

```

> #ex 1:
> 12+4-5
11 (1)

> 2^10
1024 (2)

> sin(0.1)
0.09983341665 (3)

> expand((a+b)*(a-b))
 $a^2 - b^2$  (4)

> #ex 2:
> y:=x-> 3*x^3+2*x^2-5
 $y := x \mapsto 3 \cdot x^3 + 2 \cdot x^2 - 5$  (5)

> diff(y(x),x)
 $9x^2 + 4x$  (6)

> y:=x-> sqrt(1+x^4)
 $y := x \mapsto \sqrt{1 + x^4}$  (7)

> D(y)(x)
 $\frac{2x^3}{\sqrt{x^4 + 1}}$  (8)

> y:=x->exp(x)*sin(x)*cos(x)
 $y := x \mapsto e^x \cdot \sin(x) \cdot \cos(x)$  (9)

> diff(y(x),x)
 $e^x \sin(x) \cos(x) + e^x \cos(x)^2 - e^x \sin(x)^2$  (10)

> #ex 3:
> f:=x-> 3*x^3+2*x^2-5
 $f := x \mapsto 3 \cdot x^3 + 2 \cdot x^2 - 5$  (11)

> int(f(x),x=0..1)
 $-\frac{43}{12}$  (12)

> f:=x-> 1/x^2
 $f := x \mapsto \frac{1}{x^2}$  (13)

> int(f(x),x=0..infinity)
 $\infty$  (14)

> f:=x-> exp(-x^2)
 $f := x \mapsto e^{-x^2}$  (15)

> int(f(x),x=-infinity..infinity)
 $\sqrt{\pi}$  (16)

> #ex 4:
> limit(sin(x)/x,x=0)
1 (17)

