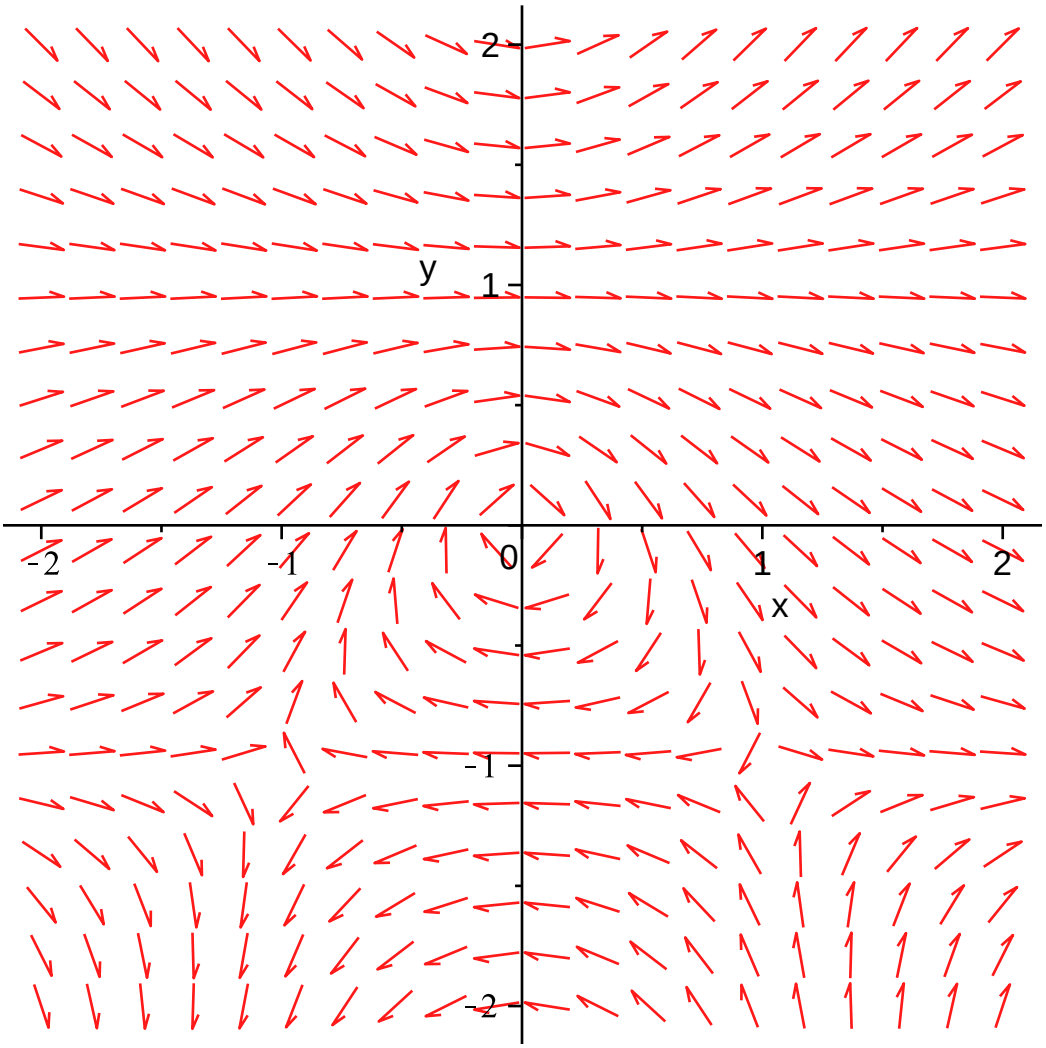
```
> with(DEtools):
> DE:= [D(x)(t) = x(t)^2 + y(t), D(y)(t) = x(t)*(y(t)^2 -1 )];
```

$$DE := [\mathrm{D}(x)(t) = x(t)^2 + y(t), \mathrm{D}(y)(t) = x(t)\,(y(t)^2 - 1)] \quad (1)$$

```
> DEplot(DE,[x,y], t=-4..4,
  x=-2..2, y=-2..2);
```



Doing this a "too hard" way.

want to solve for the fixed points.

