Universitatea Babeş–Bolyai
Facultatea de Matematică şi Informatică

Exam on Dynamical Systems
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II

1. (3.5p) We consider the differential system

$$\dot{x} = -x + 2y, \quad \dot{y} = -2x - y.$$

(a) Study the type and stability of its equilibrium point $(0, 0)$.
(b) Find its general solution.
(c) Pass to polar coordinates.
(d) Represent its phase portrait.

2. (1p) Write the statements of
(a) the existence theorem (Peano)
(b) the existence and uniqueness theorem (Cauchy-Lipschitz)
for a first order differential equation.

3. (2p) (a) Find the solution of the Initial Value Problem

$$y' = \frac{2y}{x}, \quad y(1) = \pi.$$

(b) (True or False) "The solution of the previous IVP is a bounded function."