Computergestuetzte Mathematik zur Analysis

Lektion 2

Unterschied Ausdruck (Expression) und Funktion (Function) Wiederholung

```
> r:= (a+x^2+b*x+c);
```

$$r := b\,x + x^2 + a + c \tag{1.1}$$

```
> f:= x -> sin(x*Pi);
```

$$f := x \to \sin(x\,\pi) \tag{1.2}$$

```
> f(1/2);
```

$$1 \tag{1.3}$$

```
> R := unapply(r,(a,b,c,x));
```

$$R := (a, b, c, x) \to b\,x + x^2 + a + c \tag{1.4}$$

```
> R(1,1,2,1/2);
```

$$\frac{15}{4} \tag{1.5}$$

```
> int(r,x)
Warning, inserted missing semicolon at end of statement
```

$$\frac{1}{3}\,x^3 + \frac{1}{2}\,x^2\,b + a\,x + c\,x \tag{1.6}$$

```
> int(R(a,b,c,x),x);
```

$$\frac{1}{3}\,x^3 + \frac{1}{2}\,x^2\,b + a\,x + c\,x \tag{1.7}$$

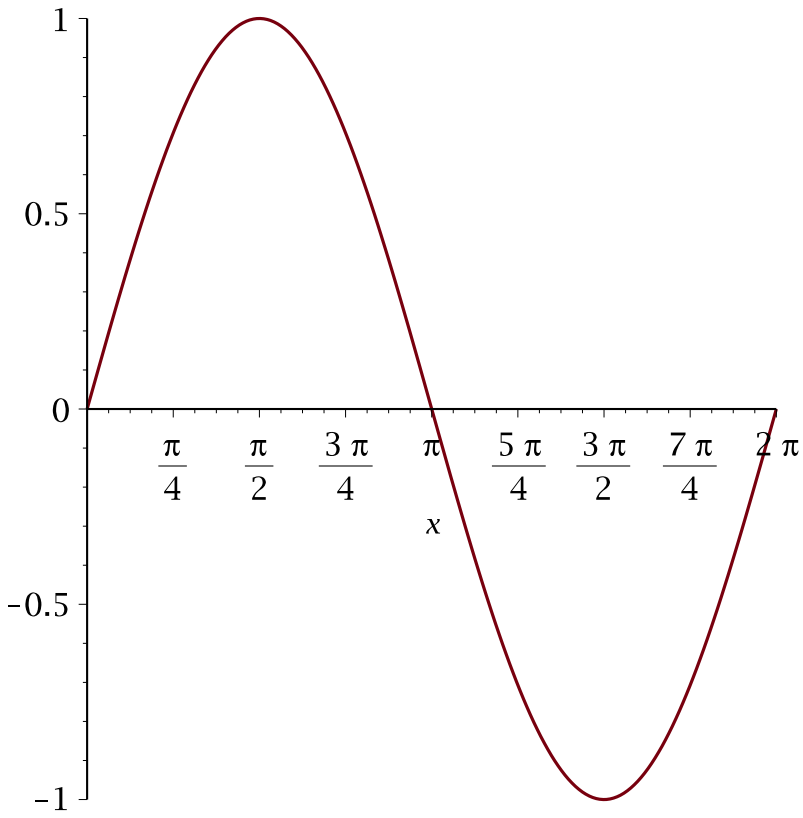
```
> R(x)
Warning, inserted missing semicolon at end of statement
Error, invalid input: R uses a 2nd argument, b, which is
missing
> r(x) # sinnlos

Warning, premature end of input, use <Shift> + <Enter> to
avoid this message.
```

Graphen von Funktionen

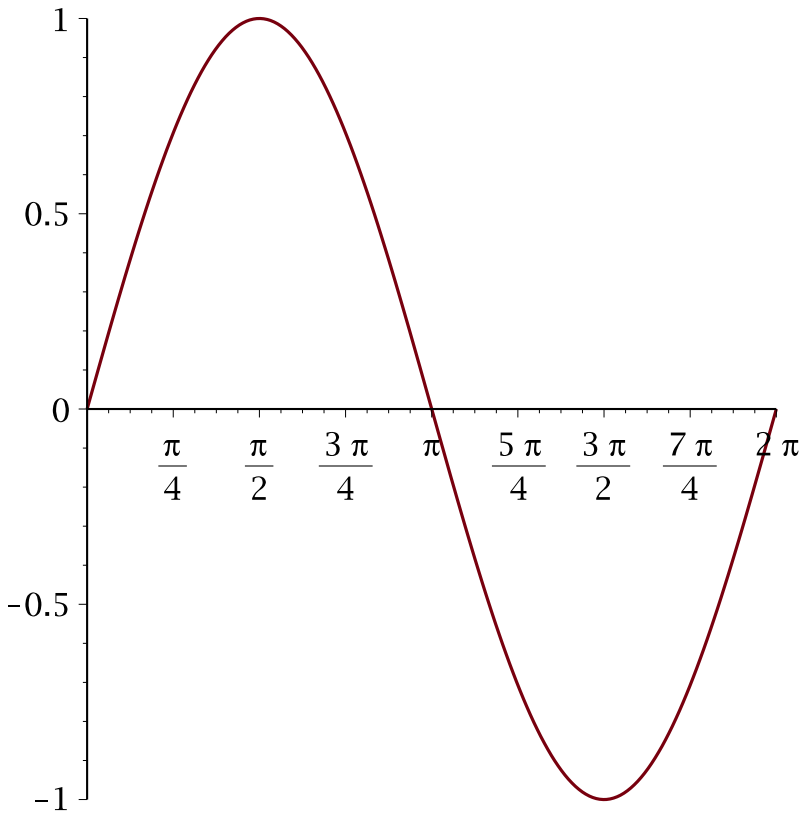
```
> ausdruck := sin(x);
```

$$ausdruck := \sin(x) \tag{2.1}$$

```
> plot(ausdruck,x=0..2*Pi)
Warning, inserted missing semicolon at end of statement
```




```
> plot(sin,0..2*Pi);
```




```
> plot(f,0..2)
```