To make life hard, get maple to get F(x,y):= [x^2+y, x*(y^2-1)]

```
> DE;
```

$$[\mathrm{D}(x)(t) = x(t)^2 + y(t), \mathrm{D}(y)(t) = x(t)\,(y(t)^2 - 1)] \quad (2)$$

```
> subs( {x(t)=X, y(t)=Y} , DE);
```

$$[\mathrm{D}(x)(t) = X^2 + Y, \mathrm{D}(y)(t) = X\,(Y^2 - 1)] \quad (3)$$

```
> rhs( "yo mama" = "so fat");
```

"so fat" (4)

```
> lhs( "yo mama" = "so fat");
```

(5)

"yo mama" (5)

```
> stuff:=[1, 3, 2.6, 6, 9];
```

$$stuff := [1, 3, 2.6, 6, 9] \quad (6)$$

```
> f:=x->x^2-2;
```

$$f := x \to x^2 - 2 \quad (7)$$

```
> [seq( f(stuff[i]), i=1..nops(stuff))];
```

$$[-1, 7, 4.76, 34, 79] \quad (8)$$

```
> map(f,stuff);
```

$$[-1, 7, 4.76, 34, 79] \quad (9)$$

```
> junk:=subs( {x(t)=X, y(t)=Y} , DE);
```

$$junk := [\mathrm{D}(x)(t) = X^2 + Y, \mathrm{D}(y)(t) = X\left(Y^2 - 1\right)] \quad (10)$$

```
> map(rhs,junk);
```

$$[X^2 + Y, X\left(Y^2 - 1\right)] \quad (11)$$

unapply...

```
> f(x);
```

$$x^2 - 2 \quad (12)$$

```
> f(sin(x*y)+y^2);
```

$$\left(\sin(x\,y) + y^2\right)^2 - 2 \quad (13)$$

one way, not quite what I want

```
> g:=(x,y)->f(sin(x*y)+y^2);
```

$$g := (x, y) \to f\left(\sin(x\,y) + y^2\right) \quad (14)$$

```
> h:= unapply(f(sin(x*y)+y^2), (x,y));
```

$$h := (x, y) \to \left(\sin(x\,y) + y^2\right)^2 - 2 \quad (15)$$

```
> g(1,Pi/2);
```

$$\left(1 + \frac{1}{4}\,\pi^2\right)^2 - 2 \quad (16)$$

```
> h(1, Pi/2);
```

$$\left(1 + \frac{1}{4}\,\pi^2\right)^2 - 2 \quad (17)$$

```
> f:=x->x^3;
```

$$f := x \to x^3 \quad (18)$$

```
> g(1,Pi/2);
```

$$\left(1 + \frac{1}{4}\,\pi^2\right)^3 \quad (19)$$

```
> h(1, Pi/2);
```

$$\left(1 + \frac{1}{4}\,\pi^2\right)^2 - 2 \quad (20)$$

```
> DE;
```

$$[\mathrm{D}(x)(t) = x(t)^2 + y(t), \mathrm{D}(y)(t) = x(t)\left(y(t)^2 - 1\right)] \quad (21)$$

```
> F:=unapply(map(rhs,
              subs( {x(t)=X, y(t)=Y} , DE)),
    (X,Y));
```

