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Appendices for the Master's degree programme(s) in Mathematics

2025-2026

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Appendix I Learning outcomes of the degree programme (art. 3.1)

Objectives of MSc Mathematics
As a consequence of the ongoing automation of society and the technological innovations that go along with it, the call of our society for mathematics is growing. Underneath virtually every form of automation lies a mathematical concept or model. In order to be able to respond to this development in society, it is important that mathematics is utilized in a proper and effective way. This requires that society has access to sufficiently many well qualified and highly trained mathematicians. The Master's degree programme in Mathematics aims to train mathematicians who meet this profile.

The Master's degree programme in Mathematics aims to impart knowledge, skills, understanding and an academic attitude in the field of mathematics by means of a broadly based curriculum building on a bachelor's degree in Mathematics, such that Master's graduates are able to pursue an independent career as independent professionals and are also qualified for further training to become academic researchers in the field.

Learning outcomes MSc Mathematics
The above objective has been translated into a set of learning outcomes for the programme. The learning outcomes consist of general learning outcomes with respect to both knowledge and skills, which are applicable for all tracks of the programme, supplemented with track-specific learning outcomes. For each learning outcome a reference to the Dublin descriptors is given between brackets.

The master graduate in Mathematics

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 themselves 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 their social and communicative skills, is able to work project-based, and is capable of taking professional responsibility [communication, judgement]

Appendix II Tracks/Specializations (art. 3.6)

The degree programme consists out of the following specializations:

- Number Theory and Algebraic Geometry
- Probability and Discrete Mathematics
- Analysis and Dynamical Systems
- Geometry and Topology
- Mathematical Physics

Additionally, it has a track in Science, Business and Policy, which has somewhat different learning outcomes, see App. I for details.

Appendix III Content of the degree programme (art. 3.8)

The degree programme is made up of the following course units

- Master Research Project in Mathematics
- Mathematics and its Environment
- Student Colloquium
- Research Seminar in Mathematics
- Topics in Dynamical Systems and Chaos A (26/27)
- Topics in Dynamical Systems and Chaos B (25/26)
- Hamiltonian Mechanics
- Topics in Algebra and Geometry A (26/27)
- Topics in Algebra and Geometry B (25/26)
- Topics in Differential Geometry
- Introduction to Algebraic Geometry
- Geometry and Topology (25/26)
- Geometry and Differential Equations (26/27)
- Topics in Number Theory (26/27)
- Arithmetic Geometry (25/26)
- Topics in Topology A (26/27)
- Topics in Topology B (25/26)
- Perturbation Theory (26/27)
- Singularity Theory (25/26)
- Integrable Systems
- Spectral Theory (25/26)
- Random Geometry and Topology A (26/27)
- Random Geometry and Topology B (25/26)
- Combinatorial Mathematics A (26/27)
- Combinatorial Mathematics B (25/26)
- Topics in Probability and Statistics
- Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26)

Specializations are based on this list, courses from other degree programmes and elective modules of the Dutch Mastermath programme consisting of about 60 Master's courses; see http://elo.mastermath.nl for details. Because the workload of modules from Mastermath is not 5 ECTS, but 6 or 8 ECTS, it may be that the total size of the programme is not exactly equal to 120 ECTS. If so, the size must be at least 120 ECTS and it should not be possible to remove 1 course and still have more than 120 ECTS; hence the total workload of the degree programme can be at most 124 ECTS. Note: At the discretion of the Board of Examiners, courses may be added as extracurricular.

For information on the modules offered by other degree programmes, see also the Teaching and Examination Regulations of the corresponding programme.

The programme for the specialization **Number Theory and Algebraic Geometry** is:

Course unit	Course code	ECTS	Entry requirements
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
≥ 25 ECTS out of: - Topics in Algebra and Geometry A (26/27) - Topics in Algebra and Geometry B (25/26) - Introduction to Algebraic Geometry - Geometry and Topology (25/26) - Topics in Number Theory (26/27) - Arithmetic Geometry (25/26)	 WMMA038-05 WMMA048-05 WMMA033-05 WMMA018-05 WMMA035-05 WMMA045-05	≥ 25 5 5 5 5 5 5	
Electives (see App. IV)		≤30-34	
Master Research Project in Mathematics	WMMA902-50	50	see Appendix V

