```
with(DEtools) : with(LinearAlgebra) : A := Matrix(2, 2, [[0, 1], [-1, 0]])
```

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

```
P := Matrix(2, 2, [[1, 0], [0, 1]])
```

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

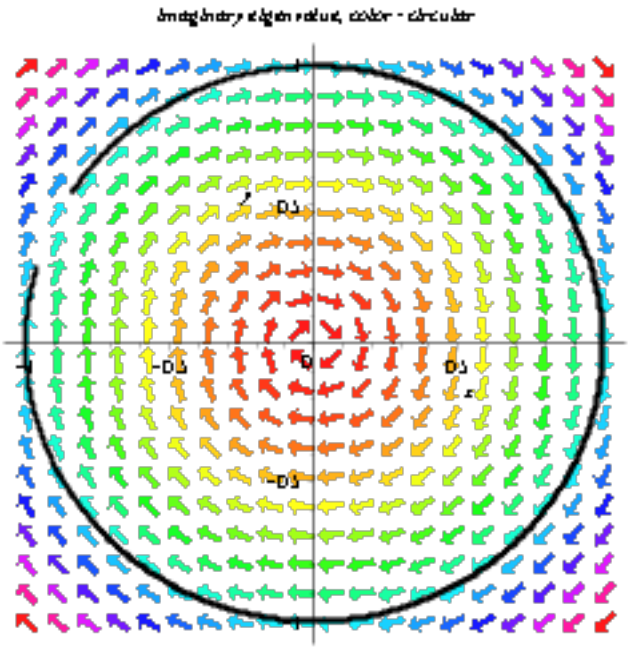
```
B := Multiply(A, P)
```

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \tag{3}$$

```
A := Multiply(P^(-1), B)
```

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \tag{4}$$

```
DEplot([diff(x(t), t) = A[1, 1]·x(t) + A[1, 2]· y(t), diff(y(t), t) = A[2, 1]*x(t) + A[2, 2]*y(t)],
    [x(t), y(t)], 0 .. 5, {[1, 0, 1], [0, 0, 1]}, color = x^2 + y^2, arrows = THICK, stepsize = .01,
    linecolor = black, title = `imaginary eigenvalues, color=circular`);
```



$$A := Matrix(2, 2, [[0, 1], [-1, 0]])$$

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \quad \textbf{(5)}$$

$$P := Matrix(2, 2, [[3, 0], [0, 1]])$$

$$\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} \quad \textbf{(6)}$$

$$B := Multiply(A, P)$$

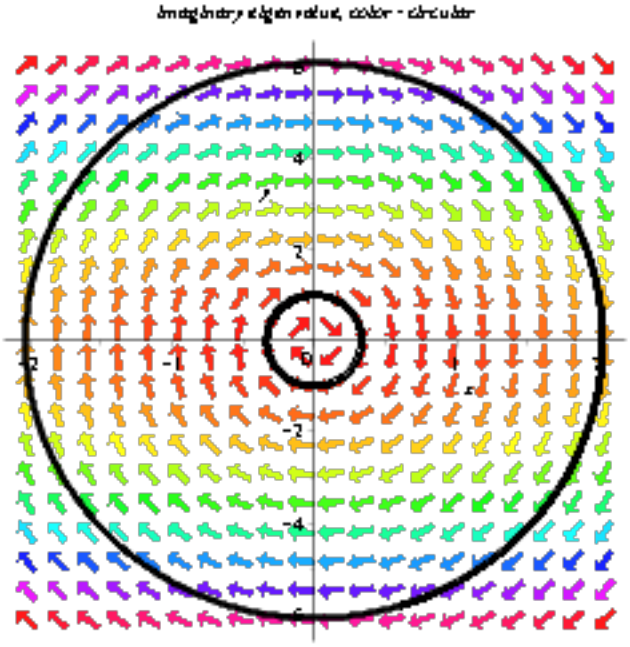
$$\begin{bmatrix} 0 & 1 \\ -3 & 0 \end{bmatrix} \quad \textbf{(7)}$$

$$A := Multiply(P^{-1}, B)$$

$$\begin{bmatrix} 0 & \frac{1}{3} \\ -3 & 0 \end{bmatrix} \quad \textbf{(8)}$$

$$DEplot([diff(x(t), t) = A[1, 1] \cdot x(t) + A[1, 2] \cdot y(t), diff(y(t), t) = A[2, 1] * x(t) + A[2, 2] * y(t)],$$

