

## Syllabus: Refresher Course in Mathematics and Statistics

Rebecca Stuart

University of Neuchâtel

12-16 September 2022

This course is a week-long refresher course covering various topics in differential calculus, probability, statistical inference and linear algebra. Teaching will take place for four hours each morning. Exercises will be circulated for completion each afternoon, and solutions will be reviewed the following morning. On the final day, both exercises and solutions will be distributed in class.

**Day 1: Single-variable calculus** (Basic functions and properties, differentiation rules and applications, integration rules and applications, extension to multi-variable functions)

**Day 2: Function maximization / minimization** (Review of unconstrained optimization, constrained optimization: Lagrange functions, examples and interpretation of the results)

**Day 3: Concepts in statistics and probability** (Basic definitions, random variables: examples, discrete and continuous distributions, covariance and correlation, conditional mean and variance)

**Day 4: Statistical inference** (population and random sampling, estimating the population mean and population variance, confidence intervals and p-value, interpretation of hypothesis testing)

**Day 5: Linear regression** (univariate model, goodness of fit and statistical significance of parameters, multivariate generalisation), **and Introductory linear algebra** (Vector/matrix notation, basic operations: addition, subtraction, product, inverse, transpose)