The total has to be at least 120 ECTS, but it should not be possible to remove 1 course and still have more than 120 ECTS

The programme for the specialization **Probability and Discrete Mathematics** is:

Course unit	Course code	ECTS	Entry requirements
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
≥ 25 ECTS out of: - Random Geometry and Topology A (26/27) - Random Geometry and Topology B (25/26) - Combinatorial Mathematics A (26/27) - Combinatorial Mathematics B (25/26) - Topics in Probability and Statistics	 WMMA038-05 WMMA048-05 WMMA036-05 WMMA046-05 WMMA039-05 WMMA061-05	≥ 25 5 5 5 5 5 5	

- Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26)			
Electives (see App. IV)		≤30-34	
Master Research Project in Mathematics	WMMA902-50	50	see Appendix V

The total has to be at least 120 ECTS, but it should not be possible to remove 1 course and still have more than 120 ECTS.

The programme for the specialization **Geometry and Topology** is:

Course unit	**Course code**	**ECTS**	**Entry requirements**
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
≥ 25 ECTS out of: - Topics in Differential Geometry - Introduction to Algebraic Geometry - Geometry and Topology (25/26) - Geometry and Differential Equations (26/27) - Topics in Topology A (26/27) - Topics in Topology B (25/26) - Integrable Systems	 WMMA040-05 WMMA033-05 WMMA018-05 WMMA017-05 WMMA034-05 WMMA044-05 WMMA037-05	≥ 25 5 5 5 5 5 5 5	
Electives (see App. IV)		≤30-34	
Master Research Project in Mathematics	WMMA902-50	50	see Appendix V

The total has to be at least 120 ECTS, but it should not be possible to remove 1 course and still have more than 120 ECTS.

The programme for the specialization **Analysis and Dynamical Systems** is:

Course unit	**Course code**	**ECTS**	**Entry requirements**
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
≥ 25 ECTS out of: - Topics in Dynamical Systems and Chaos A (26/27) - Topics in Dynamical Systems and Chaos B (25/26) - Geometry and Differential Equations (26/27) - Perturbation Theory (26/27) - Singularity Theory (25/26) - Integrable Systems - Spectral Theory (25/26)	 WMMA031-05 WMMA042-05 WMMA017-05 WMMA032-05 WMMA043-05 WMMA037-05 WMMA047-05	≥ 25 5 5 5 5 5 5 5	
Electives (see App. IV)		≤30-34	
Master Research Project in Mathematics	WMMA902-50	50	see Appendix V

The total has to be at least 120 ECTS, but it should not be possible to remove 1 course and still have more than 120 ECTS.

The programme for the specialization **Mathematical Physics** is:

Course unit	**Course code**	**ECTS**	**Entry requirements**
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
≥ 25 ECTS out of: - Hamiltonian Mechanics - Geometry and Differential Equations (26/27) - Geometry and Topology (25/26) - Perturbation Theory (26/27)	 WMMA019-05 WMMA017-05 WMMA018-05 WMMA032-05	≥ 25 5 5 5 5	

- Singularity Theory (25/26) - Integrable Systems - Spectral Theory (25/26)	WMMA043-05 WMMA037-05 WMMA047-05	5 5 5	
Electives (see App. IV)		≤30-34	
Master Research Project in Mathematics	WMMA902-50	50	see Appendix V

The total has to be at least 120 ECTS, but it should not be possible to remove 1 course and still have more than 120 ECTS.

The programme for the track **Science, Business and Policy** consists of a mathematical component (60 ECTS) and a Business and Policy component 60 ECTS:

Mathematical component			
Course unit	**Course code**	**ECTS**	**Entry requirements**
Mathematics and its Environment	WMMA013-05	5	
One out of the following two: - Student Colloquium - Research Seminar in Mathematics	 WMMA029-05 WMMA030-05	5 5 5	
≥ 20 ECTS out of the specialization specific courses listed above (restricted to one specialization)		≥ 20	
Master Research Project in Mathematics (for SBP)	WMMA903-30	30	

The total of the mathematical component has to be at least 60 ECTS, but it should not be possible to remove 1 course and still have more than 60 ECTS. At the discretion of the Board, extra courses may be added as extracurricular.

