Bilder zu Divergenz und Rotation

Buch:Höhere Mathematik sehen und verstehen, Haftendorn, Riebeseh l, Dammer, Springer Spektrum, Feb. 2021

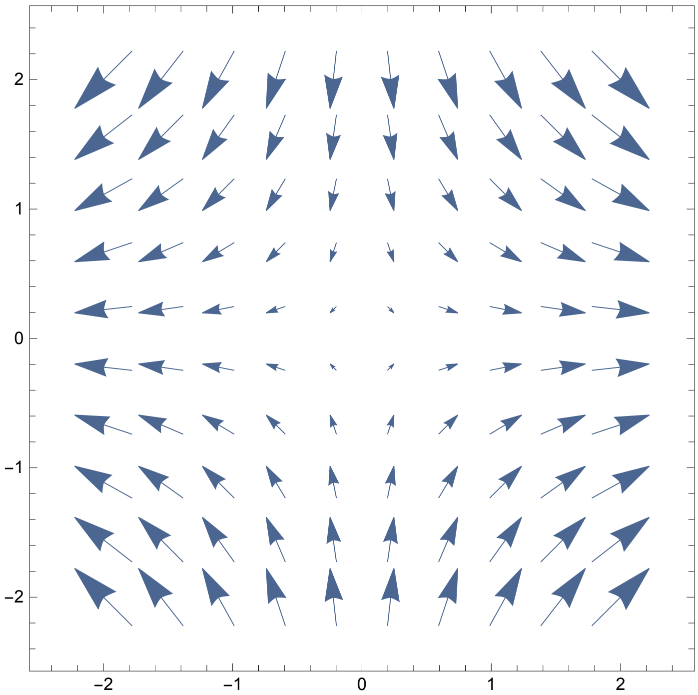
Datei Bilder Div Curl.nb zu Abschnitt 3.2.5 Seite 244, Abb. 3.16, 3.20 und 3.22

