North Carolina State University

NC STATE UNIVERSITY

Department of Mathematics

Guide for Graduate Students in Mathematics and Applied Mathematics

July 1, 2025

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Contents

Welcome

Welcome to graduate study in Mathematics at NC State.

We are proud of our Mathematics (MA) and Applied Mathematics (AMA) programs, described in detail in this guide. The primary mission of our graduate programs is to educate and train mathematics students to become outstanding research scientists, educators and leaders in the scientific community. To do so, we offer exceptional interdisciplinary training together with a strong foundation in traditional and newly emerging areas in mathematics. We provide our students with a professional and enjoyable experience, as they explore research topics, participate in high level courses, and learn to enjoy sharing with others their development as mathematicians.

Along with this guide, the NC State Graduate Handbook is another relevant document, which provides an overview of Graduate School functions and resources, as well as the rules, regulations, and procedures administered by the Graduate School. It is the responsibility of all graduate students to know and understand their degree requirements. Students are responsible for the fulfillment of those requirements.

In addition, the Code of Student Conduct establishes the expectations for student conduct in the university community.

In case of uncertainty regarding the content of this guide or for questions about the MA or AMA graduate programs involving matters not covered here, please consult mathgradprograms@ncsu.edu or:

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Helpful Websites

- Department of Mathematics Graduate Programs
- NC State Graduate School
- Fellowships and Grants
- Office of International Services
- Registration and Records
- Office of Equal Opportunity
- Counseling Center

1 Orientation and Advising

> *Il est plus aisé d'être sage pour les autres, que de l'être pour soi-même.*
>
> **— François de la Rochefoucault**

1.1 Orientation

Each fall, incoming students are required to participate in several orientation activities. Specifically:

- **Program orientation and TA training**; organized by the *Department of Mathematics*
- **New TA workshop**; organized by the *Graduate School*; requires pre-registration
- **New Graduate Student Orientation**; the Graduate School will be communicating the details of each event to incoming students over the summer.

All first and second year graduate students are encouraged to attend the *Graduate Training Seminar*. This seminar is a combination of different activities: it introduces students to best practices of effective teaching in college mathematics courses, it exposes students to research areas of different faculty in the department, and introduces different professional development opportunities in the math department and in the university beyond. In addition, the seminar includes:

- **Training modules:** These modules introduce graduate students to topics that are not likely to come up in courses. Topics range from material for beginning graduate students such as webpage setup and application for fellowships to topics of more general interest such as conference and workshop preparation, internships, job search and interview techniques. Students of all levels are encouraged to attend these modules.

1.2 Doctoral advising

Upon enrollment, every incoming PhD student is assigned a graduate *academic advisor*. The role of the academic advisor is to:

- provide advice about course choices, qualifying exams and general academic path in order to best match the student's goals and interests;
- facilitate integration into our Department and programs.

Graduate academic advisors follow the progress of their advisees during year 0 (after enrollment and before the initial semester), year 1 and possibly year 2. There is no expectation that the academic advisor of a student becomes the *research advisor* of that student (although this is certainly not excluded). Students who wish to be assigned another graduate academic advisor should contact the Director of Graduate Programs (DGP).

Students are responsible for finding their own research advisor. Typically, a student will approach a faculty member whose work and interests are known to the student through attendance at courses and seminars. The student can arrange to take a reading course with the faculty member during one or more semesters. While working on that reading course, the student and faculty member will determine whether they should continue working together on a research project leading to a thesis.

Finding an advisor and topic is an important and sometimes difficult process for students. The Director of Graduate Programs can assist and support students at this critical stage. In fact, during the entire duration of their graduate studies, students should consider the DGP as a resource available for consultation regarding all aspects of graduate studies including, but not restricted to, course choices, identification of, and interactions with, research advisors, academic difficulties, internships, participation in conferences and workshops, and job applications. More information about the available support structure for both academic and non-academic difficulties is available in § 4.5 below.

1.3 Masters advising

Mathematics and Applied Mathematics MS students are advised by the Director of Graduate Programs and other faculty.

1.4 Graduate registration

To receive financial aid of any type in a given semester, a student must be registered as **full-time** for that semester, which corresponds to taking a minimum course load of 9 credit hours (some or all of these hours can be "research hours"); see § 4.1.1 for more details. The maximum course load is 15 credit hours in a semester.

Enrolled graduate students may register online for courses using the MyPack Portal. It may be possible to adjust the course load after the beginning of the semester, for instance by dropping a course. This is trivial during the first week, non-trivial during the second week and very hard afterwards; refer to Section 3.15 of the NC State Graduate Handbook for more (important) details. Except for part-time students, full time status *must* be maintained; this is especially important for visa-holding international students.

Graduate students are required to maintain **good standing**, which is defined as maintaining a cumulative Grade-Point Average (GPA) of at least 3.000. GPAs are computed from letter grades according to Table 1.1.

letter grade	A+	A	A-	B+	B	B-	C+
grade points	4.333	4.000	3.667	3.333	3.000	2.667	2.333
	C	C-	D+	D	D-	F	
	2.000	1.667	1.333	1.000	0.667	0.000	

Tab. 1.1: Grading scale and grade points.

Students who fail to maintain good standing are in *academic difficulty*. A GPA below 3.000 will result in either academic warning, academic probation, possible loss of financial aid or termination. Under extenuating circumstances, the Director of Graduate Programs may recommend and provide justification to the Graduate School to reinstate a student's graduate classification. More information is available from the Graduate Handbook Section 3.19.

2 Doctoral Programs

> *I do like to start on time; I like to set the bar high for people.*
>
> — **Tina Fey**

2.1 Requirements

Students working toward a PhD in Mathematics or Applied Mathematics typically take between 4 to 6 years to complete the degree requirements, with an average study duration of about 5 years. **A completion time of at most five years should be considered as a goal** as standard TA offers guarantee funding for at most that time (provided good standing is maintained). State funding is not guaranteed after 5 years and tuition remission (see § 4.1) is not available past that time.