Business and Policy component			
Course unit	**Course code**	**ECTS**	**Entry Requirements**
Introduction Science and Business	WMSE001-10	10	
Introduction Science and Policy	WMSE002-10	10	
Work Placement Business and Policy	WMSE901-40	40	see Appendix V

Double Master's degree in Mathematics and Physics

A student who desires to obtain both a Masters' degree in Mathematics and a Master's degree in Physics has to be enrolled in both degree programmes and has to meet the requirements of both programmes. The following programme meets the requirements of the MSc Mathematics as well as the requirements of the MSc Physics, track Quantum Universe, where the individual Master Research Projects in Physics and Mathematics are replaced by a joint Master Research Project. The total programme comprises (at least) 180 ECTS: (at least) 100 ECTS of courses and 80 ECTS of research, and is feasible within 2 ½ years of study.

Research Project (80 ECTS)

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Master Research Project Physics and Mathematics*			see Appendix V
- Mathematics Part	WMMA905-40	40	
- Physics Part	WMPH904-40	40	
The Research Project includes:		0	
- Scientific Integrity	WMPH019-00	0	
- Academic Skills	WMPH001-00	0	
- Career Perspectives	WMPH048-00	0	
- General Physics Colloquium	WMPH002-00		

* This joint research project is formally split into two parts, however practically it is one large research project supervised and graded by one examiner from Mathematics and one from Physics and it is not necessary to split the final report into two distinct parts. The grade of the two formal parts will be determined by both supervisors. Note that the corresponding Board of Examiners for Mathematics has to approve the Physics supervisor for the Mathematics Part and vice versa.

Physics (50 ECTS)

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Advanced Quantum Mechanics	WMPH032-05	5	
Computational Physics	WMPH007-05	5	
Statistical Mechanics	WMPH029-05	5	
Mathematical Methods of Physics	WMPH016-05	5	
General Relativity	WMPH009-05	5	
Particle Physics Phenomenology	WMPH026-05	5	
Electrodynamics of Radiation Processes	WMAS008-05	5	
Student Seminar Quantum Universe	WMPH039-05	5	

Two optional courses Quantum Universe which are not part of the individual Mathematics programme of the student. Not allowed: - Geometry & Differential Equations - Geometry & Topology		10	

For information about the courses of the Master's degree programme Physics and a list of optional courses Quantum Universe see the Teaching and Examination Regulations of the Master's degree programme in Physics.

Mathematics (50 ECTS)

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	
Research Seminar in Mathematics	WMMA030-05	5	
Geometry and Differential Equations (26/27)	WMMA017-05	5	
Geometry and Topology (25/26)	WMMA018-05	5	
≥ 15 ECTS out of: - Topics in Dynamical Systems and Chaos A (26/27) - Topics in Dynamical Systems and Chaos B (25/26) - Hamiltonian Mechanics - Topics in Algebra and Geometry A (26/27) - Topics in Algebra and Geometry B (25/26) - Topics in Differential Geometry - Introduction to Algebraic Geometry - Geometry and Differential Equations (26/27) - Topics in Number Theory (26/27) - Arithmetic Geometry (25/26) - Topics in Topology A (26/27) - Topics in Topology B (25/26) - Perturbation Theory (26/27) - Singularity Theory (25/26) - Integrable Systems - Spectral Theory (25/26)	 WMMA031-05 WMMA042-05 WMMA019-05 WMMA038-05 WMMA048-05 WMMA040-05 WMMA033-05 WMMA017-05 WMMA035-05 WMMA045-05 WMMA034-05 WMMA044-05 WMMA032-05 WMMA043-05 WMMA037-05 WMMA047-05 WMMA041-05	≥15 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	

- Random Geometry and Topology A (26/27) - Random Geometry and Topology B (25/26) - Combinatorial Mathematics A (26/27) - Combinatorial Mathematics B (25/26) - Topics in Probability and Statistics - Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26)	WMMA049-05 WMMA036-05 WMMA046-05 WMMA039-05 WMMA061-05	5 5 5 5 5	
Max. 2-courses from the Mastermath programme		≤16	

The total of the Mathematics part has to be at least 50 ECTS, but it should not be possible to remove 1 course and still have more than 50 ECTS.

This common programme can be split into the following distinct programmes

Physics, track Quantum Universe:

The individual programme (120 ECTS) consists of the 50 ECTS Physics part (see above), 30 ECTS electives out of the Mathematics part (see above) and 40 ECTS for half of the joint master research project.

