MATH2130: Ordinary Differential Equations

Exercise Sheet 1: Basic Concepts

Please hand solutions in at the lecture on Monday 1st February.

1.) Find a solution of the initial value problem $x'(t) = x(t)$ and $x(1) = \mathrm{e}$.

2.) (i) Show: The function $y : \mathbb{R} \to \mathbb{R}$, $y(x) = c \cdot \mathrm{e}^{-x^2}$ is a solution of the differential equation $y'(x) + 2 \cdot x \cdot y(x) = 0$ for every constant $c \in \mathbb{R}$.

(ii) Find a solution of the initial value problem $y'(x) + 2 \cdot x \cdot y(x) = 0$ and $y(a) = 1$ for $a \in \mathbb{R}$.

3.) (i) Find a solution of the differential equation $\ddot{x} = 0$.

(ii) Find a solution of the differential equation $y'(x) = \frac{1}{x}$.

4.) Solve the following initial value problems.

(i) $x(t) \cdot x'(t) + t = 0$ and $x(t_0) = 0$.

(ii) $x(t) \cdot x'(t) = 2\,t$ and $x(0) = x_0$.

(iii) $x(t) \cdot x'(t) = 3$ and $x(0) = x_0$.

Hint: Note that $(x^2(t))' = x(t) \cdot x'(t)$.