev lahko uporabimo ukaze:

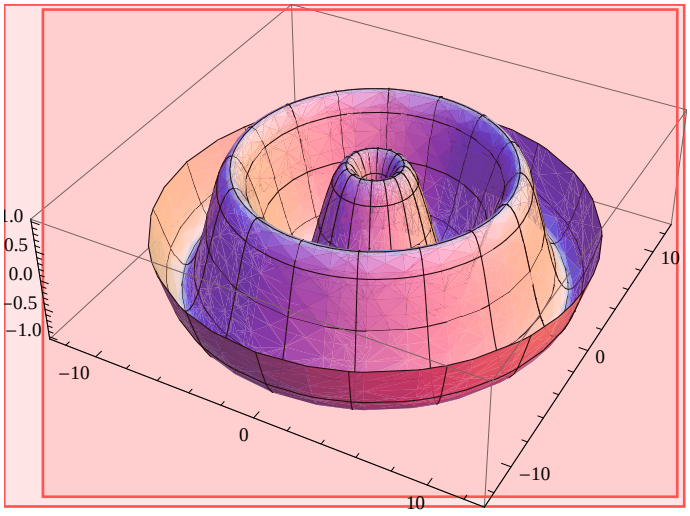
RevolutionPlot3D	vrtenina okrog z-osi	z=f(ρ) , $0<\varphi<2\pi$
SphericalPlot3D	sredi▪na ploskev	**r=f(φ,θ)**

```
? RevolutionPlot3D
? SphericalPlot3D

(* Primeri *)
polsfera = RevolutionPlot3D[Sqrt[9 - ρ^2], {ρ, 0, 3}]
sfera = SphericalPlot3D[3, {φ, 0, 2 π}, {θ, -π / 2, π / 2}]
RevolutionPlot3D[Sin[ρ], {ρ, 0, 4 π}]
```


3
2
1
0
−2
0
2
2
0
−2


2
0
−2
2
0
−2
−2
0
2



1. a) Zapisi parametri■no ena■bo stozca $z=\sqrt{x^2+y^2}$, $0<z<3$.
   Parametra naj bosta polarni koordinati (ρ,φ).
   b) Narisi stozec z ukazom **ParametricPlot3D.**
   c) Narisi naslednje *koordinatne krivulje*:
   $\rho=1,2,3$; $\varphi=0, \frac{\pi}{4}, \frac{\pi}{2}$.
   Stozec in koordinatne krivulje prikazi v isti sliki !

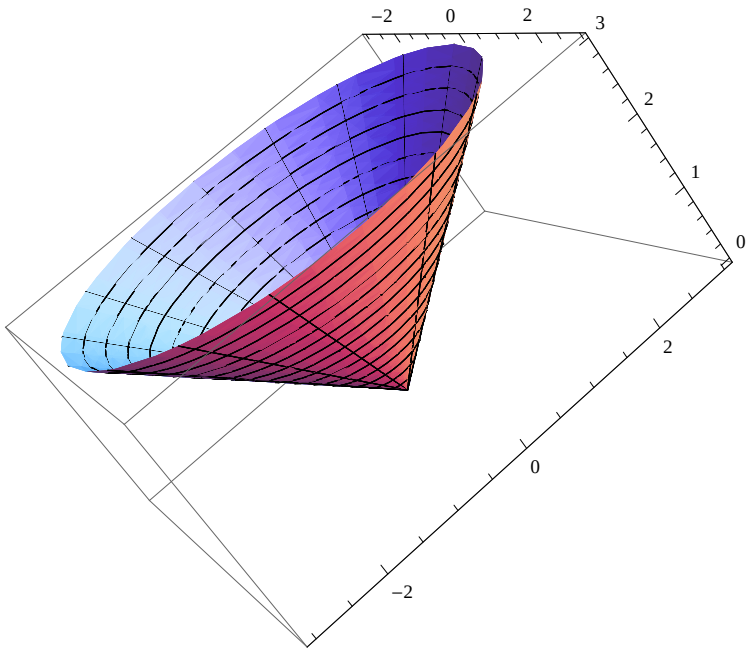
In[10]:=
```
Clear[x, y, z, r]
x = r Cos[fi]
y = r Sin[fi]
z = r
stozec = ParametricPlot3D[{x, y, z}, {fi, 0, 2 π}, {r, 0, 3}];
kr1 = ParametricPlot3D[{x, y, z}, {fi, 0, 2 π}, {r, 0, 3}] /. r → 1;
kr2 = ParametricPlot3D[{x, y, z}, {fi, 0, 2 π}, {r, 0, 3}] /. r → 2;
kr3 = ParametricPlot3D[{x, y, z}, {fi, 0, 2 π}, {r, 0, 3}] /. r → 3;
Show[stozec, kr1, kr2, kr3]
```