For a student admitted with a BS, the **milestones** of the programs are as follows (see below for details about each individual step):

- **1st stage (years 1-2)**
  - take foundational courses and complete course requirements
  - prepare for and pass written qualifying exams
  - by end of year 2 must have attempted 3 quals
  - start to explore research topics and possible advisor
- **2nd stage (year 3)**
  - finalize quals (if needed)
  - finalize search for advisor and research topic
  - develop plan of work
- **dissertation stage (years 4-5)**
  - "full time" researcher (see below)
  - preliminary exam (earlier is better)
  - work, work, write, get a job, write, work, write, write, ...
  - final exam (dissertation defense)
  - graduate 

In addition, students must accumulate a minimum of 72 credits hours. PhD students who do not hold a Masters degree in Mathematics can usually earn an MS on the way to the PhD (option B MS, see §3); consult with the Graduate Services Coordinator for procedures.

Starting with year 3, students concentrate mostly on research work (full time researcher); this means for instance that they typically reach full time (at least 9 credit hours per semester) by registering for up to 9 hours of Doctoral Dissertation Research hours (MA 893).

A TA with significant contact with students, i.e., a TA working as an instructor of record or a recitation leader, see §2.2, can also sign up for up to 3 hours of Doctoral Supervised Teaching (MA 885) when they begin a new teaching role for the first time. They can sign up for MA 885 the first time they are a recitation leader, and the first time they are an instructor for a course. Successful completion of MA 885 depends on having a certain number of observations of the teaching, and doing a certain number of peer observations.

Students admitted with an MS in Mathematics from an other (properly accredited) institution only have to accumulate 54 graduate credit hours; in other words, they are "given" 18 credit hours. However, they have to go through the above milestones one year earlier than students admitted with a BS (see below for details). Equivalence requests for specific courses have to be discussed with the Director of Graduate Programs.

IMPORTANT: Mathematics is alive and our faculty change; as a result, internal program rules do change as well. Whenever possible, each change is accompanied by a transition period during which flexibility and the interests of the students are given priority. If in doubt about a specific rule or requirement, check with the Director of Graduate Programs.

2.1.1 Course requirements

All students must take a minimum of 30 credit hours of graduate courses in mathematics numbered 500 and up. Among these should be at least **one course in each of continuous, discrete and computational mathematics** as described in Table 2.1.

Students who have not had the equivalent of MA 405 (Introduction to Linear Algebra and Matrices), MA 407 (Introduction to Modern Algebra), or MA 425-426 (Mathematical Analysis I and II) must make up these courses. Students who have not

continuous	discrete	computational
complex var. MA 513	linear prog. MA 505	computer alg. MA 522
analysis MA 515	linear alg. MA 520	uncertainty quant. MA 540
control MA 531	abstract alg. MA 521	graph th. MA/CS 565
ODEs MA 532	matrix th. MA 523	modeling MA 573
PDEs MA 534	combinatorics MA 524	numerical anal. MA 580
probability MA 546	algebraic geom. MA 726	
topology MA 551		
manifolds MA 555		

Tab. 2.1: Course requirements.

had the equivalent of MA 426 may take it for graduate credit by registering for MA 591M. The course requirements are the same in the MA and AMA PhD programs.

2.1.2 Qualifying exams for PhD students starting Fall 2025 or later

This subsection contains the rules for students who started in the Math or Applied Math PhD program in Fall 2025 or later.

Students must pass **two qualifying exams** by the end of their second year in the PhD program. Each exam consists of two parts chosen by the student from three possible subjects; these subjects are based on the one-semester courses listed in Table 2.2 below. The purpose of the exams is to ensure that every PhD student possesses foundational knowledge of Mathematics needed to study deeper subjects that prepare them to do research.

Exam 1		Exam 2	
MA 512	Introduction to Analysis	MA 520	Linear Algebra
MA 515	Functional Analysis	MA 521	Abstract Algebra
MA 551	Topology	MA 780	Numerical Analysis

Tab. 2.2: Qualifying exam subjects.

Exam Format and Guidelines

- Each exam is a 3-hour long written exam. Students can work on both parts of the exam during the whole time.

- In order to pass an exam, both parts of the exam must receive a passing grade.
- Each exam part is written and graded by two faculty members.
- At the end of the Spring semester, the two exam writers will come up with a "study guide" for the qualifying exams that year. That study guide will be given to the students in the course, and will be given to the DGP so that any students who want to take the exam and who were not in the course will be able to prepare for the exam.

Scheduling

- The qualifying exams are offered twice a year, in August during the week preceding the start of the semester, and in May during the week following final exams. Students should sign up for exams at least one month before the exams themselves.
- The two qualifying examinations do not have to be taken at the same time. However, it is recommended that students attempt both exams by the end of their first year.
- Incoming students may attempt the exams in August before they enroll in their first year. If they do not pass an exam, they have to register for a course from the corresponding group. Additionally, if they lack an undergraduate Analysis II course, they will have to take an analog of MA 426, either as MA 591-001 or starting from Spring 2026 as the new course MA 512.
- It is possible to "drop" an exam one has registered for any time up to two weeks before the exam (no questions asked). After that, we recommend students talk to the Director of Graduate Programs. Dropping an exam only applies to students who do have the option to "wait," i.e., are not required to take the exam at that exam session.
- For part-time students, years will be counted using credit hours, with one year equal to 18 credit hours. For full-time students, calendar years are used. Students who start the graduate program in the spring semester should have a statement from the DGP put into their file specifying the date by which their exams must be taken.

