$$\boxed{y' + p(t)\,y = Q(t) \qquad y_0 = y(t=0)}$$

$$y = \frac{1}{\ } \quad y = e^{-\int p(t)\,dt}\left[\int Q(t)\, e^{\int p(t)\,dt}\, dt + C\right]$$

$$y = u \cdot v$$

$$y' = u'v + v'u$$

$$u'v + v'u + p(t)uv = Q(t)$$

$$v\underbrace{\left(u' + p(t)u\right)}_{0} + v'u = Q(t)$$

$$u' + p(t)u = 0 \longrightarrow u = u_0\, e^{-\int p(t)\,dt}$$

$$v'u = Q(t)$$

$$v' = Q(t)\, e^{+\int p(t)\,dt}$$

$$\int dv = \int Q(t)\, e^{+\int p(t)\,dt}\, dt$$

$$\boxed{v = \int Q(t)\, e^{+\int p(t)\,dt}\, dt + C}$$

$$u' + p(t)u = 0$$

$$\frac{du}{dt} = -p(t)u$$

$$\int \frac{du}{u} = \int -p(t)dt$$

$$\ln u = -\int p(t)dt$$

$$u = e^{-\int p(t)dt}$$

$$\begin{cases} Y' + P(t)Y = Q(t) \\ Y_0 \end{cases}$$

$$Y = e^{-\int P(t)dt}\left[\int Q(t)\, e^{+\int P(t)dt}\, dt + C\right]$$

$$\begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = A \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = \begin{pmatrix} v_1 & v_2 \end{pmatrix} \begin{pmatrix} \lambda & 1 \\ 0 & \lambda \end{pmatrix} \begin{pmatrix} v_1 & v_2 \end{pmatrix}^{-1} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} v_1 & v_2 \end{pmatrix}^{-1} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} \dot{a} \\ \dot{b} \end{pmatrix} = \begin{pmatrix} \lambda & 1 \\ 0 & \lambda \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\dot{a} = \lambda a + b_0 e^{\lambda t}$$

$$\dot{b} = \lambda b \rightarrow b = b_0 e^{\lambda t}$$

$$a = e^{\lambda t}\left[\int b_0 e^{\lambda t} e^{-\lambda t}\, dt + C\right]$$

$$a = e^{\lambda t}\left[b_0 t + C\right]$$

$$\dot{a} = \lambda a + b_0 e^{\lambda t}$$

$$\dot{b} = \lambda b \rightarrow b = b_0 e^{\lambda t}$$

$$a = e^{\lambda t}\left[\int b_0 e^{\lambda t} e^{-\lambda t}\, dt + c\right]$$

$$a = e^{\lambda t}\left[b_0 t + c\right]$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} b_0 t + c \\ b_0 \end{pmatrix} e^{\lambda t}$$

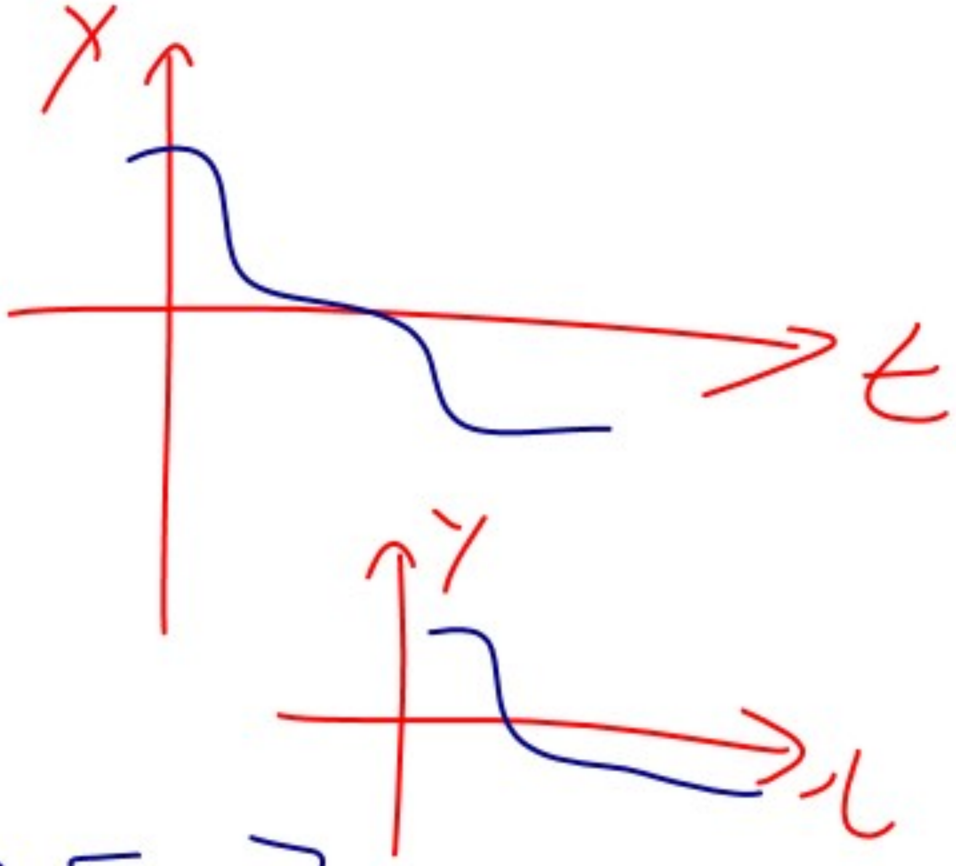
$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} Q_1 & Q_2 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} Q_1 & Q_2 \end{pmatrix} \begin{pmatrix} b_0 t + c \\ b_0 \end{pmatrix} e^{\lambda t}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = e^{\lambda t}\left[(b_0 t + c) Q_1 + b_0 Q_2\right]$$

$$= e^{\lambda t}\left[b_0 (t Q_1 + Q_2) + c Q_1\right]$$

$$\begin{pmatrix}x\\y\end{pmatrix} = e^{\lambda t}\left[b_0(tQ_1+Q_2)+cQ_1\right]$$



$$\begin{pmatrix}x_0\\y_0\end{pmatrix} = e^{\lambda\cdot 0}\left[b_0[0Q_1+Q_2]+cQ_1\right]$$

$$\begin{pmatrix}x_0\\y_0\end{pmatrix} = \left[b_0 Q_2 + cQ_1\right] = \begin{bmatrix}Q_1 & Q_2\end{bmatrix}\begin{bmatrix}c\\b_0\end{bmatrix}$$

$$\begin{bmatrix}c\\b_0\end{bmatrix} = \begin{bmatrix}Q_1 & Q_2\end{bmatrix}^{-1}\begin{bmatrix}x_0\\y_0\end{bmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}^{-1}$$

$$\lambda_{I,II} = \frac{c}{2} \pm \frac{\sqrt{c^2 - 4\Delta}}{2}$$

$$\sqrt{-0.0001}$$

$$\left| \lambda_{I} - \lambda_{II} \right| < 10^{-10}$$

$$\cancel{a + bi}$$

$$|b| < 10^{-11}$$

$$\begin{cases} x(t=0) = x_0 \\ \dot{x} - \lambda x = 0 \end{cases}$$

$$\frac{dx}{dt} = +\lambda x$$

$$\int \frac{dx}{x} = \int +\lambda \, dt$$

$$\ln x = +\lambda t + K$$

$$x = e^{K} e^{\lambda t}$$

$$x_0 = e^{K} e^{\lambda (t=0)}$$

$$x_0 = e^{K}$$

$$x = x_0 e^{\lambda t}$$