Course unit	Course code	ECTS	Entry requirements
Advanced Quantum Mechanics	WMPH032-05	5	
Computational Physics	WMPH007-05	5	
Statistical Mechanics	WMPH029-05	5	
Mathematical Methods of Physics	WMPH016-05	5	
General Relativity	WMPH009-05	5	
Particle Physics Phenomenology	WMPH026-05	5	
Electrodynamics of Radiation Processes	WMAS008-05	5	
Student Seminar Quantum Universe	WMPH039-05	5	
Two optional courses Quantum Universe which are not part of the individual Mathematics programme of the student. Not allowed: - Geometry & Differential Equations - Geometry & Topology		10	
30 ECTS electives from Mathematics (see above)		30	
Master Research Project in Physics and Mathematics - Physics Part	WMPH904-40	40	see Appendix V

Mathematics

The individual programme (120 ECTS) consists of the 50 ECTS Mathematics part (see above), 30 ECTS electives out of the Physics part (see above) and 40 ECTS for half of the joint master research project.

Course unit	Course code	ECTS	Entry requirements
Mathematics and its Environment	WMMA013-05	5	
Student Colloquium	WMMA029-05	5	

Research Seminar in Mathematics	WMMA030-05	5	
Geometry and Differential Equations (26/27)	WMMA017-05	5	
Geometry and Topology (25/26)	WMMA018-05	5	
25-29 ECTS out of: - Topics in Dynamical Systems and Chaos A (26/27) - Topics in Dynamical Systems and Chaos B (25/26) - Hamiltonian Mechanics - Topics in Algebra and Geometry A (26/27) - Topics in Algebra and Geometry B (25/26) - Topics in Differential Geometry - Introduction to Algebraic Geometry - Topics in Number Theory (26/27) - Arithmetic Geometry (25/26) - Topics in Topology A (26/27) - Topics in Topology B (25/26) - Perturbation Theory (26/27) - Singularity Theory (25/26) - Integrable Systems - Spectral Theory (25/26) - Random Geometry and Topology A (26/27) - Random Geometry and Topology B (25/26) - Combinatorial Mathematics A (26/27) - Combinatorial Mathematics B (25/26) - Topics in Probability and Statistics - Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26) - max two courses from Mastermath	 WMMA031-05 WMMA042-05 WMMA019-05 WMMA038-05 WMMA048-05 WMMA040-05 WMMA033-05 WMMA035-05 WMMA045-05 WMMA034-05 WMMA044-05 WMMA032-05 WMMA043-05 WMMA037-05 WMMA047-05 WMMA041-05 WMMA049-05 WMMA036-05 WMMA046-05 WMMA039-05 WMMA061-05	25-29 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 0-16	
30 ECTS electives from Physics (see above)		30	
Master Research Project in Physics and Mathematics - Mathematics Part	WMMA905-40	40	see Appendix V

Appendix IV Electives (art. 3.9.1)

This appendix sets out the optional course units of the Master's degree programme in Mathematics. The electives are divided into groups to facilitate a coherent choice. Note: based on a well-founded request by a student, the Board of Examiners may grant permission to choose electives other than those listed here (from the University of Groningen or another university in the Netherlands or abroad). The programme or a part of it must in any case be coherent and of master level (at the discretion of the Board of Examiners).

The electives are grouped in the following way:

Electives from Statistics

Course unit	Course code	ECTS	Entry requirements
Contemporary Statistics with Applications (26/27)	WMMA015-05	5	
Statistical Genomics (25/26)	WMMA008-05	5	
Statistical Consulting	WMMA024-05	5	
Introduction to Data Science	WMCS002-05	5	
Statistical Signal Processing	WMAS011-05	5	
Topics in Probability and Statistics	WMMA039-05	5	
Mathematical modelling and statistical analysis of the spread of infectious diseases (25/26)	WMMA061-05	5	

Electives from Computational Mathematics

Course unit	Course code	ECTS	Entry requirements
Computational Fluid Dynamics	WMMA012-05	5	
Iterative Algorithms	WMMA057-05	5	
Finite Element Methods and Applications	WMMA051-05	5	
Coupled Problems (26/27)	WMMA052-05	5	
Numerical Simulation of Turbulence (25/26)	WMMA063-05	5	

Topics in Numerical Mathematics A (25/26)	WMMA064-05	5	
Topics in Numerical Mathematics B (26/27)	WMMA065-05	5	

