```
with(plots):
# Define the system of differential equations
sys := {diff(x1(t), t) = -1/10·x1(t) + 1/50·x2(t) + 0.8, diff(x2(t), t) = 2/25·x1(t) - 1/10
    ·x2(t) + 0.1};
```

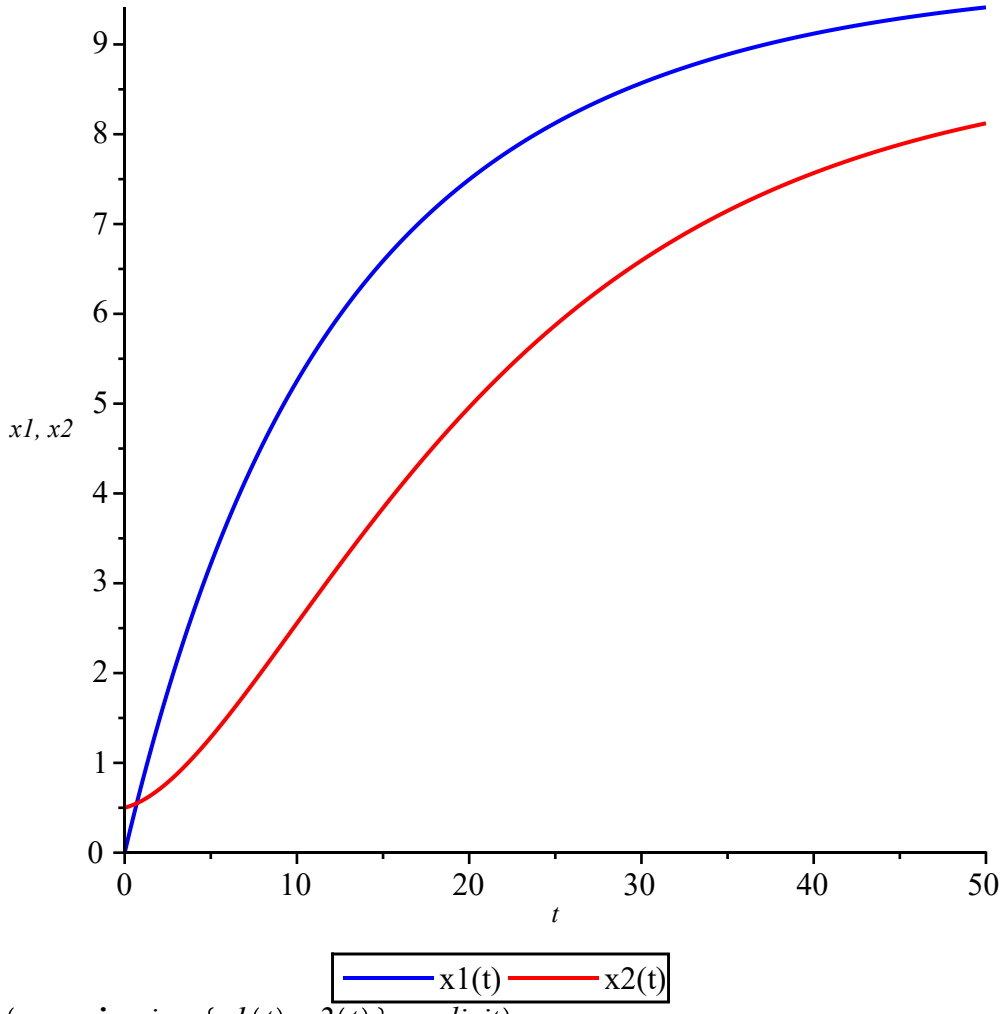
$$sys := \left\{ \frac{d}{dt} x1(t) = -\frac{x1(t)}{10} + \frac{x2(t)}{50} + 0.8,\ \frac{d}{dt} x2(t) = \frac{2\,x1(t)}{25} - \frac{x2(t)}{10} + 0.1 \right\} \quad \textbf{(1)}$$

```
# Define initial conditions
ics := {x1(0) = 0, x2(0) = 0.5};
```

$$ics := \{x1(0) = 0, x2(0) = 0.5\} \quad \textbf{(2)}$$

```
# Solve the system
sol := dsolve(sys union ics, {x1(t), x2(t)}, numeric);
 odeplot(sol, [[t, x1(t)], [t, x2(t)]], t = 0..50, color = [blue, red], legend = ["x1(t)", "x2(t)"]);
```

