



Wintersemester 24/25

# Module Guide

for the study of

## Mathematics

im Masterstudiengang "Lehramt an Gymnasien/Oberschulen"

valid in connection with the examination regulations MPO 2014/2015/2022

Gemäß Prüfungsordnung zum Fach Mathematik inkl. fachdidaktischen Anteilen im Masterstudiengang Lehramt an Gymnasien/Oberschulen vom 26. April 2022.

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## Musterstudienplan - Studienfach Mathematik im Master

### Lehramt an Gymnasien/Oberschulen Mathematik\*

Die Masterarbeit wird in Bezug auf § 6 Absatz 7 der zugehörigen fachspezifischen Ordnung hier im Studienverlaufsplan exemplarisch ausgewiesen.

	<b>Mathematik</b>	<b>Didaktik</b>	<b>Masterarbeit</b>
<b>1. Sem.</b>	Funktionentheorie 9 CP	Stoffdidaktisch denken lernen 3 CP	
<b>2. Sem.</b>		Lernprozesse in Mathematik analysieren und gestalten 3 CP	
<b>3. Sem.</b>	Vertiefung Algebra/Zahlentheorie 3 CP	Mathematisch denken und handeln 6 CP	
<b>4. Sem.</b>			Masterarbeit 21 CP

Credit Points (kurz: CP) geben den durchschnittlichen Arbeitsaufwand für eine Veranstaltung bzw. ein Modul an, wobei 1 CP = 30 Std.

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\* Gemäß geltender Prüfungsordnung genehmigt am 22.05.2014 (inkl. etwaiger Änderungsordnungen bzw. Berichtigungen)

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### 2) Subject-Specific Didactics (12 CP)

Pflichtmodule im Umfang von 12 CP. Auflistung gemäß Studienverlaufsplan

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**Module 03-MAT-MA-MGY4b: Funktionentheorie**

## Functional Analysis

**Assignment to areas of study:**

- Research Subject

**Content-related prior knowledge or skills:**

none

**Learning content:**

Construction and extension of calculus to the complex number plane; Holomorphic functions, Cauchy's integral theorem, isolated singularities, residue theorem. Riemann surfaces.

**Learning outcomes / competencies / targeted competencies:**

Students understand complex analysis as a deepening and broadening of the concepts from real analysis. Students can apply concepts from function theory to solve real and complex problems. Students expand their social skills by working on mathematical tasks in groups and communicating about mathematics. Students prepare technical content of function theory digitally for a secondary school learning environment.

**Calculation of student workload:**

84 h SWS / presence time / working hours

46 h Exam preparation

140 h Preparation / follow-up work

**Are there optional courses in the modules?**

no

**Language(s) of instruction:**

German

**Responsible for the module:**

PD Dr. Hendrik Nils Vogt

**Frequency:**

winter semester, yearly

**Duration:**

1 semester[s]

**The module is valid since / The module is valid until:**

SoSe 24 / -

**Credit points / Workload:**

9 / 270 hours

**Module examinations****Module examination:** Complex Analysis**Type of examination:** combination exam**Form of examination:**

Announcement at the beginning of the semester

**The examination is ungraded?**

no

**Number of graded components / ungraded components / prerequisites of the examination:**

1 / 2 / -

**Language(s) of instruction:**

Deutsch

**Description:**

The Coursework requirements will be decided upon by the Lecturer at the beginning of the course (Weekly Worksheets, Midterm Exam, Creation and, if necessary, implementation of a learning environment for pupils etc.).

## Module courses

<b>Course:</b> Vorlesung mit Übung	
<b>Frequency:</b> winter semester, yearly	<b>Language(s) of instruction:</b> Deutsch
<b>Contact hours:</b> 6,00	<b>University teacher:</b> Dr. Ingolf Schäfer Prof. Dr. Anke Dorothea Pohl
<b>Teaching method(s):</b>	<b>Associated module examination:</b> Kombinationsprüfung
<b>Associated module courses</b>	
<b>Funktionentheorie</b> (Lecture)	

## Module 03-MAT-MA-MGY8b: Vertiefung Algebra/Zahlentheorie

### Specialization Algebra/Number Theory

**Assignment to areas of study:**

- Research Subject

**Content-related prior knowledge or skills:**

none

**Learning content:**

Selected topics in the areas of algebra and number theory, e.g., algebraic structures, Galois theory, field extensions, number theoretical functions, Diophantine equations, quadratic reciprocity law, p-adic numbers.