Retakes

- Students must pass both exams by the May of their second year.
- Retakes can be done both in August and May, and are limited only by the time deadline that students must pass all exams by the May of their second year.
- When an exam is retaken, the student must take both parts of the exam, even if one part has previously received a passing grade.
- Retakes do not have to be in the same subjects as those initially failed.

2.1.3 Qualifying exams for PhD students starting Fall 2024 or before

This subsection contains the rules for students who started in the Math or Applied Math PhD program in Fall 2024 or earlier, as well as a few students who were enrolled in the Master's program and matriculated into the PhD program in Fall 2025. These rules will stay in effect until January 2027.

The PhD written qualifying examinations are written exams in **three** subjects selected by the student from a list of 12 possibilities, see Table 2.3. The purpose of the exams is to ensure that every PhD student acquires command of three topics to a depth appropriate to begin a PhD thesis. Each topic corresponds to a two-semester course sequence.

MA 515-715	Analysis	MA 531-731	Control
MA 520-720	Linear and Lie algebra	MA 534-734	PDEs
MA 521-721	Abstract algebra	MA 546-747	Probability
MA 522-722	Computer algebra	MA 551-555	Geometry and Topology
MA 523-723	Matrix theory	MA 573-574	Modeling
MA 524-724	Combinatorics	MA 580-780	Numerical analysis

Tab. 2.3: Qualifying exam sequences.

Exam Format and Guidelines

- Each exam is a 3-hour long written exam.
- Each exam is written and graded by two faculty members.
- At the end of the Spring semester, the two exam writers for a qualifying exam will come up with a "study guide" for the qualifying exams that year. That study guide will be given to the students in the course, and will be given to the DGP so that any students who want to take the exam and who were not in the course will be able to prepare for the exam.

Scheduling

- The qualifying exams are offered twice a year, in August and January. Both exam sessions usually take place during the week preceding the start of the semester. Students should sign up for exams at least one month before the exams themselves.

- The three qualifying examinations do not have to be taken at the same time. However, it is recommended that students attempt at least one to two exams by the end of their first year. By the end of their second year (first year for students entering with an MS in Mathematics or Applied Mathematics), students have to attempt a number of exams equal to the number of exams they have yet to pass.
- It is possible to "drop" an exam one has registered for any time up to two weeks before the exam (no questions asked). After that, we recommend students talk to the Director of Graduate Programs. Dropping an exam only applies to students who do have the option to "wait," i.e., are not required to take the exam at that exam session.
- For part-time students, years will be counted using credit hours, with one year equal to 18 credit hours. For full-time students, calendar years are used. Students who start the graduate program in the spring semester should have a statement from the DGP put into their file specifying the date by which their exams must be taken.

Retakes

- Students must pass all three exams by the January of the student's third year (second year for students with previous MS degree in Mathematics or Applied Mathematics).
- Retakes can be done both in August and January, and are limited only by the time deadline that students must pass all exams by the January of their third year (second year for students with previous MS degree in Mathematics or Applied Mathematics).
- Retakes do not have to be in the same subject as the one initially failed.
- The number of examinations taken at any given exam period cannot exceed the remaining number of passes needed to reach a total of three.

2.1.4 PhD advisor and degree audit

By the time a PhD student has passed their qualifying exams (or soon thereafter), they should identify a research PhD **advisor**. In consultation with the PhD advisor, the student must choose (a minimum of) three additional graduate faculty members for their **advisory committee**. Before the advisory committee is approved by the Graduate School, it must be approved by the DGP and the student must have signed and submitted a patent agreement form. If the committee has no outside representative beyond the student's program, a Graduate School Representative is appointed by the Graduate School; this representative is not a voting member of the committee.

The purpose of the advisory committee is to provide advice to the student on their doctoral research and preparation of the dissertation, and to ensure that the quality of the doctoral dissertation meets a high academic standard. In order for the advisory committee to properly fulfill its advice and oversight functions, it is expected that students meet with their committee members at least once a year.

The **Graduate Degree Audit** is a list of the courses the student has taken or plans to take. Submission is completed online (through the MyPack portal) after consultation with the PhD advisor. The degree audit should include whatever course work is needed to (i) prepare the student for the future that they envision and (ii) fulfill program requirements. For example:

- Students who envision a career with a strong mathematics research component will benefit from advanced courses in several related areas, possibly including courses in other departments.
- Students who plan a career focused on college teaching will benefit from courses in other mathematical sciences, especially statistics and computer science. Bear in mind that in many colleges mathematics faculty are expected to teach these subjects. Experience with applications of mathematics is also beneficial for college teaching.
- Students who plan a non-academic career will benefit from substantial course work in the related fields of science and engineering that interest them.

A student may decide, in consultation with their advisory committee, to minor in another department or program. In that case, the minor department or program should be consulted to determine its requirements, and a representative of the minor department must serve on the advisory committee. The student and their advisor should also agree on other appropriate projects that do not appear on the degree audit, such as participation in the NC State Preparing the Professoriate program.

2.1.5 Preliminary oral exam

The preliminary exam is taken after the qualifying exams have been passed and after the student has found a PhD advisor. The preliminary exam is a **thesis proposal**; its purpose is to (i) verify that the candidate has chosen a suitable topic for thesis research, (ii) evaluate the candidate's ability to complete the proposed work and (iii) offer constructive advice.

The graduate school requires that the preliminary oral exam be given at least 4 months before the final defense. To be making good progress in the math department the exam should be attempted by the end of the student's **fourth year** in the program

at the latest. It is however recommended that the exam take place as soon as a thesis proposal can reasonably be developed and presented. The student should submit the request to the Mathematics Department graduate programs office at least three weeks in advance. The graduate program office will help reserve a room for the exam.

