

# Department of Mathematics

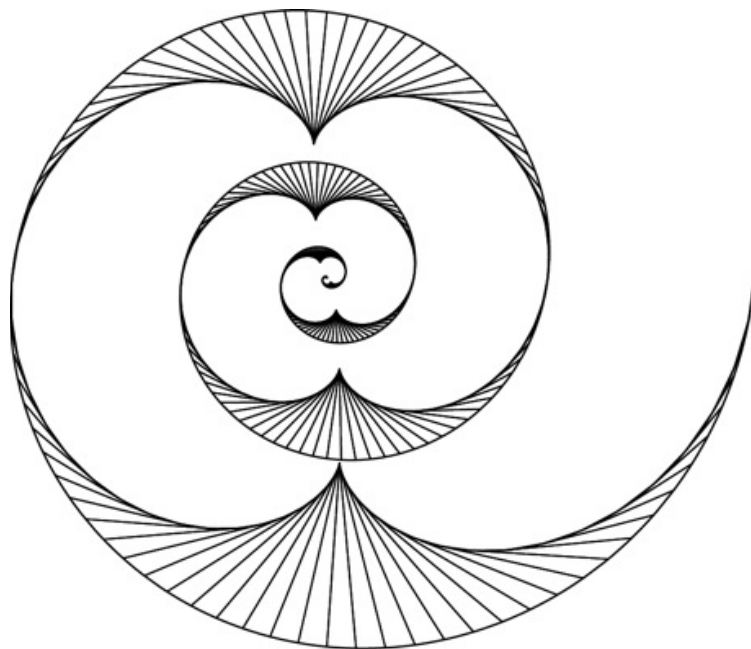


Image provided by Matthias Weber

# Graduate Student Handbook

2022-23



# Welcome

This handbook serves as a guide for the Mathematics Ph.D. program at Indiana University Bloomington. The information here is not comprehensive and is just meant to get you started and point you in the right direction. While we expect this handbook to be most useful to new students, it does also outline important guidelines for later-year students.

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# Administration

The following are the personnel who are directly relevant to the graduate program. The people in these roles sometimes change; the information is current for the 2020-21 academic year. See the section [If You Need Help](#) for more specifics on who can help with what kinds of issues.

## The Director of Graduate Studies

Matthias Weber  
[matweber@indiana.edu](mailto:matweber@indiana.edu)

The Director of Graduate Studies (DGS) is the Mathematics faculty member who oversees the graduate program and is responsible for approving student academic requirements. In consultation with the Graduate Advisory Committee and faculty, the DGS is responsible for graduate program policy. The DGS is responsible for Associate Instructor (AI) and Graduate Assistant (GA) employment in the Department of Mathematics. See the Graduate Secretary if you need to schedule an appointment with the DGS.

## The Graduate Secretary

Susan Palmiotto  
[spalmiot@iu.edu](mailto:spalmiot@iu.edu)

The Graduate Secretary manages the graduate office including graduate student records, payroll, offices, contact information, admissions, and statistical data. The Graduate Secretary reviews all graduate student records and helps students understand the requirements for completion of their degrees.

## The Graduate Advisory Committee

The Graduate Advisory Committee is a committee of Mathematics faculty members that assist the DGS with admission, student progress, and developing graduate program policy.

## Interim Advisor/Tier 3 Advisor/Thesis Advisor

When you first arrive, you will be assigned an interim advisor. You can change your interim advisor at any time by asking another research faculty member; if they agree, they become your new interim advisor. Your interim advisor is someone you can consult with for advice about classes and about making progress in the program. Interim advisors will have general knowledge about the program and specific knowledge about the field they work in, but may not know the answers to your questions, especially about program specifics or courses outside their research areas; rather, they should be able to direct you to who in the department can answer your questions.

When you write your Tier 2, you will begin to identify a possible Tier 3 advisor; when you are ready to start Tier 3, you will choose an advisor who will direct your Tier 3 studies and take over advising you in the program. To pass Tier 3, you need to have a thesis advisor, who will typically be your Tier 3 advisor, but does not need to be. Your thesis advisor will direct your Ph.D. research as well as take over advising you in the program and begin advising you on your career in Mathematics. Please inform the Graduate Secretary if you change interim advisors, acquire or change your Tier 3 advisor, or change thesis advisors.

## The Department Chair

Kevin Pilgrim

The Department Chair is the Mathematics faculty member who is responsible for the operation of the entire Department of Mathematics. Graduate student problems should be directed to the DGS and not the Department Chair.

# Essentials

## Arrival

Please plan to arrive in Bloomington approximately 4 weeks before classes begin; see the official [IU calendar](#) for the exact dates. Make your way to the Department of Mathematics in Rawles Hall (RH) and find the Graduate Secretary in RH 129 who will help you with some of the essentials listed below.