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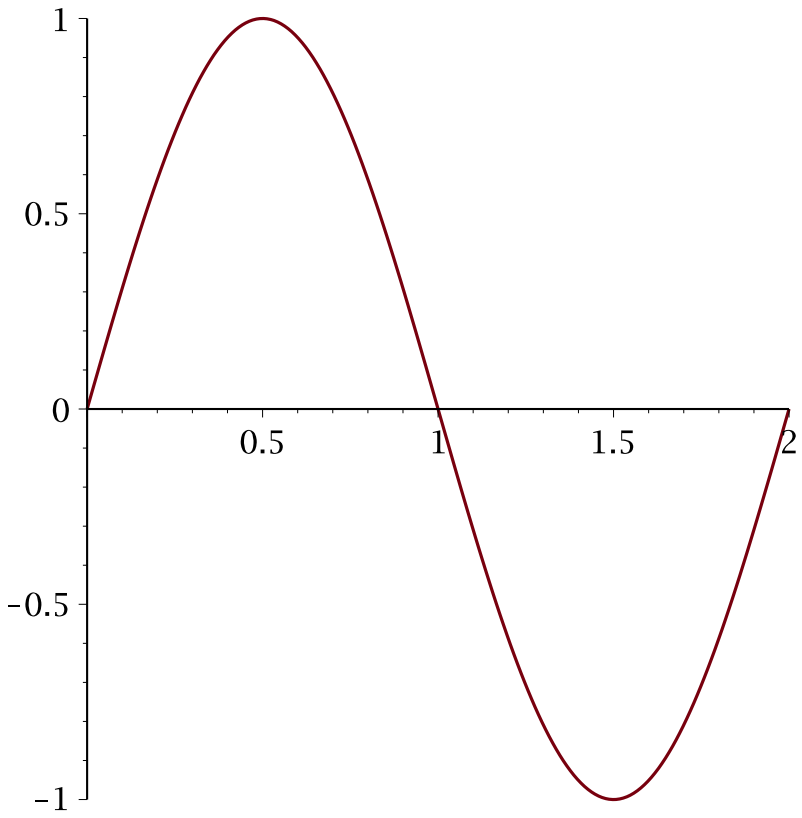
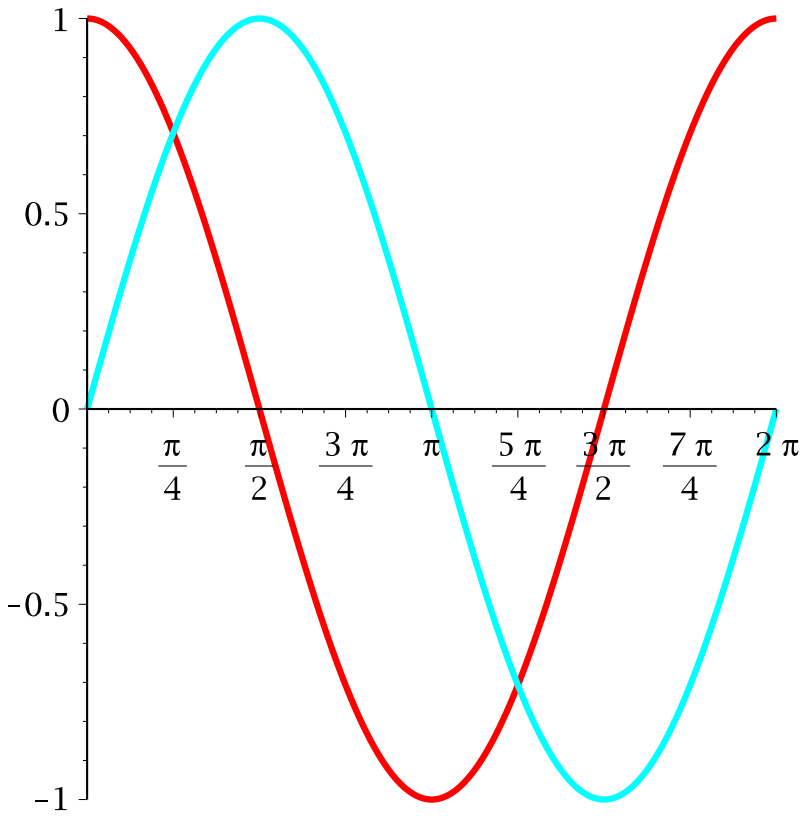


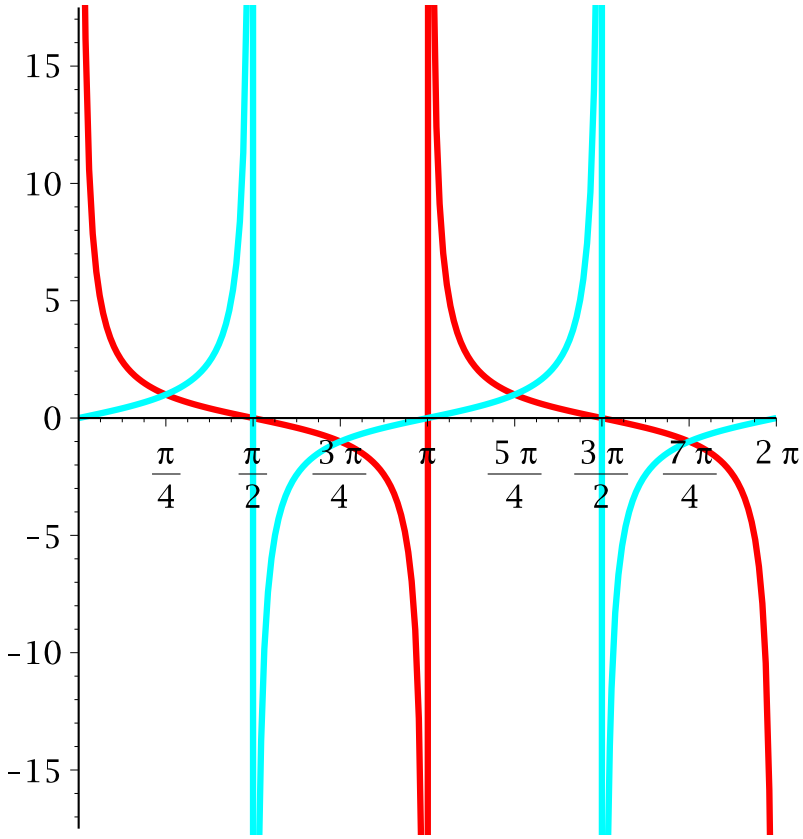

```
> plot([ cos, sin ], 0..2*Pi,color=[red,cyan],thickness=3);
```