During the exam, the student makes a presentation of a research proposal; the presentation is usually 40-50 min. long. It is required that the student develop a **syllabus**, typically 2-4 page long, explaining the thesis research proposal including:

- problem statement,
- known results,
- possible approaches and methods,
- partial progress,

and share this with the advisory committee and the Graduate Services Coordinator at least two weeks before the exam.

A unanimous vote of approval of the advisory committee is required for passing the preliminary examination. Approval may be conditional, however, and require students to meet specific requirements prescribed by their advisory committee. These conditions must be written in a clear and distinct way and communicated in such a manner that the student clearly understands what is expected; they must also be submitted to the DGP and the Graduate School.

A doctoral student is **admitted to candidacy** by the Graduate School upon successfully passing the preliminary examinations. This does not include students receiving a conditional pass. A student who fails the preliminary examination is terminated from graduate work at NC State unless the graduate advisory committee unanimously requests a re-examination. Only one single re-examination will be allowed; it can encompass written, oral, or both components as determined by the advisory committee. If the DGP or the Graduate School denies the request, the student's program is terminated.

2.1.6 Doctoral dissertation

The doctoral dissertation must present the results of the student's original investigation. It must represent a contribution to knowledge and be written in a manner consistent with the highest standards of scholarship. Writing a dissertation generally takes several months and is challenging: it is an unfamiliar task which often requires

from students new methods, new levels of motivation and standards and advanced time management skills.

All dissertations must be developed and submitted in accordance with the NC State Electronic Theses and Dissertations (ETD) guidelines. Publications stemming from the dissertation are expected and strongly encouraged.

Table 2.4 describes the deadlines related to both the dissertation and final exam. Marginal changes in these dates should be expected from year to year and can be found here.

conferral	cmte ✓	ETD ✓	take exam	draft to cmte	schedule exam
Spring 05/09	04/21	04/07	03/24	exam - 2 wks	exam - 4 wks
Summer 07/29	07/22	07/10	06/26	exam - 2 wks	exam - 4 wks
Fall 12/13	11/28	11/14	10/31	exam - 2 wks	exam - 4 wks

Tab. 2.4: Deadlines related to the dissertation and final exam for 2025-2026. The "take exam" date (3rd column) is especially important as it also coincides with the deadline for applying to graduate and with the submission of the ETD draft. To facilitate on-time approval, it is recommended that committee members select the *dissertation early approval* box on the final exam sheet (provided they are satisfied with the dissertation) leaving final approval to the committee chair (2nd column).

2.1.7 Final oral examination

The final examination covers the material in the dissertation. The request to schedule the examination should be submitted to the Mathematics Department graduate programs office at least four weeks in advance. The graduate programs office will reserve a room for your exam. **Each member of the advisory committee must receive a copy of the doctoral dissertation at least two weeks before the final oral exam**; otherwise, the committee may require the defense to be postponed. To graduate in a given semester, a student must pass the exam before the Graduate School deadline for that semester, approximately six weeks before graduation. It is strongly recommended to check about deadlines well ahead of time by consulting with the Graduate Services Coordinator.

The presentation is open to the public and anyone in attendance is allowed to ask questions of the candidate at the end of the presentation. Only the advisory committee and the Graduate School Representative, if one has been appointed, are allowed to participate in the closed session for deliberation and decision. A unanimous vote of approval of the advisory committee is required to pass the final oral examination. In the case of a conditional pass, the specific requirements must

be submitted to the student as well as the Graduate School and attached to the Exam Results form. Final approval by the advisory committee is dependent upon a student's successful completion of those conditions. Should a student fail the final examination, this terminates a student's academic program unless the advisory committee recommends a re-examination.

2.2 Financial support

Most of our PhD students receive financial support.

2.2.1 Teaching assistantships

Most teaching assistantships (TAs) in the Department are at the 50% level, i.e., 1/2 FTE (full-time equivalent) or, equivalently in plain English: 20 hours per week during the semester. At the time of this writing, the corresponding stipend is $21,375 per academic year. The rest of the time is for studies and research.

Continued support is contingent upon

- satisfactory academic progress (see § 2.3),
- satisfactory performance of the assistantship duties.

Most TAs fall into one of the three following categories

1. **Instructor of record:** The student is sole instructor of one course section with all the responsibilities that come with it, including but not limited to lecture preparation and delivery, creation of a syllabus, development and grading of tests and quizzes, office hours and class administration (gradebook, etc...). Only experienced TAs are assigned such duties.
2. **Recitation leader:** The student runs several hourly recitation sessions each week. The preparation for each session includes consulting with the instructor about what to cover, working all homework problems and preparing extra problems.
3. **Lecturer assistant:** The student attends all lectures and take notes, helps prepare, hand out and proctor tests and exams, grades all tests and exams and keep records. In addition, the TA keeps in touch with the instructor about common student problems, assists with technology (mainly Webassign, Maple, Moodle) and works as a Math consultant in the Mathematics Multimedia Center (MMC).

Some other TAs are more focused on grading responsibilities; others still help in the development of the Department online teaching initiatives. The Assistant Department Head coordinates the performance evaluations of TAs each semester. A necessary condition for reappointment is satisfactory performance of TA duties during the previous appointment.

IMPORTANT: Standard TA offers for doctoral students joining the MA or AMA program are for 5 years (4 years for students joining the programs with an MS in Mathematics). After that time, two things happen: (i) tuition support expires, see § 4.1 and (ii) financial support from the Department in the form of teaching assistantships is **not** guaranteed.

Sixth year funding may be available but will usually be at a reduced rate (currently 77% of the standard TA stipend); the funding status will be reviewed semester by semester. Full time students in this situation are urged to consider applying for a thesis completion grant from the Graduate School, see § 4.2.