**Learning outcomes / competencies / targeted competencies:**

Ability to independently research, present and process scientific work in the field of number theory/algebra. Students can:

- Independently develop a mathematical topic based on the literature
- Independently prepare these developed topics for presentation in the seminar, using appropriate software
- Present mathematical results appropriately and substantively in a lecture presentation
- Prepare a written report according to the rules of academic writing, using appropriate software

**Calculation of student workload:**

28 h Preparation / follow-up work

34 h Exam preparation

28 h SWS / presence time / working hours

**Are there optional courses in the modules?**

no

**Language(s) of instruction:**

German

**Responsible for the module:**

Prof. Dr. Anke Dorothea Pohl

**Frequency:**

winter semester, yearly

**Duration:**

1 semester[s]

**The module is valid since / The module is valid until:**

SoSe 24 / -

**Credit points / Workload:**

3 / 90 hours

## Module examinations

**Module examination:** Kombinationsprüfung MGY8b Vertiefung Algebra/Zahlentheorie

**Type of examination:** combination exam

**Form of examination:**

Presentation and written assignment

**The examination is ungraded?**

no

**Number of graded components / ungraded components / prerequisites of the examination:**

1 / 1 / -

**Language(s) of instruction:**

Deutsch

**Description:**

The Coursework requirements will be decided upon by the Lecturer at the beginning of the course (e.g. Presentation of the work process, integration of the individual topic into your own studies, etc.).

**Module courses**

**Course:** Seminar

**Frequency:**

winter semester, yearly

**Language(s) of instruction:**

Deutsch

**Contact hours:**

2,00

**University teacher:**

Dr. Tim Haga

**Teaching method(s):**

Seminar

**Associated module examination:**

Kombinationsprüfung MGY8b Vertiefung Algebra/  
Zahlentheorie

**Associated module courses**

**Vertiefung Algebra/ Zahlentheorie** (Seminar)

**Vertiefung Algebra/ Zahlentheorie** (Seminar)

**Module 03-MAT-MA-D3: Stoffdidaktisch denken lernen****Didactical learning of thinking****Assignment to areas of study:**

- Subject-Specific Didactics

**Content-related prior knowledge or skills:**

none

**Learning content:**

Selection from a range of subject-related topics in "Didactics of analysis", "Didactics of stochastics", "Didactics of linear algebra", "Didactics of analytical geometry", "Didactics of geometry", "Didactics of applications in mathematics lessons", "Didactics of elementary algebra", "Didactics of arithmetic", ...

Educational standards, educational plans and content-specific curricular implementations; aims of mathematics teaching, including basic experiences of mathematics teaching; quality criteria for mathematics teaching; teaching models and "standard situations" for mathematics lessons; mathematics didactic teaching methods; diagnostics and performance assessment in mathematics lessons; lesson planning and task construction; planning and analysis of differentiated mathematics lessons, didactic analysis and situation-appropriate adaptations; observation and reflection of lessons.

Dimensions of diversity in mathematics lessons (e.g. disabilities as defined by the Convention on the Rights of Persons with Disabilities, augmentative and alternative learning conditions such as language, social living conditions, cultural and religious orientations, gender as well as special gifts and talents).

**Learning outcomes / competencies / targeted competencies:**

Students acquire skills for the independent planning and implementation of lessons. This includes subject-didactic analysis and the reflection on mathematics teaching using didactic analyses, theoretical models and empirical findings. The students.

- Are able to justify the general educational value of mathematical content and methods, including the social significance of mathematics. They are able to place this within the context of the aims and content of mathematics lessons
- Embed specific content in educational plans and are familiar with curricular implementations
- Should acquire skills for independent didactic thinking; this includes the genesis of knowledge through didactic analyses
- Understand and reflect on the content of school mathematics on the basis of in-depth mathematical knowledge and its learning tools
- Can deal with didactic theories and methods for teaching and learning special content areas of mathematics at grammar schools/high schools in an academically appropriate manner
- Understand technical language, conceptualization, basic ideas and ways of thinking, being able to apply these to specific content areas; they can use these skills for the analysis and development of tasks in a well-founded manner
- Use digital media to design lessons
- Are able to assess the quality of content-related teaching and learning concepts for a specific content area in a didactically sound manner
- Design and create tasks that provide the core of lesson planning

**Calculation of student workload:**

32 h Preparation / follow-up work

28 h SWS / presence time / working hours

30 h Exam preparation



**Are there optional courses in the modules?**

no

<b>Language(s) of instruction:</b> German	<b>Responsible for the module:</b> Prof. Dr. Christine Knipping
<b>Frequency:</b> winter semester, yearly	<b>Duration:</b> 1 semester[s]
<b>The module is valid since / The module is valid until:</b> SoSe 24 / -	<b>Credit points / Workload:</b> 3 / 90 hours

