Matlab worksheet for Section 12.6

```
reset()
//re-initializes MuPAD session, so it behaves like a freshly started session.
```

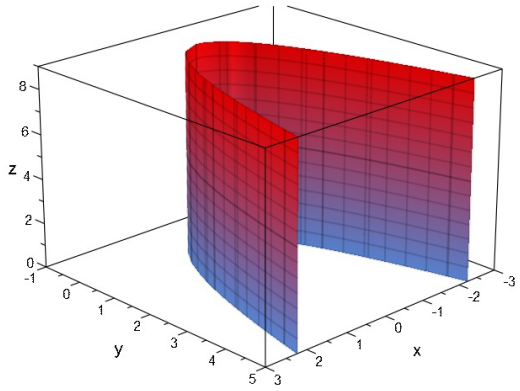
Examples:

Parabolic Cylinder

```
E1 := y-x^2=0;
pe1 := plot::Implicit3d(E1,x=-3..3,y=-1..5,z=0..9,Color=RGB::Red);
plot(pe1);
```

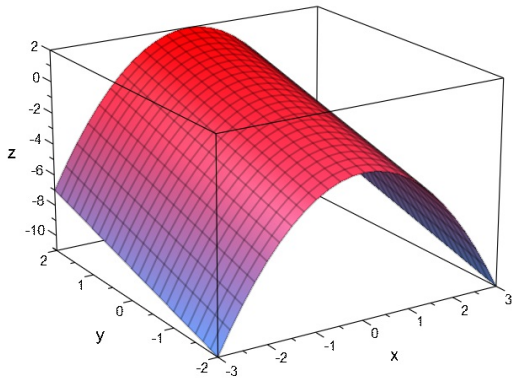
$$y - x^2 = 0$$

$$\text{plot::Implicit3d}(y - x^2,\ x = -3..3,\ y = -1..5,\ z = 0..9)$$



Not the difference between above surface and the graph of z = y - x^2.

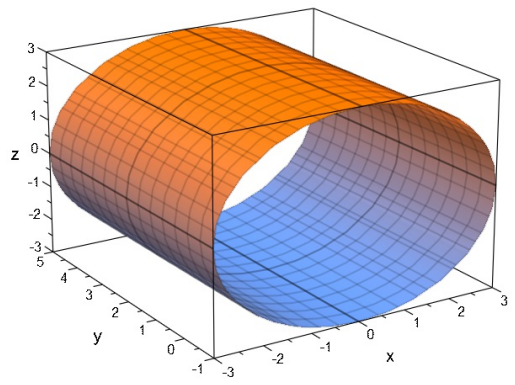
```
plotfunc3d(y-x^2,x=-3..3,y=-2..2)
```



Circular Cylinder

```
pe1 := plot::Implicit3d(x^2+z^2=9,x=-3..3,y=-1..5,z=-3..3,Color=RGB::Orange);
plot(pe1);
```

$$\text{plot::Implicit3d}(x^2 + z^2 - 9,\ x = -3..3,\ y = -1..5,\ z = -3..3)$$



Two Circular Cylinders

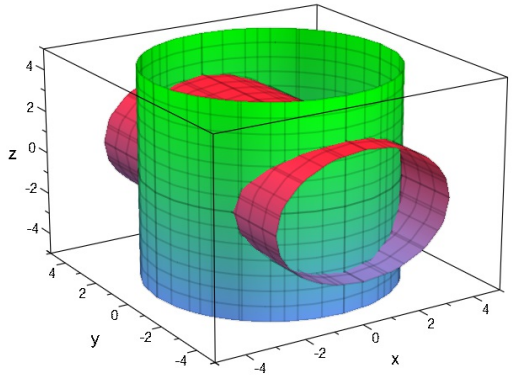
```
E1:=x^2+y^2=16;
E2:=x^2+z^2=9;
pe1 := plot::Implicit3d(E1,x=-5..5,y=-5..5,z=-5..5,Color=RGB::Green);
pe2 := plot::Implicit3d(E2,x=-5..5,y=-5..5,z=-5..5,Color=RGB::Red);
plot(pe1,pe2);
```

$$x^2 + y^2 = 16$$

$x^2 + z^2 = 9$

plot::Implicit3d($x^2 + y^2 - 16,\ x = -5..5,\ y = -5..5,\ z = -5..5$)

plot::Implicit3d($x^2 + z^2 - 9,\ x = -5..5,\ y = -5..5,\ z = -5..5$)