Out[11]= `r Cos[fi]`

Out[12]= `r Sin[fi]`

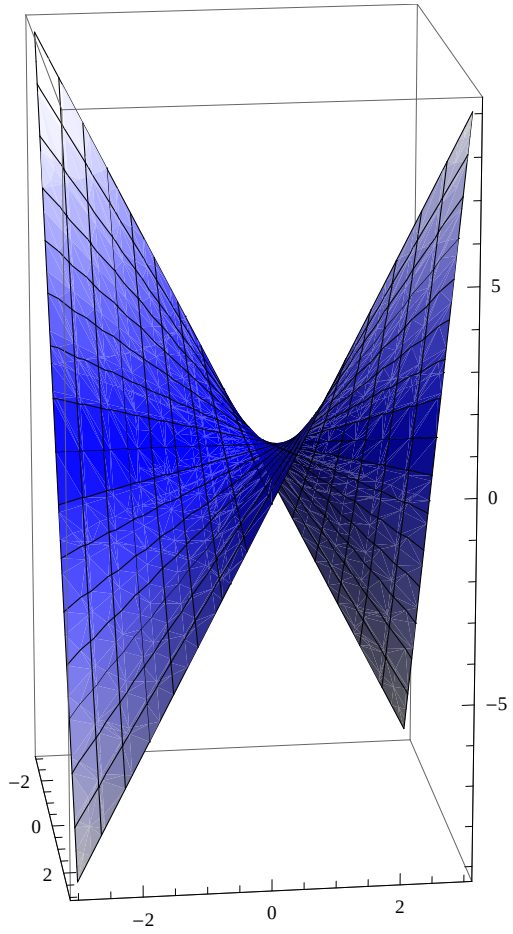
Out[13]= `r`

Out[18]=



2. Hiperboli■ni paraboloid **z=xy**, -2<x<2, -2<y<2
   ima obliko sedla.
   a) Narisi ploskev z ukazom **Plot3D**.
   b) Izboljsaj sliko z opcijama
      BoxRatios-> in **ViewPoin**t->
   c) Narisi ploskev, spodaj in zgoraj naj bo bela,
      v sredini (pri z=0) naj bo modra,
      vmes naj se barva zvezno spreminja od bele do modre.
      Za barvanje (in osvetlevanje,sen■enje) ploskev uporabi opcijo
      ColorFunction->

```
Clear[x, y, z, r]
sedlo = Plot3D[z = x y, {x, -3, 3}, {y, -3, 3},
  BoxRatios → {1, 1, 2}, ViewPoint → {2 Pi, -Pi / 4, 2},
  ColorFunction → Function[{x, y, z}, RGBColor[Abs[2 z - 1], Abs[2 z - 1], 1]]]
```




```
? BoxRatios
? ViewPoint
? ColorFunction
```

BoxRatios is an option for Graphics3D which gives
the ratios of side lengths for the bounding box of the three-dimensional picture. ≫

ViewPoint is an option for Graphics3D and related functions
which gives the point in space from which three-dimensional objects are to be viewed. ≫

ColorFunction is an option for graphics functions which specifies a function to apply to determine colors of elements. ≫