```

```
> limit((x^3+3*x^2-5)/(2*x^3-7*x),x=infinity)
```

$$\frac{1}{2}$$

(18)

```
> limit((cos(x)+1)/(x-Pi),x=Pi)
```

$$0$$

(19)

```
> #ex 5:
```

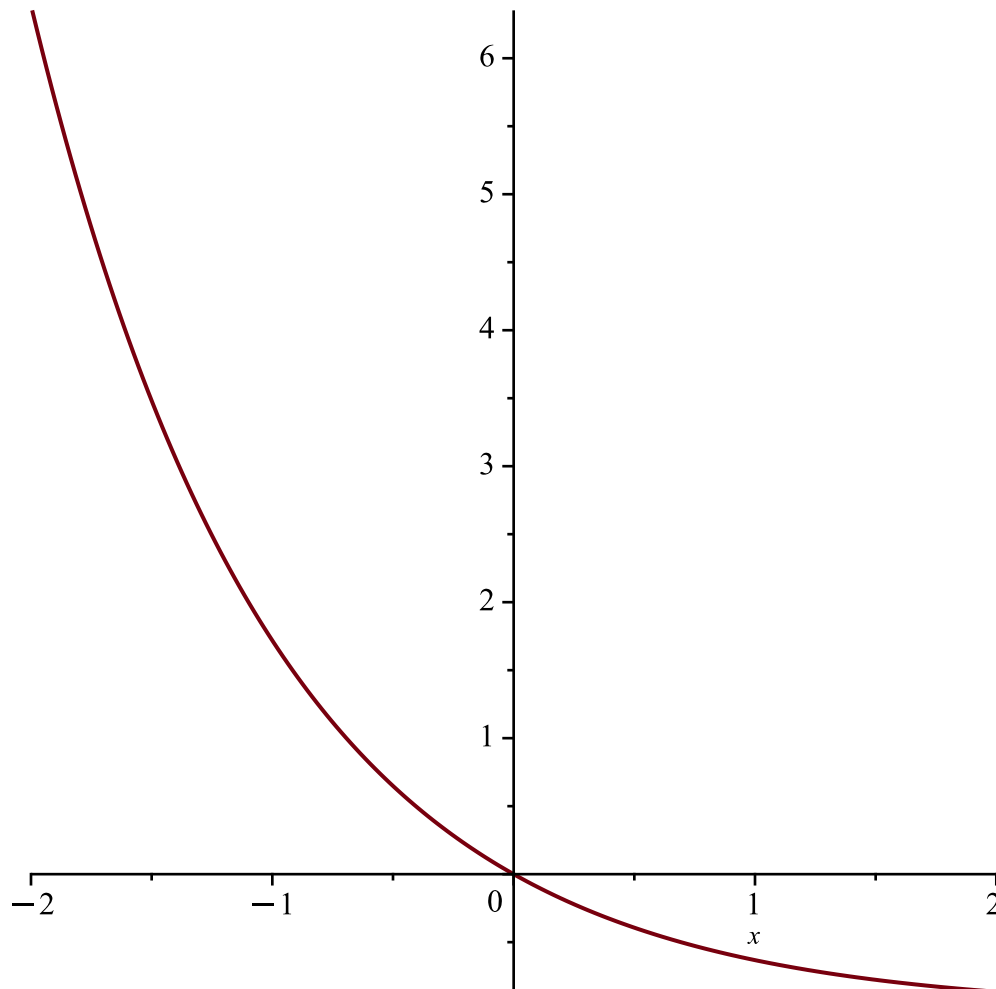
```
> f:=x-> exp(-x)-1
```

$$f := x \mapsto e^{-x} - 1$$

(20)

```
> with(plots):
```

```
> plot(f(x),x=-2..2)
```

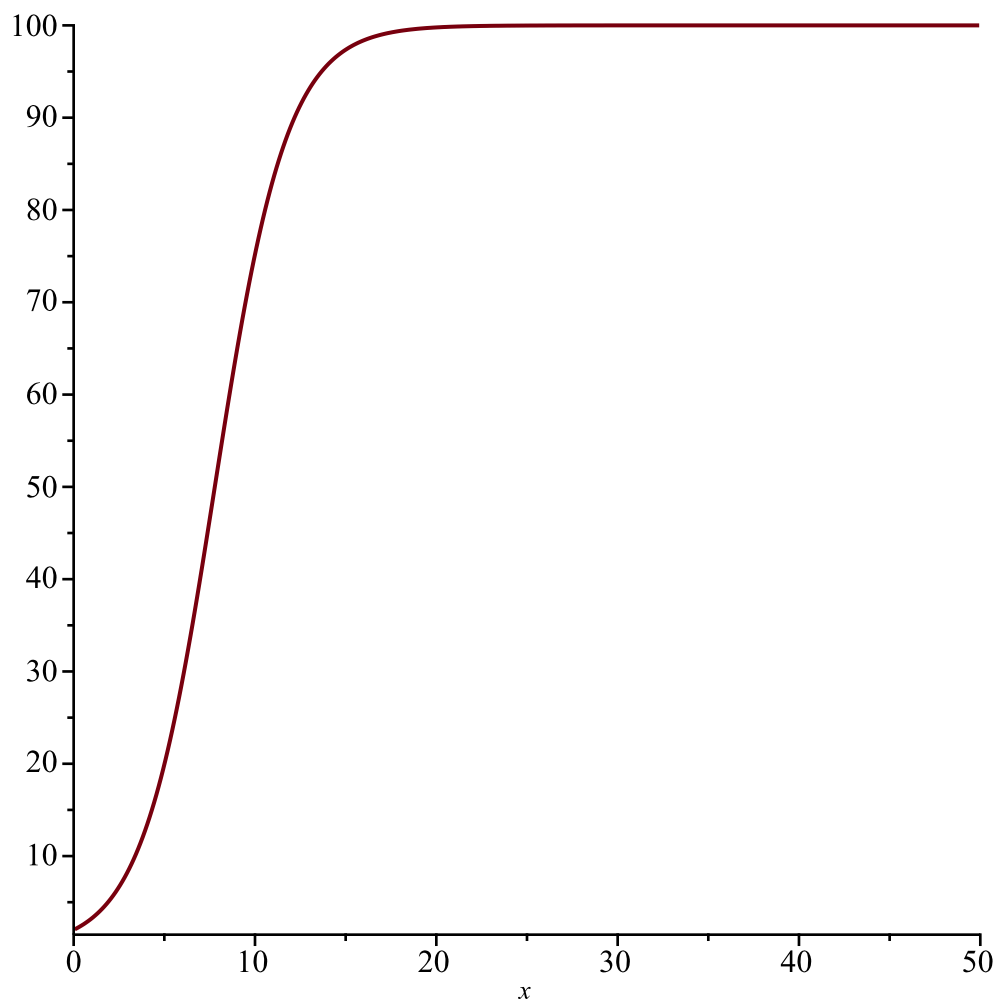


```
> f:=x-> (200*exp(0.5*x))/(2*(exp(0.5*x)-1)+100)
```

$$f := x \mapsto \frac{200 \cdot e^{0.5 \cdot x}}{2 \cdot e^{0.5 \cdot x} + 98}$$

(21)

```
> plot(f(x),x=0..50)
```

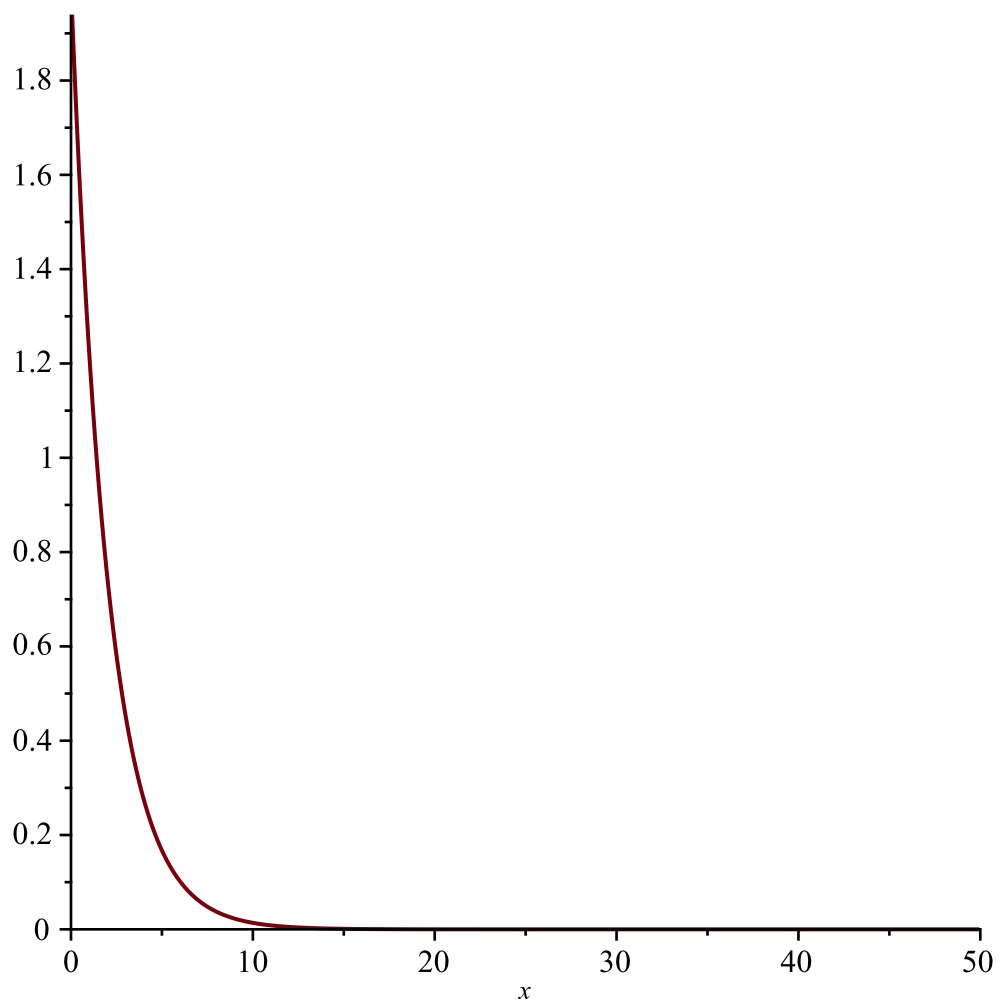


```
> f:=x-> (200*exp(-0.5*x)) / (2*(exp(-0.5*x)-1)+100)
```

$$f := x \mapsto \frac{200 \cdot e^{-0.5 \cdot x}}{2 \cdot e^{-0.5 \cdot x} + 98}$$