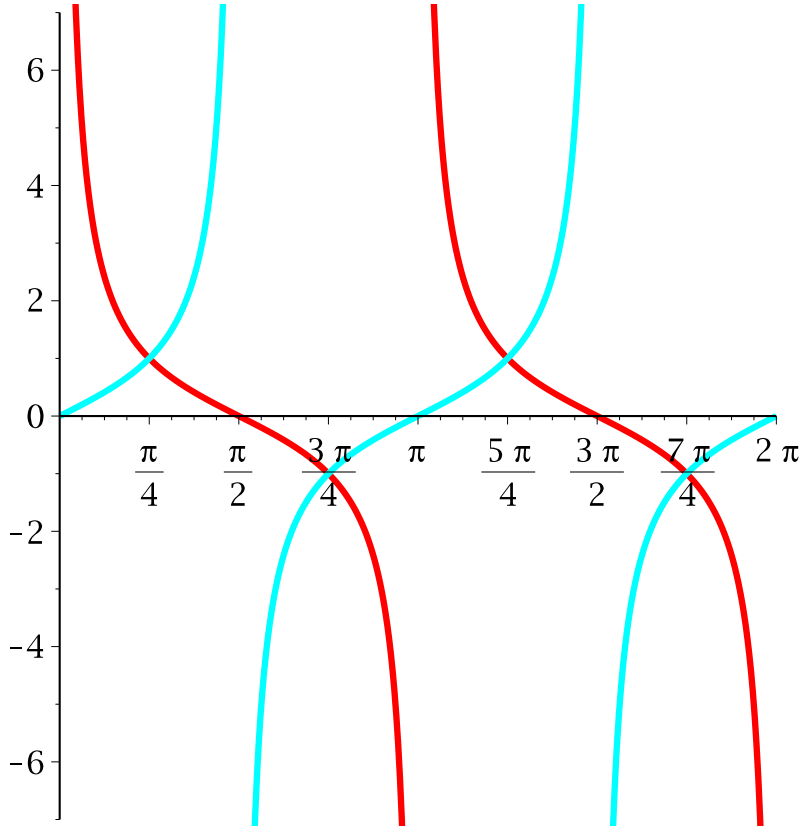

```
> optionen := color=[red,cyan],thickness=3;
```

$$optionen := color = [red, cyan], thickness = 3 \quad \textbf{(2.2)}$$

```
> plot([cot, tan],0..2*Pi,optionen);
```




```
> plot([cot, tan],0..2*Pi,optionen,discont=true);
```

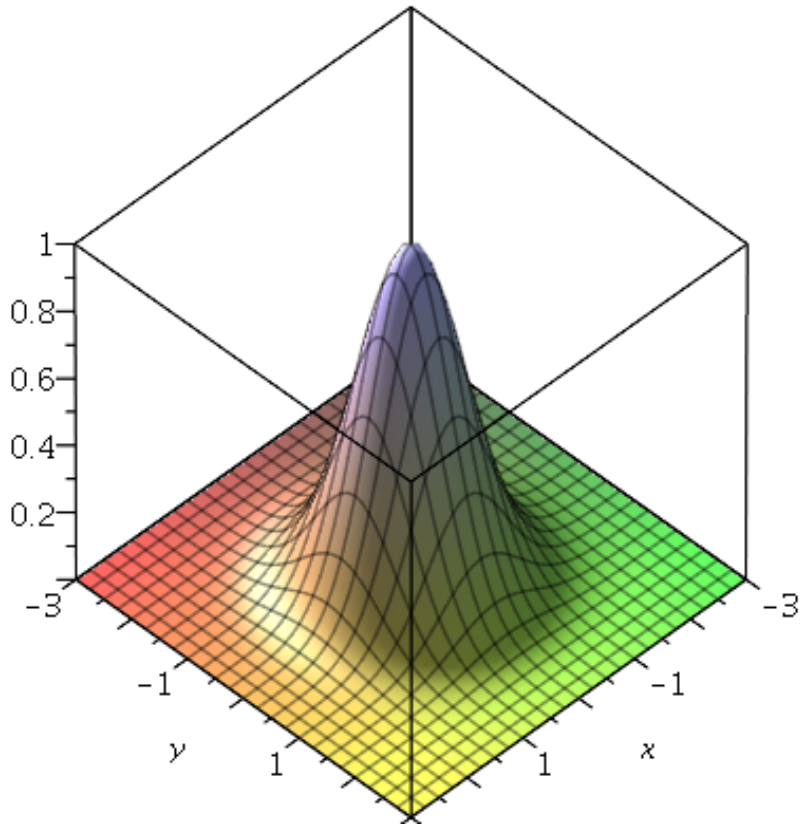


3D-Funktionsgraphen

```
> f := exp(-(x^2+y^2));
```

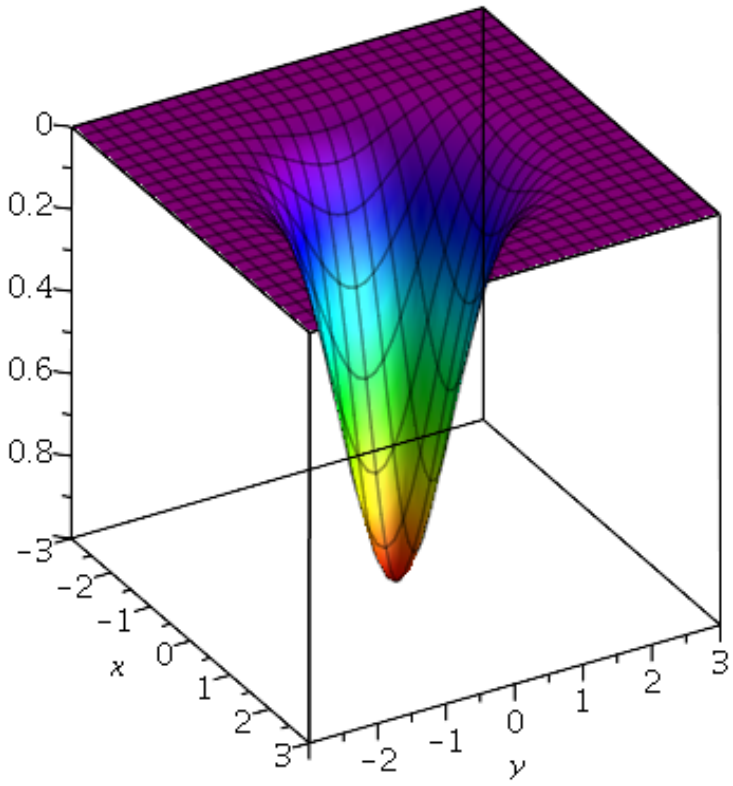
$$f := e^{-x^2 - y^2} \tag{3.1}$$

```
> plot3d(f,x=-3..3,y=-3..3)
Warning, inserted missing semicolon at end of statement
```




```
> plot3d(f,x=-3..3,y=-3..3,shading=zhue,axes="boxed",orientation=
  [-30,-60])
```

