2.4 Spezialfälle und Veranschaulichung von Funktionen f : U ⊂ R^n -> R^m

- **2.4.(i) Kurven (n=1)**
- **m = 2; Ebene Kurven**

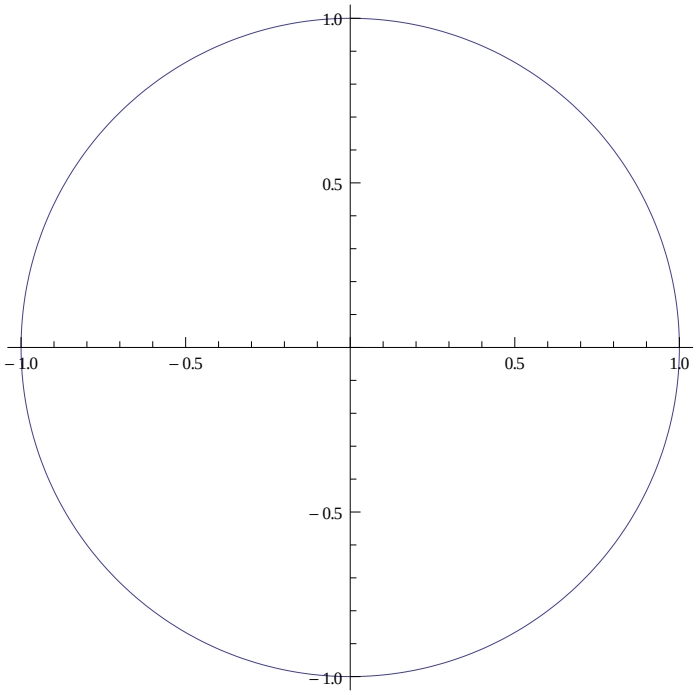
Der Befehl zum Plotten von Kurven im R^2 (ebenen Kurven) heisst ParametricPlot

In[1]:=
```
? ParametricPlot
```

ParametricPlot[{f_x, f_y}, {u, u_{min}, u_{max}}] generates a parametric plot of a curve with x and y coordinates f_x and f_y as a function of u.
ParametricPlot[{{f_x, f_y}, {g_x, g_y}, ...}, {u, u_{min}, u_{max}}] plots several parametric curves.
ParametricPlot[{f_x, f_y}, {u, u_{min}, u_{max}}, {v, v_{min}, v_{max}}] plots a parametric region.
ParametricPlot[{{f_x, f_y}, {g_x, g_y}, ...}, {u, u_{min}, u_{max}}, {v, v_{min}, v_{max}}] plots several parametric regions. ≫

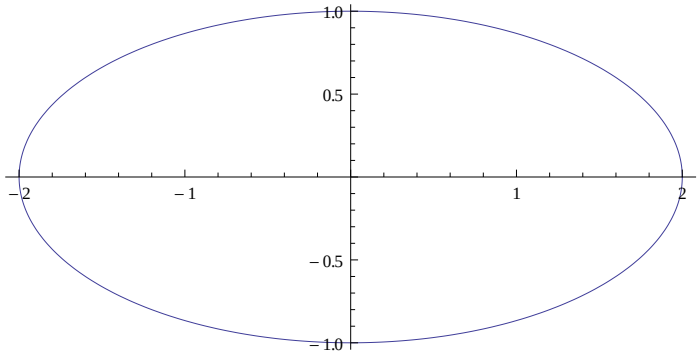
In[2]:=
```
c[t_] := {Cos[t], Sin[t]}
ParametricPlot[c[t], {t, 0, 2 * Pi}]
```

Out[3]=



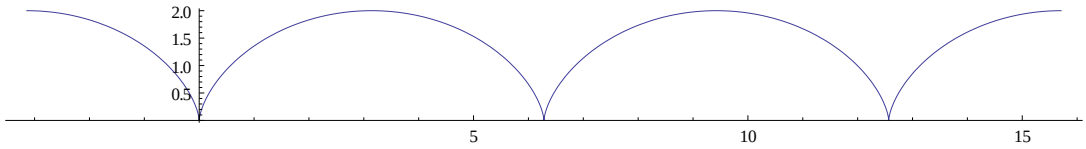
In[6]:=
```
alpha[t_] := {2 Cos[t], Sin[t]}
ParametricPlot[alpha[t], {t, 0, 2 Pi}]
```