$$F := (X, Y) \to [X^2 + Y, X\,(Y^2 - 1)\,] \tag{22}$$

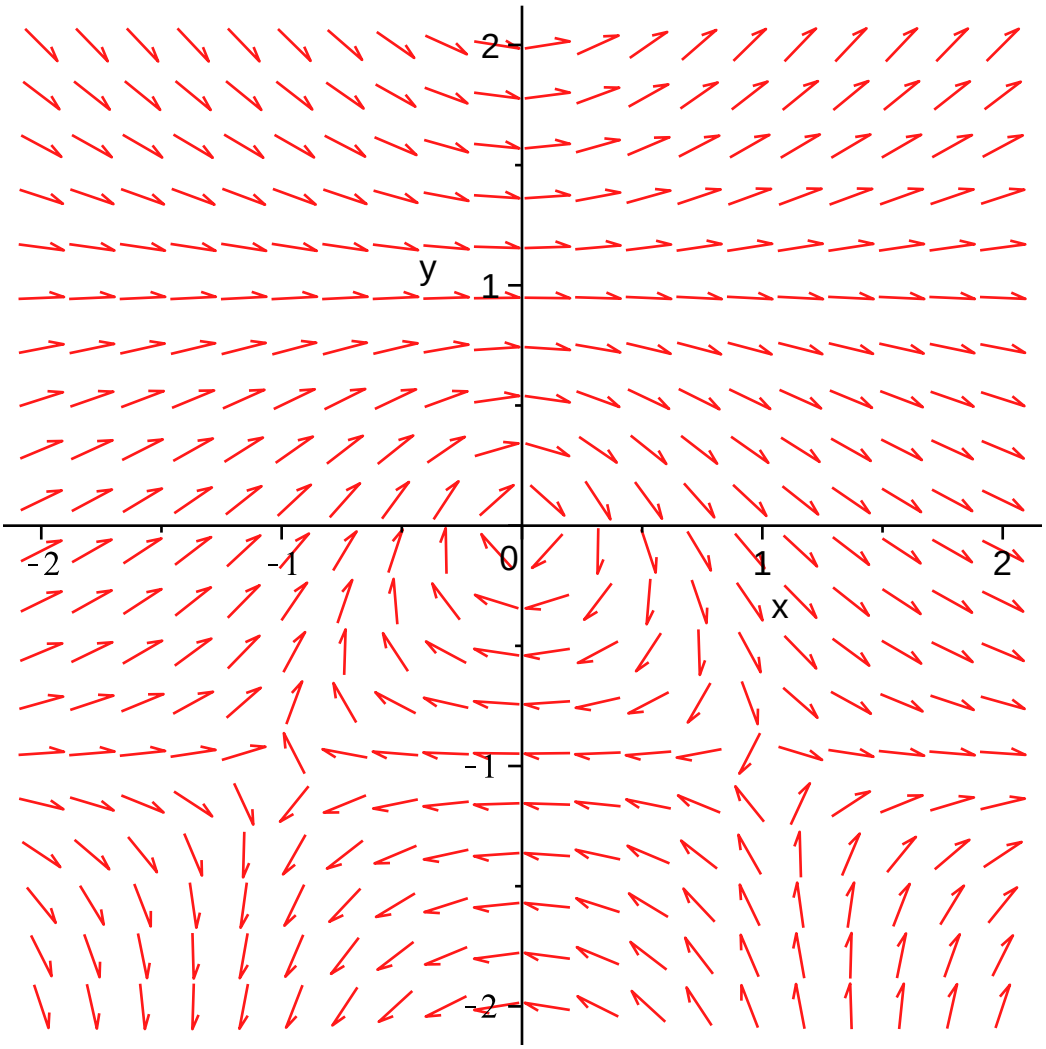
```
> F(0,0);
```

$$[0, 0] \tag{23}$$

```
> F(1,-1);
```

$$[0, 0] \tag{24}$$

```
> DEplot(DE, [x,y], t=-4..4,
  x=-2..2, y=-2..2);
```




```
> F(.01,.03);
```

$$[0.0301, -0.009991\,] \tag{25}$$

```
> F(1,-1);
```

$$[0, 0] \tag{26}$$

```
> F(1+.01, -1+.03);
```

$$[0.0501, -0.059691\,] \tag{27}$$

```
> Jacobian(F(x,y));
```

$$Jacobian\left(\left[x^2+y,\ x\left(y^2-1\right)\right]\right) \tag{28}$$

```
> with(VectorCalculus):
> Jacobian(F(x,y), [x,y]);
```

$$\begin{bmatrix} 2x & 1 \\ y^2-1 & 2xy \end{bmatrix} \tag{29}$$

```
> Jack:=unapply(Jacobian(F(x,y), [x,y]), (x,y));
```

$$Jack := (x,y) \to rtable\left(1..2,\ 1..2,\ \{(1,1)=2x,\ (1,2)=1,\ (2,1)=y^2-1,\ (2,2)=2xy\},\right.$$
$$\left.datatype=anything,\ subtype=Matrix,\ storage=rectangular,\ order=Fortran\_order\right) \tag{30}$$

```
> Jack(a,b);
```

$$\begin{bmatrix} 2a & 1 \\ b^2-1 & 2ab \end{bmatrix} \tag{31}$$

```
> Jack(0,0);
```