Before classes begin, we offer a JumpStart Program, which typically includes some Algebra and Analysis review and the opportunity to meet faculty. In the week before classes begin, we conduct the Tier 1 exams.

## CrimsonCard

The [CrimsonCard](#) is your student identification card and is necessary to use university recreational facilities, to check out library books, and to make copies in the university libraries. You will not be able to get your student ID card until you register for classes the week before the semester begins.

## Offices

You will be assigned an office. You will share this office with other graduate students. Your office is to be used for activities related to studying, research, and AI/GA duties. Office assignments are reviewed each summer and are offered based on seniority, the dates that students passed various Tier exams, and coursework progress. Each office has a telephone and all domestic calls can be made at no expense.

## Keys

The Graduate Secretary can provide you with a key to your office, a key to your mailbox in Rawles Hall, and a key to the graduate student lounge in Swain East (SE). You will need to pay a one-time deposit of \$5 for your keys; the replacement cost for a lost key is \$10 each key.

You and your officemates should keep your office locked when it is not in use. Rawles Hall and Swain East are unlocked from approximately 6:00AM to 11:00PM each day (this schedule may change during holidays).

## Computer Accounts and Printing

You should already have your computer and e-mail accounts set up before you arrive. However, if you have not yet done so, or want to check which accounts you currently have, you can find that [information](#) online. Ensure that you have an [Exchange](#) e-mail account; this is the only e-mail account considered safe for confidential information and must be used for all your AI/GA duties.

*It is essential that you regularly read your IU e-mail as that is the official form of communication.*

Most graduate student offices come equipped with a computer. You may also use the [Student Technology Centers](#) on campus which should have printing capabilities and use your AI print allotment per semester. All graduate students in Swain East can print to the printer in SE 340 for which you are allotted 500 black and white pages per month. You can print in color; however, one color page equates ten black and white pages of your allotment. E-mail Jeff Taylor at [jeffhelp@indiana.edu](mailto:jeffhelp@indiana.edu) for help in configuring your computer/phone/tablet.

The copier in Rawles Hall is only available to graduate students with offices in Rawles Hall. For access, please contact Jeff Taylor at [jeffhelp@indiana.edu](mailto:jeffhelp@indiana.edu).

All printing for fulfilling your AI/GA duties should be sent to [mathcopy@indiana.edu](mailto:mathcopy@indiana.edu). Send your request 24 hours before you need the materials.

For general computer and phone problems, contact Jeff Taylor at [jeffhelp@indiana.edu](mailto:jeffhelp@indiana.edu).

## Mailboxes

New students will be assigned a mailbox in Rawles Hall by the end of August; all mailboxes are reorganized at the end of summer. You will likely share your mailbox with another graduate student and your mailbox is located **under** your name. Your mailbox can be accessed through the mailroom or from the hallway with a key. The mailroom is open weekdays 7:30AM-4:30PM.

Mail is picked up/delivered to the department each weekday the department is open.

## Parking

Parking permits are available from [Parking Operations](#) in the Henderson Parking Garage (310 S. Fess Avenue). Students who are not financially supported by the University are only eligible for limited parking permits. Depending on the type of IU funding, you will be eligible to obtain either an EM-S or EM-P permit. The EM-S permits are significantly less expensive but the EM-S lots near the department fill up quickly in the morning (do not expect to find a spot after 8:00 AM). The EM-P permits allow you to park in the [parking garages](#) which typically have spots available throughout the day.

## Copying

Graduate students can use the copier in the mailroom in Rawles Hall to make a few copies. The code to use the copier is on the wall above the copier/printer. If you need to make more than 10 copies, please e-mail your request/PDF to [mathcopy@indiana.edu](mailto:mathcopy@indiana.edu) or leave a paper copy with instructions in the document holder outside the copy room. Please submit copy requests with at least 24-hour notice.

Copying at other campus locations requires your ID card and use of your [account](#).

# Supplies

Office supplies are kept in a cabinet in the main office (RH 115) behind the receptionist's desk.



# Classes and Fee Remission

## Course Offerings

The classes each semester can be found on the [Registrar's](#) Web page. Please note: if you plan to register for our 400-level graduate level courses, ensure that you register for the section that states "Above class open to graduates only."

## Course Loads

The usual course load for beginning graduate students is 9-12 credits (3-4 courses). While completing your coursework requirements, to maintain good academic standing in the department, you should complete at least 9 credits per semester with a 3.2 (B/B+) grade point average. Advanced students who have completed breadth and minor requirements and passed Tier 3 can maintain good academic standing with 6 credits of M800 or G901 per semester.

University rules require enrollment in at least 1 credit each semester during the academic year (excluding summer) to maintain graduate student status and 6 credits to be allowed to work as an Associate Instructor or Graduate Assistant.

