```
> eq := diff(u(x), x$2) + 5·diff(u(x), x) − 7·u(x) = 5·cos(x) − 7
```

$$eq := \frac{d^2}{dx^2} u(x) + 5 \frac{d}{dx} u(x) - 7 u(x) = 5 \cos(x) - 7 \quad \textbf{(1)}$$

```
> sol := dsolve(eq, u(x))
```

$$sol := u(x) = e^{\frac{(-5+\sqrt{53})x}{2}} c_2 + e^{-\frac{(5+\sqrt{53})x}{2}} c_1 - \frac{40\cos(x)}{89} + \frac{25\sin(x)}{89} + 1 \quad \textbf{(2)}$$

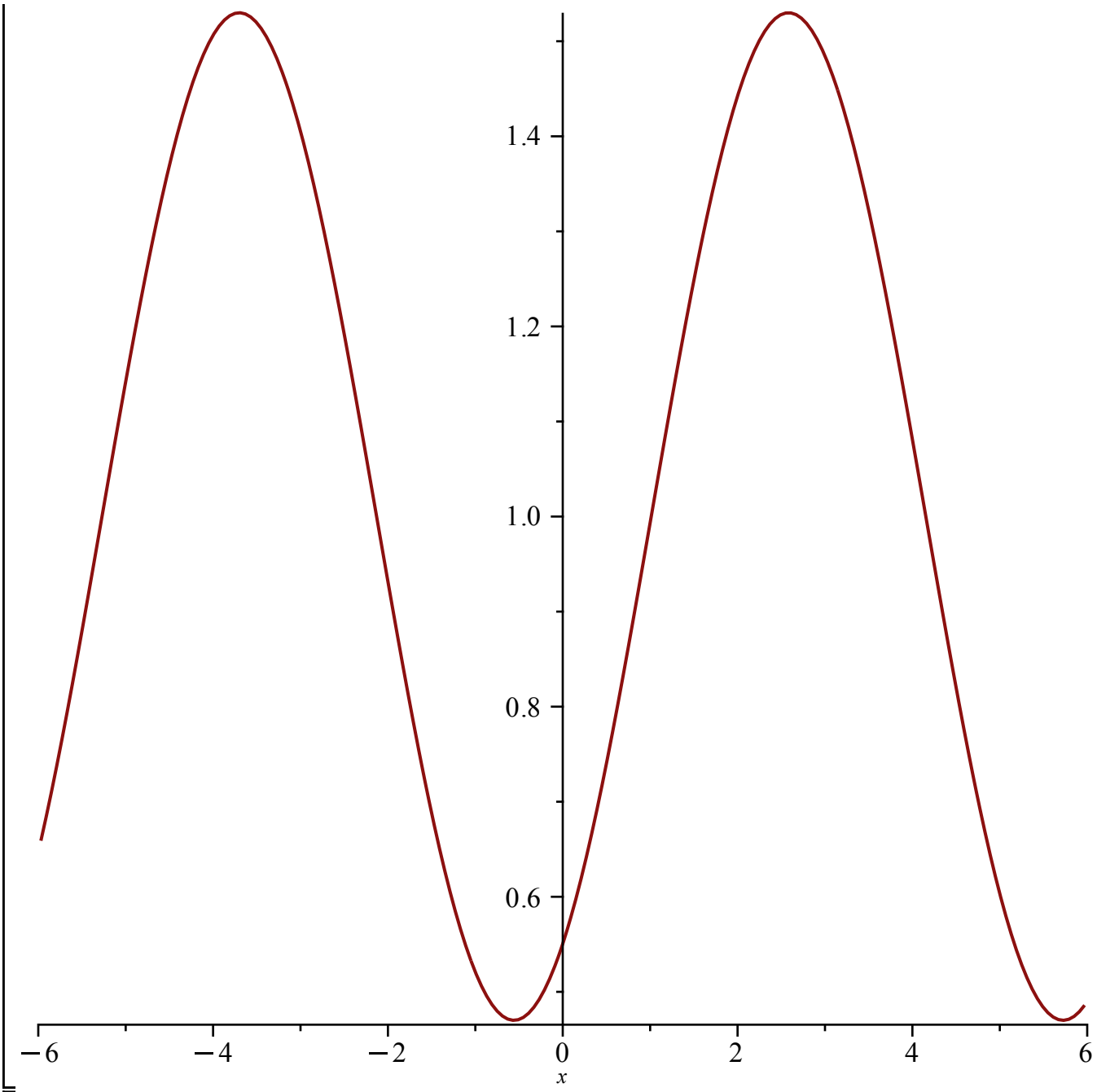
```
> t := rhs(sol)
```

$$t := e^{\frac{(-5+\sqrt{53})x}{2}} c_2 + e^{-\frac{(5+\sqrt{53})x}{2}} c_1 - \frac{40\cos(x)}{89} + \frac{25\sin(x)}{89} + 1 \quad \textbf{(3)}$$

```
> c1 := 0 : c2 := 0 :
> t := subs(_C1 = c1, _C2 = c2, t)
```

$$t := -\frac{40\cos(x)}{89} + \frac{25\sin(x)}{89} + 1 \quad \textbf{(4)}$$

```
> plot(t, x = −6..6)
```