Electives from Systems and Optimization

Course unit	**Course code**	**ECTS**	**Entry requirements**
Robust Control	WMMA021-05	5	
Convex Analysis (26/27)	WMMA060-05	5	
Iterative Algorithms	WMMA057-05	5	
Model Reduction for Control (26/27)	WMMA062-05	5	
Nonlinear Control Systems	WMSC003-05	5	
Calculus of Variations and Optimal Control (25/26)	WMMA056-05	5	
Evolution Equations (25/26)	WMMA059-05	5	
Data-based Analysis and Control (25/26)	WMMA058-05	5	

Electives from Number Theory and Algebraic Geometry

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Topics in Algebra and Geometry A (26/27)	WMMA038-05	5	
Topics in Algebra and Geometry B (25/26)	WMMA048-05	5	
Introduction to Algebraic Geometry	WMMA033-05	5	
Geometry and Topology (25/26)	WMMA018-05	5	
Topics in Number Theory (26/27)	WMMA035-05	5	
Arithmetic Geometry (25/26)	WMMA045-05	5	

Electives from Probability and Discrete Mathematics

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Random Geometry and Topology A (26/27)	WMMA041-05	5	

Random Geometry and Topology B (25/26)	WMMA049-05	5	
Combinatorial Mathematics A (26/27)	WMMA036-05	5	
Combinatorial Mathematics B (25/26)	WMMA046-05	5	
Topics in Probability and Statistics	WMMA039-05	5	
Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26)	WMMA061-05	5	

Electives from Geometry and Topology

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Topics in Differential Geometry	WMMA040-05	5	
Introduction to Algebraic Geometry	WMMA033-05	5	
Geometry and Topology (25/26)	WMMA018-05	5	
Geometry and Differential Equations (26/27)	WMMA017-05	5	
Topics in Topology A (26/27)	WMMA034-05	5	
Topics in Topology B (25/26)	WMMA044-05	5	
Integrable Systems	WMMA037-05	5	

Electives from Analysis and Dynamical Systems

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Topics in Dynamical Systems and Chaos A (26/27)	WMMA031-05	5	
Topics in Dynamical Systems and Chaos B (25/26)	WMMA048-05	5	
Geometry and Differential Equations (26/27)	WMMA017-05	5	
Perturbation Theory (26/27)	WMMA032-05	5	
Singularity Theory (25/26)	WMMA043-05	5	

Integrable Systems	WMMA037-05	5	
Spectral Theory (25/26)	WMMA047-05	5	

Electives from Mathematical Physics

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Hamiltonian Mechanics	WMMA019-05	5	
Geometry and Differential Equations (26/27)	WMMA017-05	5	
Geometry and Topology (25/26)	WMMA018-05	5	
Perturbation Theory (26/27)	WMMA032-05	5	
Singularity Theory (25/26)	WMMA043-05	5	
Integrable Systems	WMMA037-05	5	
Spectral Theory (25/26)	WMMA047-05	5	

External electives

The Departments of Mathematics of the Dutch universities organise a joint Mastermath programme consisting of about 60 Master's courses; see http://elo.mastermath.nl for details. The degree programme may contain elective modules of Mastermath. Because the workload of these modules is not 5 ECTS, but 6 or 8 ECTS, it may be that the total size of the programme is not exactly equal to 120 ECTS. If so, the size must be at least 120 ECTS and it should not be possible to remove 1 course and still have more than 120 ECTS; hence the total workload of the degree programme can be at most 124 ECTS. As long as there is no significant overlap with a local course any mastermath course can be chosen as an elective. Furthermore, at the discretion of the Board of Examiners, courses may be added as extracurricular.

For information on the modules of degree programmes of the University of Groningen other than the ones offered by the Master's degree programme in Mathematics see the Teaching and Examination Regulations of the corresponding programme.

Number Theory and Algebraic Geometry

The electives in the specialization Number Theory and Algebraic Geometry have a workload of at most 30-34 ECTS, of which 0-15 ECTS can be chosen freely (course units of Master level, relevant to Mathematics, at the discretion of the Board of Examiners), the remaining elective must be chosen from the list below.