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \tag{32}$$

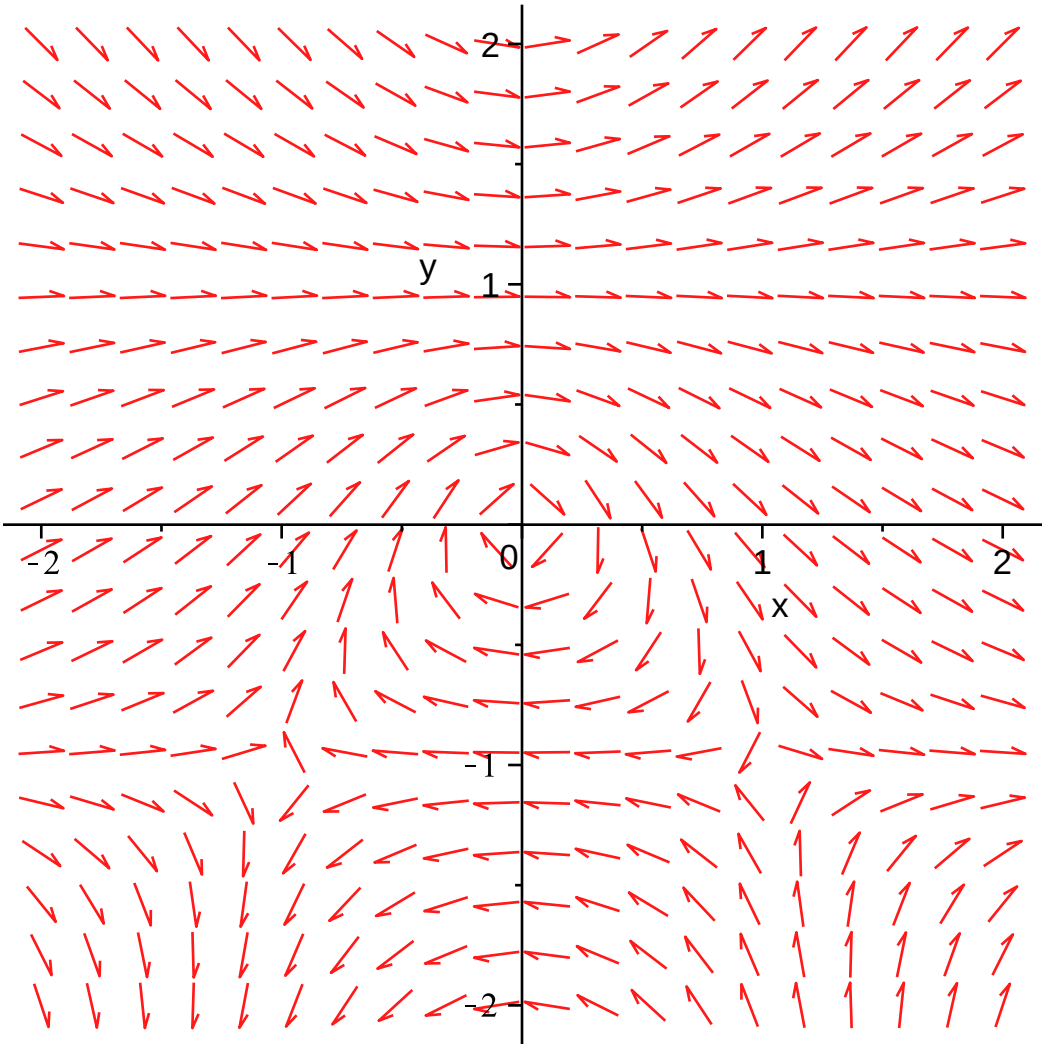
```
> Jack(-1,-1);
```

$$\begin{bmatrix} -2 & 1 \\ 0 & 2 \end{bmatrix} \tag{33}$$

```
> Jack(1,-1);
```

$$\begin{bmatrix} 2 & 1 \\ 0 & -2 \end{bmatrix} \tag{34}$$

```
> DEplot(DE, [x,y], t=-4..4,
  x=-2..2, y=-2..2);
```




```
> rand();
```

$$395718860534 \tag{35}$$

```
> r20:=rand(0..20);
```

$$r20 := \mathbf{proc}(\,)\ \mathbf{proc}(\,)\ \mathbf{option}\ builtin = RandNumberInterface;\ \ \mathbf{end\ proc}(6, 21, 5)\ \mathbf{end\ proc} \tag{36}$$

```
> r20();
```