**Module examinations**

<b>Module examination:</b> Kombinationsprüfung	
<b>Type of examination:</b> combination exam	
<b>Form of examination:</b> Portfolio (AT § 8 Abs. 8)	<b>The examination is ungraded?</b> no
<b>Number of graded components / ungraded components / prerequisites of the examination:</b> 1 / 1 / -	
<b>Language(s) of instruction:</b> Deutsch	
<b>Description:</b> The Coursework requirements will be decided upon by the Lecturer at the beginning of the course (Weekly Worksheets, Midterm Exam, etc.).	

**Module courses**

<b>Course:</b> Seminar	
<b>Frequency:</b> winter semester, yearly	<b>Language(s) of instruction:</b> Deutsch
<b>Contact hours:</b> 2,00	<b>University teacher:</b>
<b>Teaching method(s):</b> Seminar	<b>Associated module examination:</b> Kombinationsprüfung
<b>Associated module courses</b> Stoffdidaktisch denken lernen (Seminar)	

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**Module 03-MAT-MA-D4: Lernprozesse in Mathematik analysieren und gestalten**  
Analysing and arranging mathematical learning processes**Assignment to areas of study:**

- Subject-Specific Didactics

**Content-related prior knowledge or skills:**

none

**Learning content:**

Subject analysis with compartmentalization of content, planning models, philosophy of educational plan and curriculum, educational standards, subject areas and standards of mathematics teaching, mathematics-related teaching-learning research (e.g. Motivation, individuals perceptions and mistakes of students, dispositions, typical courses of action and hurdles in learning processes, structure and effects of learning environments), key questions to consider between planning and implementation, operationalization of learning objectives, design of worksheets, didactic models, progression plan, didactic-methodological analysis, origins of good learning environments, characteristics of good tasks, task culture and the selection of further tools for lesson design, didactic diagnostic approaches, determination of learning status and the corresponding support concepts, planning and analysis of differentiated mathematics lessons, forms of cooperation with special education teachers and other educational staff in the planning, implementation and diagnostic reflection of inclusive lessons

**Learning outcomes / competencies / targeted competencies:**

The module aims to introduce students to the theory-based preparation and evaluation of learning arrangements in everyday lessons. It builds on previously covered basic concepts of mathematical teaching. In the internship phase, the main focus is on expanding and reflecting on the knowledge and skills acquired in previous studies, while the educational science internship focuses on diagnosis and support within mathematics teaching. This means that students

- Plan, design, analyze and diagnose mathematical learning processes and, if necessary, interdisciplinary teaching phases
- Understand and use useful strategies, tools and models for planning and designing mathematical learning arrangements
- Prepare didactic analyses of mathematical content
- Design and cultivate meaningful tasks
- Understand and use different tools for designing subject-related interactions
- Understand and use a variety of sources for subject-specific lessons
- Use subject-specific methods and mathematical didactic models appropriately
- Create theory-based lesson plans on the basis of well-founded objectives, subject analyses, methodological-didactic analyses, learning prerequisites, ...
- Create didactically appropriate worksheets
- Evaluate mathematics lessons in a well-founded way by comparing objectives and their implementation
- Interpret student behavior appropriately according to theoretical guidelines
- Are able to analyze and plan differentiating mathematics lessons on the basis of subject-specific didactic concepts and carry them out exemplarily on the basis of initial reflected experiences
- Can work together with special education teachers and other educational staff on the basis of their subject-related expertise with regard to the planning and design of inclusive lessons, while also developing subject-related learning opportunities together with them
- Take various dimensions of diversity into account in mathematics lessons. This includes disabilities as defined by the Convention on the Rights of Persons with Disabilities, as well as special educational conditions such as language, social living conditions, cultural and religious orientations, gender and special gifts and talents

**Calculation of student workload:**

32 h Preparation / follow-up work

30 h Exam preparation

28 h SWS / presence time / working hours

**Are there optional courses in the modules?**

no

<b>Language(s) of instruction:</b> German	<b>Responsible for the module:</b> Prof. Dr. Christine Knipping
<b>Frequency:</b> summer semester, yearly	<b>Duration:</b> 1 semester[s]
<b>The module is valid since / The module is valid until:</b> SoSe 24 / -	<b>Credit points / Workload:</b> 3 / 90 hours

## Module examinations

<b>Module examination:</b> Modulprüfung	
<b>Type of examination:</b> combination exam	
<b>Form of examination:</b> Portfolio (AT § 8 Abs. 8)	<b>The examination is ungraded?</b> no
<b>Number of graded components / ungraded components / prerequisites of the examination:</b> 1 / 1 / -	
<b>Language(s) of instruction:</b> Deutsch	
<b>Description:</b> The Coursework requirements will be decided upon by the Lecturer at the beginning of the course (Weekly Worksheets, Midterm Exam, Presentations etc.).	