$[x(t), y(t)], 0 .. 15, \{[1, 0, 1], [1, 2, 1]\}, color = x^2 + y^2, arrows = THICK, stepsize = .01,$
$linecolor = black, title = `imaginary\ eigenvalues,\ color=circular`);$



$A := Matrix(2, 2, [[0, 1], [-1, 0]])$

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \quad \textbf{(9)}$$

$P := Matrix(2, 2, [[3, 2], [0, 1]])$

$$\begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} \quad \textbf{(11)}$$

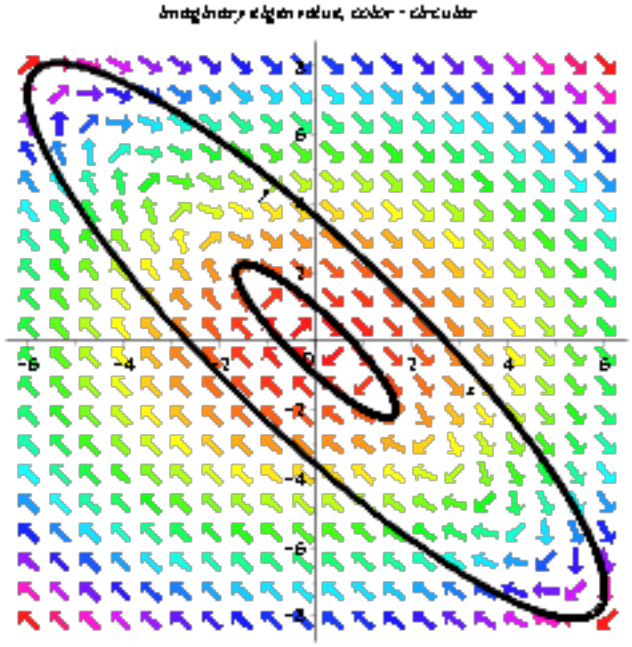
$B := Multiply(A, P)$

$$\begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix} \quad \textbf{(12)}$$

$A := Multiply(P^{-1}, B)$

$$\begin{bmatrix} 2 & \frac{5}{3} \\ -3 & -2 \end{bmatrix} \quad \textbf{(13)}$$

DEplot([*diff*$(x(t), t) = A[1,1]\cdot x(t) + A[1,2]\cdot y(t)$, *diff*$(y(t), t) = A[2,1]*x(t) + A[2,2]*y(t)$], [$x(t), y(t)$], 0 .. 15, { [1, 0, 1], [1, 2, 1] }, *color* = x^2 + y^2, *arrows* = *THICK*, *stepsize* = .01, *linecolor* = *black*, *title* = `*imaginary eigenvalues, color=circular*`);



$A := Matrix(2, 2, [[.2, 1], [-1, .2]])$

$$\begin{bmatrix} 0.2 & 1 \\ -1 & 0.2 \end{bmatrix} \quad \textbf{(14)}$$

$P := Matrix(2, 2, [[1, 0], [0, 1]])$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \textbf{(15)}$$