$$5 \tag{37}$$

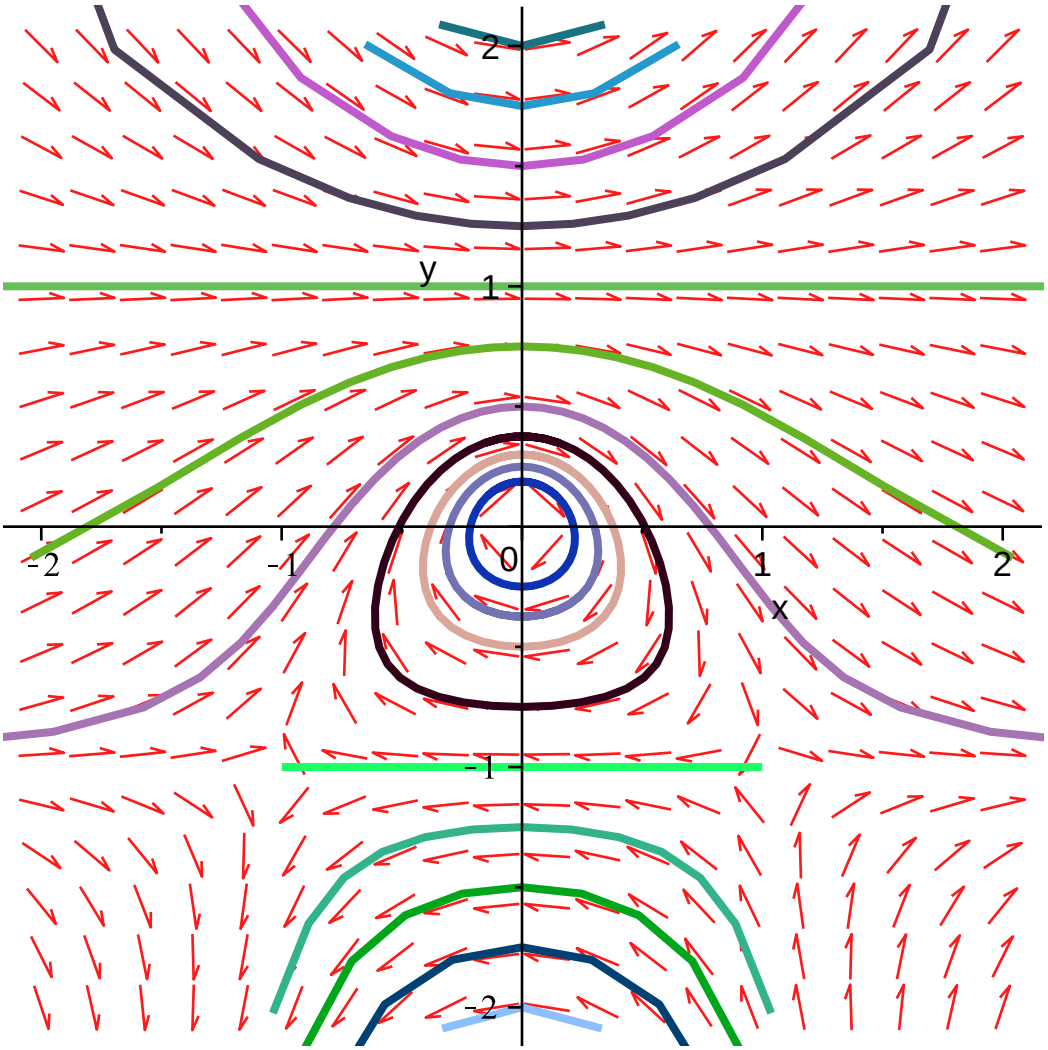
```
> RandCol:=()->COLOR(RGB, r20()/20.0, r20()/20.0, r20()/20.0);
```

$$RandCol := (\,) \rightarrow COLOR\left(RGB, r20(\,)\ \frac{1}{20.0}, r20(\,)\ \frac{1}{20.0}, r20(\,)\ \frac{1}{20.0}\right) \tag{38}$$