Out[7]=



In[14]:=
```
s[t_] := {t - Sin[t], 1 - Cos[t]}
ParametricPlot[s[t], {t, -Pi, 5 Pi}]
```

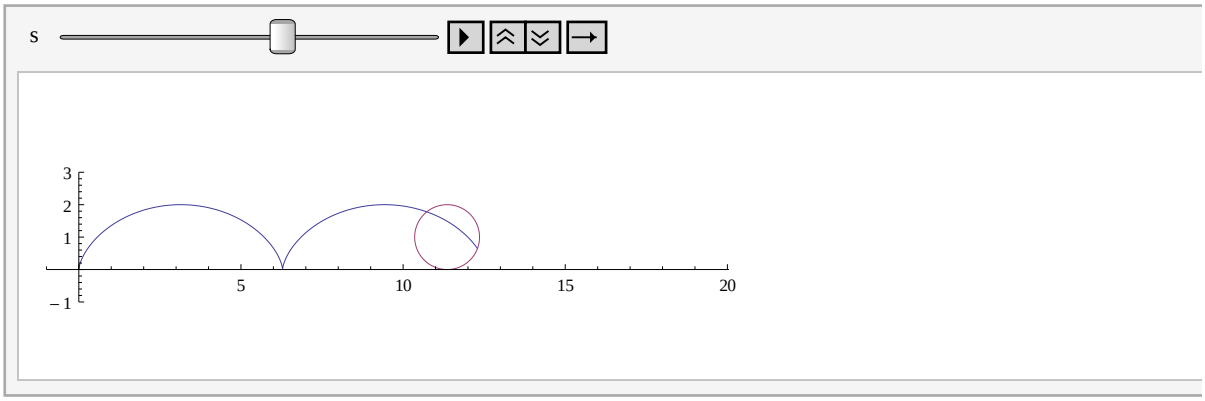
Out[15]=



Eine Animation zur Enstehung der Zykloide als Rollkurve : Die Zykloide beschreibt die Bewegung eines Randpunktes eines rollenden Rads

In[18]:=
```
Animate[
 ParametricPlot[{{s t / (2 Pi) - Sin[s t / (2 Pi)], 1 - Cos[s t / (2 Pi)]}, {s + Cos[t], 1 + Sin[t]}},
  {t, 0, 2 Pi}, AspectRatio → Automatic, (*same scale for x-and y-axis*)
  PlotRange → {{-1, 6 Pi + 1.2}, {-1, 3}}], (*same range for all frames*){s, 0, 6 Pi}]
```

Out[18]=



■ m = 3; Raumkurven

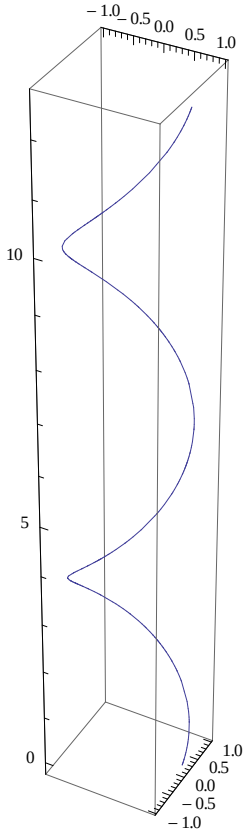
Der Befehl zum Plotten von Kurven im R^3 (Raumkurven) heisst ParametricPlot3D

In[24]:=
```
? ParametricPlot3D
```

ParametricPlot3D[{f_x, f_y, f_z}, {u, u_{min}, u_{max}}] produces a three-dimensional space curve parametrized by a variable u which runs from u_{min} to u_{max}.
ParametricPlot3D[{f_x, f_y, f_z}, {u, u_{min}, u_{max}}, {v, v_{min}, v_{max}}] produces a three-dimensional surface parametrized by u and v.
ParametricPlot3D[{{f_x, f_y, f_z}, {g_x, g_y, g_z} ...} ...] plots several objects together. ≫

In[25]:=
```
c[t_] := {Cos[t], Sin[t], t}
ParametricPlot3D[c[t], {t, 0, 4 Pi}]
```

Out[26]=



■ 2.4 (ii) Landschaften (n=2, m=1)

Ber Basisbefehl zum Plotten des Graphen einer Funktion U ⊂ R ^ 2 → R lautet Plot3D, der Befehl zur Darstellung der Höhenschichtlininen CountourPlot