(22)

```
> plot(f(x),x=0..50)
```

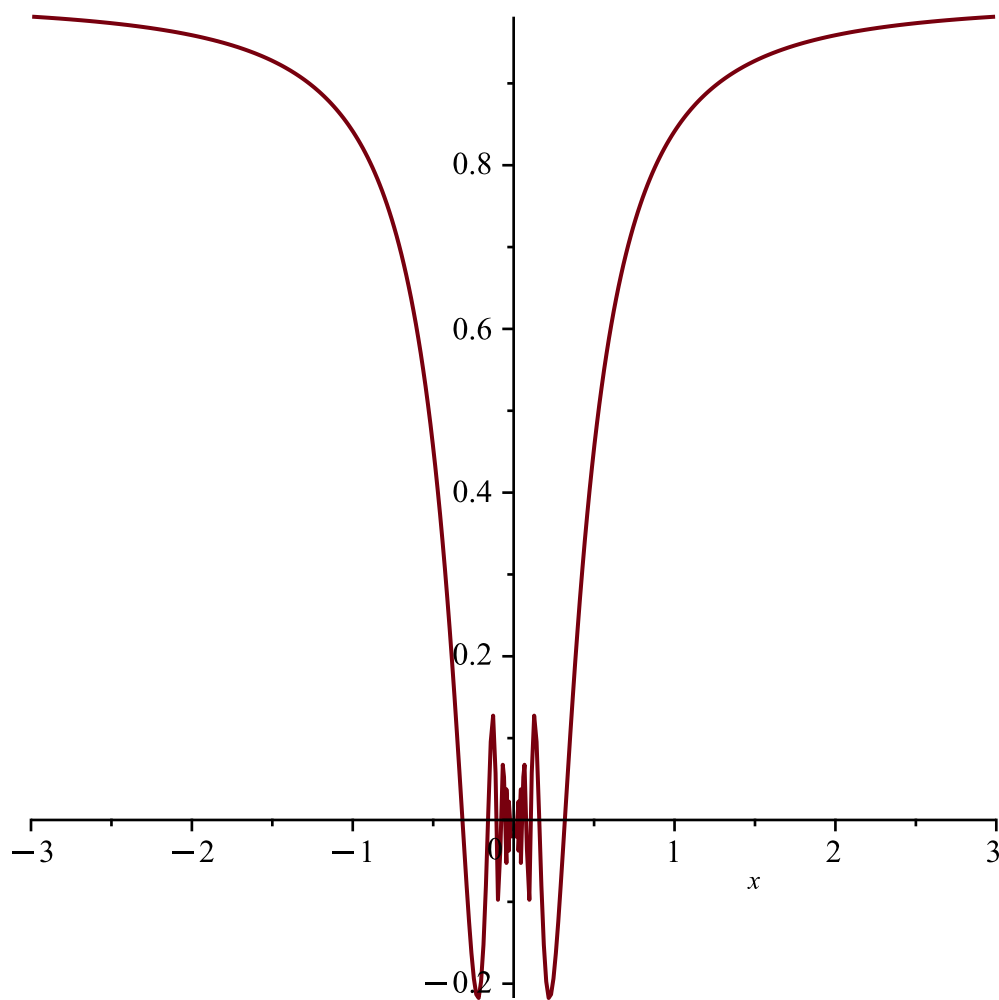


```
> f:=x-> x*sin(1/x)
```

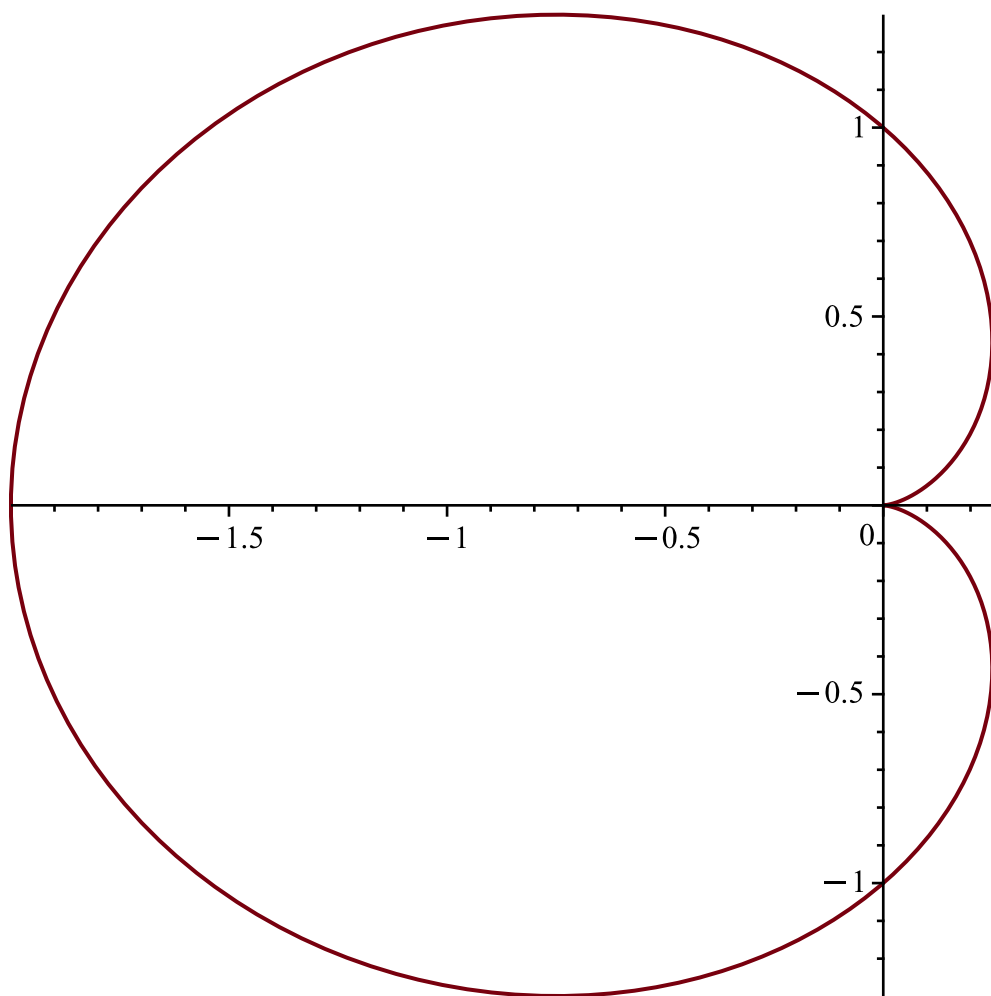
$$f := x \mapsto x \cdot \sin\left(\frac{1}{x}\right)$$