Div = Rot = 0

In[∘]:=
```
F = {x, -y};
```

In[∘]:=
```
d0r0 = VectorPlot[F, {x, -2, 2}, {y, -2, 2}, VectorPoints → 10]
```

Out[∘]=




```
Div[F, {x, y}]
```

```
0
```

```
Curl[F, {x, y}]
```

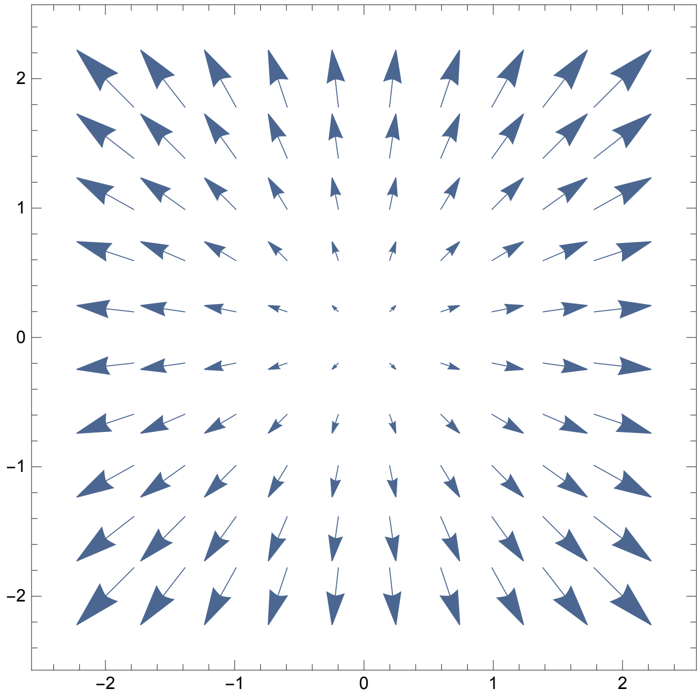
```
0
```

Div ≠0, Rot = 0

In[∘]:=
```
F = {x, y};
```

In[ ]:=
```
d2r0 = VectorPlot[F, {x, -2, 2}, {y, -2, 2}, VectorPoints → 10]
```

Out[ ]=




```
Div[F, {x, y}]
```

2

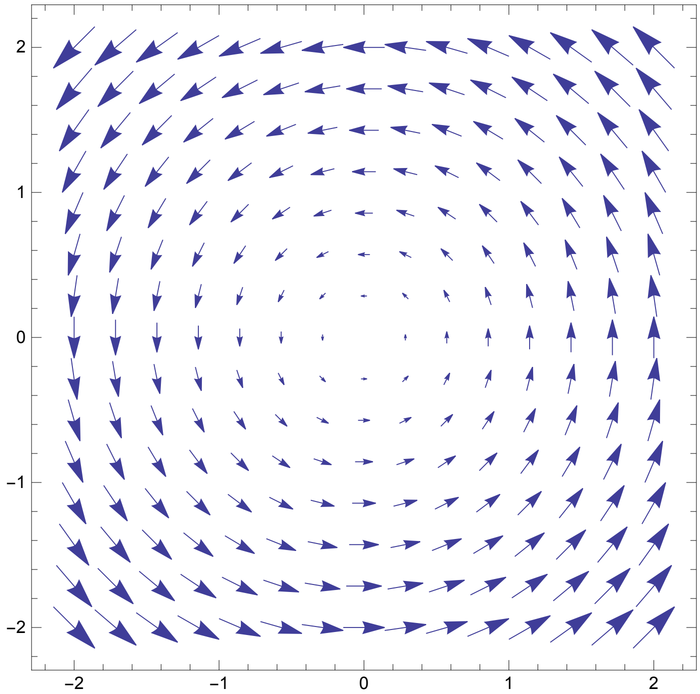
```
Curl[F, {x, y}]
```

0

Div = 0, Rot ≠ 0

```
F = {-y, x};
```

```
d0r2 = VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}]
```

0

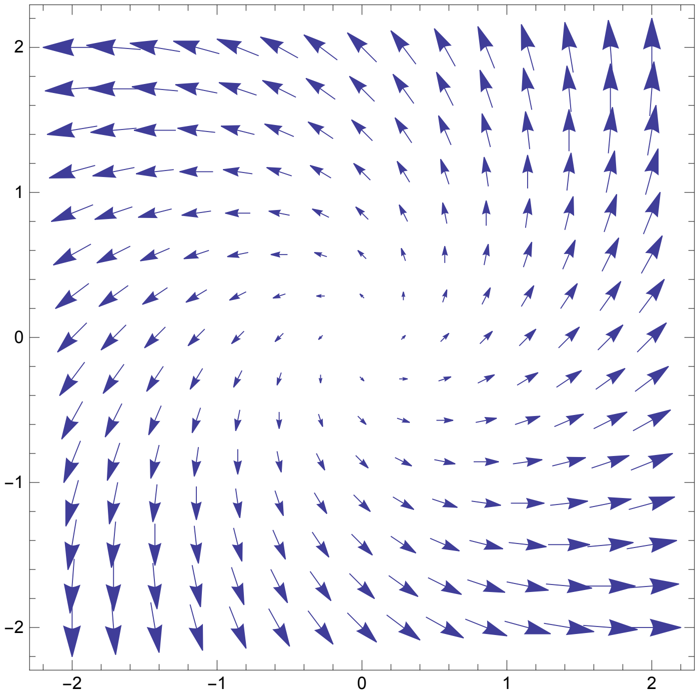
```
Curl[F, {x, y}]
```

2

Div ≠ 0, Rot ≠ 0

```
F = {-y + x, x + y};
```

```
d2r2 = VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```



