

7)  $y'' + ay' + by = 0$

$$\frac{d}{dx} \begin{pmatrix} y' \\ y \end{pmatrix} = \begin{pmatrix} -a & -b \\ 1 & 0 \end{pmatrix} \begin{pmatrix} y' \\ y \end{pmatrix}$$

$$\rightarrow J = \begin{pmatrix} -\frac{a}{2} & -\frac{\sqrt{a^2 - 4b}}{2} & 0 \\ 0 & -\frac{a}{2} + \frac{\sqrt{a^2 - 4b}}{2} \end{pmatrix}$$

if  $a^2 > 4b$ :

2 real eigenvalues:  $e^{\lambda_1 t}$ ,  $e^{\lambda_2 t}$

if  $a^2 = 4b$ :

$\lambda_1 = \lambda_2 = -\frac{a}{2}$ , with solution:  $t \cdot e^{-\frac{a}{2}t}$ ,  $e^{-\frac{a}{2}t}$

if  $a^2 < 4b$ :

2 complex eigenvalues.