(23)

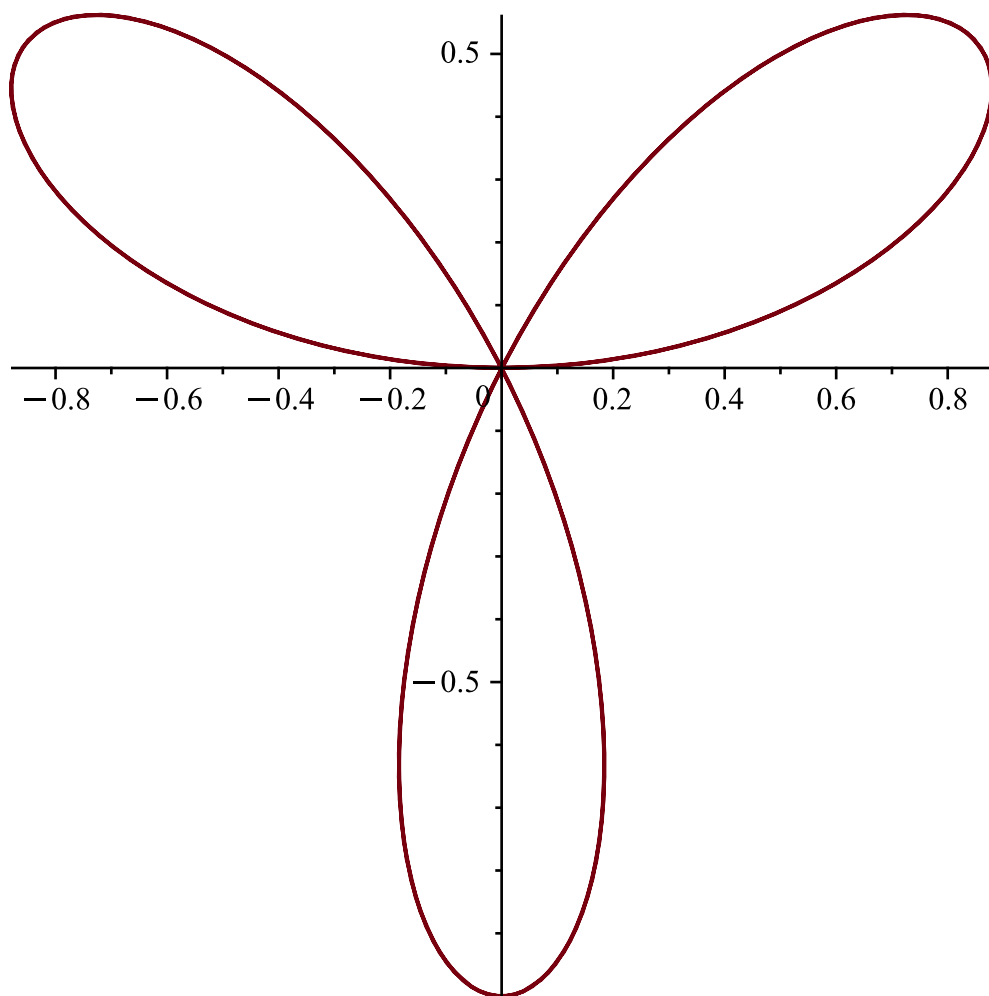
```
> plot(f(x), x=-3..3)
```



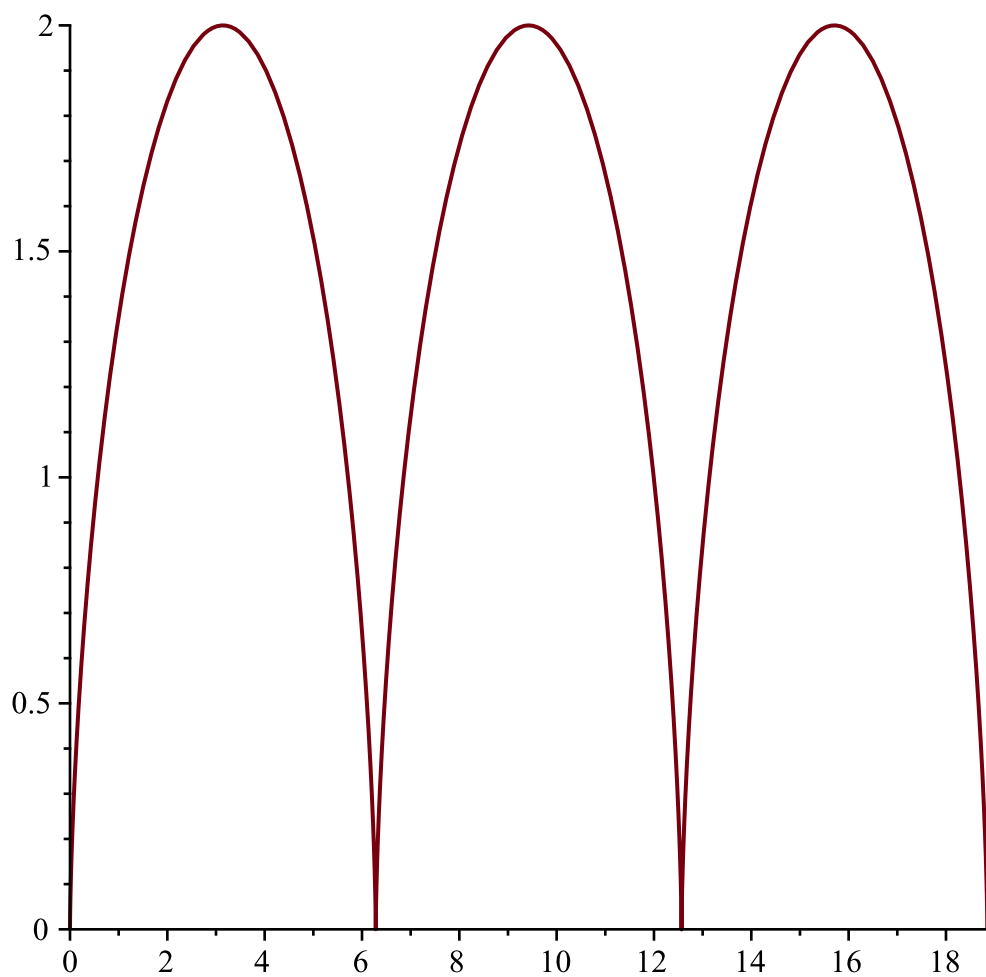
```
> #ex 6:  
> plot([(1-cos(t))*cos(t), (1-cos(t))*sin(t), t=0..2*Pi])
```



```
> plot([sin(3*t)*cos(t), sin(3*t)*sin(t), t=0..2*Pi])
```



```
> plot([t-sin(t),1-cos(t),t=0..6*Pi])
```