```
Div[F, {x, y}]
```

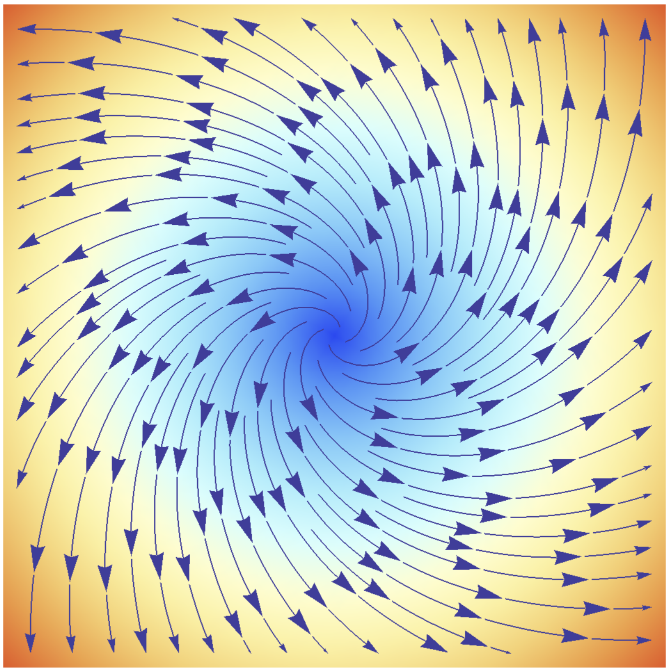
2

```
Curl[F, {x, y}]
```

2

```
ColorData["Gradients"];
```

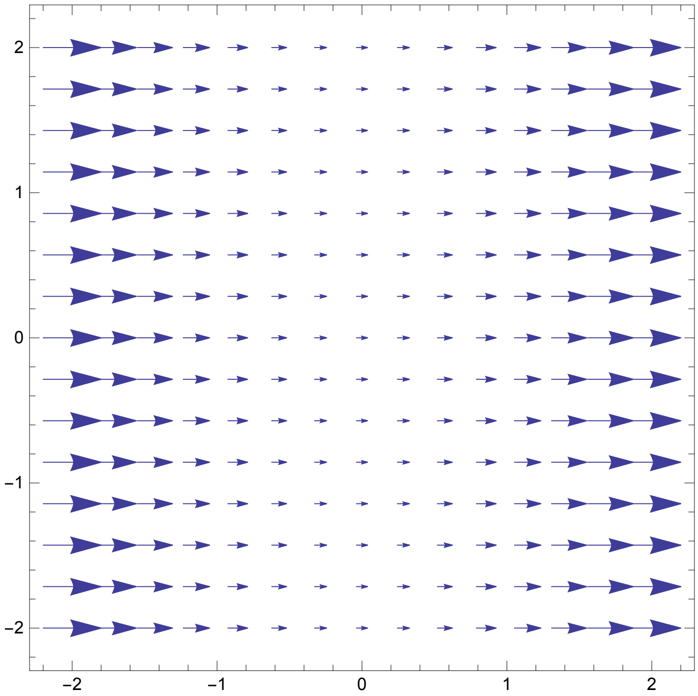
```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```



Div wechselt von negativ auf positiv

```
F = {1 + x^2, 0};
```

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}]
```

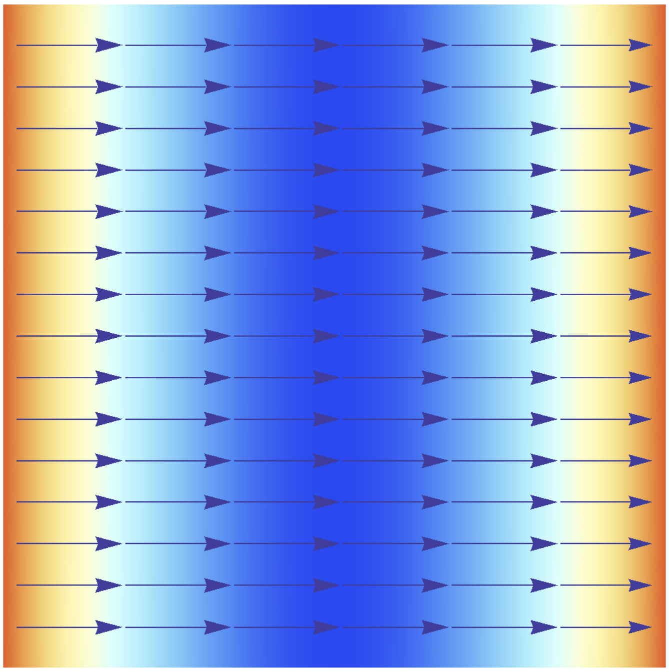
2 x

```
Curl[F, {x, y}]
```

0

```
ColorData["Gradients"];
```

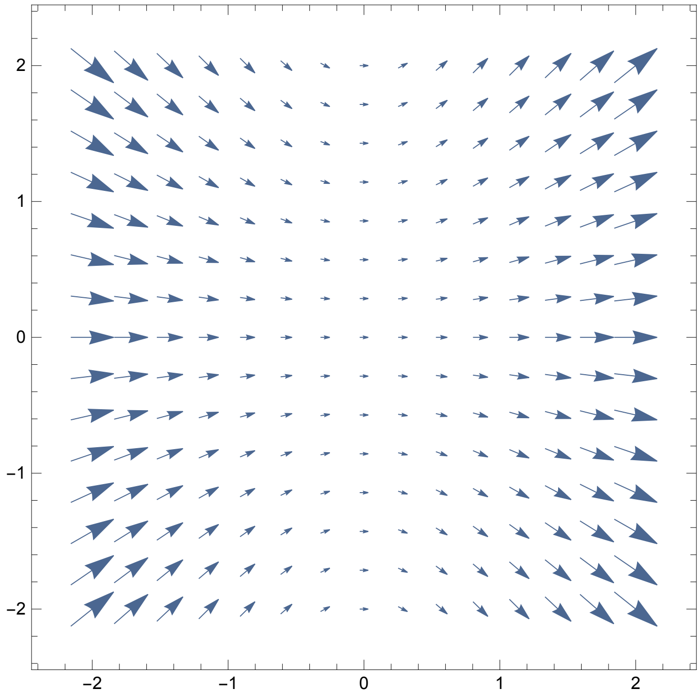
```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```



● Div wechselt von negativ auf positiv, interessanter

```
F = {x² + 1, y x};
```

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}]
```

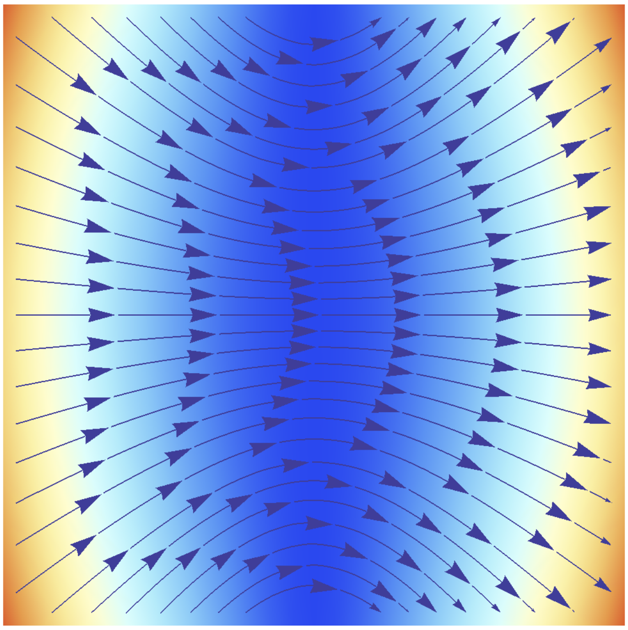
3 x