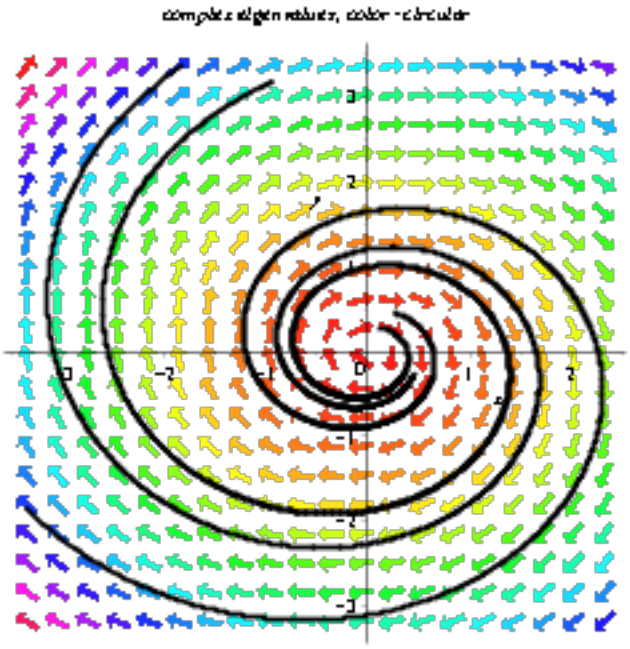
$B := Multiply(A, P)$

$$\begin{bmatrix} 0.200000000000000 & 1. \\ -1. & 0.200000000000000 \end{bmatrix} \quad \textbf{(16)}$$

$A := Multiply(P^{-1}, B)$

$$\begin{bmatrix} 0.200000000000000 & 1. \\ -1. & 0.200000000000000 \end{bmatrix} \quad \textbf{(17)}$$

$DEplot([diff(x(t), t) = A[1, 1] \cdot x(t) + A[1, 2] \cdot y(t), diff(y(t), t) = A[2, 1] * x(t) + A[2, 2] * y(t)], [x(t), y(t)], -5 .. 5, \{[1, 0, 1], [-1, 0, 1], [0, 1, 1], [0, -1, 1]\}, color = x^2 + y^2, arrows = THICK, stepsize = .01, linecolor = black, title = `complex eigenvalues, color=circular`);$



$A := Matrix(2, 2, [[.2, 1], [-1, .2]])$

$$\begin{bmatrix} 0.2 & 1 \\ -1 & 0.2 \end{bmatrix} \quad \textbf{(18)}$$

$P := Matrix(2, 2, [[3, 0], [0, 1]])$

$$\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} \quad \textbf{(19)}$$

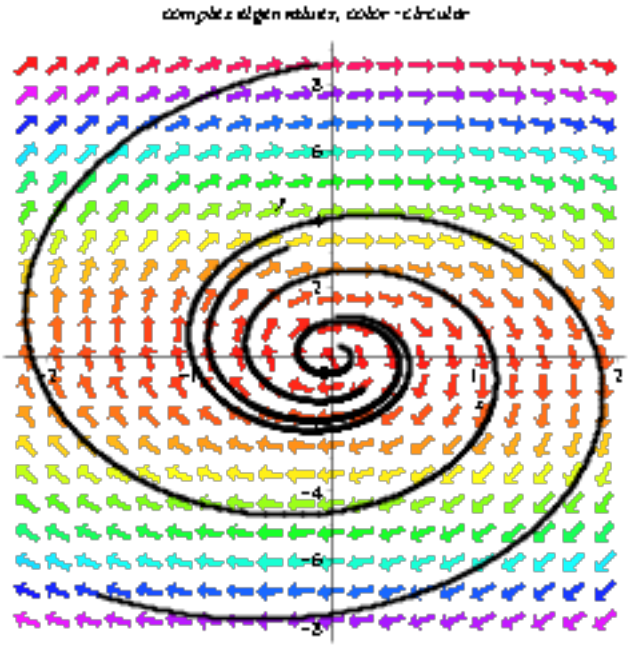
$B := Multiply(A, P)$

$$\begin{bmatrix} 0.600000000000000 & 1. \\ -3. & 0.200000000000000 \end{bmatrix} \quad \textbf{(20)}$$

$A := Multiply(P^{-1}, B)$

$$\begin{bmatrix} 0.200000000000000 & 0.333333333333333 \\ -3. & 0.200000000000000 \end{bmatrix} \quad \textbf{(21)}$$

$DEplot([diff(x(t), t) = A[1, 1] \cdot x(t) + A[1, 2] \cdot y(t), diff(y(t), t) = A[2, 1] * x(t) + A[2, 2] * y(t)],$
$[x(t), y(t)], -5 .. 5, \{[1, 0, 1], [-1, 0, 1], [0, 1, 1], [0, -1, 1]\}, color = x^2 + y^2, arrows$
$= THICK, stepsize = .01, linecolor = black, title = `complex eigenvalues, color=circular`);$