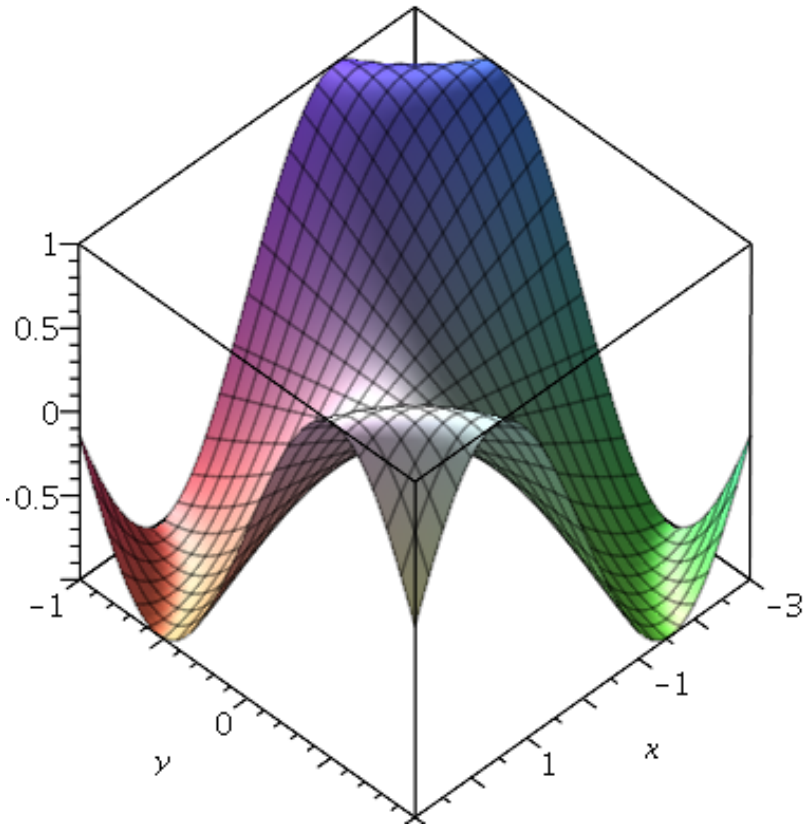
Warning, inserted missing semicolon at end of statement



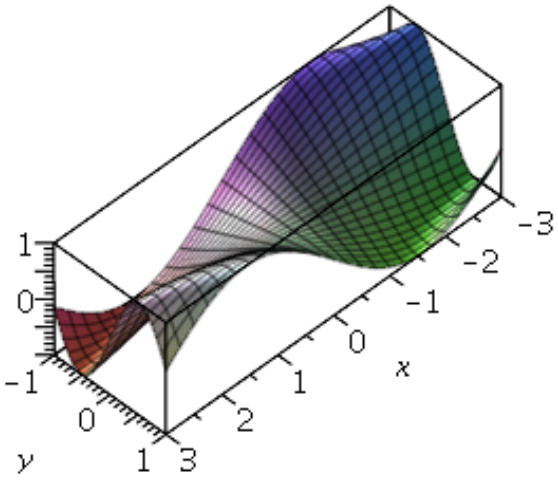

```
> g:= sin(x*y);
```

$$g := \sin(x\,y) \tag{3.2}$$

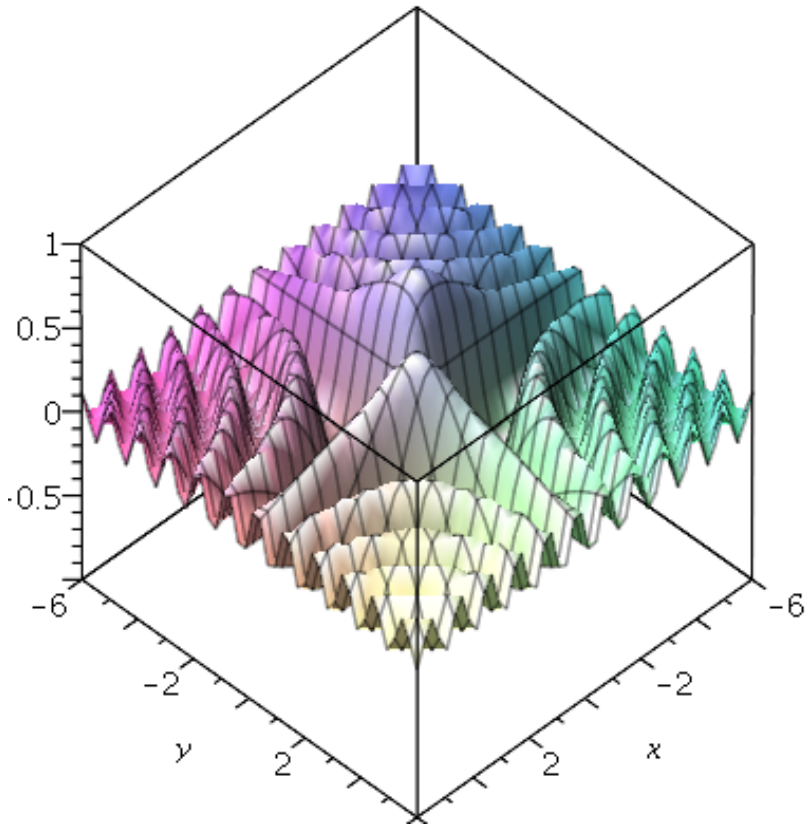
```
> plot3d(g,x=-3..3,y=-1..1);
```




```
> plot3d(g,x=-3..3,y=-1..1,scaling=constrained);
```




```
> plot3d(g/sqrt(x^2+y^2),x=-6..6,y=-6..6,view=-1..1,numpoints=
  2024,lightmodel=light4);
```

