Universitatea Babeş–Bolyai
Facultatea de Matematică şi Informatică

Exam on Dynamical Systems
June 12, 2013

1. Find the solution of the IVP

$$x'' + 4x' + 5x = 0, \quad x(0) = 1, \quad x'(0) = -2.$$

Represent the corresponding integral curve and describe its long-term behavior.

2. Find (directly) the solution of

$$x_{k+2} + x_{k+1} + x_k = 0, \quad x_0 = 0, \quad x_1 = 1.$$

3. Study the stability of the linear difference system

$$x_{k+1} = \frac{1}{3}x_k - \frac{1}{3}y_k, \quad y_{k+1} = \frac{1}{3}x_k + \frac{1}{3}y_k.$$

4. Let $k, t_0, x_0 \in \mathbb{R}$ be fixed parameters. Find the solution of the IVP

$$x' = k(21 - x), \quad x(t_0) = x_0.$$

5. Let $f : \mathbb{R} \to \mathbb{R}$ be a continuous map. Define the notions of fixed point and p-periodic point of the map f. Which is the corresponding orbit in each case?

Find the fixed points of $f(x) = 3x(1 - x)$.