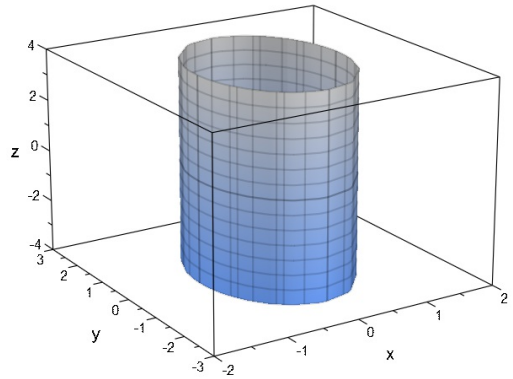
Elliptical Cylinder

```
reset();
E3 := x^2/a^2+y^2/b^2=1;
a:=1: b:=2: c:=3: E3;
pec := plot::Implicit3d(E3, x=-a-1..a+1, y=-b-1..b+1, z=-c-1..c+1,Color=RGB::Gray);
plot(pec);
```

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

$x^2 + \frac{y^2}{4} = 1$

plot::Implicit3d$\left(x^2 + \frac{y^2}{4} - 1,\ x = -2..2,\ y = -3..3,\ z = -4..4\right)$



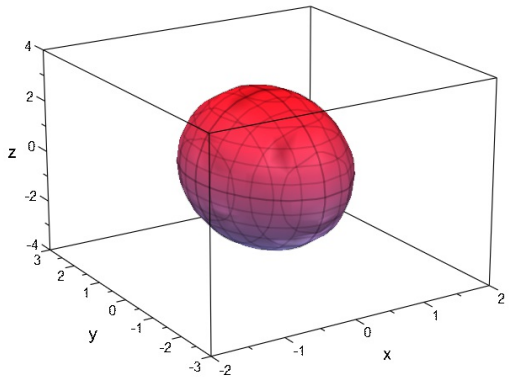
Example 2. **Ellipsoid**

```
E2 := x^2/a^2+y^2/b^2+z^2/c^2=1;
a:=1: b:=2: c:=3: E2;
pec := plot::Implicit3d(E2, x=-a-1..a+1, y=-b-1..b+1, z=-c-1..c+1, Color=RGB::Cadmium);
plot(pec);
```

$x^2 + \frac{y^2}{4} + \frac{z^2}{9} = 1$

$x^2 + \frac{y^2}{4} + \frac{z^2}{9} = 1$

plot::Implicit3d$\left(x^2 + \frac{y^2}{4} + \frac{z^2}{9} - 1,\ x = -2..2,\ y = -3..3,\ z = -4..4\right)$



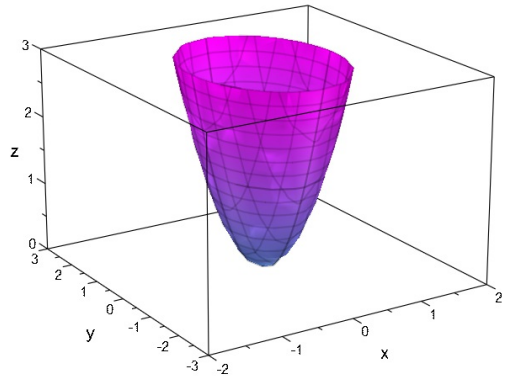
Example 3. **Elliptical Paraboloid**

```
E2 := x^2/a^2+y^2/b^2=z/c;
a:=1: b:=2: c:=3: E2;
pec := plot::Implicit3d(E2, x=-a-1..a+1, y=-b-1..b+1, z=0..c, Color=RGB::Pink);
plot(pec);
```

$$x^2+\frac{y^2}{4}=\frac{z}{3}$$

$$x^2+\frac{y^2}{4}=\frac{z}{3}$$

$$\text{plot::Implicit3d}\left(-\frac{z}{3}+x^2+\frac{y^2}{4},\ x=-2..2,\ y=-3..3,\ z=0..3\right)$$



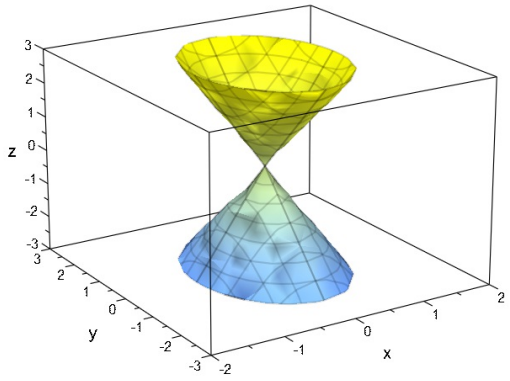
Example 4. **Elliptical Cone**

```
E2 := x^2/a^2+y^2/b^2=z^2/c^2;
a:=1: b:=2: c:=3: E2;
pec := plot::Implicit3d(E2, x=-a-1..a+1, y=-b-1..b+1, z=-c..c, Color=RGB::Yellow);
plot(pec);
```

$$x^2+\frac{y^2}{4}=\frac{z^2}{9}$$

$$x^2+\frac{y^2}{4}=\frac{z^2}{9}$$

$$\text{plot::Implicit3d}\left(x^2+\frac{y^2}{4}-\frac{z^2}{9},\ x=-2..2,\ y=-3..3,\ z=-3..3\right)$$