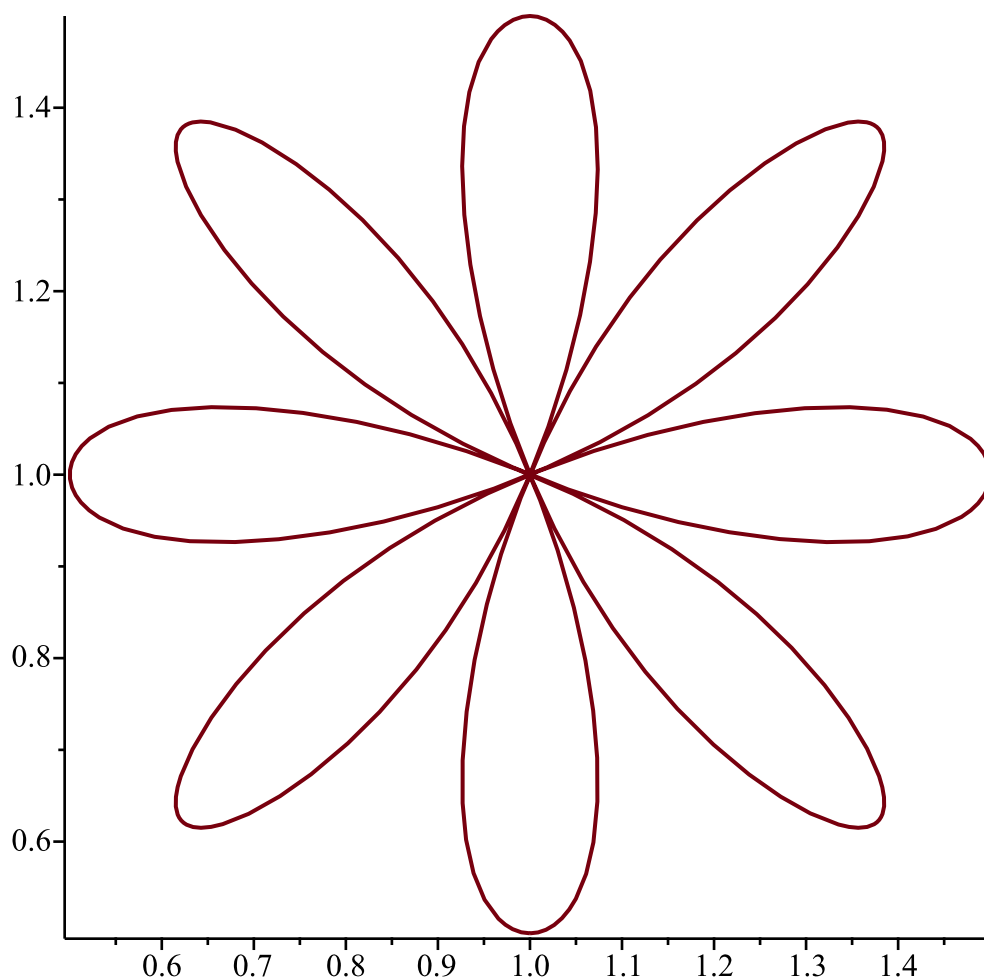
```
> #ex 7:
> f:=(t,s)-> 1-(s*cos(4*t)*cos(t))/sqrt(1-s^2*(cos(4*t))^2*(sin(t))^2)
```

$$f := (t, s) \mapsto 1 - \frac{s \cdot \cos(4 \cdot t) \cdot \cos(t)}{\sqrt{1 - s^2 \cdot \cos(4 \cdot t)^2 \cdot \sin(t)^2}}$$

(24)

```
> plot([f(t-Pi/2,0.5),f(t,0.5),t=0..2*Pi])
```





```
> plot([f(t-Pi/2,0.5),f(t,0.5),t=0..2*Pi])
> restart
> f:=(t,s)-> 1-((s/10)*cos(4*t)*cos(t))/sqrt(1-(s/10)^2*(cos(4*t))^2*(sin(t))^2)
```

$$f := (t, s) \mapsto 1 - \frac{s \cdot \cos(4 \cdot t) \cdot \cos(t)}{10 \cdot \sqrt{1 - \frac{s^2 \cdot \cos(4 \cdot t)^2 \cdot \sin(t)^2}{100}}} \quad (25)$$

```
> lista:=[f(t-Pi/2,s),f(t,s)]$s=1..10
```