$A := Matrix(2, 2, [[.2, 1], [-1, .2]])$

$$\begin{bmatrix} 0.2 & 1 \\ -1 & 0.2 \end{bmatrix} \quad \textbf{(22)}$$

$P := Matrix(2, 2, [[3, 2], [0, 1]])$

$$\begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix} \tag{23}$$

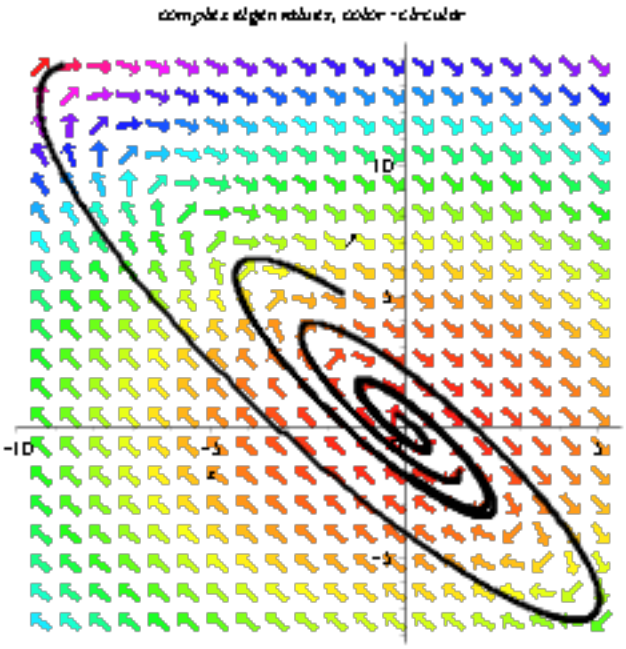
$B := Multiply(A, P)$

$$\begin{bmatrix} 0.600000000000000 & 1.40000000000000 \\ -3. & -1.80000000000000 \end{bmatrix} \tag{24}$$

$A := Multiply(P^{-1}, B)$

$$\begin{bmatrix} 2.20000000000000 & 1.66666666666667 \\ -3. & -1.80000000000000 \end{bmatrix} \tag{25}$$

$DEplot([diff(x(t), t) = A[1, 1] \cdot x(t) + A[1, 2] \cdot y(t), diff(y(t), t) = A[2, 1] * x(t) + A[2, 2] * y(t)], [x(t), y(t)], -5 .. 5, \{[1, 0, 1], [-1, 0, 1], [0, 1, 1], [0, -1, 1]\}, color = x\text{^}2 + y\text{^}2, arrows = THICK, stepsize = .01, linecolor = black, title = `complex eigenvalues, color=circular`);$



$A := Matrix(2, 2, [[-.2, 1], [-1, -.2]])$

$$\begin{bmatrix} -0.2 & 1 \\ -1 & -0.2 \end{bmatrix} \tag{26}$$

$P := Matrix(2, 2, [[1, 0], [0, 1]])$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \tag{27}$$

$B := Multiply(A, P)$

$$\begin{bmatrix} -0.200000000000000 & 1. \\ -1. & -0.200000000000000 \end{bmatrix} \tag{28}$$

$A := Multiply(P^{-1}, B)$

$$\begin{bmatrix} -0.200000000000000 & 1. \\ -1. & -0.200000000000000 \end{bmatrix} \tag{29}$$

$DEplot([diff(x(t), t) = A[1, 1] \cdot x(t) + A[1, 2] \cdot y(t), diff(y(t), t) = A[2, 1] * x(t) + A[2, 2] * y(t)], [x(t), y(t)], -5 .. 5, \{[1, 0, 1], [-1, 0, 1], [0, 1, 1], [0, -1, 1]\}, color = x^2 + y^2, arrows = THICK, stepsize = .01, linecolor = black, title = `complex eigenvalues, color=circular`);$