```
Curl[F, {x, y}]
```

y

```
ColorData["Gradients"];
```

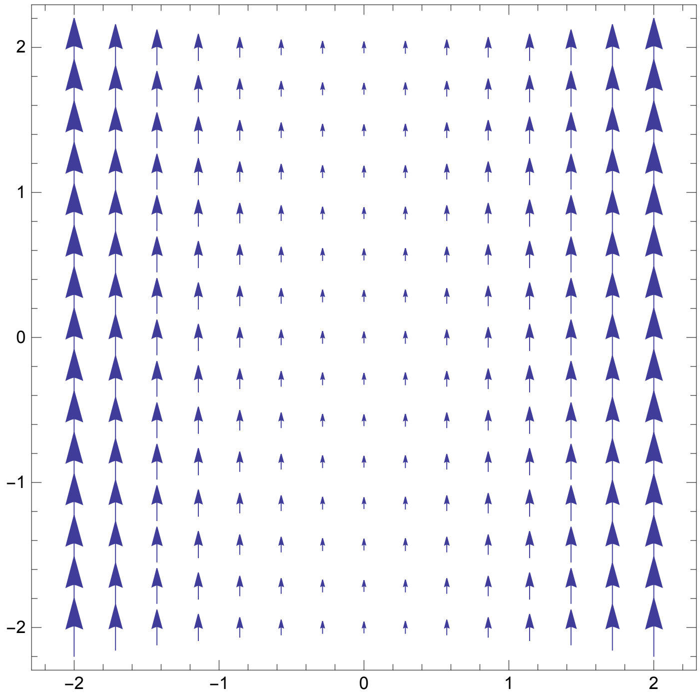
```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```



- Curl wechselt von negativ auf positiv

```
F = {0, 1 + x^2};
```

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}]
```

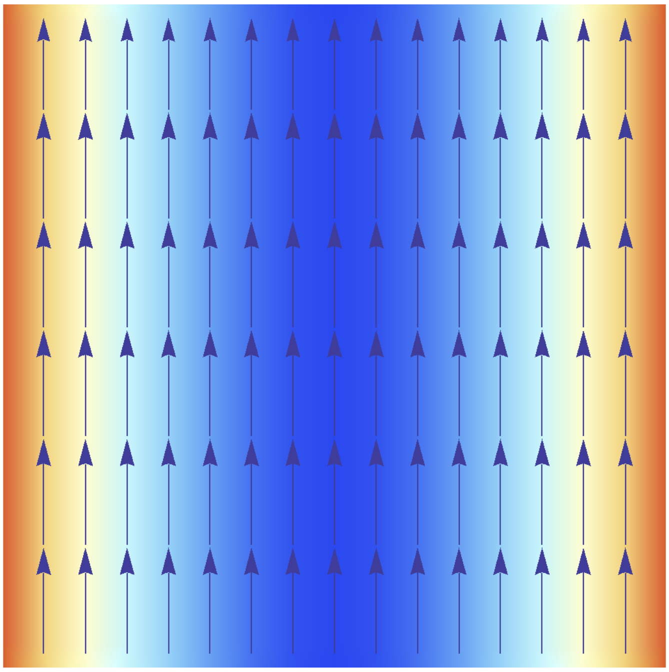
0

```
Curl[F, {x, y}]
```

2 x

```
ColorData["Gradients"];
```

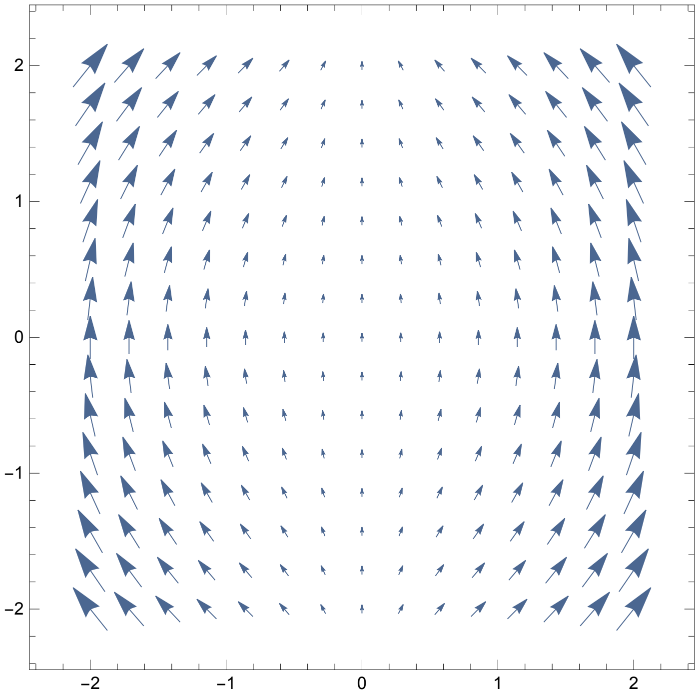
```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```