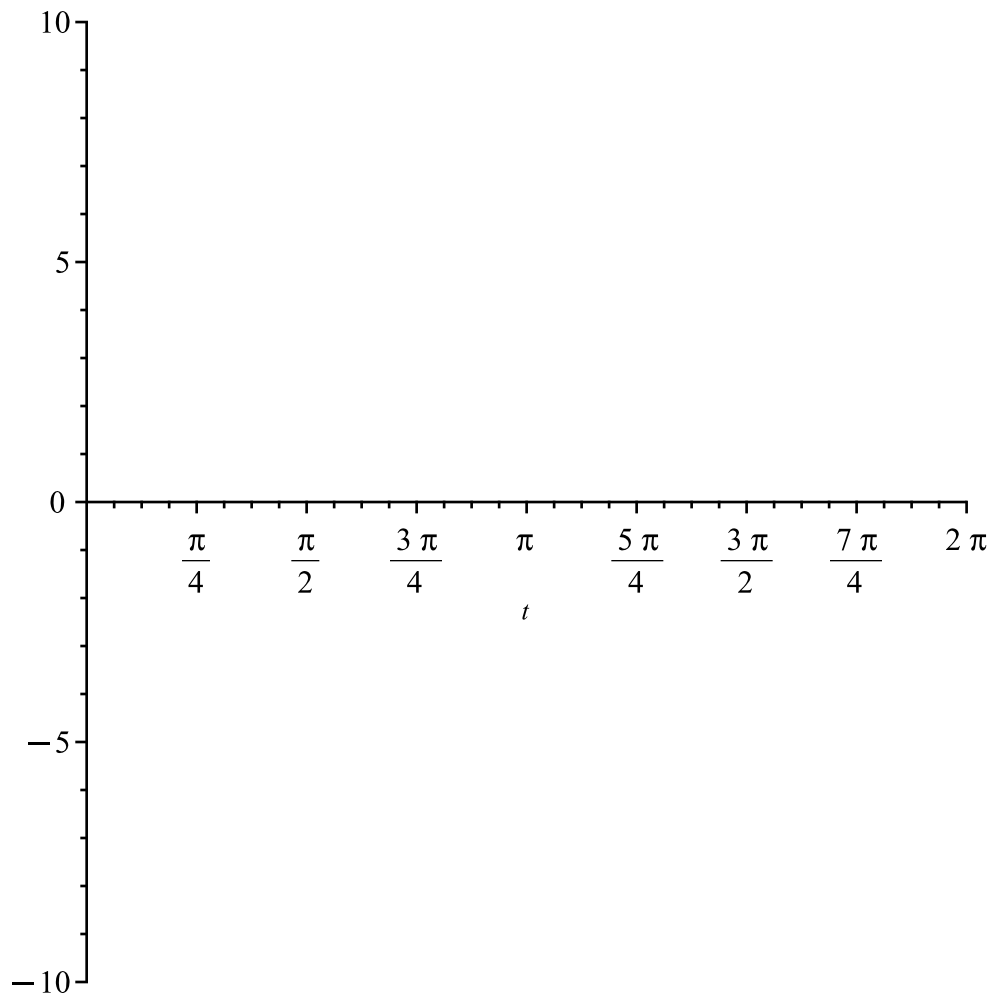
$$\begin{aligned} lista := & \left[ 1 - \frac{\cos(4t) \sin(t)}{\sqrt{100 - \cos(4t)^2 \cos(t)^2}}, 1 - \frac{\cos(4t) \cos(t)}{\sqrt{100 - \cos(4t)^2 \sin(t)^2}} \right], \left[ 1 \right. \\ & - \frac{2 \cos(4t) \sin(t)}{\sqrt{100 - 4 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{2 \cos(4t) \cos(t)}{\sqrt{100 - 4 \cos(4t)^2 \sin(t)^2}} \left. \right], \left[ 1 \right. \\ & - \frac{3 \cos(4t) \sin(t)}{\sqrt{100 - 9 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{3 \cos(4t) \cos(t)}{\sqrt{100 - 9 \cos(4t)^2 \sin(t)^2}} \left. \right], \left[ 1 \right. \\ & - \frac{4 \cos(4t) \sin(t)}{\sqrt{100 - 16 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{4 \cos(4t) \cos(t)}{\sqrt{100 - 16 \cos(4t)^2 \sin(t)^2}} \left. \right], \left[ 1 \right. \end{aligned} \quad (26)$$

$$\begin{aligned}
& - \frac{5 \cos(4t) \sin(t)}{\sqrt{100 - 25 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{5 \cos(4t) \cos(t)}{\sqrt{100 - 25 \cos(4t)^2 \sin(t)^2}} \Bigg], \Bigg[ 1 \\
& - \frac{6 \cos(4t) \sin(t)}{\sqrt{100 - 36 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{6 \cos(4t) \cos(t)}{\sqrt{100 - 36 \cos(4t)^2 \sin(t)^2}} \Bigg], \Bigg[ 1 \\
& - \frac{7 \cos(4t) \sin(t)}{\sqrt{100 - 49 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{7 \cos(4t) \cos(t)}{\sqrt{100 - 49 \cos(4t)^2 \sin(t)^2}} \Bigg], \Bigg[ 1 \\
& - \frac{8 \cos(4t) \sin(t)}{\sqrt{100 - 64 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{8 \cos(4t) \cos(t)}{\sqrt{100 - 64 \cos(4t)^2 \sin(t)^2}} \Bigg], \Bigg[ 1 \\
& - \frac{9 \cos(4t) \sin(t)}{\sqrt{100 - 81 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{9 \cos(4t) \cos(t)}{\sqrt{100 - 81 \cos(4t)^2 \sin(t)^2}} \Bigg], \Bigg[ 1 \\
& - \frac{10 \cos(4t) \sin(t)}{\sqrt{100 - 100 \cos(4t)^2 \cos(t)^2}}, 1 - \frac{10 \cos(4t) \cos(t)}{\sqrt{100 - 100 \cos(4t)^2 \sin(t)^2}} \Bigg]
\end{aligned}$$

```
> with(plots):
```

