

```
> evalf(int(exp(-t^2), t = 0 .. Pi), 3)
```

0.885 (1)

```
> with(linalg) : with(LinearAlgebra) : with(Student[LinearAlgebra]) :
> A := Matrix([[1, 7, 3, 3], [-2, 5, 1, 1], [1, 2, -2, 1], [1, -1, 3, 1]])
```

(2)

$$A := \begin{bmatrix} 1 & 7 & 3 & 3 \\ -2 & 5 & 1 & 1 \\ 1 & 2 & -2 & 1 \\ 1 & -1 & 3 & 1 \end{bmatrix}$$

```
> eig := Eigenvalues(A)
```

(3)

$eig :=$

$\text{evalf}(eig, 3)$

(3)

$$\begin{bmatrix} 3.52 + 2.39 \text{ I} \\ 3.52 - 2.39 \text{ I} \\ 0.90 \\ -2.94 \end{bmatrix} \quad (4)$$

$$\begin{aligned} &> eq := \text{diff}(u(t), t) = u(t)^{-2} \\ &eq := \frac{d}{dt} u(t) = \frac{1}{u(t)^2} \end{aligned} \quad (5)$$

$$\begin{aligned} &> ic := u(0) = 1 \\ &ic := u(0) = 1 \end{aligned} \quad (6)$$

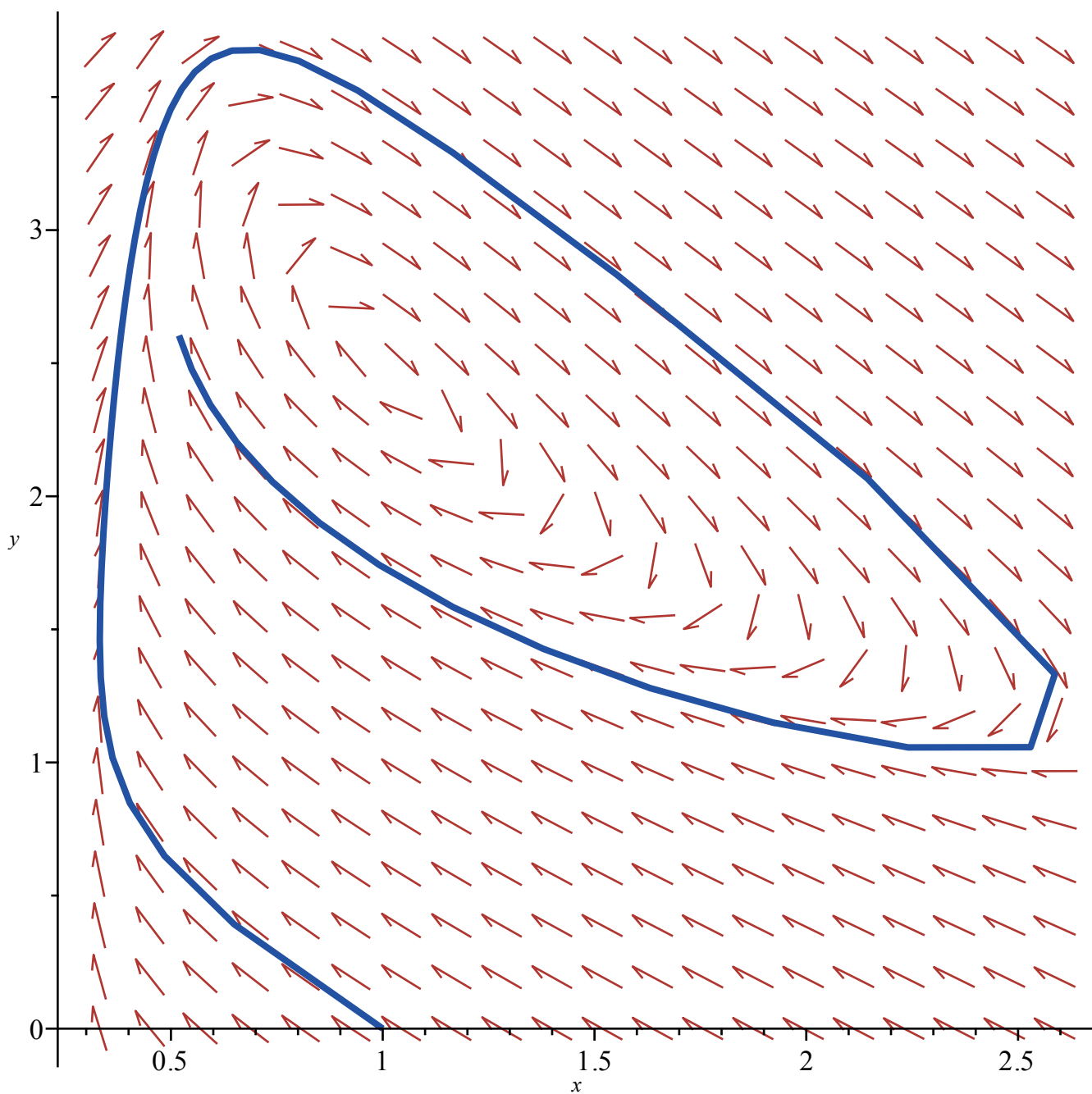
$$\begin{aligned} &> sol := \text{dsolve}(\{eq, ic\}, u(t)) \\ &sol := u(t) = (3t + 1)^{1/3} \end{aligned} \quad (7)$$