Curl wechselt von negativ auf positiv, interessanter

```
F = {-y x, x^2 + 1};
```

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}]
```

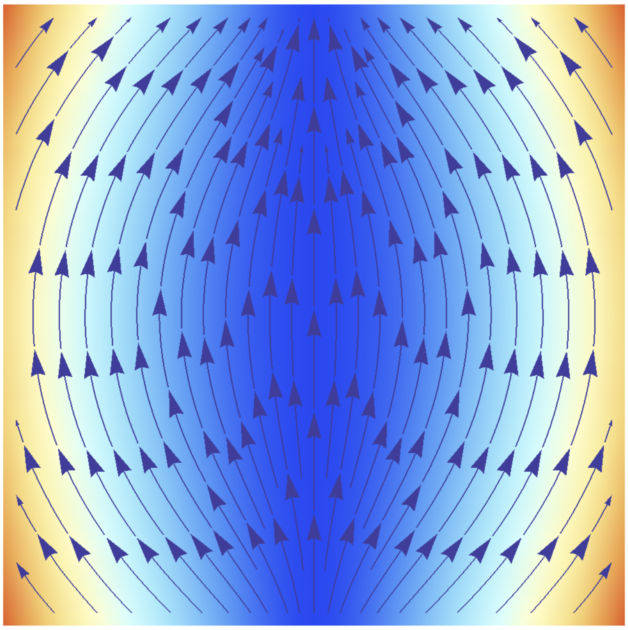
$-y$

```
Curl[F, {x, y}]
```

$3\,x$

```
ColorData["Gradients"];
```

```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```



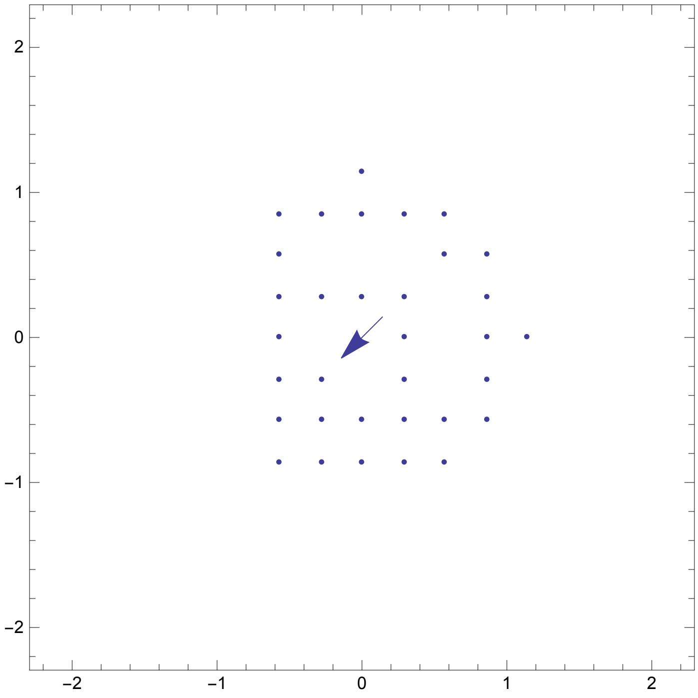
- Sieht aus, als wäre Rotation vorhanden, ist es aber nicht!

$$\text{Grad}\left[\frac{1}{2}\,\text{Log}\left[x^2 + y^2\right],\ \{x, y\}\right]$$