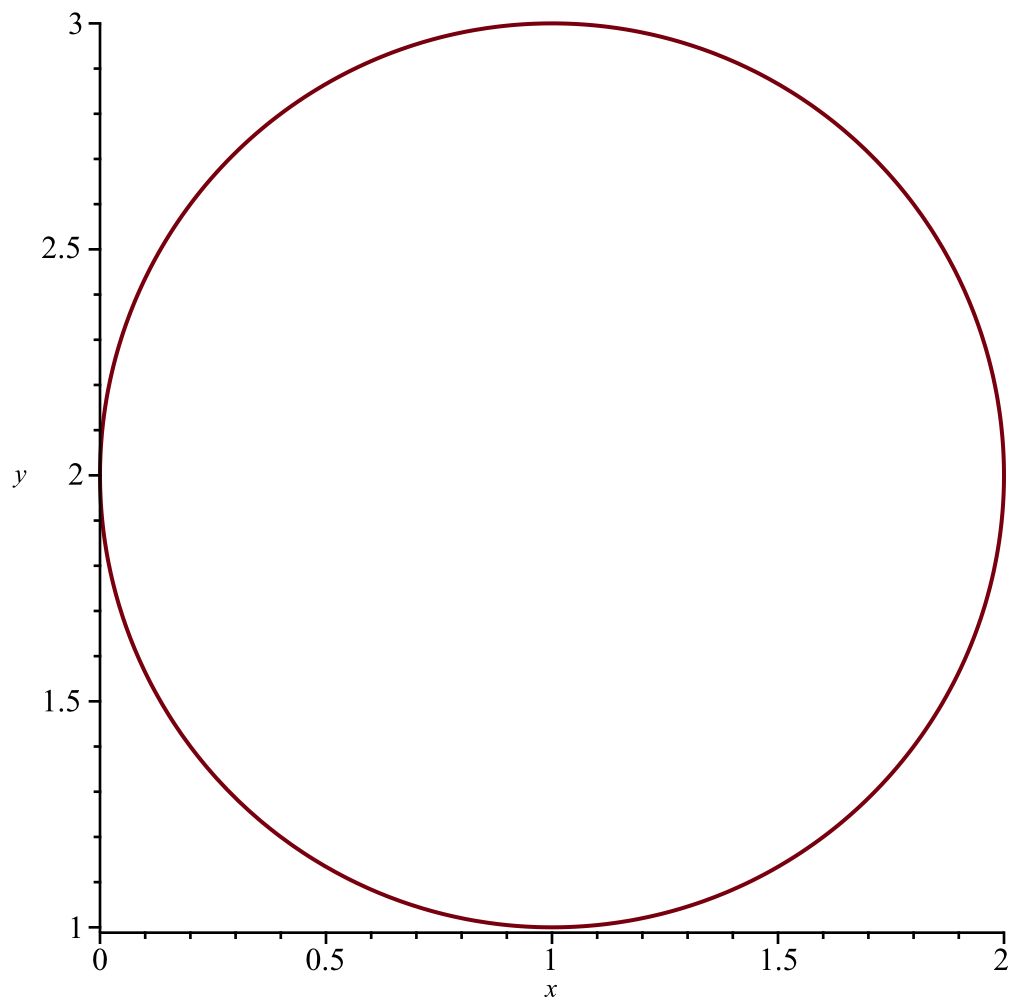
```
> plot([lista], t=0..2*Pi)
```

Warning, expecting only range variable t in expression lista to be plotted but found name lista

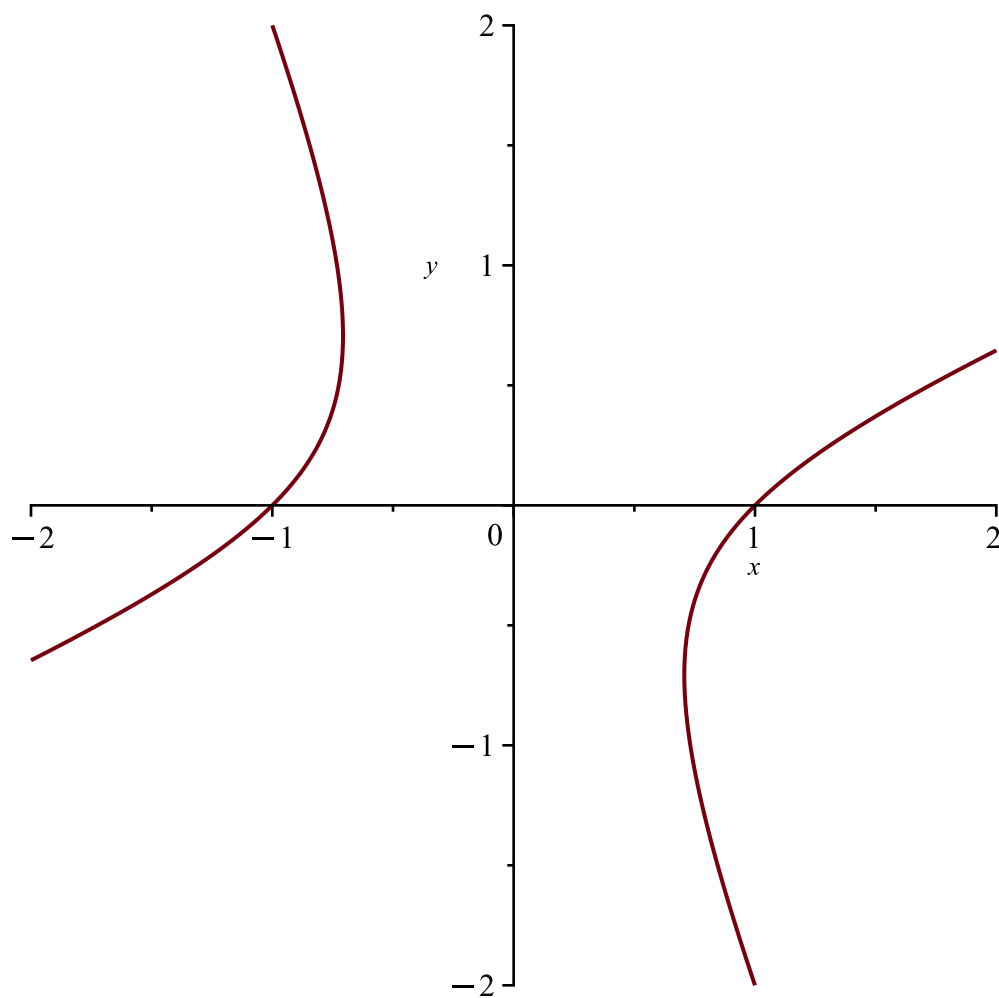


```
> #ex 8:
```

```
> implicitplot(x^2+y^2-2*x-4*y+4=0,x=-5..5,y=-5..5)
```



```
> implicitplot(x^2-2*x*y-y^2=1,x=-2..2,y=-2..2)
```