> $eval\left(t, x = \exp\left(\frac{1}{2}\right)\right)$

$$-\frac{40\cos\left(e^{\frac{1}{2}}\right)}{89} + \frac{25\sin\left(e^{\frac{1}{2}}\right)}{89} + 1 \quad \textbf{(5)}$$

> $eval\left(diff(t, x), x = \exp\left(\frac{1}{2}\right)\right)$

$$\frac{40\sin\left(e^{\frac{1}{2}}\right)}{89} + \frac{25\cos\left(e^{\frac{1}{2}}\right)}{89} \quad \textbf{(6)}$$

> $with(Student[LinearAlgebra]) : with(LinearAlgebra) : with(linalg) :$

> $A := Matrix([[-7, 0], [1, 7]])$

$$A := \begin{bmatrix} -7 & 0 \\ 1 & 7 \end{bmatrix} \quad (7)$$

> $deter := Determinant(A)$

$$deter := -49 \quad (8)$$

> $eig := Eigenvalues(A)$

$$eig := \begin{bmatrix} 7 \\ -7 \end{bmatrix} \quad (9)$$

> $mexp := MatrixExponential(t \cdot A)$

$$mexp := \begin{bmatrix} e^{\frac{280\cos(x)}{89} - \frac{175\sin(x)}{89} - 7} & \cdots \\ -\frac{e^{\frac{280\cos(x)}{89} - \frac{175\sin(x)}{89} - 7}}{14} + \frac{e^{-\frac{280\cos(x)}{89} + \frac{175\sin(x)}{89} + 7}}{14} & \cdots \end{bmatrix} \quad (10)$$

> $eq1 := diff(x(w), w) = -7 \cdot x(w)$

$$eq1 := \frac{d}{dw} x(w) = -7\,x(w) \quad (11)$$

> $eq2 := diff(y(w), w) = x(w) + 7 \cdot y(w)$

$$eq2 := \frac{d}{dw} y(w) = x(w) + 7\,y(w) \quad (12)$$

> $dsolve(\{eq1, eq2, x(0) = 2, y(0) = 0\}, \{x(w), y(w)\})$

$$\left\{x(w) = 2\,e^{-7w}, y(w) = -\frac{e^{-7w}}{7} + \frac{e^{7w}}{7}\right\} \quad (13)$$