$$\left\{\frac{x}{x^2 + y^2},\ \frac{y}{x^2 + y^2}\right\}$$

$$F = \{x, y\}\ \frac{1}{x^2 + y^2};$$

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}]
```




```
Div[F, {x, y}] // Simplify
```

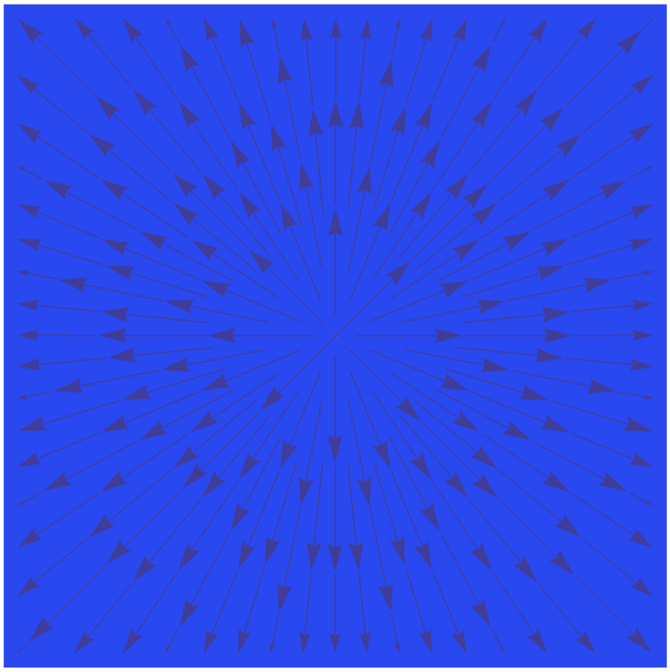
0

```
Curl[F, {x, y}]
```

0

```
ColorData["Gradients"];
```

```
StreamDensityPlot[F, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "LightTemperatureMap", Frame → False, StreamScale → Medium]
```

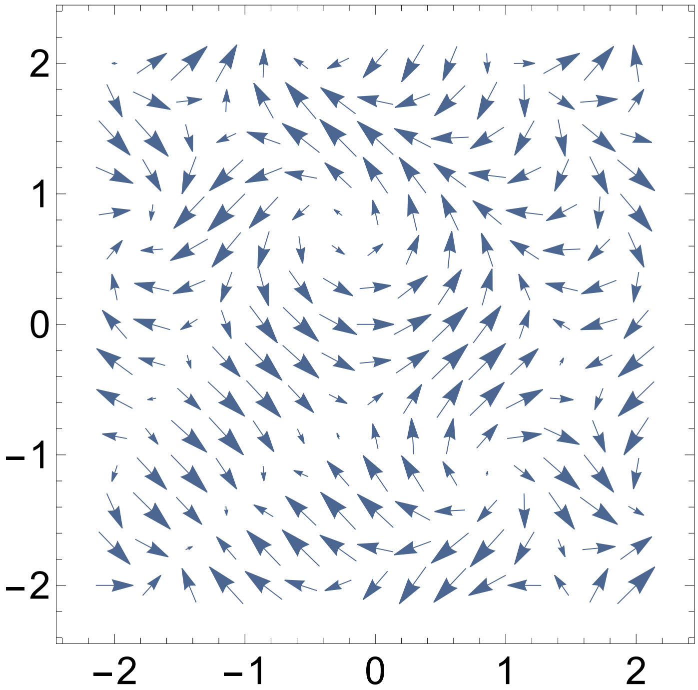


Komplizierteres mit Div ≠ 0, Rot ≠ 0

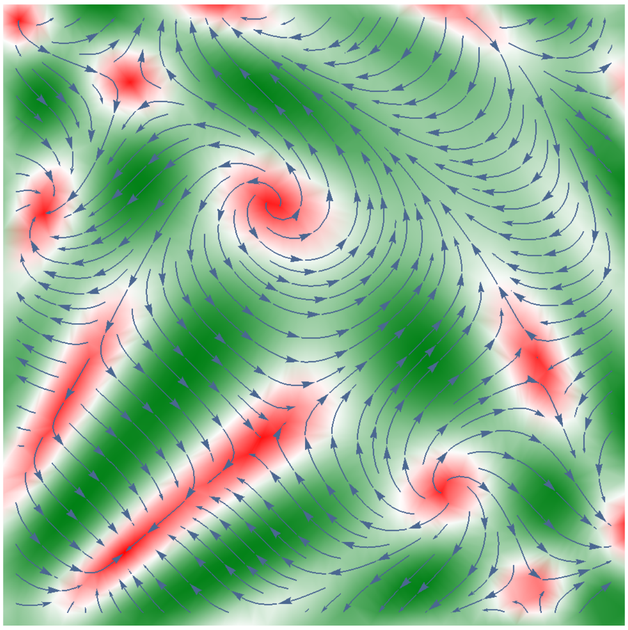
```
F = {Cos[x + y^3], Sin[y + x^3]};

F = {Cos[x + y^3], Sin[y^2 + 2 x]};

F = {Cos[x^2 + 2 y], Sin[y^2 + 2 x]};

F[x, y] // TeXForm
```

```
\left\{\cos \left(x^2+2 y\right),\sin \left(2 x+y^2\right)\right\}(x,y)
```

```
VectorPlot[F, {x, -2, 2}, {y, -2, 2}, BaseStyle → FontSize → 20]
```



```
StreamDensityPlot[{F, Norm[F[x, y]]} // Evaluate, {x, -2, 2}, {y, -2, 2},
 ColorFunction → "RedGreenSplit", Frame → False, StreamPoints → Fine]
```