## Module courses

<b>Course:</b> Seminar	
<b>Frequency:</b> summer semester, yearly	<b>Language(s) of instruction:</b> Deutsch
<b>Contact hours:</b> 2,00	<b>University teacher:</b>
<b>Teaching method(s):</b> Seminar	<b>Associated module examination:</b> Modulprüfung

**Module 03-MAT-MA-D5: Mathematisch denken und handeln**

## Thinking and acting mathematically

**Assignment to areas of study:**

- Subject-Specific Didactics

**Content-related prior knowledge or skills:**

none

**Learning content:**

The course content is based on the following list of topics:

1. Mathematical thinking such as problem solving, reasoning, proving, modeling
2. Process-related skills such as communicating, using technical language, writing and reading mathematical texts, using computers in mathematics lessons, the composition of mathematical knowledge, securing mathematical knowledge
3. Horizontal and vertical networking of content-related skills
4. Methods and characteristics of competence-oriented teaching in typical learning situations and in heterogeneous groups
5. Methods and characteristics of cognitively activating and dialogue based mathematics teaching
6. Theories and concepts for the construction of tasks that promote mathematical thinking and action
7. Models and theories of mathematical abstraction and the construction of mathematical knowledge
8. Other topics, especially current movements in mathematical thinking and action

Dimensions of diversity in mathematics teaching (e.g. disabilities as defined by the Convention on the Rights of Persons with Disabilities, augmentative and alternative conditions such as language, social living conditions, cultural and religious orientations, gender as well as special gifts and talents)

**Learning outcomes / competencies / targeted competencies:**

This module covers the enrichment of current research areas of mathematical didactics, thinking and acting. Methodologically, the characteristics of research-based learning should be included as comprehensively as possible. In particular, students should

- Understand special theories and models of mathematical thinking and acting (e.g. competence models, theories of mathematical thinking, ...)
- Use empirical findings and theoretical knowledge to observe and analyze teaching-learning processes
- Adopt research literature on this topic
- Create theoretical based learning arrangements
- Anticipate and methodically design processes of mathematical learning with regard to mathematical thinking and action, e.g. for competence development and the development of thought processes such as modelling, problem solving, networking, patterns of mathematization, ...
- Understand and evaluate tools for competence-oriented mathematics learning and the development of mathematical thinking skills (computer, textbook, didactic material, models, ...), with focus on their learning potential
- Be able to appropriately adopt developments in the field of digitization from a subject-specific and didactic perspective and to critically reflect on the possibilities and limits of digitization. Be able to use the knowledge gained from this in subject-specific didactic contexts and incorporate it into the further development of teaching and curricular concepts
- Be sensitive to the opportunities offered by digital learning media in terms of accessibility and also use digital media for differentiation and individual support in lessons

**Calculation of student workload:**

92 h Preparation / follow-up work  
 52 h SWS / presence time / working hours  
 32 h Exam preparation

**Are there optional courses in the modules?**

no

**Language(s) of instruction:**

German

**Responsible for the module:**

Dr. Ingolf Schäfer

**Frequency:**

summer semester, yearly

**Duration:**

1 semester[s]

**The module is valid since / The module is valid until:**

SoSe 24 / -

**Credit points / Workload:**

6 / 180 hours

**Module examinations****Module examination:** Kombinationsprüfung**Type of examination:** combination exam**Form of examination:**

Portfolio (AT § 8 Abs. 8)

**The examination is ungraded?**

no

**Number of graded components / ungraded components / prerequisites of the examination:**

1 / 1 / -

**Language(s) of instruction:**

Deutsch

**Module courses****Course:** Seminar**Frequency:**

summer semester, yearly

**Language(s) of instruction:**

Deutsch

**Contact hours:**

4,00

**University teacher:**

Lehrende der Mathematik

**Teaching method(s):**

Seminar

**Associated module examination:**

Kombinationsprüfung

**Associated module courses****Mathematisch denken und handeln** (Seminar)