Course unit	Course code	ECTS	Entry requirements
Mastermath courses		6/8	
Electives from Statistics			
Electives from Computational Mathematics			
Electives from Systems and Optimization			
Electives from Probability and Discrete Mathematics			
Electives from Geometry and Topology			
Electives from Analysis and Dynamical Systems			
Electives from Mathematical Physics			
Neem Regie*	TEM0110-24	10	

*Note: The course Neem Regie (TEM0110-24) offers students the possibility to get acquainted with the work of a high school Mathematics teacher in the Netherlands. The course is taught in Dutch. Upon successful completion of the course students have the possibility to follow the post-master degree programme 'Leraar Voorbereidend Hoger Onderwijs in de Betawetenschappen' (LVHO) where they only still have to follow 50 ECTS, instead of the normal 60 ECTS.

Probability and Discrete Mathematics

The electives in the specialization Probability and Discrete Mathematics have a workload of at most 30-34 ECTS, of which 0-15 ECTS can be chosen freely (course units of Master level, relevant to Mathematics, at the discretion of the Board of Examiners), the remaining electives must be chosen from the list below.

Course unit	Course code	ECTS	Entry requirements
Mastermath courses		6/8	
Electives from Statistics			
Electives from Computational Mathematics			
Electives from Systems and Optimization			
Electives from Number Theory and Algebraic Geometry			
Electives from Geometry and Topology			
Electives from Analysis and Dynamical Systems			
Electives from Mathematical Physics			
Modal Logic and Proof Theory	WMCS027-05	5	
Neem Regie*	TEM0110-24	10	

* See corresponding note at specialization Number Theory and Algebraic Geometry

Geometry and Topology

The electives in the specialization Geometry and Topology have a workload of at most 30-34 ECTS, of which 0-15 ECTS can be chosen freely (course units of Master level, relevant to Mathematics, at the discretion of the Board of Examiners), the remaining electives must be chosen from the list below.

Course unit	Course code	ECTS	Entry requirements
Mastermath courses		6/8	
Relevant courses from the MSc Physics/ Astrophysics: Quantum Universe (at the discretion of the Board of Examiners)			
Electives from Statistics			

Electives from Computational Mathematics			
Electives from Systems and Optimization			
Electives from Number Theory and Algebraic Geometry			
Electives from Probability and Discrete Mathematics			
Electives from Analysis and Dynamical Systems			
Electives from Mathematical Physics			
Neem Regie*	TEM0110-24	10	

* See corresponding note at specialization Number Theory and Algebraic Geometry

Analysis and Dynamical Systems

The electives in the specialization Analysis and Dynamical Systems have a workload of at most 30-34 ECTS, of which 0-15 ECTS can be chosen freely (course units of Master level, relevant to Mathematics, at the discretion of the Board of Examiners), the remaining electives must be chosen from the list below.

Course unit	**Course code**	**ECTS**	**Entry requirements**
Mastermath courses		6/8	
Relevant courses from the MSc Physics/ Astrophysics: Quantum Universe (at the discretion of the Board of Examiners)			
Electives from Statistics			
Electives from Computational Mathematics			
Electives from Systems and Optimization			
Electives from Number Theory and Algebraic Geometry			
Electives from Probability and Discrete Mathematics			
Electives from Geometry and Topology			
Electives from Mathematical Physics			
Neem Regie*	TEM0110-24	10	

* See corresponding note at specialization Number Theory and Algebraic Geometry

Mathematical Physics

The electives in the specialization Mathematical Physics have a workload of at most 30-34 ECTS, of which 0-15 ECTS can be chosen freely (course units of Master level, relevant to Mathematics, at the discretion of the Board of Examiners), the remaining electives must be chosen from the list below.

Course unit	Course code	ECTS	Entry requirements
Mastermath courses		6/8	
Relevant courses from the MSc Physics/ Astrophysics: Quantum Universe (at the discretion of the Board of Examiners)			
Electives from Statistics			
Electives from Computational Mathematics			
Electives from Systems and Optimization			
Electives from Number Theory and Algebraic Geometry			
Electives from Probability and Discrete Mathematics			
Electives from Geometry and Topology			
Electives from Analysis and Dynamical Systems			
Neem Regie*	TEM0110-24	10	

* See corresponding note at specialization Number Theory and Algebraic Geometry

Appendix V Entry requirements and compulsory order (art. 4.4)