```
Div[F, {x, y}]
```

$2\,y\cos\left[2\,x + y^2\right] - 2\,x\sin\left[x^2 + 2\,y\right]$

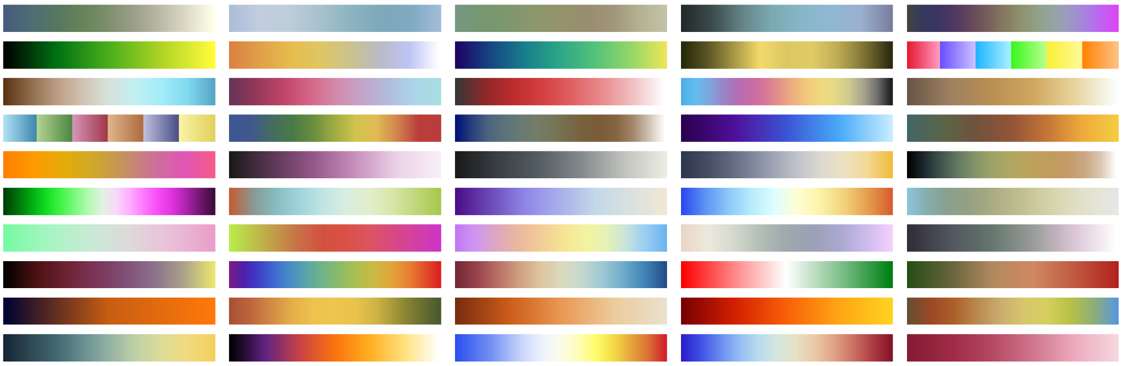
```
Curl[F, {x, y}]
```

$2\cos\left[2\,x + y^2\right] + 2\sin\left[x^2 + 2\,y\right]$

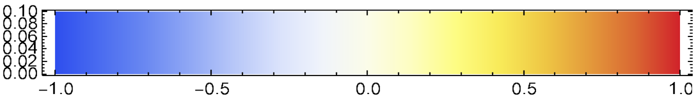
```
Partition[ColorData["Gradients"], 5] // MatrixForm
```

AlpineColors	Aquamarine	ArmyColors	AtlanticColors	AuroraColors
AvocadoColors	BeachColors	BlueGreenYellow	BrassTones	BrightBands
BrownCyanTones	CandyColors	CherryTones	CMYKColors	CoffeeTones
DarkBands	DarkRainbow	DarkTerrain	DeepSeaColors	FallColors
FruitPunchColors	FuchsiaTones	GrayTones	GrayYellowTones	GreenBrownTerrain
GreenPinkTones	IslandColors	LakeColors	LightTemperatureMap	LightTerrain
MintColors	NeonColors	Pastel	PearlColors	PigeonTones
PlumColors	Rainbow	RedBlueTones	RedGreenSplit	RoseColors
RustTones	SandyTerrain	SiennaTones	SolarColors	SouthwestColors
StarryNightColors	SunsetColors	TemperatureMap	ThermometerColors	ValentineTones

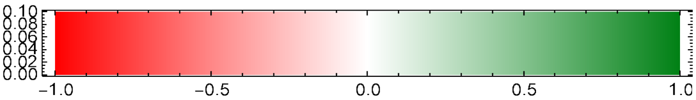
```
Grid[
 Partition[Show[ColorData[#, "Image"], ImageSize → 110] & /@ ColorData["Gradients"], 5],
 Spacings → .5]
```



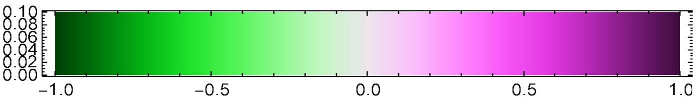
```
DensityPlot[x, {x, -1, 1}, {y, 0, 0.1},
 ColorFunction → "TemperatureMap", AspectRatio → 0.1]
```



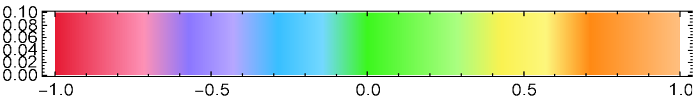

```
DensityPlot[x, {x, -1, 1}, {y, 0, 0.1},
 ColorFunction → "RedGreenSplit", AspectRatio → 0.1]
```



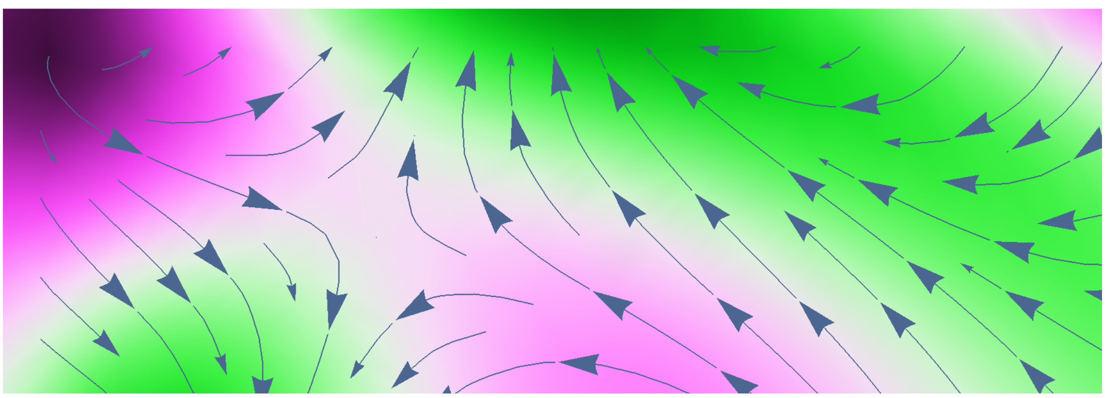

