

Assessment plan for the curriculum of the Master's degree programme in Mathematics, 2024-2025

Programme director: prof. dr. S (Stephan) Trenn

Date advice Board of Examiners: June 5, 2024

Date approval Faculty Board:

1. Vision on assessment

1. Assessment evaluates the student's skills to formulate and justify mathematical statements.
2. Assessment stimulates the student to develop structured approaches to solving abstract mathematical problems.
3. Assessment stimulates the development of both research and presentation skills in academic and professional contexts.

2. Assessment guidelines

Please explain the general assessment procedures that are used in the programmes. For example, 4-eyes principle in test design, standardised grading forms, rubrics.

1. All summative assessment is organized onsite; formative assessment can be organized either online or onsite.
2. The formative and summative assessment are designed by the course coordinator in such a way that the assessment covers all the intended learning outcomes of the course.
3. Summative assessments in the form of final exams are designed by the course coordinator and are peer reviewed by the second examiner in order to ensure that the exam assesses the course material representatively and sufficiently.
4. Summative assessments in the form of take home exams are verified by additional in-person discussions.
5. When making use of mathematical literature when writing assignments, the student must explain how this literature was used.

3. Learning outcomes of the degree programme

Learning outcomes for the degree programme, further specified learning outcomes (where relevant) and/or specified for tracks within the degree programme. Please add extra rows if necessary.

	Learning Outcome <i>At the end of the programme, the graduate ...</i>
A1	has an understanding of the most important concepts of the field, [knowledge and understanding]
A2	is able to contribute to the scientific advancement of a subfield of mathematics, [applying knowledge and understanding]

A3	is able to use abstract thinking and mathematical reasoning to get to the root of a problem and thus recognize whether existing methods are applicable, or to ascertain that new methods must be developed, [applying knowledge and understanding]
A4	is able to function in multidisciplinary teams, [applying knowledge and understanding]
A5	is familiar with the social and ethical aspects of applying mathematics in practice, [judgement]
A6	understands the scientific relevance of problem definitions and results, and the validity of the scientific method, [judgement]
A7	is able to describe solutions in both general and formal mathematical terms, [communication]
A8	is able to express him- or herself well both orally and in writing, [communication]
A9	is able to evaluate the scientific literature so as to keep their knowledge up to date. [learning]
	In addition, the master graduate in Mathematics, except for the track Science, Business and Policy,
P1	has specialized knowledge of theories, methods and techniques in at least one of the following subfields of mathematics: [knowledge and understanding] a. Number Theory and Algebraic Geometry b. Probability and Discrete Mathematics c. Analysis and Dynamical Systems d. Geometry and Topology e. Mathematical Physics
P2	has experience with formulating ideas and problems in the mathematical language and with interpreting the mathematical results in the light of the original, non-mathematical problem, [applying knowledge and understanding]
P3	is able to apply scientific results and insights to concrete problems in mathematics or in related fields (natural sciences or applied mathematics), [applying knowledge and understanding]
P4	is familiar with and experiences mathematics as a coherent organic unit. [judgement]
	Whereas the master graduate in Mathematics track Science, Business and Policy
M1	has an understanding of the way in which businesses and policy organizations are functioning (governments and non-governmental organizations, NGO's) [knowledge and understanding]
M2	understands the connections between natural science research, business, and policy [knowledge and understanding]
M3	Is able to integrate aspects of natural science, business and management [applying knowledge and understanding]
M4	has developed his/her social and communicative skills, is able to work project-based, and is capable of taking professional responsibility [communication, judgement]

4. Overview of assessment methods, test moments for course units, and examiners

This table shows all the course units for each year of the programme and assessment methods. Please add extra rows if necessary.