Course unit	ECTS	Entry requirements
Master Research Project	50	- Successful completion of 35 ECTS of modules of the Master's degree programme in Mathematics. - Enrolment in progress for the research project course - Approval of research plan including project schedule by supervisors and Master Project coordinator.
Work Placement Business and Policy	40	Successful completion of Introduction Science and Business (WMSE001-10), Introduction Science and Policy (WMSE002-10), the 60 ECTS mathematical component of the programme (including Master Research Project in Mathematics (for SBP) (30 ECTS)).
Master Research Project in Physics and Mathematics	2x40	- Successful completion of 35 ECTS of modules of the Mathematics part and 45 ECTS of modules of the Physics part. - Enrolment in progress for both parts of the joint research project - Approval of research plan including project schedule by supervisors and Master Project coordinator of both programmes. - Both parts can only be completed together, i.e. it is not possible to register a final grade for only one of the two parts

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Appendix VI Admission to the degree programme (art. 2.1A.1 + 2.1B.1)

Holders of the following Bachelor's degrees from the University of Groningen or any other Dutch university are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Mathematics on that basis:

- BSc Mathematics
- BSc Applied Mathematics

The above degrees from other Dutch universities are considered equivalent to the corresponding UG degrees.

Appendix VII Pre-master programmes

Board of Admissions decides:

a. The content and the student workload of a tailormade Pre-Master's programme.
   or
b. Admission is not accepted.

Appendix VIII Transitional provisions (art. 7.1)

Since the TER for this academic year is applicable to all students registered in the Master's degree programme in Applied Mathematics, regardless of the starting date of students, transitional arrangements are in place.

For cohort 2024-2025 and earlier
The courses WMMA055-05 "Numerical Bifurcation Analysis", WMMA054-05 "Multiscale Numerical Methods" and WMMA053-05 "Model Reduction for PDEs" are discontinued, but if successfully completed in the past, can still be used as one of the "Computational Mathematics" electives.

For cohort 2023-2024 and earlier
The names of the following courses have been changed and hence are considered equivalent. Therefore, students are not allowed to include both the old and new course in their programme.

Old course	**New Course**
Modeling and Identification (WMMA007-05)	Model Reduction for Control (WMMA062-05)
Modelling and Control of Complex Nonlinear Engineering Systems (WMMA020-05)	Nonlinear Control Systems (WMSC003-05)
Web and Cloud Computing (WMCS005-05)	Cloud Computing and Cloud-based Applications (WMCS032-05)
Basiscursus Master Lerarenopleiding (Dutch) (TEM0105) Masterstage 1 (Dutch) (TEM0205)	Neem Regie (TEM0110-24)

For cohort 2022-2023 and earlier
In 2023/24 the tracks Mathematics & Complex Dynamical Systems and Statistics & Big Data have been discontinued. Students who were enrolled in these tracks can finish these tracks according to the TER MSc Mathematics 2022/23**.**

Appendix IX Additional Requirements Open Degree Programmes (Art. 3.10)

In exceptional circumstances, students wishing to pursue an open degree programme may file a request with the Board of Examiners. An Open Degree Programme must always be approved in advance by the Board of Examiners. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme and can determine further conditions in their rules and regulations.

The Open Degree Programme in Mathematics must include the Master Research Project in Mathematics, the course units Mathematics and its Environment, Student Colloquium and Research Seminar in Mathematics and at least 5 courses are to be taken from

- Topics in Dynamical Systems and Chaos A (26/27)
- Topics in Dynamical Systems and Chaos B (25/26)
- Hamiltonian Mechanics
- Topics in Algebra and Geometry A (26/27)
- Topics in Algebra and Geometry B (25/26)
- Topics in Differential Geometry
- Introduction to Algebraic Geometry
- Geometry and Topology (25/26)
- Geometry and Differential Equations (26/27)
- Topics in Number Theory (26/27)
- Arithmetic Geometry (25/26)
- Topics in Topology A (26/27)
- Topics in Topology B (25/26)
- Perturbation Theory (26/27)
- Singularity Theory (25/26)
- Integrable Systems
- Spectral Theory (25/26)
- Random Geometry and Topology A (26/27)
- Random Geometry and Topology B (25/26)
- Combinatorial Mathematics A (26/27)
- Combinatorial Mathematics B (25/26)
- Topics in Probability and Statistics
- Mathematical Modelling and Statistical Analysis of the Spread of Infectious Diseases (25/26)