

$$\text{ode1} \quad \text{diff}(x1(t), t) = D \begin{pmatrix} k01 & k21 \\ x1(t) & k12 x2(t) \end{pmatrix}, \text{diff}(x2(t), t) = k21$$

$$\text{ode1} := \frac{d}{dt} x1(t) = D \begin{pmatrix} k01 & k21 \\ x1(t) & k12 x2(t) \end{pmatrix}, \frac{d}{dt} x2(t) = k21 x1(t) \quad (1)$$

ode1

$$\frac{d}{dt} x1(t) = D \begin{pmatrix} k01 & k21 \\ x1(t) & k12 x2(t) \end{pmatrix}, \frac{d}{dt} x2(t) = k21 x1(t) \quad k12 x2(t) \quad (2)$$

$$\text{ics} \quad x1(0) = 20, x2(0) = 0$$

$$\text{ics} := x1(0) = 20, x2(0) = 0 \quad (3)$$

dsolve([*ode1*, *ics*])

$$x1(t) = \frac{1}{k01} \left(D \frac{1}{2} \left(\begin{pmatrix} 10 & k01 \end{pmatrix} \right) \right) \quad (4)$$

$$10 \sqrt{k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2} D \quad 10 k12$$

$$10 k21) \left(\sqrt{k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2} k21 \right)$$

$$k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2$$

$$\sqrt{k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2} k01$$

$$\sqrt{k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2} k12)$$

$$e^{\frac{1}{2} (k01 - k21 - k12 \sqrt{k01^2 - 2 k01 k21 - 2 k12 k01 - k21^2 - 2 k21 k12 - k12^2}) t} / (k01^2$$

$$2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2) \quad \frac{1}{2} \left((10 k_{01}$$

$$10 \sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \quad D \quad 10 k_{12}$$

$$10 k_{21}) \left(\sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \quad k_{21} \right.$$

$$\left. \sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \quad k_{01} \right.$$

$$\left. \sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \quad k_{12} \quad k_{01}^2 \right.$$

$$\left. 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2) \right)$$

$$e \left(\frac{1}{2} k_{01} \quad \frac{1}{2} k_{21} \quad \frac{1}{2} k_{12} \quad \frac{1}{2} \sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \right) t \Bigg/$$

$$\left(k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right), x_2(t)$$

$$= \frac{1}{2} \frac{1}{k_{12} k_{01}} \left(2 D k_{21} \quad \frac{1}{2} \left((10 k_{01}$$

$$10 \sqrt{k_{01}^2 \quad 2 k_{01} k_{21} \quad 2 k_{12} k_{01} \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2} \quad D \quad 10 k_{12}$$

$$10 k_{21}) \left(\sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{21} \right.$$

$$k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{01} \right.$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{12} \right)$$

$$k_{01} e^{\frac{1}{2} (k_{01} - k_{21} - k_{12} \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2}) t} \Big/$$

$$(k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2) \frac{1}{2} \left(\left(\right. \right.$$

$$10 k_{01} - 10 \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \Big) \quad D$$

$$10 k_{12} - 10 k_{21}) \left(\right.$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{21} - k_{01}^2 \right.$$

$$2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{01} \right.$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} k_{12} \right)$$

$$k_{21} e^{\frac{1}{2} (k_{01} \quad k_{21} \quad k_{12} \quad \sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2}) t} \Big/$$

$$(k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2) \quad \frac{1}{2} \left(($$

$$10k_{01} \quad 10\sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2} \quad D$$

$$10k_{12} \quad 10k_{21}) \left($$

$$\sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2} \quad k_{21} \quad k_{01}^2$$

$$2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2$$

$$\sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2} \quad k_{01}$$

$$\sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2} \quad k_{12})$$

$$e^{\frac{1}{2} (k_{01} \quad k_{21} \quad k_{12} \quad \sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2}) t} \Big/ k_{12} \Big/$$

$$(k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2) \quad \frac{1}{2} \left(($$

$$10k_{01} \quad 10\sqrt{k_{01}^2 \quad 2k_{01}k_{21} \quad 2k_{12}k_{01} \quad k_{21}^2 \quad 2k_{21}k_{12} \quad k_{12}^2} \quad D$$

$$10k_{12} \quad 10k_{21}) \left($$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_1 \quad k_0^2$$

$$2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2$$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_0$$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_2$$

$$e^{\frac{1}{2}(k_0 - k_1 - k_2 \sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2})t}$$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad \frac{1}{2} \left(\left(\right. \right.$$

$$10k_0 - 10\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad D$$

$$10k_2 - 10k_1)$$

$$\left(\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_1 \right.$$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_0$$

$$\sqrt{k_0^2 - 2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2} \quad k_2 \quad k_0^2$$

$$2k_0k_1 - 2k_1k_2 + k_1^2 - 2k_1k_2 - k_2^2)$$

$$k_{01} e^{\left(\frac{1}{2} k_{01} \quad \frac{1}{2} k_{21} \quad \frac{1}{2} k_{12} \quad \frac{1}{2} \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \right) t}$$

$$\left(k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2 \right) \frac{1}{2} \left(\left(\right.$$

$$10 k_{01} \quad 10 \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \quad D$$

$$\left. 10 k_{12} \quad 10 k_{21} \right)$$

$$\left(\sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \quad k_{21} \right.$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \quad k_{01} \right.$$

$$\left. \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \quad k_{12} \quad k_{01}^2 \right.$$

$$\left. 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2 \right)$$

$$k_{21} e^{\left(\frac{1}{2} k_{01} \quad \frac{1}{2} k_{21} \quad \frac{1}{2} k_{12} \quad \frac{1}{2} \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \right) t}$$

$$\left(k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2 \right) \frac{1}{2} \left(\left(\right.$$

$$10 k_{01} \quad 10 \sqrt{k_{01}^2 - 2 k_{01} k_{21} - 2 k_{12} k_{01} - k_{21}^2 - 2 k_{21} k_{12} - k_{12}^2} \quad D$$

$$\left. 10 k_{12} \quad 10 k_{21} \right)$$

$$\begin{aligned}
& \left(\sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_{21} \right. \\
& \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_0 \\
& \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_{12} \quad k_0 I^2 \\
& \left. 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) \\
& e^{\left(\frac{1}{2} k_0 \quad \frac{1}{2} k_{21} \quad \frac{1}{2} k_{12} \quad \frac{1}{2} \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) t} \Bigg|_{k_{12}} \\
& / \left(k_0 I^2 \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) \frac{1}{2} \left(\left(\right. \right. \\
& 10 k_0 \quad 10 \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad D \\
& \left. 10 k_{12} \quad 10 k_{21} \right) \\
& \left(\sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_{21} \right. \\
& \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_0 \\
& \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \quad k_{12} \quad k_0 I^2 \\
& \left. 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) \\
& e^{\left(\frac{1}{2} k_0 \quad \frac{1}{2} k_{21} \quad \frac{1}{2} k_{12} \quad \frac{1}{2} \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) t} \Bigg|_{k_{12}} / \\
& \left. \sqrt{k_0 I^2} \quad 2 k_0 k_{21} \quad 2 k_{12} k_0 \quad k_{21}^2 \quad 2 k_{21} k_{12} \quad k_{12}^2 \right) \Bigg\}
\end{aligned}$$