2.2.2 Research assistantships

Graduate Research Assistantships (RAs) are generally funded through external grants obtained by faculty through various funding agencies or companies. The appointment of a specific student to a given project is determined by the Principal Investigator of that project; such appointments are managed (HR actions, etc,...) by the Math Graduate Office. Students interested in joining an externally funded project should contact the involved faculty directly.

RA stipends vary but are generally at least at the level of the standard TA stipend in the Department. RA duties also vary and have to be established through discussions with the investigator/advisor.

2.2.3 Fellowships

Graduate fellowships may take several forms; general information is available from the NC State Graduate School Fellowships and Grants page. For instance, our students have recently had substantial success with the NSF Graduate Research Fellowship Program.

2.3 Progress assessment

Our PhD programs typically require five years. Progress assessment is an important avenue of communication with our students. It is discussed at yearly one-on-one meetings with the director of graduate programs. The following table shows **good**, **satisfactory**, and **unsatisfactory** progress toward graduation for a full-time student.

year	good	satisfactory	unsatisfactory
1	6 courses with A or B and at least 2 quals	6 courses and at least 1 qual	less than 6 courses or 0 quals
2	all req. courses with A or B and all quals	not all req. courses or only 2 quals	only 0 or 1 qual
3	work with advisor and plan of work	no supervised work	no supervised work and not all required courses
4	thesis progress or prelim exam	no plan of work or slow progress	no supervised work
5	thesis writing and final exam	no thesis writing	no plan of work, no prelim or slow work

Tab. 2.5: Progress assessment milestones for full-time PhD students. The boxes in the table indicate work that has been completed (not just attempted) by the end of the corresponding academic year (the last day of summer).

The above designations have the following meanings.

- **good:** Good progress. For departmental TAs, continued funding is expected.
- **satisfactory:** Satisfactory progress. For departmental TAs, continued funding is expected.
- **unsatisfactory:** Unsatisfactory progress.

Good and satisfactory designations are feedback to the student. An unsatisfactory designation triggers a review by the Graduate Program Advisory Committee, which may result in loss of financial support or even termination from the program. Unsatisfactory status may also be triggered from academic warning or probation, which may be imposed by the Graduate School if the student fails to maintain a cumulative GPA of 3.0 or better.

3 Masters Programs

> *Wanna hear something even funnier than 24? 25!*
>
> **— SpongeBob**

3.1 Requirements

The Masters degree programs in Mathematics and Applied Mathematics can be completed in one to two years. Our programs are non-thesis Option B which means that

- a comprehensive exam is not required,
- a thesis is not required,
- students have a single advisor, see §1.3,
- the degrees cannot carry an official minor.

To graduate, the Graduate School requires an approved Option B Master's Plan of Work submitted.

The Option B Master's Plan of Work should only contain 30 credit hours. The following are specific credit-hour limitations and requirements.

- At least 18 credit hours of letter-graded courses ("A," "B," "C", etc.) must be graduate MA course credits at the 500 level and above, and must have been earned while the student is enrolled in the graduate program. Up to three courses at the 500 level and above in mathematics-related disciplines are allowed, but the specific courses should be discussed in advance with the Director of Graduate Programs.
  - If desired by the student, one of these ten courses can be replaced by a one-semester Master's Project (MA 676); students interested in this option should consult with the Director of Graduate Programs before signing up for MA 676.

- At least one course in each of continuous, discrete and computational mathematics as described in Table 2.1 must be passed. In addition, students must fulfill an in-depth requirement of two two-course sequences or a group of three related courses (to be discussed in consultation with the student's advisor).
- Students who have not had the equivalent of MA 405 (Introduction to Linear Algebra and Matrices), MA 407 (Introduction to Modern Algebra), or MA 425-426 (Mathematical Analysis I and II) must make up these courses. Students who have not had the equivalent of MA 426 may take it for graduate credit by registering for MA 591M.
- Up to six credits at the 400 level may be counted toward the master's degree, but only if those courses come from outside of mathematics, and have prior approval from the Director of Graduate Programs.
- Credit hours for the following courses may NOT be used to satisfy the 30-credit hour requirement: Seminar (MA 601), Master's Supervised Teaching (MA 685), Non-Thesis Master's Examination (XXX 690), Master's Thesis Research (XXX 695), Summer Thesis Research (XXX 696), Non-Thesis Master's Continuous Registration (XXX 688 and XXX 689), or the 800 level equivalents of these courses.

MS students interested in taking PhD qualifying exams should consult with the Director of Graduate Programs. Being authorized to take such an exam and passing it does not imply by itself any guarantee of being admitted to the PhD program.

3.2 Support

Most of our MS students are self-supported. There may however be possibilities of finding hourly positions within the Department, or TA positions, depending on need. Please, consult with the Graduate Service Coordinator or Director of Graduate Programs.

3.3 Accelerated Bachelor's/Master's program

The Accelerated Bachelors/Master's (ABM) degree program allows exceptional undergraduate students in Mathematics or Applied Mathematics at NC State an opportunity to complete the requirements for both the Bachelor's and Master's degrees at an accelerated pace. These undergraduate students may double count up to 12 credits and obtain a Master's degree in Mathematics or Applied Mathematics within 12 months of completing the Bachelor's degree. Students must receive a grade of B or better in the double counted graduate-level courses (500 or 700 level)

while maintaining a 3.500 GPA. Courses with a grade of B- or below cannot be double counted between the two degrees.

3.3.1 Eligibility requirements

- Students may apply once they have completed a minimum of seventy-five (75) credit hours in their undergraduate programs, including credits earned from advanced placement, but they must apply before completion of the undergraduate degree.
- Transfer students must have completed a minimum of two semesters as a full-time student at NC State, a minimum of 24 hours.
- Students must have a minimum accumulated grade point average (GPA) of 3.500 at NC State at the time of admission into the ABM degree program.

