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Exam on Dynamical Systems
June 19, 2013

1. Find the general solution of each of the following equations.
a) $x' - tx = t$, b) $t^2x'' - 3tx' + 3x = 0$, $t \in (0, \infty)$.
(Hint: At b) look for solutions of the form $x = t^r$ with $r \in \mathbb{R}$).

2. Describe the motion of a spring-mass system whose equation is $x'' + k/m\ x = 0$, where $k, m > 0$.

3. We consider the IVP $\dot{x} = -200\ x$, $x(0) = 1$.
a) Find the solution and its limit as $t \to \infty$.
b) Write the Euler's numerical formula with constant step-size h.
c) Find a range of values for the step-size h such that the solution $(x_k)_{k\geq 0}$ of the difference equation found at b) satisfies $\lim_{k\to\infty} x_k = 0$.