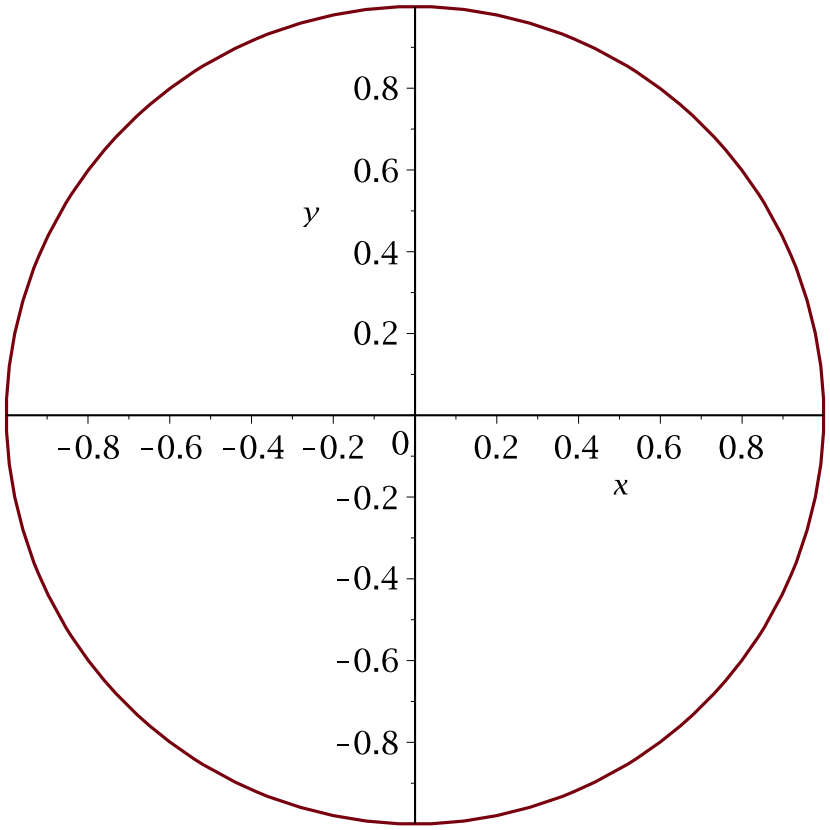


Implizite Graphen

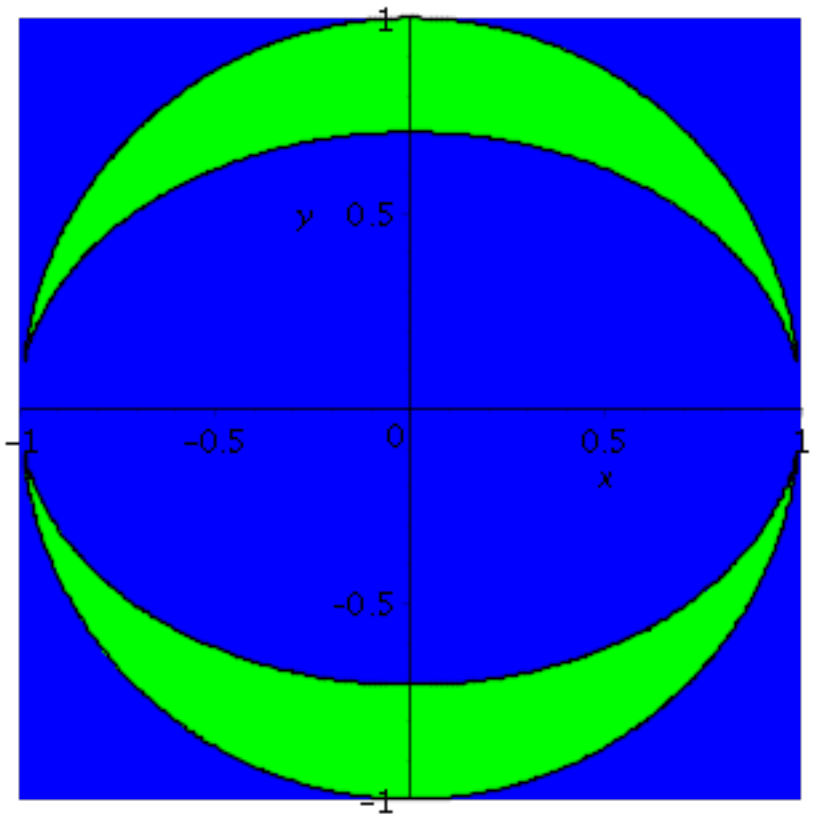
```
> with(plots);
```

[*animate*, *animate3d*, *animatecurve*, *arrow*, *changecoords*, *complexplot*, *complexplot3d*, *conformal*, *conformal3d*, *contourplot*, *contourplot3d*, *coordplot*, *coordplot3d*, *densityplot*, *display*, *dualaxisplot*, *fieldplot*, *fieldplot3d*, *gradplot*, *gradplot3d*, *implicitplot*, *implicitplot3d*, *inequal*, *interactive*, *interactiveparams*, *intersectplot*, *listcontplot*, *listcontplot3d*, *listdensityplot*, *listplot*, *listplot3d*, *loglogplot*, *logplot*, *matrixplot*, *multiple*, *odeplot*, *pareto*, *plotcompare*, *pointplot*, *pointplot3d*, *polarplot*, *polygonplot*, *polygonplot3d*, *polyhedra_supported*, *polyhedraplot*, *rootlocus*, *semilogplot*, *setcolors*, *setoptions*, *setoptions3d*, *spacecurve*, *sparsematrixplot*, *surfdata*, *textplot*, *textplot3d*, *tubeplot*] **(4.1)**