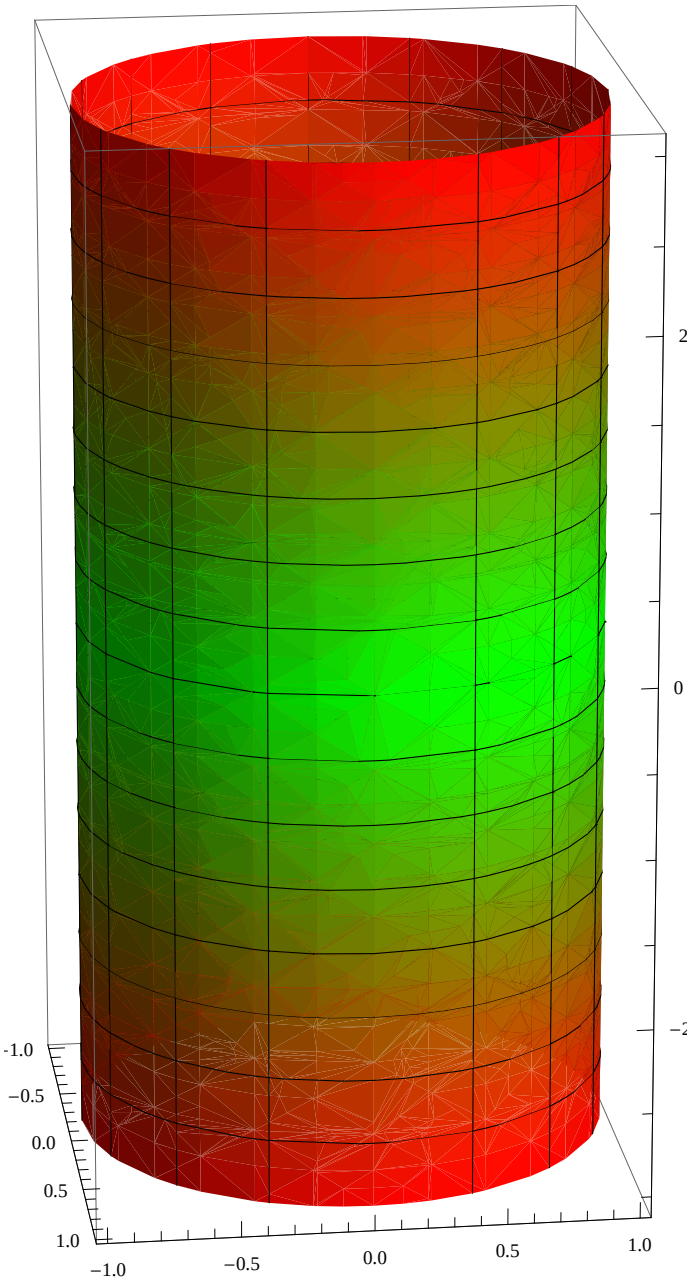
3. Dan je valj **x^2+y^2=1**, -5<z<5.
Narisi valj z ukazom **ParametricPlot3D**. V sredini naj bo zelene barve, zgoraj in spodaj naj bo rde■, vmes naj se barva zvezno spreminja.

```
Clear[x, y, z, r, fi]
x = Cos[fi]
y = Sin[fi]
z = u
valj = ParametricPlot3D[{x, y, z}, {fi, 0, 2 Pi},
  {u, -3, 3}, BoxRatios → {1, 1, 2}, ViewPoint → {2 Pi, -Pi / 4, 2},
  ColorFunction → Function[{x, y, z}, RGBColor[Abs[2 z - 1], 1 - Abs[2 z - 1], 0]]]
```

```
Cos[fi]
```

```
Sin[fi]
```

```
u
```



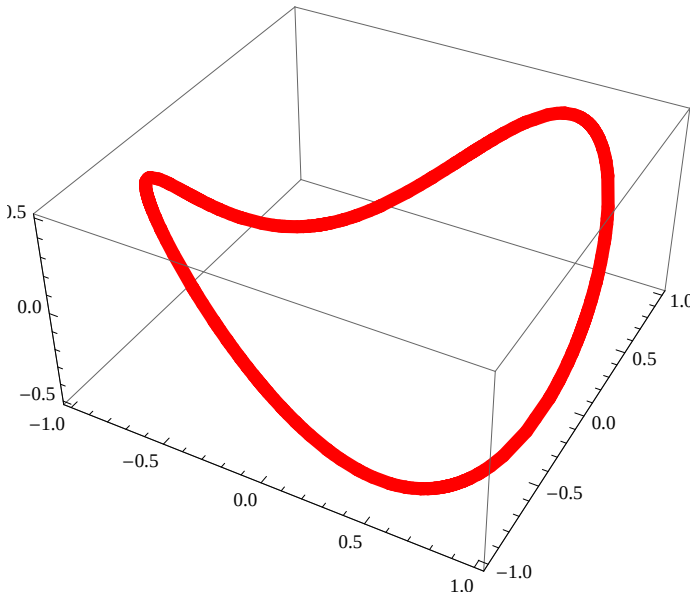
4. Z ukazom **ParametriPlot3D** narisi krivuljo, ki je presek dveh ploskev iz nalog 2. in 3. Krivuljo povdari z debelino in rdečo barvo.

```
Clear[x, y, z, r, fi]
x = Cos[fi]
y = Sin[fi]
z = x y
presek = ParametricPlot3D[{x, y, z}, {fi, 0, 2 Pi}, PlotStyle → {Red, Thickness[0.02]}]
```

```
Cos[fi]
```

```
Sin[fi]
```

```
Cos[fi] Sin[fi]
```

