



university of  
 groningen

faculty of mathematics  
 and natural sciences

**Appendices**  
**to**  
**Teaching and Examination regulations:**  
**Master's degree programme in Mathematics**



## Appendix I Teaching outcomes of the degree programme (art. 1.3)

The learning outcomes consist of general learning outcomes with respect to both knowledge and skills, which are applicable for both the P-variant and M-variant, supplemented with variant-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 modelling 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 of the P-variant

- P1. has specialized knowledge of theories, methods and techniques in at least one of the following subfields of mathematics: [knowledge and understanding]
  - a. Algebra & Geometry
  - b. Dynamical Systems and Analysis
  - c. Statistics and Probability
- P2. has experience with the mathematical modelling of non-mathematically formulated ideas and problems 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 of the M-variant Science, Business and Policy: (Since the Business and Policy part of the M-variant is taught in Dutch the M-variant specific learning outcomes are in Dutch).

- M1. heeft inzicht in het functioneren van bedrijven en beleidsorganisaties (overheden en niet-gouvernementele organisaties, NGO's).
- M2. heeft inzicht in de verbanden tussen natuurwetenschappelijk onderzoek, het bedrijfsleven en overheidsbeleid.
- M3. is in staat natuurwetenschappelijke en bedrijf- en beleidsmatige aspecten te integreren, in concreto:
  - (a) het kunnen vertalen van een concreet bedrijfs- of beleidsmatig probleem naar een natuurwetenschappelijk probleem
  - (b) het kunnen relateren van natuurwetenschappelijke aspecten van een probleem aan andere relevante kennisvelden
  - (c) het kunnen plaatsen van onderzoeksresultaten in een beleid- of bedrijfsmatige context



M4. beschikt over sociale en communicatieve vaardigheden, in concreto:

- (a) het kunnen schrijven van doelgerichte teksten
- (b) het kunnen opstellen van een innovatie- en beleidsplan voor respectievelijk een bedrijf of overheid
- (c) het kunnen houden van overtuigende mondelinge presentaties
- (d) een actieve bijdrage kunnen leveren aan plenaire discussies
- (e) vergadertechnieken beheersen, waaronder voorzitten
- (f) het kunnen werken aan een project in teamverband
- (g) het geven en ontvangen van feedback op het functioneren in een team

M5. is in staat projectmatig te werken, in concreto:

- (a) rekening kunnen houden met het belang of de doelstelling van een opdrachtgever
- (b) het zelfstandig kunnen plannen van een project
- (c) kunnen samenwerken met de voor het project relevante partijen
- (d) adequaat kunnen omgaan met beperkingen in tijd, informatie en middelen
- (e) het kunnen voorbereiden van de implementatie van een projectresultaat

M6. is in staat beroepsverantwoordelijkheid te nemen, in concreto:

- (a) het kunnen nemen van verantwoordelijkheid voor de organisatie
- (b) het kunnen herkennen van strategische aspecten van het eigen project
- (c) praktische invulling kunnen geven aan ethische beroepscodes van het eigen vakgebied en de organisatie

## **Appendix II Specializations of the degree programme (art. 2.2)**

The degree programme has a P-variant and an M-variant with the following specializations:

P-variant:

- Algebra and Geometry
- Dynamical Systems and Analysis
- Statistics and Probability

M-variant:

- Science, Business and Policy



## Appendix III Content of the degree programme (art. 2.3)

### P-variant

The P-variant of the degree programme has the following specializations:

- Algebra and Geometry
- Dynamical Systems and Analysis
- Statistics and Probability

The master programme comprises 120 ECTS.

The requirements on the programme are the following.

