



**Stellenbosch**

UNIVERSITY  
IYUNIVESITHI  
UNIVERSITEIT

**Departement Ekonomie  
Department of Economics**

Mathematical Methods for Postgraduate  
Economics Students 771

Course Outline 2023

Dr M von Fintel

# 1 Background

The use of mathematics in economics is often viewed negatively by practitioners, ranging from mild opposition to much deeper skepticism in the underlying epistemology. These skeptics see quantitative methods as a compromised mode of expression that is best done away with.

Sometimes these sorts of sentiments are justified. A great deal of economics nowadays proceeds on the basis that an elegant mathematical proof of something is truth, no matter the empirical evidence for or against the theorem/theory in question.

While a sober assessment of its usefulness as a tool is to be encouraged, much of this sort of disagreeable sentiment is premised on a misunderstanding of the role played by mathematics in economics. The mathematical formulation of an argument is a style of reasoning that lends itself to disciplines, like economics, where evidence plays a central role. Of course, good writing can accomplish the same goal, but this is a rare skill that very few possess. So first and foremost, mathematical formalisms help to communicate ideas succinctly and with clarity that is often more difficult to do any other way.

But a second, perhaps more important role for mathematics, is that it helps us clarify how our conclusions (say over the efficacy of policy) follow from our (often hidden) assumptions. A formal approach to theorising about the economy offers a way of making transparent the underlying assumptions behind received ideas. Indeed, some of the most celebrated advances in economics during the 20th century have embodied exactly this idea.

In the end however, mathematical techniques are nothing but tools. Good economics requires ingenuity as well as creativity in the application of these tools. Although few might aspire to be like the Kenneth Arrow's of the world - brilliant masters of both mathematical formalism and narrative exposition - both manners of communicating in the discipline are encouraged. Formal training in mathematical methods is therefore a core competency demanded by our post-graduate coursework degree programmes.

# 2 Course Contacts

| Role           | Name                 | E-mail                    | Room | Consultation     |
|----------------|----------------------|---------------------------|------|------------------|
| Lecturer       | Dr Marisa von Fintel | marisavonfintel@sun.ac.za | 611  | By appointment   |
| Tutor          | Mr Tim Ngalande      | timngalande@sun.ac.za     | -    | During Tutorials |
| Administration | Ms Carina Smit       | carina@sun.ac.za          | 506A | -                |

### 3 Course Objectives

- To provide students with a necessary foundation in calculus and linear algebra
- To provide a thorough grounding in unconstrained and constrained optimisation that will be applied in Microeconomics and Macroeconomics theory courses
- To introduce students to the concepts of homogeneity, concavity/convexity, quasi-concavity/-convexity, and Eigenvalues which are foundational to applied Microeconomics and Macroeconomics theory courses

### 4 Prescribed Text and Course Resources

- The core text for this course is  
Simon, C.P. and L. Blume, (1994). *Mathematics for Economists*, New York: WW Norton & Company.
- For interested students, additional examples can be found in  
Chiang, A. and Wainwright, K, (2004). *Fundamental Methods of Mathematical Economics*, McGraw Hill.
- All information, announcements, lecture notes, assignments and tutorials will be posted on SunLearn:
  - <http://learn.sun.ac.za>

### 5 Course Structure

#### 5.1 Lectures, Tutorials and Problem Sets

A detailed weekly outline is provided in the table below. Formal lectures are scheduled for every week of the semester, mostly on Mondays from 08:30-10:30, but for some weeks also on Fridays from 8:30-10:30. In addition to formal lectures, a weekly tutorial is scheduled on Fridays. This slot will be used to work through problems with the tutor. This course requires a substantial amount of practice to be able to implement and grasp the theoretical concepts and solve the problems in tests and exams. Students should prioritize the attendance of tutorials and the completion of problem sets.

When a chapter is covered in the lectures, a set of problems from the text will be posted on SUNLearn. Completed problem sets need to be handed in to the tutor at the venue before the beginning of each tutorial (except in circumstances where there are venue constraints, in which case there will be a link on SUNLearn for the problem set to be handed in). The tutor will go through the solution to each problem during the tutorial, however he will only mark a random selection

of questions (which will not be communicated to students beforehand) from the problem set. Students are therefore still required to complete the problem set in full. The marks from these randomly chosen questions will constitute your tutorial mark (10% of the final mark).

## 5.2 Assessment

The final mark for this course will be calculated as follows (please note the relevant dates of assessment):

1. Tutorial mark: 10%
2. Term test: 30% (20 March 2023 during the lecture slot; Examinable material: Chapters 12 to 15)
3. Final exam: 60% (Exact date to be confirmed; Examinable material: Chapters 16-21, 23, Appendix A4)

Please note the following important information:

- Tutorials
  - There will be 9 tutorials in total. Students are expected to hand in all problem sets. However, only the best 6 marks for each student (out of 9 opportunities) will count to make up the final tutorial mark.
  - Any problem sets which have not been handed in on time will automatically count as 0.
- Term test
  - The test will cover material from Chapters 12 to 15.
  - All students are required to write the test in March.
  - Any student who misses the test is required to submit a valid medical certificate <sup>1</sup> to marisavonfintel@sun.ac.za within 48 hours.

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<sup>1</sup>Medical certificates must meet the following requirements to be accepted:

Name of the patient (student);

Date and time of medical examination;

An indication that the certificate has been issued after a personal observation (this excludes telephonic consultation or communication) of the student by a suitably registered medical practitioner;

Confirmation that the student will not be able to or was not able to attend class or take the class test(s) or carry out the class work, due to illness, and

Any other information which, in the judgement of the practitioner would be required or relevant.

