

MAT292

Tutorial 5 Solution

QiLin Xue

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1. See tutorial 4.

2. (a) We have

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} -a & b \\ c & -d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} \beta \\ \delta \end{bmatrix}$$

(b) $x'(t) = 0$ occurs at

$$0 = -ax + by + \beta \implies ax - by = \beta$$

which is a straight line.

(c) The direction field will be strictly vertical since $x' = 0$.

(d) We have $0 = cx + -dy + \delta \implies -cd + dy = \delta$.

(e) The intersection is equilibrium

(f) This occurs at

$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{ad - bc} \begin{bmatrix} b\delta + d\beta \\ a\delta + c\beta \end{bmatrix}$$

(g)