<i>Parts</i>	<i>Constraints</i>	<i>ECTS</i>
<b>Student colloquium</b>		5
<b>At least five modules from the list of modules given at the University of Groningen, the modules in the specialization area are compulsory</b>	<p><i>Specialization Algebra and Geometry:</i></p> <ul style="list-style-type: none"> <li>- Caput Algebra and Geometry (annual)</li> <li>- Geometry and Topology (every two years, 2015-2016)</li> <li>- Geometry and Differential Equations (every two years, 2014-2015)</li> <li>- Caput Differential Geometry (annual)</li> </ul> <p><i>Specialization Dynamical Systems and Analysis:</i></p> <ul style="list-style-type: none"> <li>- Dynamical Systems and Chaos (annual)</li> <li>- Caput Dynamical Systems (every two years, 2014-2015)</li> <li>- Caput Mathematical Physics (every two years, 2015-2016)</li> <li>-Hamiltonian Mechanics (annual)</li> </ul> <p><i>Specialization Statistics and Probability:</i></p> <ul style="list-style-type: none"> <li>- Contemporary Statistics with Applications (every two years, 2014-2015)</li> <li>- Statistical Genomics (every two years, 2015-2016)</li> </ul> <p><i>Specialization Computational Science and Numerical Mathematics (Applied mathematics):</i></p> <ul style="list-style-type: none"> <li>- Computational Fluid Dynamics (annual)</li> <li>- Computational Engineering (every two years, 2014-2015)</li> <li>- Boundary Layers (every two years, 2015-2016)</li> </ul> <p><i>Specialization Systems, Control and Optimization (Applied mathematics):</i></p> <ul style="list-style-type: none"> <li>- Robust Control (annual)</li> <li>- Modeling and Identification (every two years, 2014-2015)</li> <li>- Modeling and Control of Complex Nonlinear Engineering Systems (annual)</li> </ul>	≥ 25



<b>At least three modules from the Mastermath programme</b>	From these modules at least two have to be in the specialization area and at least one has to be outside the specialization area.  For information on the modules of the Mastermath programme see: <a href="http://www.mastermath.nl">www.mastermath.nl</a>	≥18
<b>Advanced modules of programmes taught at the University of Groningen other than the master programmes mathematics and applied mathematics</b>	These modules have to be of at least third year bachelor level, and have to be relevant for the master Mathematics (at the discretion of the exam committee).	≤ 10
<b>Free choice</b>		≤ 5
<b>Final Research Project</b>	Research project in the specialization area.	50

### M-variant

The M-variant of the degree programme is called *Science, Business and Policy*.

The master programme comprises 120 ECTS and consists of a mathematical component (60 ECTS) and a Business and Policy component (60 ECTS)

The requirements on the programme are the following.

<b>Mathematical component (60 ECTS)</b>		
<i>Parts</i>	<i>Constraints</i>	<i>ECTS</i>
<b>At least three modules from the list of modules given at the University of Groningen. At least two modules have to be chosen from the modules of the specialization area.</b>	<p><i>Specialization Algebra and Geometry:</i></p> <ul style="list-style-type: none"> <li>- Caput Algebra and Geometry (annual)</li> <li>- Geometry and Topology (every two years, 2015-2016)</li> <li>- Geometry and Differential Equations (every two years, 2014-2015)</li> <li>- Caput Differential Geometry (annual)</li> </ul> <p><i>Specialization Dynamical Systems and Analysis:</i></p> <ul style="list-style-type: none"> <li>- Dynamical Systems and Chaos (annual)</li> <li>- Caput Dynamical Systems (every two years, 2014-2015)</li> <li>- Caput Mathematical Physics (every two years, 2015-2016)</li> <li>- Hamiltonian Mechanics (annual)</li> </ul>	≥ 15



	<p><i>Specialization Statistics and Probability:</i></p> <ul style="list-style-type: none"> <li>- Contemporary Statistics with Applications (every two years, 2014-2015)</li> <li>- Statistical Genomics (every two years, 2015-2016)</li> </ul> <p><i>Specialization Computational Science and Numerical Mathematics:</i></p> <ul style="list-style-type: none"> <li>- Computational Fluid Dynamics (annual)</li> <li>- Computational Engineering (every two years , 2014-2015)</li> <li>- Boundary Layers (every two years, 2015-2016)</li> </ul> <p><i>Specialization Systems, Control and Optimization:</i></p> <ul style="list-style-type: none"> <li>- Robust Control (annual)</li> <li>- Modeling and Identification (every two years, 2014-2015)</li> <li>- Modeling and Control of Complex Nonlinear Engineering Systems (annual)</li> </ul>	
<b>At most three modules from the Mastermath programme</b>	For information on the modules of the Mastermath programme see: <a href="http://www.mastermath.nl">www.mastermath.nl</a>	≤ 18
<b>Advanced modules of programmes taught at the University of Groningen other than the master programmes mathematics and applied mathematics</b>	These modules have to be of at least third year bachelor level, and have to be relevant for the master Mathematics (at the discretion of the exam committee).	≤ 10
<b>Mathematical Research Project</b>	Research project in the specialization area.	30
<b><i>Business and Policy component (60 ECTS)</i></b>		
<i>Parts</i>	<i>Constraints</i>	<i>ECTS</i>
Module Science, Business and Policy		20
Internship Science, Business and Policy		40

For information on the modules of the Mastermath programme see <http://www.mastermath.nl>.