> $t := 't'$

$$t := t \quad (14)$$

> $eq1 := diff(x(t), t) = -x(t) + x(t) \cdot y(t)$

$$eq1 := \frac{d}{dt} x(t) = -x(t) + x(t)\,y(t) \quad (15)$$

> $eq2 := diff(y(t), t) = y(t) - x(t) \cdot y(t)$

$$eq2 := \frac{d}{dt} y(t) = y(t) - x(t)\,y(t) \quad (16)$$

> $eeq1 := -x + xy = 0$

$$eeq1 := -x + xy = 0 \quad (17)$$

> $eeq2 := y - xy = 0$

$$eeq2 := y - xy = 0 \quad (18)$$

```
> solve({eeq1, eeq2}, {x, y})
```

$$\{x = xy, y = xy\} \tag{19}$$

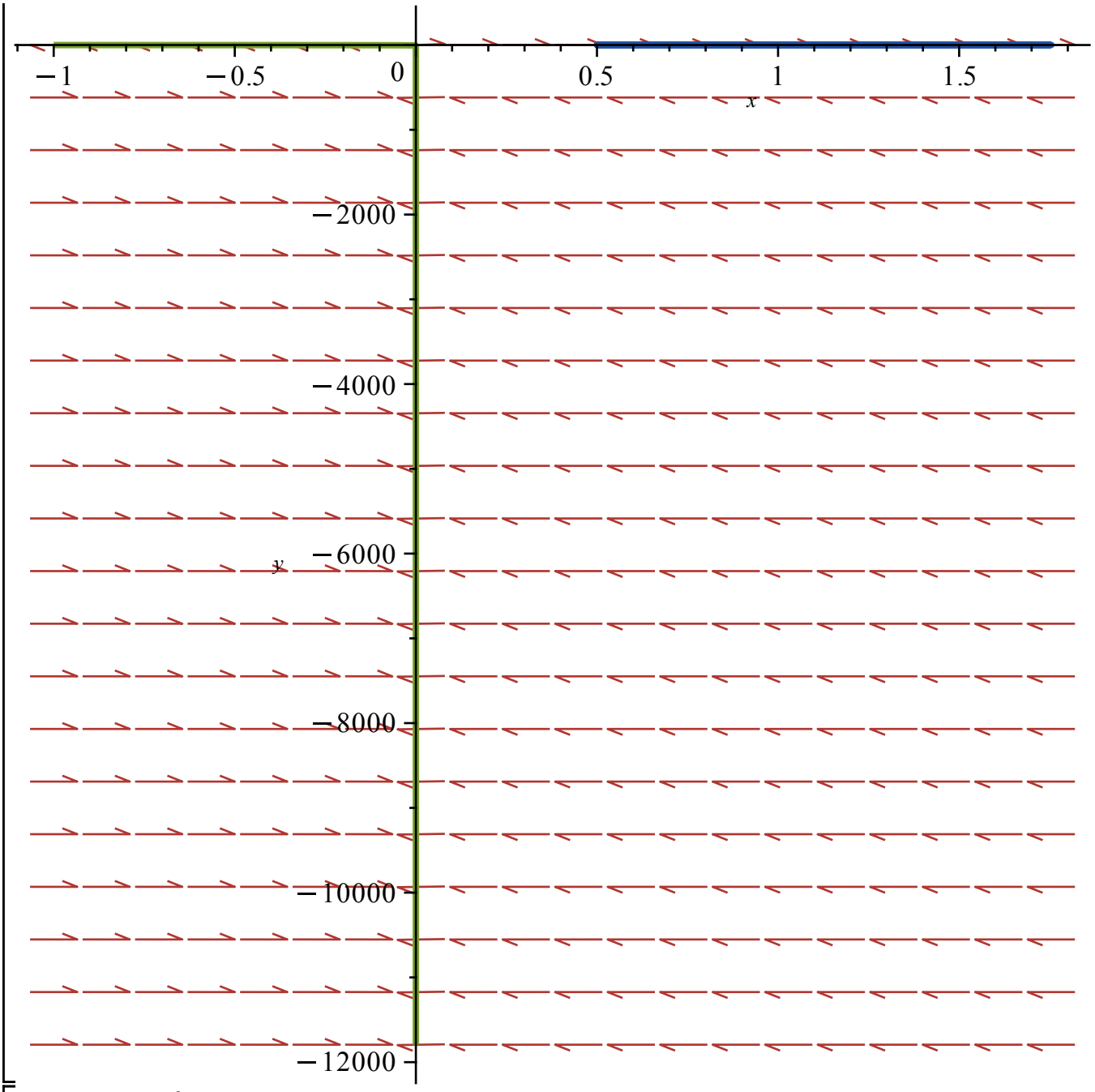
```
> with(DETools) :
> sys := {eq1, eq2}
```

$$sys := \left\{ \frac{d}{dt} x(t) = -x(t) + x(t)\, y(t), \frac{d}{dt} y(t) = y(t) - x(t)\, y(t) \right\} \tag{20}$$

```
> initialcond := [[x(0) = 1, y(0) = 0.5], [x(0) = -1, y(0) = -0.5]];
```

$$initialcond := [[x(0) = 1, y(0) = 0.5], [x(0) = -1, y(0) = -0.5]] \tag{21}$$

```
> DEplot(sys, [x(t), y(t)], t = 0..20, [[x(0) = 1, y(0) = 0.5], [x(0) = -1, y(0) = -0.5]])
Warning, plot may be incomplete, the following errors(s) were issued:
   cannot evaluate the solution further right of 9.8639011, maxfun
limit exceeded (see ?dsolve,maxfun for details)
```