International students sometimes have different requirements; consult the [Office of International Services](#) for more details.

## Outside Courses

We expect that the majority of your courses will be taken within the Department of Mathematics, but outside courses may be taken when they are necessary for your degree. With the exception of English as a second language courses, these require approval of the DGS. Courses outside the College in addition require permission of the College, which you will request through the DGS. The College will not approve outside courses except in the following circumstances:

1. Courses to satisfy the [breadth requirements](#) using the outside topic (limit 2).
2. An outside minor for your Ph.D. Consult with the relevant school or department for specific requirements.
3. If your advisor states a specific course is essential for your degree and this is approved by the DGS.

## Fees and Fee Remission

As an Associate Instructor or Graduate Assistant, the College will pay the fee remission for up to 12 credit hours per semester and 6 credit hours in the summer (if you were supported during the academic year). This covers courses offered by departments within the College and courses that are required for your degree.

Fee remission covers 100% of the cost of tuition. The university also assesses all students various fees to cover technology, transportation, health and recreation, etc. These fees will appear on your Bursar bill.

## Bursar Bill

Bills are generally due on the 10<sup>th</sup> of each month, which should be after your first pay for the fall semester. The Graduate Secretary will inform you of the fall pay dates. If you are not paid by the indicated pay date, please see the Graduate Secretary immediately. For a list of [fees](#) and [billing and payment](#) information, visit [Student Central](#). There is a [1.5%](#) late fee for each month the bill is past due, but in most cases this is less than the fees for a payment arrangement. As fees sometimes change, please consult the [Bursar](#) for current information. In past fall semesters (only), there has been a grace period for payment of the first bursar bill, giving students until November 9 (or the last weekday before it) to pay the bill without a late fee; before relying on this, double-check your communications from the Bursar's Office or confirm with them, as their policies can change from year to year.

## Dropping and Adding Classes

For official deadlines on registering or dropping classes, please check the official calendar available through the [Registrar](#).

Dropping and adding classes is free except for a small drop/add fee until Thursday the first week of classes in fall and spring semesters and will not result in a W on your transcript. After that, dropping classes results in a reduction of your fee remission by 25% that increases each week. For more information on specifics, consult with the Graduate Secretary.

# If You Need Help

If you are unsure about something, please ask your advisor, the Graduate Secretary, or the DGS. In general, consult your advisor about course recommendations and general academic questions; consult the Graduate Secretary for information about forms, deadlines, formal program requirements, and other administrative issues; consult the DGS about academic and policy questions about the program.

## Academic Rules

Academic requirements are detailed in the University Graduate School [Bulletin](#), which is updated each academic year. You can use any version of the Bulletin beginning with the year you are admitted.

## Student Academic Appointments

The [Handbook for Student Academic Employees](#) explains the rules, regulations, and benefits.

## College of Arts and Sciences Rules

The College of Arts and Sciences (College) has its own [policies and procedures](#). [Insurance](#) information can be found through the University Human Resource Services.

## Health Issues

The IU Health Center can be used for [medical](#), [counseling](#), and [mental health](#) issues.

## Academic Progress

For questions regarding your academic progress, please meet with your advisor, the Graduate Secretary, or the DGS.

## Building and/or Office Problems

All facility problems should be reported to the Receptionist in Rawles Hall 115; specific office issues should be reported to the Graduate Secretary. Issues with your officemates can be discussed with the DGS.

# Student Academic Appointments

Student Academic Appointment (SAA) is the term for the position of Associate Instructor (AI) and Graduate Assistant (GA). In the Department of Mathematics, students whose native language is not English begin as GAs and get promoted to AIs after passing the [Test of English Proficiency for Associate Instructor Candidates](#) (TEPAIC) exam. Students who have not passed the TEPAIC exam can only receive assignments that do not include student contact hours; typically these are grading jobs. (See the [individual job descriptions](#) below.)

## Workload and Expectations

The total workload for an SAA should be an average of approximately 16 hours per week or less, which is often divided among multiple assignments with different supervisors. We try to keep assignments reasonably balanced, but different supervisors may have different requirements, which vary across classes and semesters. If your workload exceeds an average of 16 hours a week, please discuss it with your supervisors and/or the DGS.

We expect you to carry out all of your SAA duties diligently, professionally, and in a timely manner: our undergraduate program depends on the work you do. If you need a substitute, please discuss this with your supervisor and find a substitute well in advance. If you experience any difficulties with your assignment, please contact your supervisor and/or the DGS immediately.

## Preference Forms

Each semester the Graduate Secretary will send out an *Assignment Preference Form*, which will allow you to express your preferences for the different assignment types and to specify your class schedule to avoid time conflicts. Make sure to submit your form on time to ensure your preferences and class schedules are taken into account when assignments are decided. Schedule changes made after forms have been submitted may not always be accommodated. Every effort is made to accommodate assignment preferences, and we almost always succeed for students with a reasonable amount of flexibility in their preferences; for students who indicate narrow preferences, we do not always succeed.