```
DensityPlot[x, {x, -1, 1}, {y, 0, 0.1},
 ColorFunction → "GreenPinkTones", AspectRatio → 0.1]
```

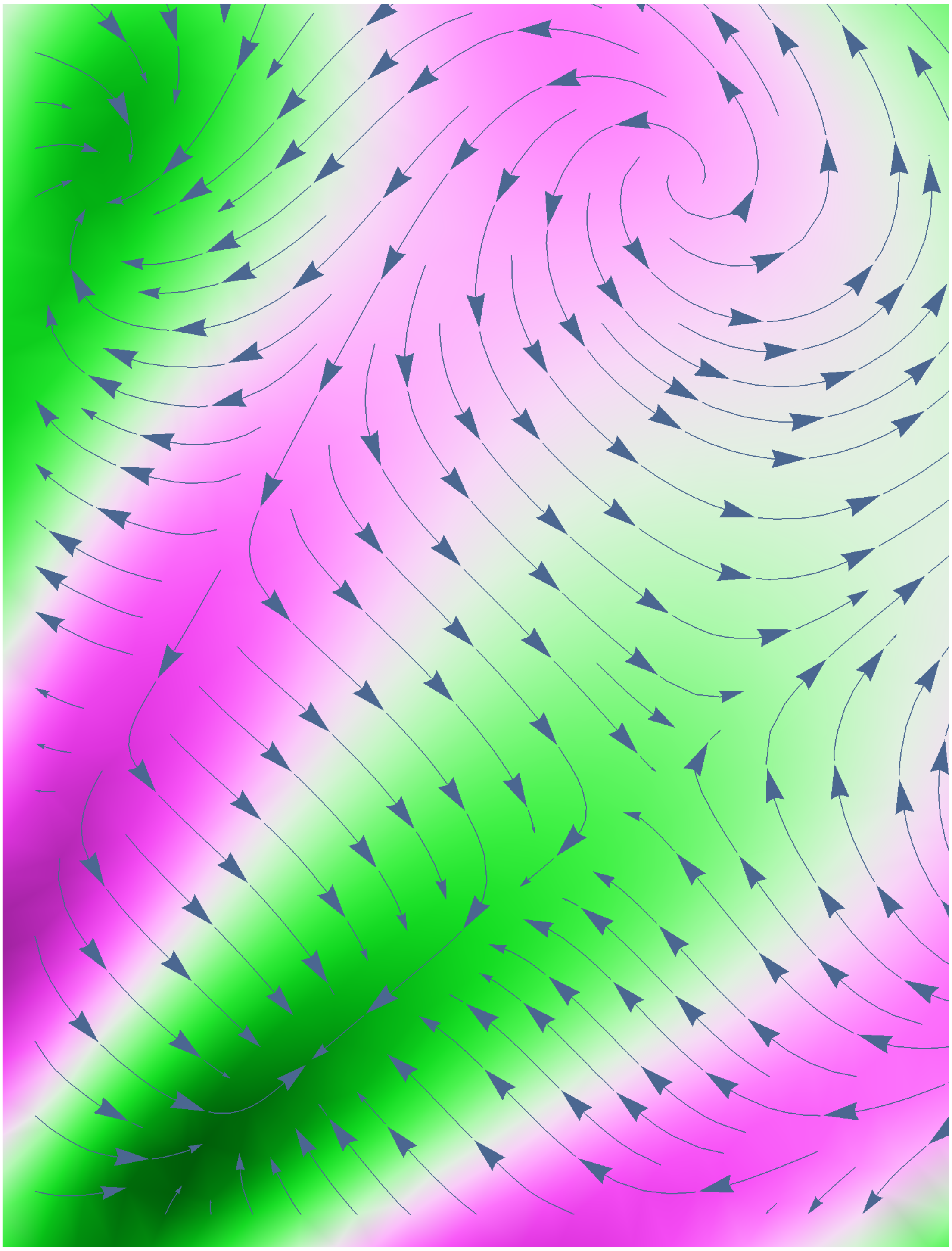



```
DensityPlot[x, {x, -1, 1}, {y, 0, 0.1}, ColorFunction → "BrightBands", AspectRatio → 0.1]
```




```
divplot = StreamDensityPlot[{F, Div[F, {x, y}]} // Evaluate, {x, -2, 2}, {y, -2, 2},
  ColorFunction → "GreenPinkTones", Frame → False, StreamPoints → Fine]
```





```
curlplot = StreamDensityPlot[{F, Curl[F, {x, y}]} // Evaluate, {x, -2, 2},
  {y, -2, 2}, ColorFunction → "TemperatureMap", Frame → False, StreamPoints → Fine]
```