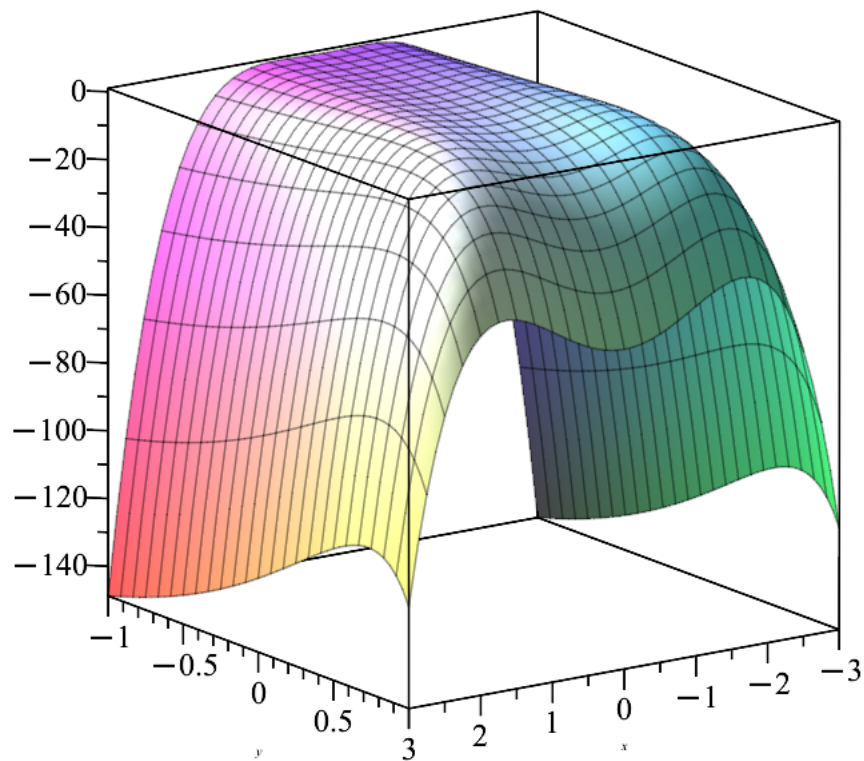


```

> #ex 9:
> z:=(x,y)-> 4*x^2*exp(y)-2*x^4-exp(4*y)
               z := (x,y) ↦ 4·x2·ey - 2·x4 - e4·y
> plot3d(z(x,y),x=-3..3,y=-1..1,axes=boxed)

```

(27)

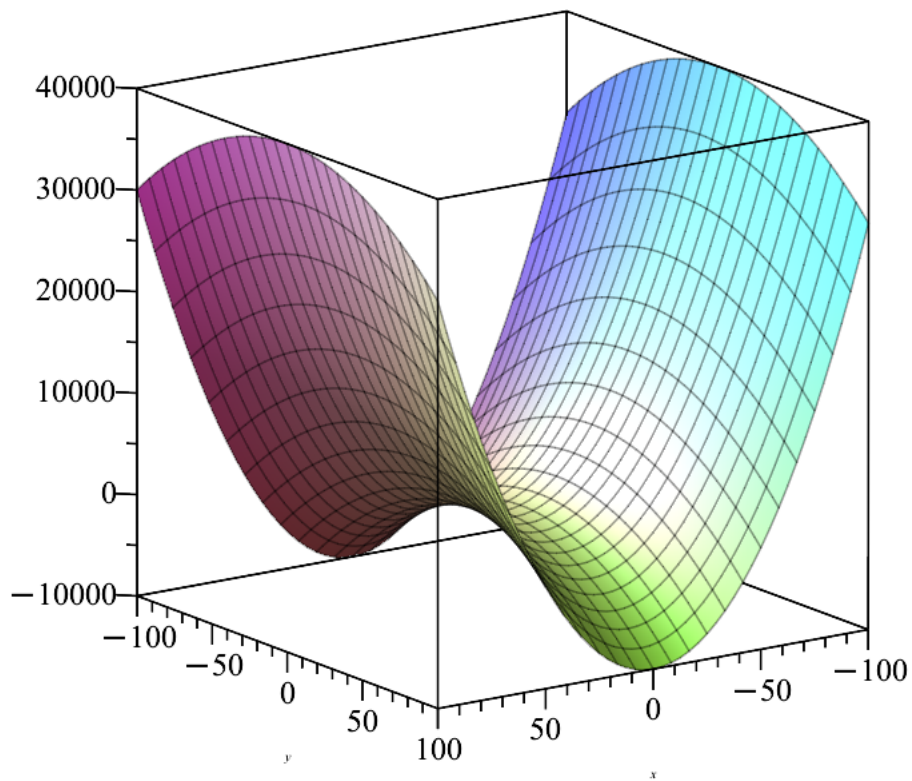


```
> z:=(x,y)-> 4*x^2-y^2
```

$$z := (x, y) \mapsto 4 \cdot x^2 - y^2$$

(28)

```
> plot3d(z(x,y),x=-100..100,y=-100..100,axes=boxed)
```



```

> #ex 10:
> with(linalg):
> A:= matrix([ [1,2,-1],[0,1,0],[3,-1,2] ])

```

$$A := \begin{bmatrix} 1 & 2 & -1 \\ 0 & 1 & 0 \\ 3 & -1 & 2 \end{bmatrix} \quad (29)$$

```

> B:= matrix([ [1,2,3],[1,1,2],[2,1,1] ])

```

$$B := \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 1 & 1 \end{bmatrix} \quad (30)$$

```

> C:= matrix([ [2,1,1],[0,1,-1],[4,2,2] ])

```

$$C := \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & -1 \\ 4 & 2 & 2 \end{bmatrix} \quad (31)$$

```

> evalm(2*A - B &* C)

```

(32)

$$\left[ \begin{array}{ccc} -12 & -5 & -7 \\ -10 & -4 & -4 \\ -2 & -7 & 1 \end{array} \right] \quad (32)$$

**> evalm(B^(-1))**

$$\left[ \begin{array}{ccc} -\frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{3}{2} & -\frac{5}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{3}{2} & -\frac{1}{2} \end{array} \right] \quad (33)$$

**> eigenvals(C)**

$$0, 3, 2 \quad (34)$$

**> eigenvects(C)**

$$\left[ 3, 1, \left\{ \left[ \begin{array}{ccc} -1 & 1 & -2 \end{array} \right] \right\} \right], \left[ 0, 1, \left\{ \left[ \begin{array}{ccc} -1 & 1 & 1 \end{array} \right] \right\} \right], \left[ 2, 1, \left\{ \left[ \begin{array}{ccc} 1 & -2 & 2 \end{array} \right] \right\} \right] \quad (35)$$