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
All Specializations (excluding SBP)								
1	2A	Mathematics and its Environment (WMMA013-05)	5	R, P, AST	No	Exam week	prof. dr. J. Top	dr. R. Szabó
1	2B	Student Colloquium (WMMA029-05)	5	R, P	No	Last lecture week	prof. dr. M.A. Grzegorzcyk	dr. J. Koellermeier, prof. dr. J.S. Müller, prof. dr. J.G. Peypouquet, prof. dr. O. Lorscheid
1	2A-2B	Elective: Neem Regie (Dutch) (TEM0110-24)	10	See MSc Lerarenopleiding				
2	Whole Year	Research Seminar in Mathematics (WMMA030-05)	5	P	Yes	Exam week, Continuous	prof. dr. J.S. Müller	prof. dr. J.P. Trapman
2	Whole year	Master Research Project in Mathematics (WMMA902-50)	50	R, P	No	End of project, Continuous	See list below (section 6)	
Specialization: Probability and Discrete Mathematics								
1	1A	Random Geometry and Topology A (24/25) (WMMA041-05)	5	WE, AST	Yes	Exam week, Continuous	dr. G.F.Y. Bonnet	dr. R. Szabó
1	1A	Random Geometry and Topology B (23/24) (WMMA049-05)	5	WE, AST	No	Exam week, Continuous	dr. R. Szabó	prof. dr. J.P. Trapman

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1B	Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (23/24) (WMMA061-05)	5	WE, P	No	Exam week, Continuous (homework)	prof. dr. J.P. Trapman	dr. R. Szabó
1	1B	Topics in Probability and Statistics (WMMA039-05)	5	WE, AST, R	Yes	Exam week, Continuous (homework)	prof. dr. J.P. Trapman	dr. S.A. Donderwinkel
1	2A	Combinatorial Mathematics A (24/25) (WMMA036-05)	5	WE, AST	Yes	Exam week, Continuous (homework)	prof. dr. T. Müller	dr. S.A. Donderwinkel
1	2A	Combinatorial Mathematics B (23/24) (WMMA046-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. S.A. Donderwinkel	prof. dr. T. Müller
1	1B	Modal Logic and Proof Theory (WMCS027-05)	See MSc CS					
1	1A-2B	Electives from relevant courses Mastermath, other specializations Mathematics, specializations Applied Mathematics	See Mastermath regulations and MSc AM					
Specialization: Number Theory and Algebraic Geometry								
1	1A	Introduction to Algebraic Geometry (WMMA033-05)	5	OR	Yes	Exam week	prof. dr. C. Salgado Guimarães da Silva	prof. dr. J.Top

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1B	Geometry and Topology (23/24) (WMMA018-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. J.Top
1	1B	Topics in Algebra and Geometry A (24/25) (WMMA038-05)	5	OR, AST	No	Exam week, Continuous (homework)	prof. dr. O. Lorscheid	prof. dr. J.S. Müller
1	1B	Topics in Algebra and Geometry B (23/24) (WMMA048-05)	5	OR, AST	No	Exam week, Continuous (homework)	prof. dr. J. Top	prof. dr. C. Salgado Guimarães da Silva
1	2A	Arithmetic Geometry (23/24) (WMMA045-05)	5	OR, AST	No	Exam week, Continuous (homework)	prof. dr. J.S. Müller	prof. dr. J. Top
1	2A	Topics in Number Theory (24/25) (WMMA035-05)	5	OR, AST	No	Exam week, Continuous (homework)	prof. dr. J.S. Müller	dr. P. Kilicer
1	1A-2B	Electives from relevant courses Mastermath, other specializations Mathematics, specializations Applied Mathematics	See Mastermath regulations and MSc AM					
Specialization: Mathematical Physics								
1	1A	Hamiltonian mechanics (WMMA019-05)	5	R, P	Yes	Continuous	prof. dr. M. Seri	dr. H. Jardón Kojakhmetov
1	1A	Pertubation Theory (24/25) (WMMA032-05)	5	WE, P	No	Exam week, Various	dr. H. Jardón Kojakhmetov	dr. N. Martynchuk

