

Exam on Dynamical Systems.
June 08, 2009

1. (1p) Find the general solution of the following differential equation

$$x' - 2x = 2t - 3.$$

2. (0.5p) Find the second order linear homogeneous differential equation with constant coefficients that has as solutions e^{-t} and $5e^{-2t}$.

3. (1.5p) Find the coefficients of the power series solution (around $t = 0$) of the Initial Value Problem

$$\begin{cases} x'' + t^2x = 0 \\ x(0) = 0 \\ x'(0) = 1. \end{cases}$$

4. (2p) Specify the type and stability of the equilibrium point $(0, 0)$ of the differential system:

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

Represent the phase portrait of this system.

5. (1.5p) Find the equilibria and study their stability for the differential equation

$$\ddot{\theta} + 4\dot{\theta} + \sin \theta = 0.$$