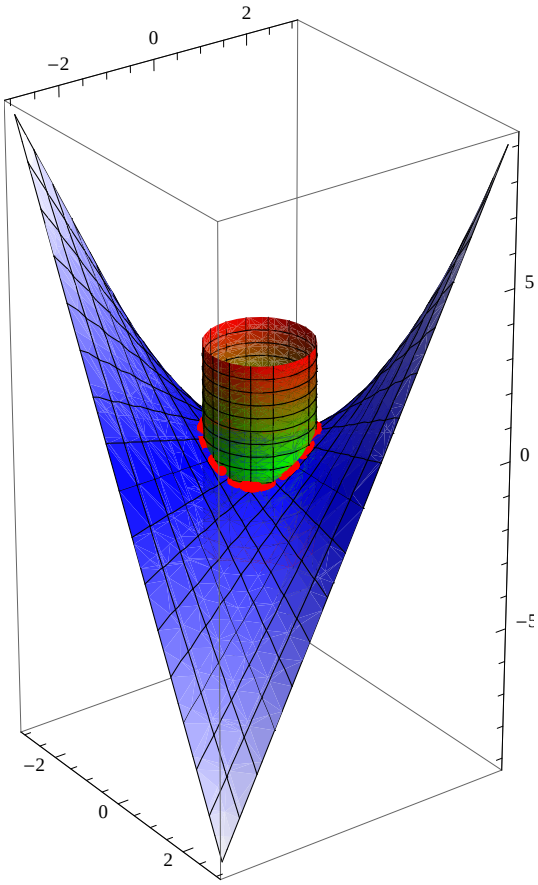



```
? Thickness
```

Thickness[*r*] is a graphics directive which specifies that lines which follow are to be drawn with thickness *r*. The thickness *r* is given as a fraction of the horizontal plot range. ≫

5. Rezultat nalog 2.3. in 4. prikazi v isti sliki z ukazom **Show**.

```
Show[sedlo, valj, presek]
```



6. Izra■unaj, pod kaksnim kotom se v to■ki z najve■jo koordinato z sekata ploskvi $x^2 + y^2 = 1$ in $z = xy$.
   Rez.: $\frac{3\pi}{4}$

```
Clear[x, y, z, r, fi]
x = Cos[fi]
y = Sin[fi]
z = x y /. {{fi → -3 π/4}, {fi → -π/4}, {fi → π/4}, {fi → 3 π/4}}
F = x^2 + y^2 - 1
Solve[D[z, fi] == 0, fi]
n1 =
```

```
Cos[fi]
```

```
Sin[fi]
```

$$\left\{\frac{1}{2}, -\frac{1}{2}, \frac{1}{2}, -\frac{1}{2}\right\}$$

```
-1 + Cos[fi]^2 + Sin[fi]^2
```

```
{{}}
```

```
Clear[x, y, z, r, fi]
z = x y
x = Cos[fi]
y = Sin[fi]
F = x^2 + y^2 - 1
ns = {D[z, x], D[z, y], -1}
nv = {D[F, x], D[F, y], 0}
kot = VectorAngle[ns, nv] /. {fi → Pi / 4}
```

```
x y
```

```
Cos[fi]
```

```
Sin[fi]
```

```
-1 + Cos[fi]^2 + Sin[fi]^2
```

```
{Sin[fi], Cos[fi], -1}
```

```
{2 Cos[fi], 2 Sin[fi], 0}
```

$$\frac{\pi}{4}$$

Integrali s parametrom

7. Narisi graf funkcije $f(x) = \int_0^1 \text{sign}(x - y)\, \mathbb{d}y$.

   Najprej narisi graf funkcije **sign(*x*)**.
   Ta enostavna funkcija je vgrajena v paket *Mathematica*.

```
Clear[x, y, z, r, fi]
```

```
Plot[Integrate[Sign[x - y], {y, 0, 1}], {x, -5, 5}]
```