3.3.2 Application to the ABM program

1. Interested students that meet the GPA requirement should schedule a meeting with their Directors of Undergraduate and Graduate Programs to develop tentative academic plans for the ABM program. The Graduate School requires an approved ABM Plan of Work form to admit a student into an ABM program. The ABM Plan of Graduate Work should clearly indicate:
   - the courses (a maximum of 12 graduate credit hours, 500 or 700 level) that will be double counted for both bachelor's and master's degrees,
   - the courses that will be taken after matriculating into the graduate program,
   - the graduation date for the master's degree that meets the time limit for the ABM program.

   Approval to pursue an ABM degree program does not guarantee an admission to the Graduate School.
2. While still an undergraduate, students must submit the standard application for admission to the Graduate School (MS program in either MA or AMA) with the following differences
   - the GRE test is not required,
   - students do not need to upload their NC State transcript,
   - students do need to upload the ABM Plan of Work.

   As with other applicants, three letters of reference are required as well as an application fee.
3. Any deviations from the approved ABM Plan of Work form, require that the updates be approved by the Directors of Undergraduate and Graduate Programs as well as the Graduate School.

4 General Information

> *I have you now.*
>
> **— Darth Vader**

4.1 Graduate Student Support Plan

The Graduate Student Support Plan (GSSP) is an important part of the benefits offered to graduate students at NC State. Eligible students are those who

- are enrolled full-time in an on-campus master's or doctoral program (distance ed. or graduate certificate programs do not qualify),
- are supported on a qualifying graduate assistantship (teaching or research) or fellowship of at least $20,000 annualized for PhD students (or $15,000 annualized for Master's students).

The GSSP provides two types of support: (i) tuition support § 4.1.3 and (ii) health insurance § 4.1.4.

4.1.1 Full time status

To be considered full-time, graduate students must take a minimum course load of nine (9) credit hours each semester.

During the semester when less than nine (9) credit hours remain to be completed, a student will be full-time when registered for that amount as long as registration is for at least three (3) credit hours. Full-time for all subsequent semesters shall be at least three (3) credit hours and the course number shall not matter. For example, if a PhD student needs only seven (7) hours to reach 72 hours in a given semester, seven (7) hours shall be full-time for that semester. If that student needs only one (1) credit hour to complete, full-time would still be three (3) credit hours.

4.1.2 Student fees

For the 2025-26 academic year, these fees per semester are as follows:

- 1-8 credit hours: $139.14 per credit hour,
- 9 credit hours and above: $1,252.25.

An itemized breakdown of these fees is available from the Student Services Center. Students fees are not covered by the GSSP. Due in part to recent changes, student fees are increasingly unlikely to be paid from any sources but the students themselves; see for instance this memorandum from the Provost.

4.1.3 Tuition support

For the 2025-26 academic year, the graduate tuition is as follows for full time students (9+ credit hours) per semester:

NC residents: $\$5,115.00$ **out-of-state residents:** $\$15,764.00$.

Below, **tuition remission** refers to the difference between out-of-state and in-tuition benefit, i.e., 15,764-5,115 = $10,649 per semester.

Doctoral students without a previous related master's degree upon initial enrollment are eligible for GSSP tuition support for **ten semesters**; the corresponding period is **eight semesters** for doctoral students with a previous related master's degree and **four semesters** for graduate students enrolled in a master's program. For all eligible students, tuition support is as follows

Year 1: tuition is fully covered for two semesters regardless of residency status.

After year 1: the in-state part of the tuition is still covered. To receive tuition remission support, out-of-state graduate students (US citizens and students with visa types able to establish in-state residency) must have been granted reclassification to in-state residency status.

After year 5: All tuition benefits end after 10 semesters (8 for students who entered with an MS); health insurance benefits are usually unchanged, see § 4.1.4.

IMPORTANT REMARKS:

- Financial support from the Department in the form of teaching assistantships is **not** guaranteed beyond the 5th year (4th for students who entered with an MS), see § 2.2.1.

- Most students who "time out" of the GSSP tuition benefits have completed all required credit hours and can reach full time with 3 credits only, see § 4.1.1.
- Most international students on visa are not eligible for state residency and are thus not eligible for tuition remission support. International students are typically billed out-of-state tuition rates and **the GSSP will cover the total tuition** as long as the students are meeting GSSP eligibility requirements.

4.1.4 Health insurance

The GSSP provides health insurance through Student Blue (Blue Cross & Blue Shield of North Carolina) at no cost to the student. The corresponding NCSU RA-TA health insurance plan is a "gold" metallic tier student health insurance plan available to all graduate students that meet GSSP eligibility requirements, at all times. Only GSSP eligible students can participate as members of the NCSU RA-TA health insurance plan. Students that have actively met all GSSP eligibility requirements in the HR and Student Information Systems are automatically enrolled in the NCSU RA-TA health insurance plan and waived from the University Mandatory Student Health Insurance Plan. Typical coverage start dates are Aug. 1 for fall and Jan. 1 for spring.

In any academic year, students who are supported through a TA for both fall and spring semesters are automatically covered through the subsequent summer. Students on RAs or on mixed support are urged to check the Math Graduate Office about their summer coverage as corresponding rules and regulations are currently in flux. Dependent coverage is possible but is not covered through the GSSP (i.e., it is at the student's expense). Students can waive/decline coverage on the NCSU RA-TA Plan if they have alternate health insurance that they would prefer.

For further information, please, refer to the GSSP Handbook directly.

4.2 Student awards

4.2.1 Departmental awards and additional resources

The Department and its faculty are strongly committed to the success of their students. The named awards below all result from the generosity of current or former faculty in the Department and their families.