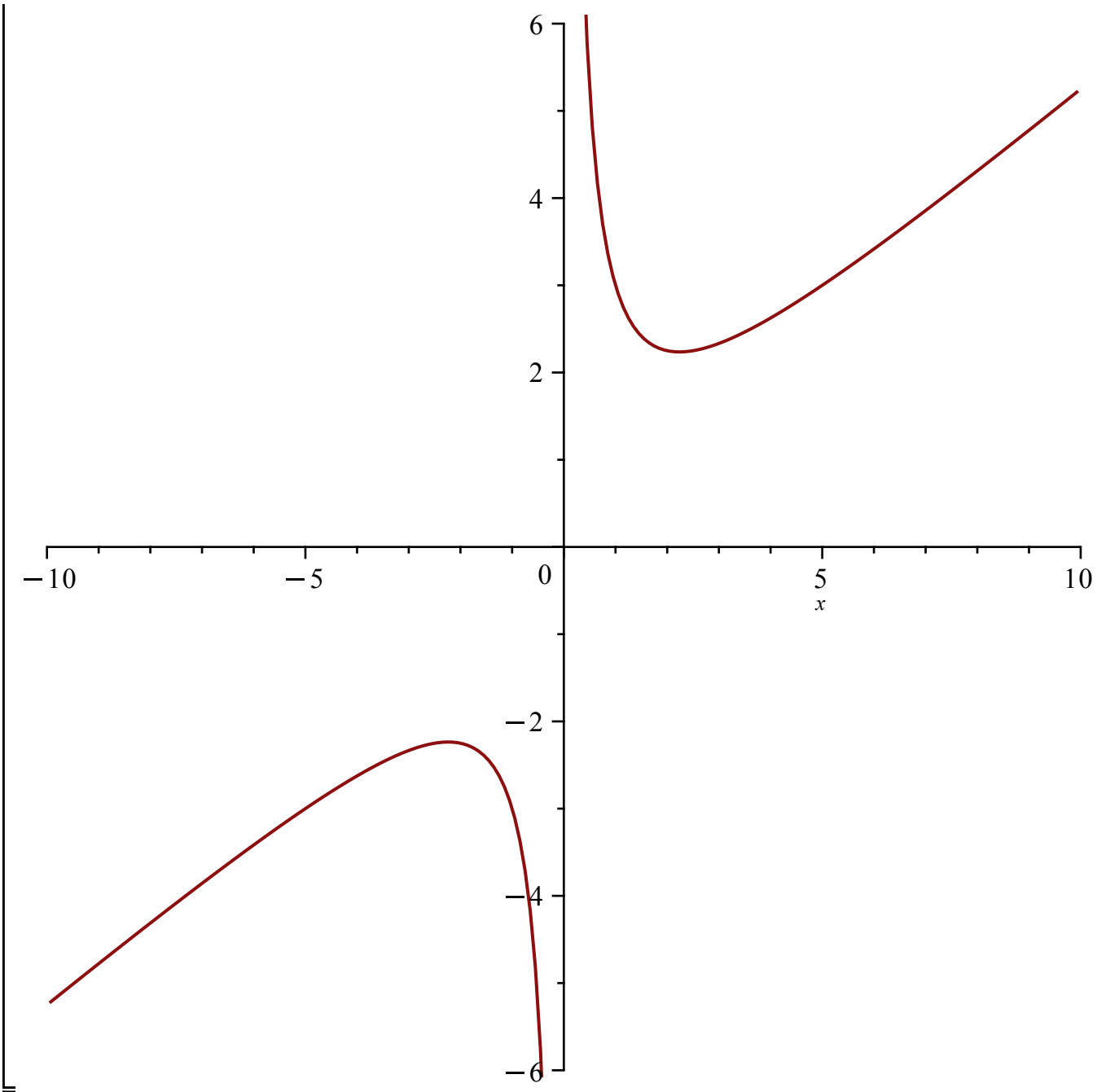
> $f := x \mapsto \frac{(x^2+5)}{2 \cdot x}$

$$f := x \mapsto \frac{x^2+5}{2 \cdot x} \quad \textbf{(22)}$$

> $solve(f(x) = x)$

$$-\sqrt{5}, \sqrt{5} \quad \textbf{(23)}$$

> $plot(f(x), x = -10..10)$




```
> x := 2 :for k from 1 to 5 do x := f(x) : psi(x) := x : print(x); od:
```

$$\frac{9}{4}$$

$$\frac{161}{72}$$

$$\frac{51841}{23184}$$

$$\frac{5374978561}{2403763488}$$

$$\frac{57780789062419261441}{25840354427429161536}$$

(24)

```
> x := 10 :for k from 1 to 5 do x := f(x) : psi(x) := x : print(x); od:
```

$$\frac{21}{4}$$

$$\frac{521}{168}$$

$$\frac{412561}{175056}$$

$$\frac{323429594401}{144442556832}$$

$$\frac{208924963655223119929921}{93433995140834302995264} \qquad \textbf{(25)}$$

```
> x := -3 :for k from 1 to 5 do x := f(x) : psi(x) := x : print(x); od:
```

$$-\frac{7}{3}$$

$$-\frac{47}{21}$$

$$-\frac{2207}{987}$$

$$-\frac{4870847}{2178309}$$

$$-\frac{23725150497407}{10610209857723} \qquad \textbf{(26)}$$

```
>
```