For information on the modules of programmes of the University of Groningen other than the master programmes mathematics and applied mathematics see the teaching and examination regulations of the corresponding programme.



The Mathematics and Applied Mathematics modules given at the University of Groningen are

<b>module</b>	<b>offered</b>	<b>ECTS</b>	<b>assessment</b>	<b>practical</b>
Caput Algebra and Geometry	annual	5	Take home exam followed by an oral discussion of the problems	
Geometry and Topology	every two years	5	Written examination, homework assignment	
Geometry and Differential Equations	every two years	5	Assignment with oral presentation	
Caput Differential Geometry	annual	5	Assignments, paper, oral presentation	
Boundary Layers	every two years	5	Oral examination or written exam (if #students >5), assignment	x
Caput Dynamical Systems	every two years	5	Oral presentation, essay	
Caput Mathematical Physics	every two years	5	Oral presentation, essay	
Computational Engineering	every two years	5	Homework assignments, assignments, written exam	x
Computational Fluid Dynamics	annual	5	Assignments, oral examination	x
Contemporary Statistics with Applications	every two years	5	Homework, examination	
Dynamical Systems and Chaos	annual	5	Oral presentation, essay	
Hamiltonian Mechanics	annual	5	Homework assignments, Oral presentation, essay	
Final Research Project (P-variant only)	annual	50	Assessment of performance, report, oral presentation	
Mathematical Research Project (M-variant only)	annual	30	Assessment of performance, report, presentation	
Modelling and Identification	every two years	5	Take home exams followed by an oral discussion of the problems	
Modeling and Control of Complex Nonlinear Engineering Systems	annual	5	Homework assignments, written examination	
Robust Control	annual	5	Take home assignments, written exam	
Statistical Genomics	every two years	5	homework assignments, assignments, examination	
Student Colloquium	annual	5	Oral presentation, article	

The modules of the Business and Policy component are

<b>module</b>	<b>offered</b>	<b>ECTS</b>	<b>assessment</b>	<b>practical</b>
Science, Business and Policy	annual	20	Assignment, examination	
Internship Science, Business and Policy	annual	40	Assessment of performance, reports	



## **Appendix IV Optional modules (art. 2.4)**

See Appendix III.

## **Appendix V Entry requirements and compulsory order of examinations (art. 3.2)**

The entry requirement for the internship Science, Business and Policy is a successful completion of the module Science, Business and Policy (20 ECTS) and the mathematical research project (30 ECTS).

## **Appendix VI Admission to the degree programme and different specializations (art. 4.1.1 + art. 4.2)**

Holders of the following Bachelor's degree from the University of Groningen 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





## Appendix VII

### Application deadlines for admission (art. 4.7.1)

<b>Deadline of Application</b>	<b>Non-EU students</b>	<b>EU students</b>
Nanoscience	February 1st 2015	February 1st 2015
Behavioural and Cognitive Neurosciences	April 1st 2015	May 1st 2015
Biomolecular Sciences (topprogramme)	April 1st 2015	April 1st 2015
Evolutionary Biology (topprogramme/EM)	January 15th 2015	January 15th 2015
Remaining FMNS Masters (amongst which Mathematics)	April 1st 2015	May 1st 2015

### Decision deadlines (art. 4.7.3)

<b>Deadline of Decision</b>	<b>Non-EU students</b>	<b>EU students</b>
Nanoscience	June 1st 2015	June 1st 2015
Behavioural and Cognitive Neurosciences	June 1st 2015	June 1st 2015
Biomolecular Sciences (topprogramme)	June 1st 2015	June 1st 2015
Evolutionary Biology (topprogramme/EM)	June 1st 2015	June 1st 2015
Remaining FMNS Masters (amongst which Mathematics)	June 1st 2015	June 1st 2015