1. **Banks award:** The award recognizes current outstanding students associated with the Center for Research in Scientific Computing (CRSC). Winners are chosen yearly by the Associate Directors of CRSC.
2. **Luh award:** The award goes to accepted students in the programs who are interested in research in algebra; awardees are identified by the DGP in consultation with the graduate admission committee.
3. **Maltbie award:** The award recognizes excellence in teaching among MA and AMA Teaching Assistants. Winners are chosen each year by the Assistant Department Head among the nominees to the Graduate Student association's teaching excellence award (see below).
4. **Siewert award:** The award goes to accepted students in the programs who are interested in research in applied mathematics; awardees are identified by the DGP in consultation with the graduate admission committee.
5. **Winton-Rose award:** The award is given to a PhD candidate who is close to graduation (which is defined as having passed the qualifiers as well as the oral preliminary exam, and having an expected graduation date within 15 months). Nominations are opened every year in late spring and have to be initiated by the student's advisor. The winners are chosen by the Graduate Program Committee.
6. **Travel award:** Subject to availability, the Department makes limited funds available to facilitate the travel of our graduate students to workshops and conferences. Interested students should contact the DGP directly with the name, location and date of the event they wish to attend, the nature of their involvement (speaker, poster presenter, participant in job fair . . .) and a rough budget. In addition, students are strongly encouraged to seek other sources of funding from the event's organizers when available (such as professional societies, Math Institutes, etc. . .), travel awards from the NC State Graduate Student Association (see below) or funds from their advisor.

4.2.2 University awards and programs

1. **Graduate Student Association's teaching excellence award:** The award recognizes outstanding graduate student teachers. Students are invited yearly to apply for the award (self-nomination) in the middle of February. More information is available the Graduate Student Association Teaching Awards page.
2. **Preparing the Professoriate (PTP):** PTP is a nationally recognized program designed to give exceptional doctoral students and postdoctoral scholars an immersive mentoring, teaching, and future faculty preparation experience. Essentially, each participant (PTP fellow) is associated with a faculty for one academic year. In the fall, the fellow attends a course taught by the PTP

faculty mentor. The next semester, the roles are flipped and the fellow teaches the course under the guidance of the mentor. PTP Fellows also take part in additional activities during the year. The Graduate School provides further information about this outstanding professional development opportunity.
The Graduate School holds **mandatory** information sessions in early spring each year for interested students. Also, the Math Department has at times enforced an internal selection process first. If in doubt, please, consult with the Director of the Undergraduate Program, the Director of the Graduate Programs or the Assistant Department Head.

3. **Thesis completion grant:** The Doctoral Dissertation Completion Grant program provides both funding and intensive mentoring to doctoral candidates who are within six months of completing their dissertations. It is designed to enable candidates to focus full time on the writing of their dissertations, improving the quality of the dissertation and shortening the time required to complete the doctoral degree. Eligibility is limited to those who have the potential for completing the dissertation within the 6-month grant period. Students at the end of their fifth year (fourth for students who entered with an MS) are strongly urged to consider applying.
   There are two possible grant periods each year (July 1 to December 31 and January 1 to June 30) and corresponding deadlines (May 16 and October 16). Nominations are to be submitted by the DPG. Interested students should contact their advisor and/or the DGP well in advance. More information can be found at the Graduate School webpage.
4. **Graduate Student Association's travel award:** The GSA makes two types of travel awards available to NC State graduate students: a conference award (up to $1,500) and a travel assistance award (up to $500). A student can only receive each award at most once during his/her studies. Deadlines for fall and spring semesters are respectively September 15 and February 15. Students can self-nominate at the GSA webpage. The conference award requires two letters of recommendation while the travel assistance award requires one.

4.3 Student life and associations

Students are encouraged to get involved early in associations and social events in the department. Joining a professional society such as the American Mathematical Society or the Society for Industrial and Applied Mathematics can be done cheaply or for free(!); this not only gives access to rebates on conferences and publications but also facilitates integration in communities of like-minded scientists (networking...).

MGSA: The Mathematics Graduate Student Association (MGSA) represents and provides resources to students in the Mathematics, Applied Mathematics, and Financial Mathematics graduate programs at North Carolina State University. The purpose of the organization is:

- To represent the graduate student body of the Mathematics Department.
- To provide a forum for graduate student opinion.
- To voice graduate student opinion in all matters of mutual interest to graduate faculty and students.
- To disseminate information of interest or importance to students.
- To promote professional interest and fellowship among graduate students.

AMS NC State student chapter: This AMS graduate student chapter sponsored by the American Mathematical Society is devoted to the furtherance of the interests of mathematical scholarship and research. This includes, but is not limited to

- the communication of mathematics graduate student research,
- helping new mathematics graduate students adjust to graduate life,
- assisting and informing NC State math grad students on the job market.

AWM NC State student chapter: The purpose of the Association for Women in Mathematics is to encourage women and girls to study and to have active careers in the mathematical sciences, and to promote equal opportunity and the equal treatment of women and girls in the mathematical sciences. NC State faculty mentor: Lorena Bociu.

SIAM NC State student chapter: The purpose of the SIAM student chapter is to generate interest in applied mathematics and computational science by providing students opportunities to:

- Share ideas and enthusiasm with fellow students and faculty from any relevant department on campus.
- Explore career opportunities.
- Make contacts that will last a lifetime.
- Develop leadership skills.

4.4 Facilities

AMA and MA PhD students are assigned individual desk space either in SAS Hall or in the adjoining Language and Computer Labs building. Incoming PhD students also receive a new laptop which is meant to be their main computer for the duration of their graduate study at NC State. For high performance computing needs, the Office of Information Technology offers access to clusters and related courses. Interested students should contact their advisors to receive an account (faculty have to initiate

the requests). The Department also maintains a smaller cluster; see here for more details.