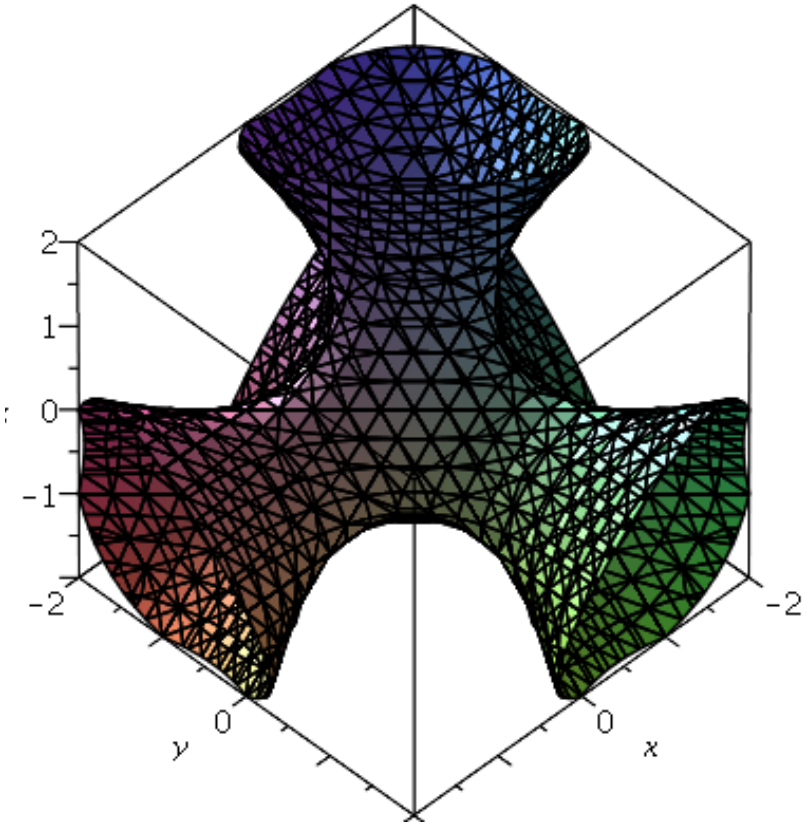
```
> implicitplot(x^2+y^2=1,x=-1..1,y=-1..1);
```



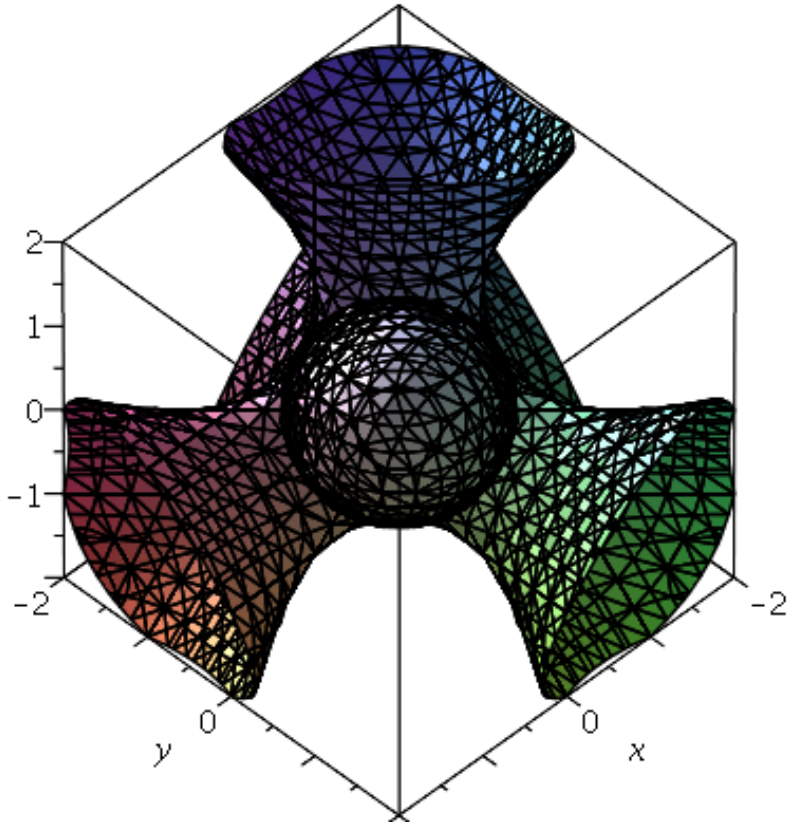

```
> implicitplot((x^2+y^2-1)*(x^2+2*y^2-1),x=-1..1,y=-1..1,scaling=
  constrained,numpoints=20000,coloring=[green,blue],
  filledregions=true);
```




```
> implicitplot3d(x^3+y^3+z^3+1=(x+y+z+1)^3, x= -2..2,y=-2..2,z=
  -2..2,numpoints=6000);
```

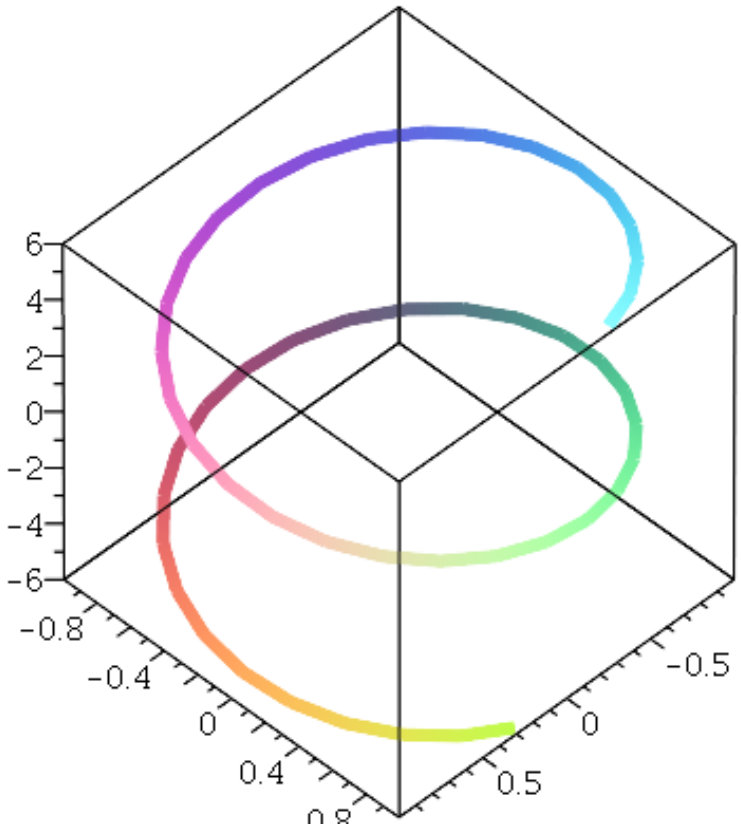



```
> implicitplot3d([x^3+y^3+z^3+1=(x+y+z+1)^3, x^2+y^2+z^2-1], x=
  -2..2,y=-2..2,z=-2..2,numpoints=6000);
```