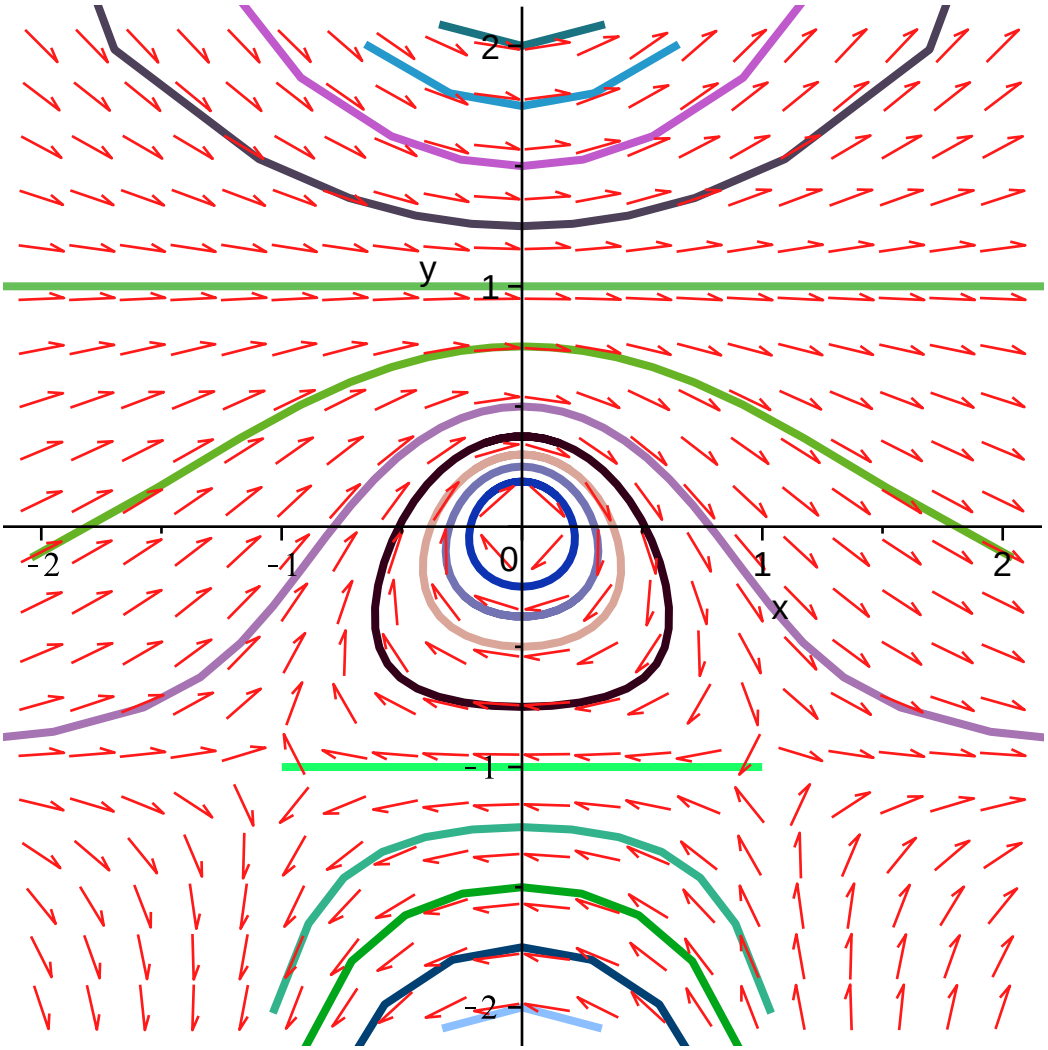
```
> RandCol();
```

$$COLOR(RGB, 0.8500000000, 0.9500000000, 0.5000000000) \tag{39}$$

```
> Clist:=[seq(RandCol(),i=1..100)]:
> DEplot(DE, [x,y], t=-4..4,
  x=-2..2, y=-2..2,
  [seq([x(0)=0, y(0)=k], k=-2..2,.25)],  linecolor=Clist);
```




```
> DEplot(DE, [x,y], t=-4..4,
  x=-2..2, y=-2..2,
  [seq([x(0)=0, y(0)=k], k=-2..2,.25)], linecolor=Clist,
  animatecurves=true);
```