NC State maintains licenses for a large number of software applications; the software licensing page offers more details about what is available (NC State login required). Some of these resources have restricted off-campus access and may require the use of Virtual Private Network (VPN) to connect and use from off-campus. The Mathematics information technology webpage offers more information (NC State login required).

All students have full access to the state-of-the-art NCSU Libraries. This includes large book collections, extensive electronic access to journals and databases but also access to group study rooms, technology lending and more.

4.5 Difficulties

We recognize that graduate studies can be stressful. All the personnel associated with the math graduate office, i.e., the director of the programs and the graduate services coordinator, are dedicated to the success of every single student in our programs. Students should not hesitate to consult with us in case of academic difficulties, issues with advisors, non-academic difficulties, etc.

4.5.1 Counseling center

The NC State Counseling Center provides a wide range of services to help students address emotional, interpersonal and academic concerns. They are here to help and their staff is amazing. If you feel lost, discouraged, aimless or just need to talk to someone, please, get in touch with them (contact info).

The College of Sciences has an Embedded Counselor, Nicole Johnson. See this article on Nicole and her work.

4.5.2 Pack essentials

NC State and campus partners have developed many programs "Pack Essentials" to support students in need of food, housing, financial and educational security. Includes food and housing resources (including Feed the Pack Pantry), financial resources (includes Student Emergency Fund and PACK ASSIST), student legal services, and many others.

4.5.3 Student ombuds

An independent, neutral, confidential, and informal office at NC State, Student Ombuds Services is here to be a personal guide for conflict management, prevention and resolution while advocating for fair processes and empowering students to successfully navigate NC State.

4.5.4 Grievance procedure

Student grievances are limited to matters that both (i) adversely affect the student and (ii) involve a misapplication or misinterpretation of university policy, regulation, or rule, or a violation of state or federal law. Grievances may not be used to challenge policies or procedures of general applicability.

Before submitting a written grievance, it is generally advisable to attempt informal resolution; depending on the nature of the grievance, the chair of the advisory committee and/or the DGP and/or the Division of Human Resources (Employee Relations) and/or the Office of Equal Opportunity may be consulted. Should informal resolution fail, formal resolution procedures (i.e., written complaints) are described in REG 11.35.04.

5 Affiliated Programs

> *3 is a good approximation of 5.*
>
> **— Joey Hart, 2018 AMA PhD graduate**

5.1 Graduate certificate in Mathematics

Students take a combination of graduate and undergraduate mathematics courses that are tailored to the individual student. The certificate requires 12 hours of mathematics courses, taken for a grade at NC State. There is no specific list of courses for the certificate. Of the 12 hours, 3 hours may be at the 400 level with prior approval of the Director of Graduate Programs. The other 9 hours will be at the 500 level or above. Students must complete at least one course per semester to remain in good standing. Students who have been out of school for some time or who need extra preparation before graduate courses may need to take additional 300- or 400-level courses prior to the 500-level courses. A grade of C- is required for a course to count toward the certificate. A 3.00 GPA (B average) is required to earn the certificate.

The certificate is also available as an online degree.

5.2 Biomathematics graduate program

The NC State Biomathematics graduate program sits at the interface of the mathematical and biological sciences, and has an emphasis on the use of modeling as a tool for understanding biological systems. The program offers courses in mathematical biology, leading to Masters and Doctoral degrees. The program covers a wide range of research areas, including physiology, ecology, evolution, infectious disease, developmental biology, toxicology and pharmacology. The Biomathematics faculty is made up of members from Mathematics, Statistics and a wide range of departments in the Biological Sciences.

5.3 Operations Research graduate program

The Operations Research Program is interdisciplinary; its faculty members come from various departments and programs such as industrial and systems engineering, civil, electrical and computer engineering, computer science, business and management sciences, textiles engineering, biomathematics, bioinformatics, financial mathematics, mathematics, and statistics. The program offers three advanced degrees: Master of OR (MOR), Master of Science in OR (MSc), and Doctor of Philosophy in OR (PhD).

5.4 Masters of Financial Mathematics

The Financial Mathematics Program provides technically trained professionals with an understanding of how to value financial derivatives and complex investments, and assess the associated risks. Graduates receive a rigorous training in mathematics, especially in the area of stochastic processes and probability, in statistics, and in computation, together with a foundation in the institutional operation of financial markets. The program offers a Master of Financial Mathematics.

5.5 Masters in Foundations of Data Science

Launched in Fall 2023, NC State's Master's degree in Foundations of Data Science (MSFDS) will help meet the demand for a new breed of data science professionals. MSFDS is a terminal professional degree program based on course work and integrated professional development activities. The program will equip its graduates with both depth and breadth, balanced across three core disciplines lying at the heart of data science: Mathematics, Statistics, and Computer Science. No research, thesis or comprehensive examination is required. MSFDS students are normally self-supported.

5.6 Graduate minor programs

Graduate students in non-mathematics programs may elect to minor in mathematics. It is recommended that students interested in a minor in mathematics contact the Mathematics Department director of graduate programs before submitting a plan of work.

5.6.1 Doctoral degree with minor in Mathematics

- A minimum of twelve hours of coursework in mathematics in 500- or 700-level courses is required (4 courses), with at least a B average and no grade below B-. Courses taken for a master's degree minor will not count toward the Ph.D. minor.
- The student must have a Department of Mathematics representative on their graduate advisory committee. This representative should be selected early in the student's program in order to help in the choice of courses.

5.6.2 Master's degree with minor in Mathematics

- A minimum of 9 hours of coursework in mathematics is required (3 courses) with at least a B average and no grade below B-. At least 6 of these hours must be in 500- or 700-level courses.

5.7 3+2 Master's program

The 3+2 Master's Program is a cooperative program between certain schools in China with NC State University. Select students from these universities enroll in graduate-level NC State courses during the fall semester which also counts towards the completion of their undergraduate degree.