

$$\left. \begin{aligned} \dot{x} &= x + y \\ \dot{y} &= 4x - 2y \\ (x, y)_{t=0} &= (2, -3) \end{aligned} \right\} \begin{aligned} \tau &= -1 \\ \Delta &= -6 \end{aligned} \left\{ \begin{aligned} \lambda_1 &= 2 \\ \lambda_2 &= -3 \end{aligned} \right. \quad \begin{aligned} \vec{v}_1 &= \begin{pmatrix} 1 \\ 1 \end{pmatrix} \\ \vec{v}_2 &= \begin{pmatrix} 1 \\ -4 \end{pmatrix} \end{aligned}$$

$$\vec{x}(t) = c_1 \begin{pmatrix} 1 \\ 1 \end{pmatrix} e^{2t} + c_2 \begin{pmatrix} 1 \\ -4 \end{pmatrix} e^{-3t} \quad \text{with } c_1 = c_2 = 1 \text{ from init. cond.}$$

Can draw phase portrait directly from eigenvalues & eigenvectors:

Saddle Point

(one positive real
and one negative
real eigenvalue)