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1A	Singularity Theory (23/24) (WMMA043-05)	5	P, AST	No	Exam week, Various	dr. N. Martynchuk	prof. dr. H. Waalkens
1	1B	Geometry and Topology (23/24) (WMMA018-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. J. Top
1	1B	Integrable Systems (WMMA037-05)	5	P, AST	Yes	Continuous	dr. T.F. Görbe	dr. N. Martynchuk
1	1B	Spectral Theory (23/24) (WMMA047-05)	5	OE, AST	No	Continuous	prof. dr. M. Seri	prof. dr. H. Waalkens
1	2A	Geometry and Differential Equations (24/25) (WMMA017-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. R.I. van der Veen
1	1A-2B	Electives from relevant courses Mastermath, other specializations Mathematics, specializations Applied Mathematics, relevant courses from the MSc Physics/ Astrophysics: Quantum Universe	See Mastermath regulations, MSc AM, MSc PH					
Specialization: Geometry and Topology								
1	1A	Introduction to Algebraic Geometry (WMMA033-05)	5	OR	No	Exam week	prof. dr. C. Salgado Guimarães da Silva	prof. dr. J.Top
1	1B	Geometry and Topology (23/24) (WMMA018-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. J. Top

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1B	Integrable Systems (WMMA037-05)	5	P, AST	Yes	Continuous	dr. T.F. Görbe	dr. N. Martynchuk
1	1B	Topics in Differential Geometry (WMMA040-05)	5	AST, P	No	Exam week, Continuous (homework)	dr. N. Martynchuk	TBD
1	2A	Geometry and Differential Equations (24/25) (WMMA017-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. R.I. van der Veen
1	2A	Topics in Topology A (24/25) (WMMA034-05)	5	P, PR, AST	No	Continuous	prof. dr. R.I. van der Veen	dr. A.V. Kiselev
1	2A	Topics in Topology B (WMMA044-05)	5	P, PR, AST	No	Continuous	prof. dr. R.I. van der Veen	dr. A.V. Kiselev
1	1A-2B	Electives from relevant courses Mastermath, other specializations Mathematics, specializations Applied Mathematics, relevant courses from the MSc Physics/ Astrophysics: Quantum Universe	See Mastermath regulations, MSc AM, MSc PH					
Specialization: Analysis and Dynamical Systems								
1	1A	Pertubation Theory (24/25) (WMMA032-05)	5	WE, P	No	Exam week, Various	dr. H. Jardon Kojakhmetov	dr. N. Martynchuk
1	1A	Singularity Theory (23/24) (WMMA043-05)	5	P, AST	No	Continuous	dr. N. Martynchuk	prof. dr. H. Waalkens

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1A	Topics in Dynamical Systems and Chaos A (24/25) (WMMA031-05)	5	OE, AST	No	Exam week	dr. A.E. Sterk	dr. H. Jardón Kojakhmetov
1	1A	Topics in Dynamical Systems and Chaos B (23/24) (WMMA42-05)	5	OE, AST	No	Exam week	dr. A.E. Sterk	dr. H. Jardon Kojakhmetov
1	1B	Integrable Systems (WMMA037-05)	5	P, AST	Yes	Continuous	dr. T.F. Görbe	dr. N. Martynchuk
1	1B	Spectral Theory (23/24) (WMMA047-05)	5	OE, AST	No	Continuous	prof. dr. M. Seri	prof. dr. H. Waalkens
1	2A	Geometry and Differential Equations (24/25) (WMMA017-05)	5	WE, AST	No	Exam week, Continuous (homework)	dr. A.V. Kiselev	prof. dr. R.I. van der Veen
1	1A-2B	Electives from relevant courses Mastermath, other specializations Mathematics, specializations Applied Mathematics, relevant courses from the MSc Physics/ Astrophysics: Quantum Universe	See Mastermath regulations, MSc AM, MSc PH					
Track: Science, Business and Policy								
1	Whole year	Master Research Project in Mathematics (for SPB) (WMMA903-30)	30	R, P	No	End of project, Continuous	See list below (section 6)	
1	Whole Year	Research Seminar in Mathematics (WMMA030-05)	5	P	Yes	Exam week, Continuous	prof. dr. J.S. Müller	prof. dr. J.P. Trapman

Year	Period	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	2A	Mathematics and its Environment (WMMA013-05)	5	R, P, AST	No	Exam week	prof. dr. J.Top	dr. R. Szabó
1	2B	Student Colloquium (WMMA029-05)	5	R, P	No	Exam week	prof. dr. M.A. Grzegorzcyk	dr. J. Koellermeier, prof. dr. J.S. Müller, prof. dr. J.G. Peypouquet, prof. dr. O. Lorscheid
2	1A + 1B	Introduction Science and Policy (WMSE002-10)	10	See Assessment Plan SBP				
2	1A	Introduction Science and Business (WMSE001-10)	10	See Assessment Plan SBP				
2	1B	Work Placement Business and Policy (WMSE902-40)	40	See Assessment Plan SBP				
1		<i>Specialization specific courses</i>						

The abbreviations for the relevant teaching methods are explained in the legend of the table.

