Universitatea Babeş–Bolyai
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Exam on Dynamical Systems.
June 10, 2011

1. Find the general solution of the following differential equations
a) (1p) $x' - 3x = 5t$.

b) (1p) $x' = y, \quad y' = -x - 2y$.

c) (0.5p) $y' = 2y/x$.

2. a) (0.5p) Write the statement of the existence and uniqueness theorem for first order nonlinear differential equations.

b) (0.5p) Prove that the Initial Value Problem $y' = 1 - 4y^2, y(0) = 1/2$ has a unique solution and than name it.

c) (0.5p) Give an example of an Initial Value Problem for which existence and uniqueness theorem is not applicable. Justify.

3. (2p) We consider the nonlinear planar autonomous system

$$\dot{x} = -x + xy, \quad \dot{y} = -4y + 8xy.$$

Find its equilibria and study their stability.