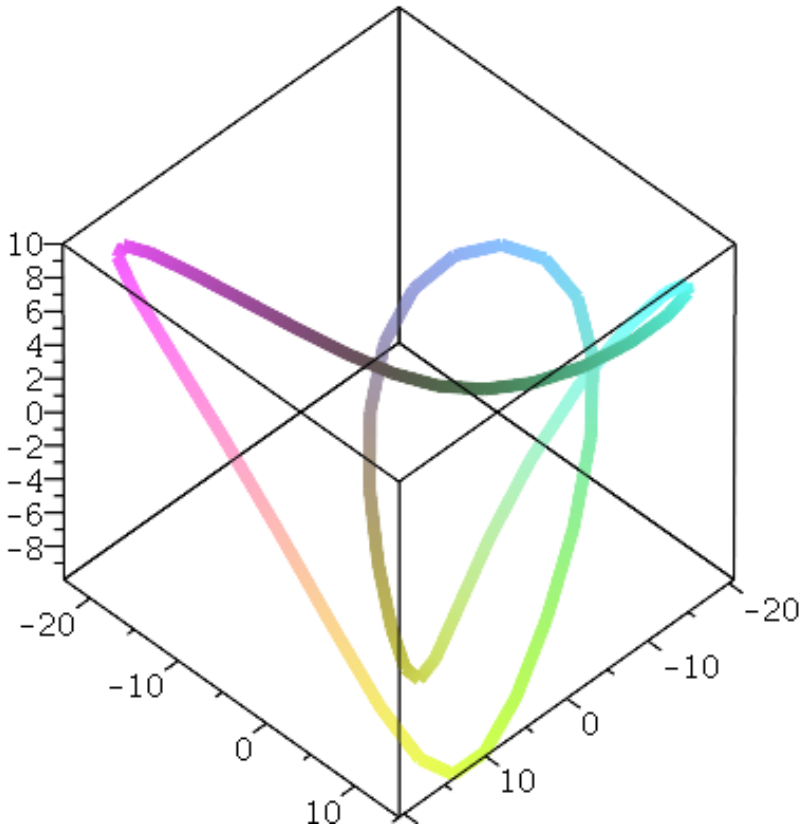

```
> spacecurve([sin(t),cos(t),t],t=-6..6,thickness=6)
```

Warning, inserted missing semicolon at end of statement




```
> knot:= [-10*cos(t)-2*cos(5*t)+15*sin(2*t), 15*cos(2*t) + 10*sin
  (t)-2*sin(5*t),10*cos(3*t)];
  spacecurve(knot,t=0..2*Pi,thickness=6);
```

$$knot := [-10\cos(t) - 2\cos(5\,t) + 15\sin(2\,t),\ 15\cos(2\,t) + 10\sin(t) - 2\sin(5\,t),\ 10\cos(3\,t)]$$