Examples of assessment methods include:

- *Written Exam (WE)*
- *Multiple Choice (MC)*
- *Oral Exam (OR)*
- *Report (R)*
- *Presentation (P)*
- *Practical Work (PR)*
- *Assignment (AST)*

The abbreviations for other master programmes are as follows:

- *MSc AI: Artificial Intelligence*
- *MSc AS: Astronomy*
- *MSc BM: Biomedical Sciences*
- *MSc CS: Computer Science*
- *MSc IEM: Industrial Engineering and Management*
- *MSc ME: Mechanical Engineering*
- *MSc PH: Physics*
- *MSc SC: Systems and Control*

5. Relationship between course units and details of the learning outcomes

Please note in the table below the course units per block in the programme. Indicate which learning outcomes are assessed in which courses by adding an X in the relevant cell. Please add extra rows if necessary.

An X means that the learning outcome is explicitly assessed (not merely addressed) in the course.

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
Period	Course	Year 1 – compulsory courses																		
All Specializations (excluding SBP)																				
2A	Mathematics and its Environment (WMMA013-05)					X	X		X		X			X				X		
2B	Student Colloquium (WMMA029-05)			X			X	X	X	X	X	X	X	X						
Track: Science, Business and Policy																				
Whole year	Master Research Project in Mathematics (for SPB) (WMMA903-30)	X	X	X		X	X	X	X	X								X		
2A	Mathematics and its Environment (WMMA013-05)					X	X		X		X			X				X		
Period	Course	Year 1 Electives (if applicable)																		
All Specializations (excluding SBP)																				
2A+2B	Neem Regie (Dutch) (TEM0110-24)					X			X	X										

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
Specialization: Probability and Discrete Mathematics																				
1A	Random Geometry and Topology A (24/25) (WMMAo41-05)	X	X	X			X	X		X	X	X	X	X						
1A	Random Geometry and Topology B (23/24) (WMMAo49-05)	X	X	X			X	X		X	X	X	X	X						
1B	Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (23/24) (WMMAo61-05)	X		X	X	X				X	X	X	X							
1B	Topics in Probability and Statistics (WMMAo39-05)	X	X	X			X	X	X		X	X	X	X						
2A	Combinatorial Mathematics A (24/25) (WMMAo36-05)	X		X			X	X		X	X	X	X							
2A	Combinatorial Mathematics B (23/24) (WMMAo46-05)	X		X			X	X		X	X	X	X							
1B	Modal Logic and Proof Theory (WMCS027-05)	X	X	X	X		X	X			X		X							

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
Specialization: Number Theory and Algebraic Geometry																				
1A	Introduction to Algebraic Geometry (WMMA033-05)	X		X			X	X			X			X						
1B	Geometry and Topology (23/24) (WMMA018-05)	X	X				X	X	X		X		X	X						
1B	Topics in Algebra and Geometry A (24/25) (WMMA038-05)	X	X	X			X	X			X		X							
1B	Topics in Algebra and Geometry B (23/24) (WMMA048-05)	X	X	X			X	X			X		X							
2A	Arithmetic Geometry (23/24) (WMMA045-05)	X	X	X			X	X		X	X		X	X						
2A	Topics in Number Theory (24/25) (WMMA035-05)	X	X	X			X	X		X	X		X	X						
Specialization: Mathematical Physics																				
1A	Hamiltonian mechanics (WMMA019-05)	X	X		X	X	X	X	X	X	X	X	X	X						
1A	Pertubation Theory (24/25) (WMMA032-05)	X	X	X			X	X			X	X	X							