$$\begin{aligned} &> \text{map}(\text{limit}, \text{rhs}(sol), t = \infty) \\ &\infty \end{aligned} \quad (8)$$

$$\begin{aligned} &> soll := \text{dsolve}(\{\text{diff}(x(t), t) = 1 + x(t)^2 \cdot y(t) - 2.5 \cdot x(t) - x(t), \text{diff}(y(t), t) = 2.5 \cdot x(t) \\ &\quad - x(t)^2 \cdot y(t), y(0) = 0\}, \{x(t), y(t)\}) \\ &soll := () \end{aligned} \quad (9)$$

$$\begin{aligned} &> equilibira := \text{solve}(\{1 + x^2 \cdot y - 2.5 \cdot x - x = 0, 2.5 \cdot x - x^2 \cdot y = 0\}, \{x, y\}) \\ &equilibira := \{x = 1., y = 2.500000000\} \end{aligned} \quad (10)$$

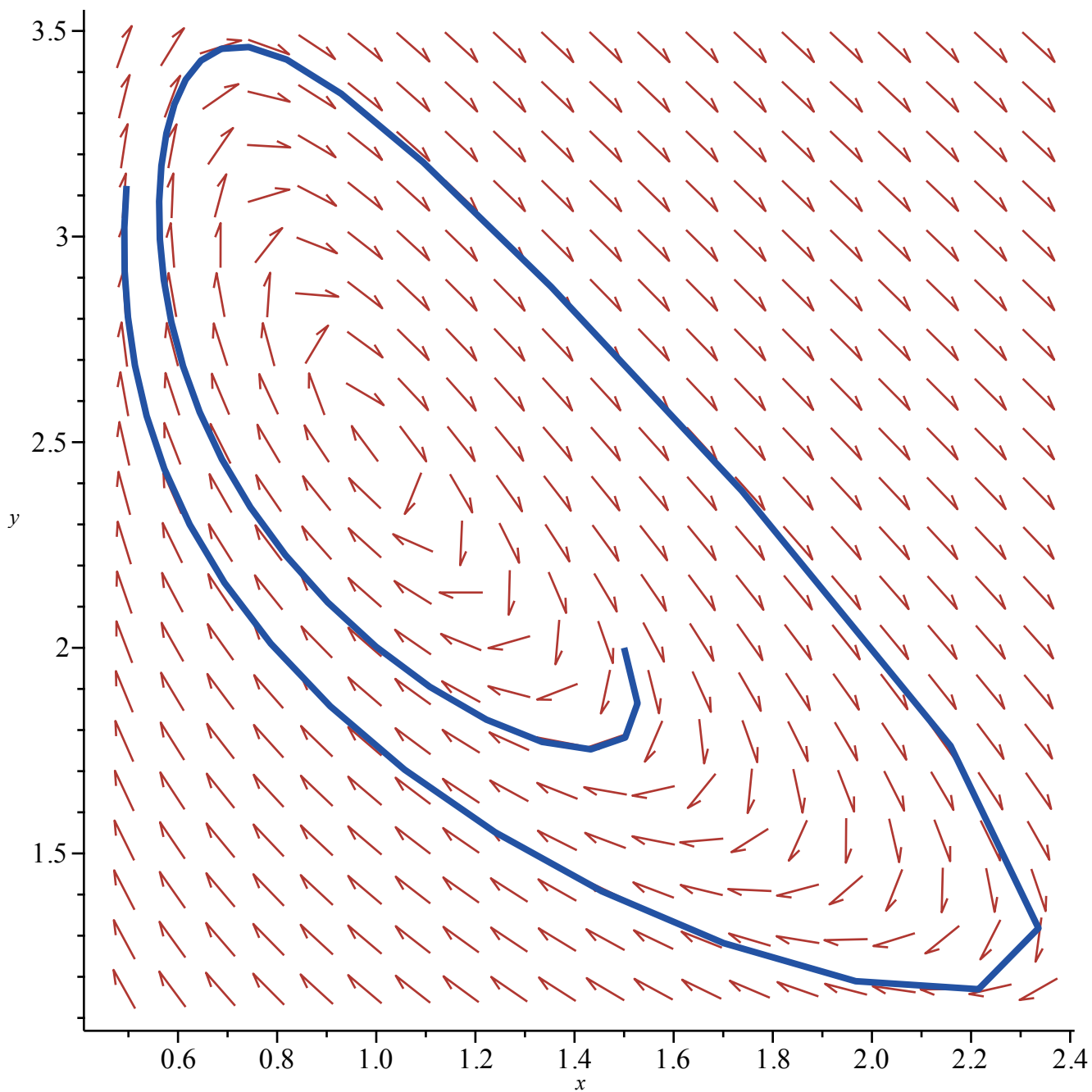
$$\begin{aligned} &> \text{with}(DEtools) : \\ &> \text{phaseportrait}([D(x)(t) = 1 + x(t)^2 \cdot y(t) - 2.5 \cdot x(t) - x(t), D(y)(t) = 2.5 \cdot x(t) - x(t)^2 \\ &\quad \cdot y(t)], [x(t), y(t)], t = 0..10, [[x(0) = 1, y(0) = 0]]) \end{aligned}$$



```

> sys := {D(x)(t) = 1 + x(t)2·y(t) - 2.5·x(t) - x(t), D(y)(t) = 2.5·x(t) - x(t)2·y(t)}
          sys := {D(x)(t) = 1 + x(t)2 y(t) - 3.5 x(t), D(y)(t) = 2.5 x(t) - x(t)2 y(t)}
(11)
