

Syllabus

Course name: Mathematical and Quantitative Economics, 3684, Helsinki and Vaasa

Period: P1-P2, 2026/2027

Language of instruction: English

Course credits: 10 ECTS

Course description: See Sisu

Intended learning outcomes: See Sisu

Workload: 267h = scheduled (contact hours): 26h + non-scheduled work: 241h

Prerequisites: Strongly recommended: basic mathematics course.

Instructor information: Agnieszka Jach, agnieszka.jach at hanken.fi, Office hours: Wednesday 15-16h in D612/MS Teams

Mode of teaching & participation: Blended learning, see Table 1

Course literature:

Essential Mathematics for Economic Analysis (2021). Knut Sydsaeter, Peter Hammond, Arne Strom, Andres Carvajal, 6th edition. Harlow: Pearson. (available as an e-book from Hanken's library)

The Economy 1.0

<https://core-econ.org/the-economy/v1/index.html>

Introduction to Statistical Learning with Applications in Python (2023), James et.al.
<https://www.statlearning.com/>

Key concepts: analytical and quantitative economic analyses, mathematical manipulations, Python, JupyterNotebook.

External partner: No

Examination and assessment:

Final exam (90%): exam consists of 8-10 exercises embedded into a Moodle quiz; exam has to be performed in max. 6h, 09:00h-15:00h; **exam dates:** 17.12.2026 (Thu; first attempt), 06.02.2027 (Sat; second attempt); exercises have to be answered sequentially (you can only go forward; you cannot go back to modify your answers).

Pre-requisite: to be allowed to take the exam, you need to obtain at least half of the points from the quizzes.

Quizzes (10% = 4x1% + 2% + 4%): Moodle quizzes; each quiz has to be performed in max. 6h from when you start/open it; quiz can be opened between 00:00h and 23:59h on a given Friday - see Table 1 for the exact dates; questions/exercises have to be answered sequentially (you can only go forward; you cannot go back to modify your answers). Each quiz is a mixture of math- and quant-based questions.

- math-based questions: questions requiring calculations 'by hand' (show-your-work type) and choosing intermediate and/or final answers in a quiz question; there will also be questions where answers have to be entered as an algebraic expression using special syntax; it is recommended that you type-set at least some of your solutions in Jupyter Notebook, using markdown and latex syntax
- quant-based questions: software-based; questions requiring quantitative/analytical analyses in Python and choosing intermediate and/or final answers in a quiz question.

Plagiarism and AI use: Hanken's Action Plan against Academic Misconduct in Studies.
AI use: exam-quiz and hw-quizzes: red light. Everything else: green light.

Schedule: See Table 1

Week	Dates (Mon-Fri)	Part = theory [math&quant] + practice [math&quant] + quiz [math&quant]	Helsinki classroom & MS Teams Workshop Wednesday	Quiz (to be performed in max.6h from when you start; quiz can be open between 00:00-23:59h) Friday
36	31.08-04.09	1 One-var. Fun and Diff	16-19:15h in A305	Quiz1 (Part 1) due
37	07-11.09	1	16-19:15h in A305	
38	14-18.09	2 One-var. Optim	16-19:15h in A305	
39	21-25.09	2	16-19:15h in A305	
40	28.09-02.10	3 One-var. Integr	16-19:15h in A305	Quiz3 (Part 3) due
41	05-09.10	4 Linear Algebra	16-19:15h in A305	Quiz4 (Part 4) due
42	12-16.10	4	16-17:30h in A305	
43	19-23.10	P1-P2 break		
44	26-30.10	5 Multivar. Fun,Diff,Optim		
45	02-06.11	5		Quiz5 (Part 5) due
46	09-13.11	5		
47	16-20.11	6 Data Science/ML		
48	23-27.11	6		
49	30.11-04.12	6		Quiz6 (Part 6) due

Table 1: Detailed agenda.

Additional information: Each part consists of three subparts: a) Theory/Fundamentals, b) Practice, c) Quiz, and each subpart is comprised of mathematical and quantitative/analytical elements.

- Part 1. One-variable Functions and Differentiation
Chapter(s) in the textbook: 4. Functions of One Variable, 5. Properties of Functions, 6. Differentiation (and Limits), 7. Derivatives in Use
- Part 2. One-variable Optimization
Chapter(s) in the textbook: 8. Single-variable Optimization
- Part 3. One-variable Integration
Chapter(s) in the textbook: 9. Integration
- Part 4. Linear Algebra
Chapter(s) in the textbook: 15. Matrix and Vector Algebra 16. Determinants and Inverse Matrices
- Part 5. Multivariable Functions, Differentiation, Optimization
Chapter(s) in the textbook: 11. Functions of Many Variables, 12. Tools for Comparative Statics, 13. Multivariable Optimization, 14. Constrained Optimization, 17. Linear Programming
- Part 6. Data Science/Machine Learning
Chapter(s) in the (main) textbook: not applicable;
Chapters in Introduction to Statistical Learning with Applications in Python: 3. Regression, 4. Classification, 8. Tree-based Methods

You are expected to know the contents of Chapter 1 of the main textbook and of the Appendices.

Quantitative/analytical (software/Python-oriented) :

- QuantEcon
<https://quantecon.org/>
- Jan Boone
<https://github.com/janboone>
https://janboone.github.io/python_economics/economics.html
- Python for Everybody
<https://www.py4e.com/>
- <https://lectures.scientific-python.org/>
- Introduction to Statistical Learning with Applications in Python (2023), James et.al.
<https://www.statlearning.com/>

Software: Python (computing, symbolic calculations and graphics) and markdown (generation of documents with latex syntax for type-setting mathematical formulas) used in Jupyter Notebook. Python code can also be run in Spyder. All software ingredients can be obtained at once by installing Anaconda (instructions can be found on Moodle).