

# CAAM 336 · DIFFERENTIAL EQUATIONS

## Homework 45

Posted Wednesday 2 April 2014. Due 1pm Friday 25 April 2014.

45. [25 points]

Let the norm  $\|\cdot\| : \mathbb{R}^2 \rightarrow \mathbb{R}$  be defined by

$$\|\mathbf{y}\| = \sqrt{\mathbf{y} \cdot \mathbf{y}}.$$

Let

$$\mathbf{A} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

and consider the problem of finding  $\mathbf{x}(t)$  such that

$$\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t), \quad t > 0$$

and

$$\mathbf{x}(0) = \begin{bmatrix} 2 \\ 0 \end{bmatrix}.$$

(a) Compute  $\mathbf{x}(t)$ .

(b) How does  $\|\mathbf{x}(t)\|$  behave as  $t \rightarrow \infty$ ?