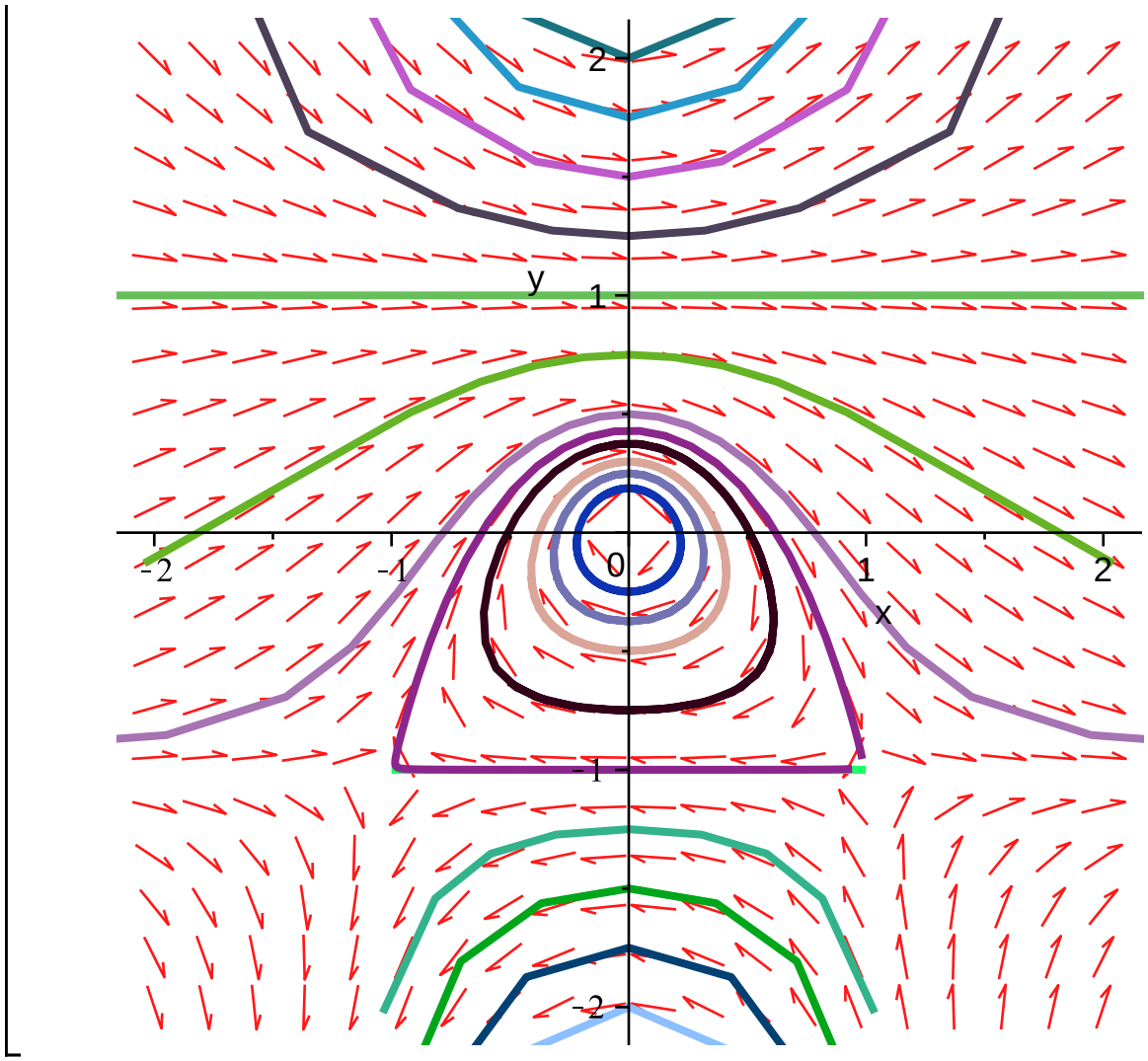

```
> Jack(-1,-1);
```

$$\begin{bmatrix} -2 & 1 \\ 0 & 2 \end{bmatrix} \tag{40}$$

```
> with(LinearAlgebra):
> Eigenvectors(Jack(-1,-1));
```

$$\begin{bmatrix} -2 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 & \frac{1}{4} \\ 0 & 1 \end{bmatrix} \tag{41}$$

```
> DEplot(DE, [x,y], t=-4..8,
  x=-2..2, y=-2..2,
  [seq([x(0)=0, y(0)=k], k=-2..2,.25), [x(0)=-1+.025, y(0)=-1+.01]
  ], linecolor=Clist);
```


2
y
1
-2
-1
0
1
2
x
-1
-2