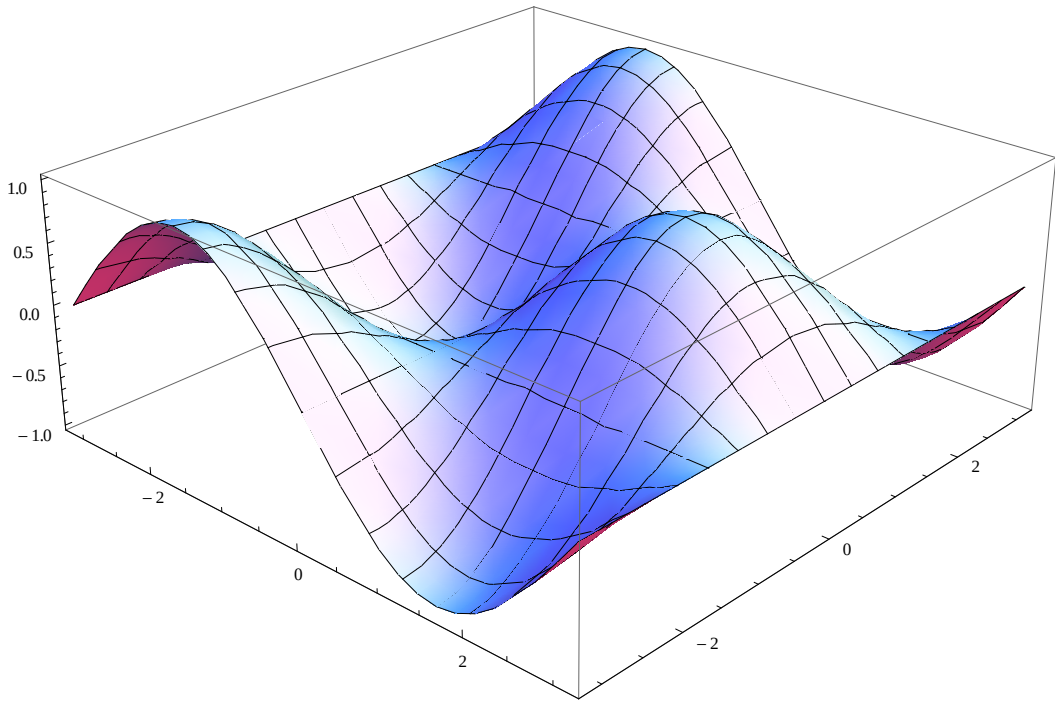
In[31]:=
```
? Plot3D
? ContourPlot
```

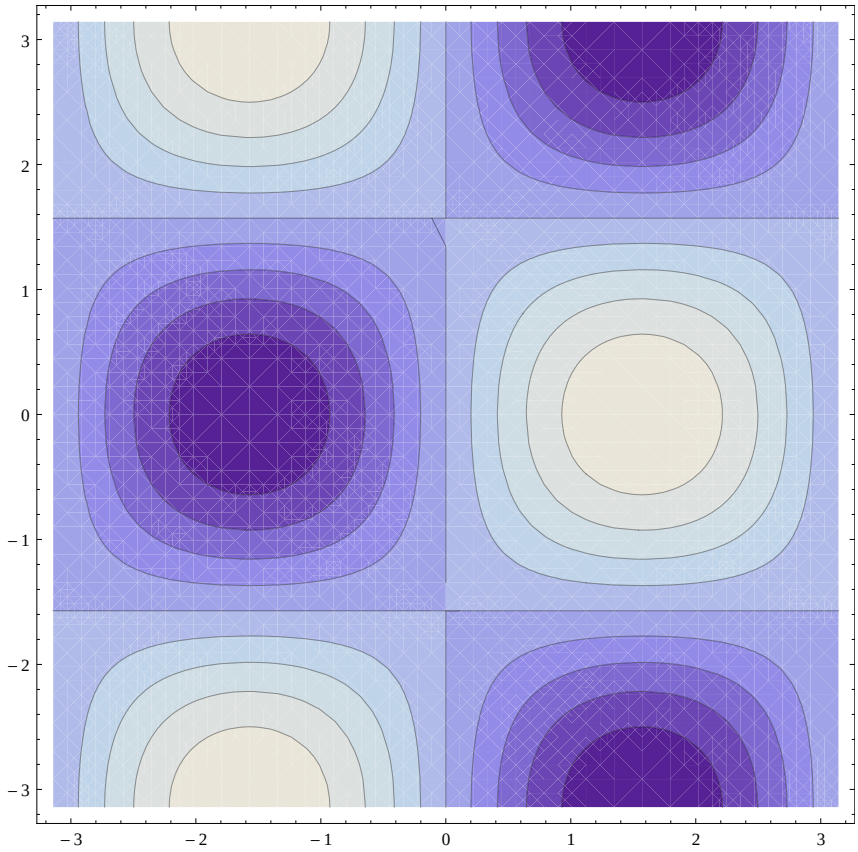
Plot3D[f , {x , x_min , x_max} , {y , y_min , y_max}]
generates a three−dimensional plot of f as a function of x and y.
Plot3D[{f_1, f_2, ...} , {x , x_min , x_max} , {y , y_min , y_max}] plots several functions. ≫

