# Analysis II

Janis Hutz
https://janishutz.com

October 1, 2025

TITLE PAGE COMING SOON

"*Some funny quote from the lecture still needed*"
- Özlem Imamoglu, 2025

HS2025, ETHZ
Cheat-Sheet based on Lecture notes and Script
https://metaphor.ethz.ch/x/2025/hs/401-0213-16L/sc/script-analysis-II.pdf

# Contents

# 1 Introduction

This Cheat-Sheet does not serve as a replacement for solving exercises and getting familiar with the content. There is no guarantee that the content is 100% accurate, so use at your own risk. If you discover any errors, please open an issue or fix the issue yourself and then open a Pull Request here:

`https://github.com/janishutz/eth-summaries`

This Cheat-Sheet was designed with the HS2025 page limit of 10 A4 pages in mind. Thus, the whole Cheat-Sheet can be printed full-sized, if you exclude the title page, contents and this page. You could also print it as two A5 pages per A4 page and also print the Analysis I summary in the same manner, allowing you to bring both to the exam

# 2 Differential Equations

## 2.1 Introduction

**Ex 2.1.1:** $f'(x) = f(x)$ has only solution $f(x) = ae^x$ for any $a \in \mathbb{R}$; $f' - a = 0$ has only solution $f(x) = \int_{x_0}^{x} a(t)\ \mathrm{d}t$

**T 2.1.6:** Let $F : \mathbb{R}^2 \to \mathbb{R}$ be a differential function of two variables. Let $x_0 \in \mathbb{R}$ and $y_0 \in \mathbb{R}^2$. The Ordinary Differential Equation (ODE) $y' = F(x, y)$ has a unique solution $f$ defined on a "largest" interval $I$ that contains $x_0$ such that $y_0 = f(x_0)$

## 2.2 Linear Differential Equations

**D 2.2.1:** *(Linear differential equation of order k)* $y^{(k)} + a_{k-1}y^{(k-1)} + \ldots + a_1y' + a_0y = b$, with $a_i$ and $b$ functions in $x$. If $b(x) = 0\ \ \forall x$, ***homogeneous***, else ***inhomogeneous***