> phaseportrait([D(x)(t) = 1 + x(t)2·y(t) - 2.5·x(t) - x(t), D(y)(t) = 2.5·x(t) - x(t)2
  ·y(t)], [x(t), y(t)], t = 0..10, [[x(0) = 1.5, y(0) = 2]])

```



```
> ic1 := {x(0) = 0, y(0) = 0}
      ic1 := {x(0) = 0, y(0) = 0} (12)
```

```
> dsolve({sys union ic1}, {x(t), y(t)})
Error, (in dsolve) invalid input: PDEtools/sdsolve expects its 1st
argument, SYS, to be of type Or(set({<>`, `=`, algebraic}), list({<>`,
`=`, algebraic}), `casesplit/ans` (list, list)), but received {x(0) = 0,
y(0) = 0, D(x)(t) = 1+x(t)^2*y(t)-7/2*x(t), D(y)(t) = 5/2*x(t)-x(t)^2*y
(t)}
```

```
> restart:
```

```
> del := diff(x(t), t) = 1 + x(t)^2*y(t) - 2.5*x(t) - x(t)
      del := d/dt x(t) = 1 + x(t)^2*y(t) - 3.5*x(t) (13)
```

```
> de2 := diff(y(t), t) = 2.5·x(t) - x(t)2·y(t)
      de2 :=  $\frac{d}{dt} y(t) = 2.5 x(t) - x(t)^2 y(t)$  (14)
```

```
> ic1 := x(0) = 1
      ic1 := x(0) = 1 (15)
```

```
> ic2 := y(0) = 0
      ic2 := y(0) = 0 (16)
```

```
> sol := dsolve({de1, de2, ic1, ic2}, {x(t), y(t)}, numeric)
      sol := proc(x_rkf45) ... end proc (17)
```

```
> with(plots) : odeplot(sol, [x(t), y(t)], t = 0..20)
```