Example 5. **Hyperboloid of one sheet**

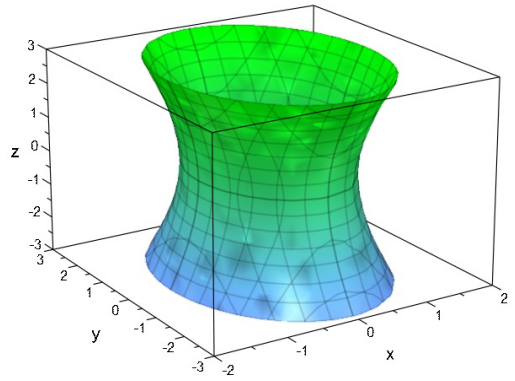
```
E2 := x^2/a^2+y^2/b^2-z^2/c^2=1;
a:=1: b:=2: c:=3: E2;
```

```
pec := plot::Implicit3d(E2, x=-a-1..a+1, y=-b-1..b+1, z=-c..c, Color=RGB::Green);
plot(pec);
```

$$x^2 + \frac{y^2}{4} - \frac{z^2}{9} = 1$$

$$x^2 + \frac{y^2}{4} - \frac{z^2}{9} = 1$$

$$\text{plot::Implicit3d}\left(x^2 + \frac{y^2}{4} - \frac{z^2}{9} - 1,\ x = -2..2,\ y = -3..3,\ z = -3..3\right)$$



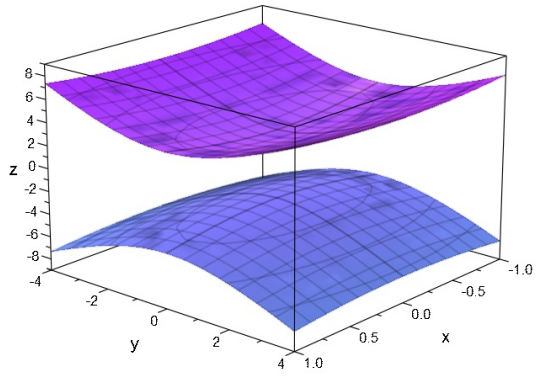
Example 6. **Hyperboloid of two sheets**

```
E2 := -x^2/a^2-y^2/b^2+z^2/c^2=1;
a:=1: b:=2: c:=3: E2;
pec := plot::Implicit3d(E2, x=-a^2..a^2, y=-b^2..b^2, z=-c^2..c^2, Color=RGB::Purple);
plot(pec);
```

$$-x^2 - \frac{y^2}{4} + \frac{z^2}{9} = 1$$

$$-x^2 - \frac{y^2}{4} + \frac{z^2}{9} = 1$$

$$\text{plot::Implicit3d}\left(-x^2 - \frac{y^2}{4} + \frac{z^2}{9} - 1,\ x = -1..1,\ y = -4..4,\ z = -9..9\right)$$



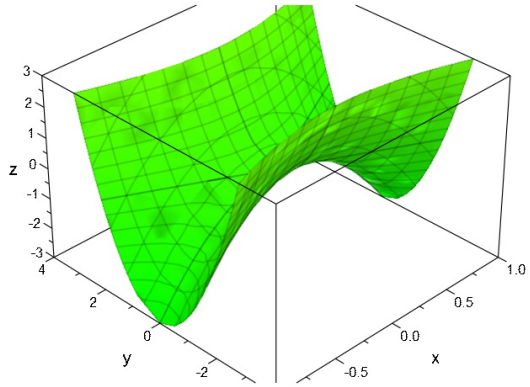
Example 7. **Hyperbolic Paraboloid - Saddle Point**

```
E2 := -x^2/a^2+y^2/b^2-z/c=0;
a:=1: b:=2: c:=3: E2;
pec := plot::Implicit3d(E2, x=-a^2..a^2, y=-b^2..b^2, z=-c..c, Color=RGB::BrightGreen, FillColor2=RGB::Green);
plot(pec);
```

$$-x^2 + \frac{y^2}{4} - \frac{z}{3} = 0$$

$$-x^2 + \frac{y^2}{4} - \frac{z}{3} = 0$$

$$\text{plot::Implicit3d}\left(-\frac{z}{3} - x^2 + \frac{y^2}{4},\ x = -1..1,\ y = -4..4,\ z = -3..3\right)$$




```
RGB::plotColorPalette("red")
```