


# Mathematics for Machine Learning: Course Overview

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## Key skills

- ▶ Probability meets linear algebra, i.e. multiple variables
- ▶ Linear algebra and statistics underlying learning algorithms
- ▶ Probability to analyse learning algorithms

Follows on from:

# Prerequisites

This course follows on from:

- ▶ 40016 - Y1 - Calculus
- ▶ 40017 - Y2 - Linear Algebra
- ▶ 50008 - Y2 - Probability & Statistics

An incomplete collection of skills that will be assumed:

- ▶ Linear Algebra (e.g. change of basis, eigenvectors)
- ▶ Differentiation & Integration
- ▶ Probability and basic stats (maximum likelihood)

We collected exercises to support you in revising this.

# Logistics: In-person teaching

Two lecturers: Myself, and Dr Yingzhen Li.

Teaching schedule:

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- ▶ In-person TA sessions on Fri 10-11am.

# Coursework

Two courseworks.

- ▶ Coding exercise, designed to put the theory into practice.
- ▶ Code submission to LabTS, where it will be automatically graded by unittests.
- ▶ Feedback provided by TAs.

# Exercise sheet

- ▶ Unassessed but crucial for your practice.
- ▶ TAs are here **every week** to provide feedback.
- ▶ But, your responsibility to instigate.

# TA sessions

- ▶ Your opportunity ask questions, discuss exercises, get feedback.
- ▶ This is **student led**: up to you to make the most of it. Suggestion:
  - ▶ Discuss specific questions about the course material.
  - ▶ Go through (selection of) exercises. You explain your solution to the TAs. TA gives feedback on your solution.
  - ▶ Discuss differences to the solution provided.
  - ▶ Discuss steps you are uncertain about (e.g. why is a step needed).
- ▶ You will need to sign up to a specific TA beforehand (to be communicated over EdStem).

You can also ask questions on EdStem, and TAs or lecturers will respond.

# Course overview

In this course, we will consider two machine learning problems:

- ▶ Supervised learning
- ▶ Unsupervised learning

We will teach you the mathematics needed to **implement** and **analyse** the methods, e.g.:

- ▶ Linear Regression
  - ▶ Differentiation, Optimisation (implementation)
  - ▶ Probability and Statistics (analysis)

We care catering to students with a wide variety of backgrounds. Some need to catch up, so there is a lot of material. Focus on the skills needed for implementation if it is too much.

# Course materials

- ▶ The **only** link you need for material:  
<https://scientia.doc.ic.ac.uk/2223/modules/70015>
- ▶ This links to all our materials on GitHub:  
<https://github.com/markvdw/mml-autumn-2022>
- ▶ All L<sup>A</sup>T<sub>E</sub>X sources are on GitHub too.
- ▶ Please do suggest improvements to exercise solutions, fix typos, etc. Just fork and submit a PR.
- ▶ For those who contribute, there will be cake.