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# Exam on Dynamical Systems
June 22, 2013

1. We consider the equation $x'' - x = te^{-2t}$.

a) Find a particular solution of the form $x_p(t) = (at + b)e^{-2t}$, where $a, b \in \mathbb{R}$.

b) Find the general solution.

c) Find the solution that satisfies the initial conditions $x(0) = 0$, $x'(0) = 0$.

2. Let $f : \mathbb{R} \to \mathbb{R}$ be given by $f(x) = x - (x^2 - 2)/4$.

a) Find the fixed points of $f$ and study their stability.

b) What can we say about the solution of $x_{k+1} = f(x_k)$ with $x_0 = \sqrt{2}$ and, respectively, with $x_0 \in \mathbb{R}$ such that $|x_0 - \sqrt{2}|$ is sufficiently small?

3. Find the general solution of $dy/dx = -2y/x$ .