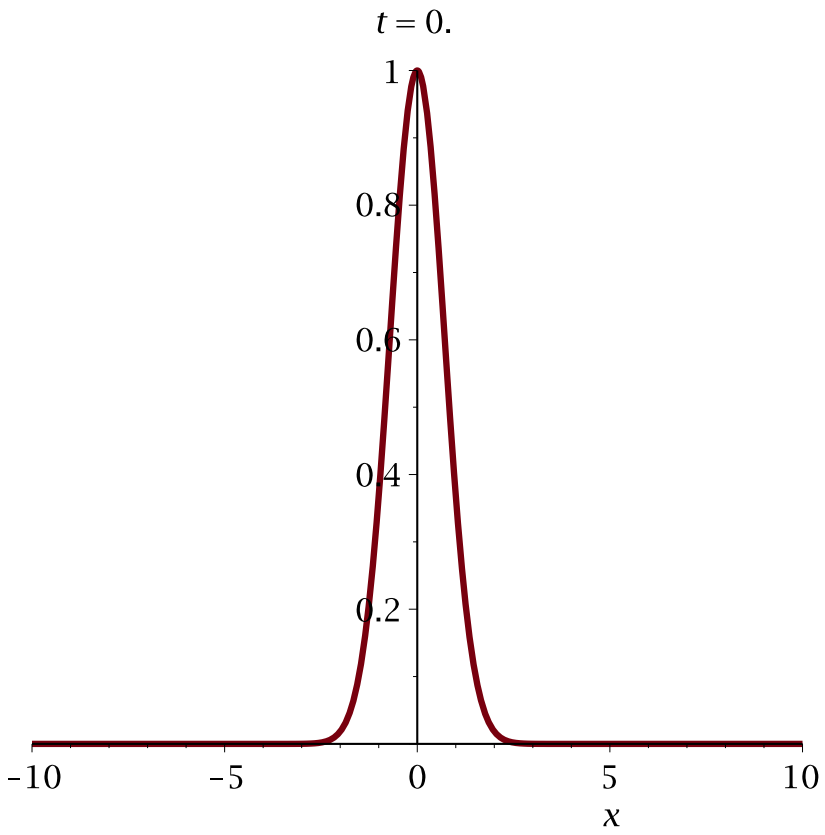


Bewegte Bilder

```
> u:=exp( -((x-t)^2));
```

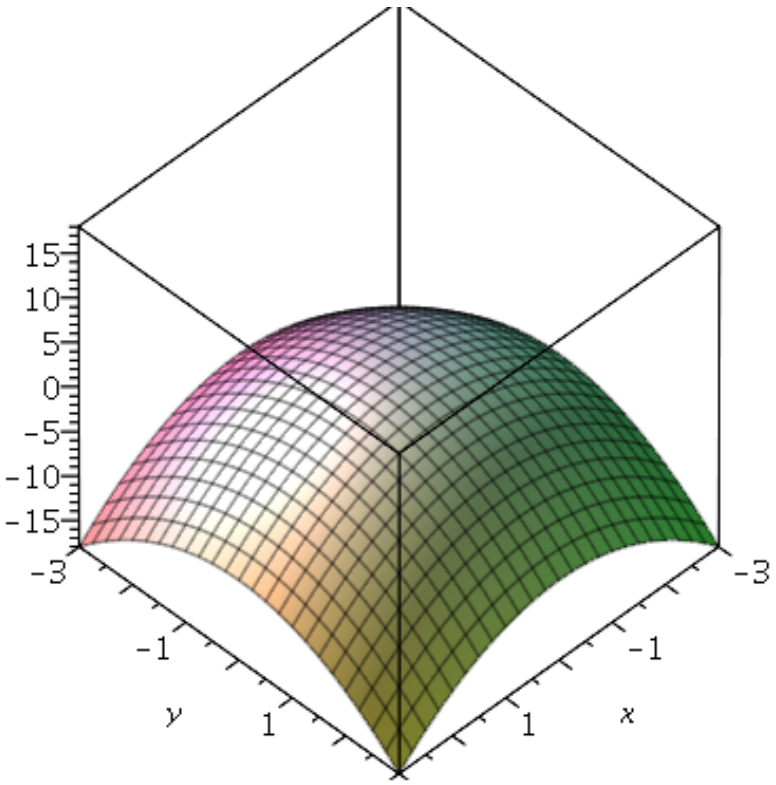
$$u := e^{-(x-t)^2} \tag{5.1}$$

```
> animate( plot, [u,x=-10..10,thickness=3],t=0..5,trace=5,frames=
  50);
```

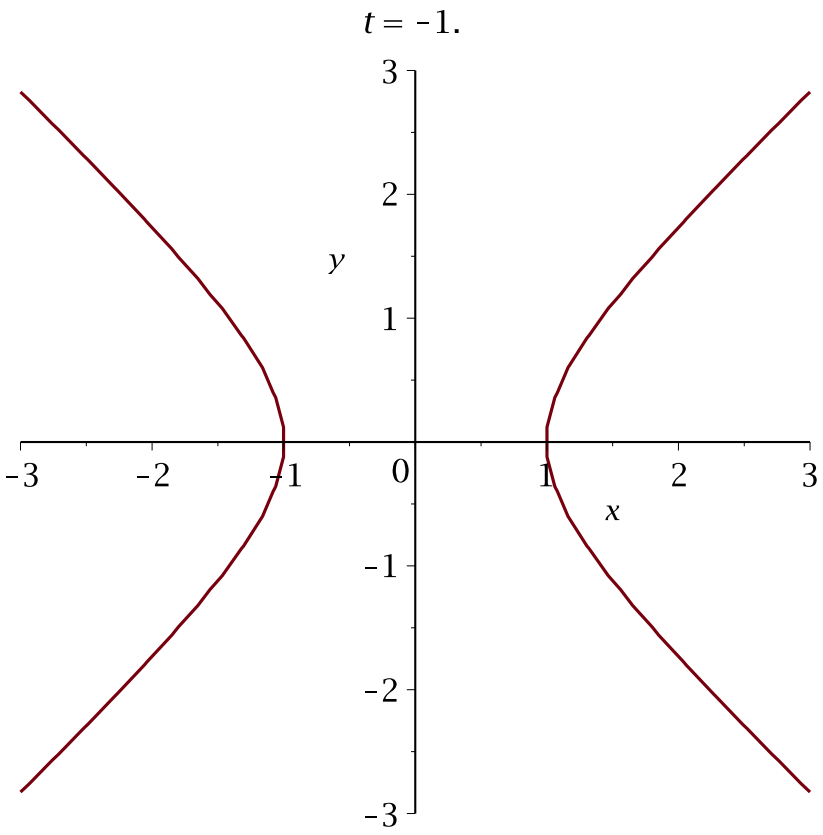



```
> animate( plot3d, [A*(x^2+y^2),x=-3..3,y=-3..3],A=-1..1);
```

$A = -1.$




```
> animate(implicitplot,[x^2+t*y^2=1,x=-3..3,y=-3..3], t=-1..1);
```



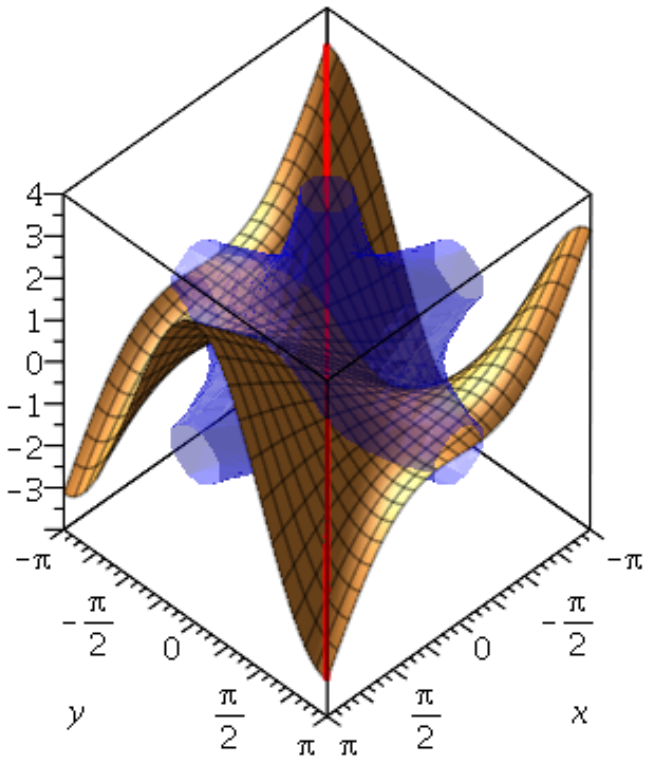
Mehrere Zeichnungen in einer Graphik

```
> with(plots):

  S := (x,y) -> sin(x)*(y/3)^2+x*cos(y):

> p1 := plot3d(S(x,y),x=-Pi..Pi,y=-Pi..Pi,color=gold):

  sc := spacecurve([t,t,S(t,-t)],t=-Pi..Pi,color=red,thickness=3)
  :
  su := implicitplot3d( x^2*z^2+y^2*x^2+z^2*y^2=4,
    x=-Pi..Pi,y=-Pi..Pi,z=-4..4,numpoints=5000,
    transparency=0.6,style=surface,color=blue):
> display([p1, sc, su], scaling = constrained);
```


4
3
2
1
0
-1
-2
-3
-π
-π/2
0
π/2
π
y
-π
-π/2
0
π/2
π
x