Please refer to the University Calendar, Part 1, for further information.

- **Students who miss the term test and submit a valid medical certificate** are required to write the medical term test (2 hours). The medical term test will take place on the same day as the exam, with a short controlled break between the two assessments (i.e. a 3 hour exam plus a 2 hour medical term test, with a 30-minute break in between). The medical term test will examine the same material as the term test in March (Chapter 12 to 15).

- Examination

- The exam will last for 3 hours and will cover Chapters 16-21, 23, and Appendix A4.
- All students are required to write the exam.
- **Students who miss the examination due to illness** are obliged to present a valid medical certificate to the department, after which they may qualify to write the medical exam. Only students who wrote the term test in March can qualify for a medical examination. This assessment will take place together with the supplementary exam, and will be scheduled in the same week as all other supplementary exams of the postgraduate programme. The date will be announced in due course.
- **Students who write the first exam may qualify for a supplementary examination**, which will be written in the same week as all other supplementary exams of the postgraduate programme. After the first examination, passes, fails and supplementaries are awarded according to the following classifications:

|                   |             | <i>Exam Mark</i> |                                       |
|-------------------|-------------|------------------|---------------------------------------|
|                   |             | $<40\%$          | $\geq 40 \%$                          |
| <i>Final Mark</i> | $\geq 50\%$ | Fail             | Pass                                  |
|                   | $< 50 \%$   | Fail             | Supplementary (cap final mark at 50%) |

- **Students who are ill and submit a medical certificate for the first examination** will not receive a mark for any of the assessments completed on the day of the examination. This entails that no mark will be awarded for the medical term test, should students have missed the term test. Should this occur, module results will be recorded as "incomplete" and students should register again for the course in a following academic year.
- **Students who miss both the term test and the exam**, will not be awarded the credits for this module, and results will be recorded

as "incomplete" and students should register again for the course in the following academic year. This includes students who are ill during the first exam period.

## 6 Basic Course Outline

The following times and venues apply:

*Lecture I: Monday 08:30-10:30 - Schumann Room 225*

*Lecture II: Friday 8:30-10:30 - Schumann Room 225*

*Tutorial: Friday 14:00-16:00 - Schumann Room 225*

| <b>Lecture I (L)</b> |  | <b>Lecture II (L)</b> |   | <b>Tutorial (T)</b>  |                   |
|----------------------|--|-----------------------|---|----------------------|-------------------|
| Monday (08:30-10:30) |  | Friday (8:30-10:30)   |   | Friday (14:00-16:00) |                   |
| 6-Feb                | Ch 12: Limits and Open Sets (L)                | 10-Feb                | Ch 13: Functions of Several Variables (L)     | 10-Feb               | *                 |
| 13-Feb               | Ch 14: Calculus of Several Variables (L)       | 17-Feb                | Ch 14: Calculus of Several Variables (L)      | 17-Feb               | Ch 12 (T)         |
| 20-Feb               | Ch 15: Implicit Functions and Derivatives (L)  | 24-Feb                | Ch 15: Implicit Functions and Derivatives (L) | 24-Feb               | Ch 13 (T)         |
| 27-Feb               | Ch 16: Quadratic Forms (L)                     | 3-Mar                 | *   | 3-Mar                | Ch 14 (T)         |
| 6-Mar                | <b>RECESS</b>                                  | 10-Mar                | <b>RECESS</b>                                 | 10-Mar               | <b>RECESS</b>     |
| 13-Mar               | Ch 17: Unconstrained Optimisation (L)          | 17-Mar                | *   | 17-Mar               | Ch 15 (T)         |
| 20-Mar               | <b>TERM TEST</b>                               | 24-Mar                | *   | 24-Mar               | Ch 16 & Ch 17 (T) |
| 27-Mar               | Ch 18: Constrained Optimisation I (L)          | 31-Mar                | Ch 18: Constrained Optimisation II (L)        | 31-Mar               | *                 |
| 3-Apr                | <b>RECESS</b>                                  | 7-Apr                 | <b>RECESS</b>                                 | 7-Apr                | <b>RECESS</b>     |
| 10-Apr               | <b>EASTER MONDAY</b>                           | 14-Apr                | Ch 19: Constrained Optimisation (L)           | 14-Apr               | *                 |
| 17-Apr               | Ch 20: Homogenous and Homothetic Functions (L) | 21-Apr                | *   | 21-Apr               | Ch 18 & Ch 19 (T) |
| 24-Apr               | Ch 21: Concave and Quasiconcave functions (L)  | 28-Apr                | *   | 28-Apr               | *                 |
| 1-May                | <b>WORKERS' DAY</b>                            | 5-May                 | Ch 23: Eigenvalues and vectors I (L)          | 5-May                | Ch 20 & Ch 21 (T) |
| 8-May                | Ch 23: Eigenvalues and vectors II (L)          | 12-May                | Appendix A4: Integral Calculus (L)            | 19-May               | Ch 23 (T)         |
| 15-May               | *  | 19-May                | *   | 19-May               | Appendix A4 (T)   |

Please monitor the course website and listen for announcements in class regarding the slots with an (\*). (L) denotes a formal lecture for a specific date, while (T) indicates a tutorial. The time taken and order of the topics may be adjusted to suit the schedule, but will be timeously communicated to students in class and/or via the course website.