ContourPlot[f , {x , x_min , x_max} , {y , y_min , y_max}] generates a contour plot of f as a function of x and y.
ContourPlot[f == g , {x , x_min , x_max} , {y , y_min , y_max}] plots contour lines for which f = g.
ContourPlot[{f_1 == g_1, f_2 == g_2, ...} , {x , x_min , x_max} , {y , y_min , y_max}] plots several contour lines. ≫

In[48]:=
```
f[x_, y_] := Sin[x] * Cos[y]
Plot3D[f[x, y], {x, -Pi, Pi}, {y, -Pi, Pi}]
ContourPlot[f[x, y], {x, -Pi, Pi}, {y, -Pi, Pi}]
```

Out[49]=





2.4 (iii) Vektorfelder (n=m)

n = 2 = m

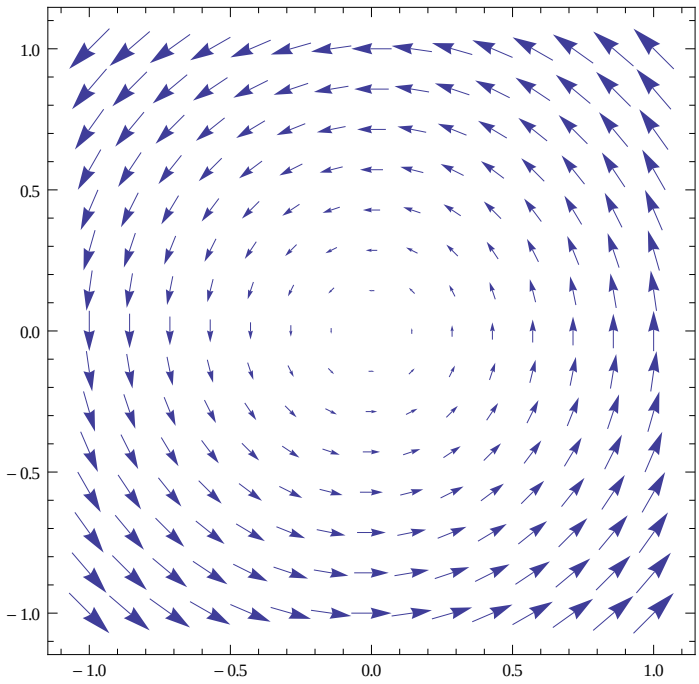
Der Basisbefehl zum Plotten von Vektorfeldern im R^2 lautet VectorPlot.

In[51]:=
```
? VectorPlot
```

VectorPlot[{v_x, v_y}, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}]
generates a vector plot of the vector field {v_x, v_y} as a function of x and y.
VectorPlot[{{v_x, v_y}, {w_x, w_y}, ...}, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}] plots several vector fields. ≫

In[52]:=
```
v[x_, y_] := {-y, x}
VectorPlot[v[x, y], {x, -1, 1}, {y, -1, 1}]
```

Out[53]=



n = 3 = m

In[54]:=
```
Vektorfelder im R^3 werden von (erraten!) VectorPlot3D erzeugt.
? VectorPlot3D
```

VectorPlot3D[{v_x, v_y, v_z}, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}, {z, z_{min}, z_{max}}]
generates a 3D vector plot of the vector field {v_x, v_y, v_z} as a function of x, y and z.
VectorPlot3D[{$field_1$, $field_2$, ...}, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}, {z, z_{min}, z_{max}}]
plots several vector fields. ≫

Out[54]=
```
im R^3 VectorPlot3D Vektorfelder von werden erzeugt.Null erraten!
```

In[55]:=
```
w[x_, y_, z_] := {x, y, z}
VectorPlot3D[w[x, y, z], {x, -1, 1}, {y, -1, 1}, {z, -1, 1}]
```

Out[56]=