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
1A	Singularity Theory (23/24) (WMMAo43-05)	X	X	X			X	X			X	X	X							
1B	Geometry and Topology (23/24) (WMMAo18-05)	X	X				X	X	X		X		X	X						
1B	Integrable Systems (WMMAo37-05)	X	X	X			X	X			X	X	X							
1B	Spectral Theory (23/24) (WMMAo47-05)	X	X	X			X	X			X	X	X	X						
2A	Geometry and Differential Equations (24/25) (WMMAo17-05)	X	X		X		X	X	X	X	X	X		X						
Specialization: Geometry and Topology																				
1A	Introduction to Algebraic Geometry (WMMAo33-05)	X		X			X	X			X			X						
1B	Geometry and Topology (23/24) (WMMAo18-05)	X	X				X	X	X		X		X	X						
1B	Integrable Systems (WMMAo37-05)	X	X	X			X	X			X	X	X							
1B	Topics in Differential Geometry (WMMAo40-05)	X	X	X			X	X	X	X	X		X	X						
2A	Geometry and Differential	X	X		X		X	X	X	X	X	X		X						

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
	Equations (24/25) (WMMA017-05)																			
2A	Topics in Topology A (24/25) (WMMA034-05)	X	X	X			X	X		X	X		X	X						
2A	Topics in Topology B (WMMA044-05)	X	X	X			X	X		X	X		X	X						
Specialization: Analysis and Dynamical Systems																				
1A	Pertubation Theory (24/25) (WMMA032-05)	X	X	X			X	X			X	X	X							
1A	Singularity Theory (23/24) (WMMA043-05)	X	X	X			X	X			X	X	X							
1A	Topics in Dynamical Systems and Chaos A (24/25) (WMMA031-05)	X	X	X	X	X	X	X	X		X	X	X	X						
1A	Topics in Dynamical Systems and Chaos (23/24) (WMMA042-05)	X	X	X	X	X	X	X	X		X	X	X	X						
1B	Integrable Systems (WMMA037-05)	X	X	X			X	X			X	X	X							
1B	Spectral Theory (23/24) (WMMA047-05)	X	X	X			X	X			X	X	X							
2A	Geometry and Differential	X	X		X		X	X	X	X	X	X		X						

		Learning outcomes of the degree programme																		
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	P 1	P 2	P 3	P 4	M 1	M 2	M 3	M 4		
	Equations (24/25) (WMMA017-05)																			
Track: Science, Business and Policy																				
Whole year	Research Seminar in Mathematics (WMMA030-05)			X			X	X	X	X				X						
2B	Student Colloquium (WMMA029-05)			X			X	X	X	X	X	X	X	X						
Period	Course	Year 2 compulsory courses																		
All Specializations (excluding SBP)																				
Whole Year	Research Seminar in Mathematics (WMMA030-05)			X			X	X	X	X	X	X	X	X				X		
Whole Year	Master Research Project in Mathematics (WMMA902-50)	X	X	X		X	X	X	X	X	X	X	X	X						
Track: Science, Business and Policy																				
1A+1B	Introduction Science and Policy (WMSE002-10)				X	X			X						X	X	X	X		
1A	Introduction Science and Business (WMSE001-10)				X	X			X						X	X	X	X		
Whole year	Work Placement Business and Policy (WMSE902-40)				X	X			X						X	X	X	X		

6. Examiners for Research Project (30 ECTS and 50 ECTS) and Work Placement Science, Business and Policy

dr. G.F.Y. Bonnet
dr. S.A. Donderwinkel
dr. T.F. Görbe
prof. dr. M.A. Grzegorzcyk
dr. H. Jardón Kojakhmetov
dr. P. Kilicer
dr. A.V. Kiselev
dr. W.P. Krijnen
prof. dr. O. Lorscheid
prof. dr. J.S. Müller
prof. dr. T. Müller
dr. N. Martynchuk
prof. dr. J.G. Peypouquet
prof.dr. C. Salgado Guimarães da Silva
prof. dr. M. Seri
dr. A.E. Sterk
dr. R. Szabó
dr. P. Tibboel
prof. dr. J.P. Trapman
prof. dr. J. Top
prof. dr. R.I. van der Veen
prof. dr. H. Waalkens

Examiners of the research project of the master's degree programme in applied mathematics may act as a second examiner for the research project of the master's degree programme in mathematics as well.

On an individual basis the Board of Examiners can allow examiners of other degree programmes to act as examiner for the research project of the master's degree programme in mathematics as well.