$$sol := \textbf{proc}(x\_rkf45)\ \ldots\ \textbf{end proc}$$




```
sol := dsolve(sys union ics, {x1(t), x2(t)}, explicit);
```

$$sol := \left\{ x1(t) = -\frac{167\,e^{-\frac{3t}{50}}}{24} - \frac{157\,e^{-\frac{7t}{50}}}{56} + \frac{205}{21},\ x2(t) = -\frac{167\,e^{-\frac{3t}{50}}}{12} + \frac{157\,e^{-\frac{7t}{50}}}{28} + \frac{185}{21} \right\} \quad (3)$$

```
# Load necessary package
with(LinearAlgebra) :

# Define the coefficient matrix A
A := <<-1/10, 1/50>|<2/25, -1/10>>;

# Define the constant vector B
B := <0.8, 0.1>;

# Define the variable vector X
X := <x1(t), x2(t)>;
```

$$A := \begin{bmatrix} -\frac{1}{10} & \frac{2}{25} \\ \frac{1}{50} & -\frac{1}{10} \end{bmatrix}$$

$$B := \begin{bmatrix} 0.8 \\ 0.1 \end{bmatrix}$$

$$X := \begin{bmatrix} x1(t) \\ x2(t) \end{bmatrix} \quad (4)$$

```
# Compute eigenvalues and eigenvectors
(λ, V) := Eigenvectors(A);
```

$$\lambda, V := \begin{bmatrix} -\frac{3}{50} \\ -\frac{7}{50} \end{bmatrix}, \begin{bmatrix} \frac{1}{2} & -\frac{1}{2} \\ 1 & 1 \end{bmatrix} \quad (5)$$

```
Xp := -MatrixInverse(A) . B;
```

$$Xp := \begin{bmatrix} 9.76190476190476 \\ 8.80952380952381 \end{bmatrix} \quad (6)$$

```
# Define general solution
X_general := C1 · exp(λ[1] · t) · V[ .., 1] +
             C2 · exp(lambda[2] · t) · V[ .., 2] + Xp;

# Display the full general solution
X_general;
```

$$X\_general := \begin{bmatrix} \frac{C1\, e^{-\frac{3t}{50}}}{2} - \frac{C2\, e^{-\frac{7t}{50}}}{2} + 9.76190476190476 \\ C1\, e^{-\frac{3t}{50}} + C2\, e^{-\frac{7t}{50}} + 8.80952380952381 \end{bmatrix}$$

$$\begin{bmatrix} \frac{C1\, e^{-\frac{3t}{50}}}{2} - \frac{C2\, e^{-\frac{7t}{50}}}{2} + 9.76190476190476 \\ C1\, e^{-\frac{3t}{50}} + C2\, e^{-\frac{7t}{50}} + 8.80952380952381 \end{bmatrix} \quad \textbf{(7)}$$

 # Define initial conditions
$ics := \{x1(0) = 0, x2(0) = 0.5\};$

 # Solve for C1 and C2
$constants := solve(\{C1 * V[1,1] + C2 * V[1,2] + Xp[1] = 0,$
$C1 * V[2,1] + C2 * V[2,2] + Xp[2] = 0\}, \{C1, C2\});$

 # Substitute back into the general solution
$X\_final := subs(constants, X\_general);$

 # Display the final explicit solution
$X\_final;$

$$ics := \{x1(0) = 0, x2(0) = 0.5\}$$

$$constants := \{C1 = -14.16666667, C2 = 5.357142857\}$$

$$X\_final := \begin{bmatrix} -7.083333335\, e^{-\frac{3t}{50}} - 2.678571428\, e^{-\frac{7t}{50}} + 9.76190476190476 \\ -14.16666667\, e^{-\frac{3t}{50}} + 5.357142857\, e^{-\frac{7t}{50}} + 8.80952380952381 \end{bmatrix}$$

$$\begin{bmatrix} -7.083333335\, e^{-\frac{3t}{50}} - 2.678571428\, e^{-\frac{7t}{50}} + 9.76190476190476 \\ -14.16666667\, e^{-\frac{3t}{50}} + 5.357142857\, e^{-\frac{7t}{50}} + 8.80952380952381 \end{bmatrix} \quad \textbf{(8)}$$

$$Xp := \begin{bmatrix} 10.4761904761905 \\ 3.09523809523810 \end{bmatrix} \quad \textbf{(9)}$$