## Supervisors

For each part of your AI/GA assignments, you will have a supervisor: for assisting, grading, and recitation assignments, your supervisor will be the lecturer for your section; for teaching assignments, your supervisor will be the course coordinator for the course. If you are unsure who your supervisor is, ask the Graduate Secretary. It is your responsibility to check in with your supervisor(s) well before the beginning of classes; do not wait for your supervisor to contact you. Contact your supervisor as soon as you have your assignment; introduce yourself and ask about your duties. Usually your supervisor will want to schedule a meeting before the start of classes or during your first week of classes to go over your responsibilities in the class.

Communication with your supervisor is vital to your success as an AI/GA. Let your supervisor know how best to reach you, and expect to receive e-mail via your University e-mail account.

Communications from your supervisor need to be answered promptly. As a good rule of thumb, an e-mail from your supervisor in the morning should be answered by the evening of the same day, and an e-mail from your supervisor in the evening should be answered by the next morning. Often an e-mail from your supervisor will contain a request or instructions; all such e-mails need to be acknowledged: your supervisor needs to know that you received the e-mail and will follow the instructions.

## Grievance Procedures

If an issue arises between SAA and supervisor, the complaining party (SAA or supervisor) must give written notice (e.g., by e-mail) to the other party and the issue must be recorded in written form. The SAA and the supervisor are encouraged to resolve the issue with good communication. If there continues to be disagreement, the SAA or supervisor are asked to discuss the issue with the DGS, unless there is conflict of interest (e.g., the SAA is an advisee of the DGS) in which case the Associate Chair or Chair should be contacted.

If redress is not reached a departmental committee will be formed. This committee will consist of faculty and at least 1 SAA. Each party will have an opportunity to be heard and the committee will provide a solution for the issue.

The procedure must comply with the rules set out in section **Grievance Procedures** of the document **Graduate Student Academic Appointees Guide**

<https://vpfaa.indiana.edu/doc/graduate-student-academic-appointees-guide.pdf>

## Assignment Types

GA assignments will typically be grading for 2 or more sections; AI assignments will almost always consist of one or more of the following assignment types:

### Grading

We have grading assignments in most 3 credit 300-level, 400-level, and 500-level courses. These courses typically have weekly homework on a set schedule, though some lower level courses may have daily homework, and some 500-level courses may have homework on a different or irregular schedule. AIs with grading assignments may be asked to hold office hours; GAs cannot hold office hours. AI/GAs with grading assignments may be asked to proctor or help proctor exams when they do not have a schedule conflict. The main duty of a grading assignment is grading homework, quizzes, and in some cases help grading exams. Talk with your supervisor about how they want the grading done; even in the same course different instructors often have different expectations about grading. Ask your supervisor about a grading rubric that outlines what emphasis you should give to various aspects of the homework and about a grading scale that determines how grades should be marked on the papers and entered in the gradebook. Ask your supervisor about expected turnaround times and deadlines. Usually it will be your responsibility to enter grades in the gradebook; this needs to be done accurately and responsibly.

### Assisting

We have assisting assignments for M118, M119, M120, and their variants. Assisting may include a wide variety of duties: tutoring in the departmental help sessions, holding office hours, helping prepare and proctor exams, grading exams and entering grades, recording clicker scores, and answering student e-mails. You may be required to attend class and assist during the lectures. The required duties may vary with the supervisor. Please contact your supervisor to discuss the precise duties for each class.

## Recitation

We have recitation assignments in M211, M212, M311, and their variants. Each recitation section is affiliated with a lecture section, and the lecturer in that section is your supervisor for the recitation assignment. A typical recitation assignment is two recitation sections (but other combinations are possible such as one recitation section and one grading section). Recitation sections meet once a week and typically discuss class topics, work examples, and have a quiz; however, your supervisor may have other instructions for how to spend the recitation time. In addition to running the recitation section, duties of a recitation assignment include tutoring in the departmental help sessions and may include holding office hours, grading homework and quizzes, proctoring exams, helping grade exams, and answering student e-mails.

## Teaching

We have teaching assignments in 000-level courses and some 100-level courses. If you are interested in teaching a class, you should take the M595/6 Seminar(s) on Teaching. If you plan to continue in academics, it is highly advisable to get as much experience teaching as you can. We do try to give an opportunity to teach to all AIs who want to (and who have taken the Seminar on Teaching), subject to our responsibility to offer high quality instruction at all levels.

## Office Hours

In most types of assignments, AIs will be expected to hold office hours. Please confirm the times and location of your office hours as acceptable to your supervisor and confirm any changes with him or her ahead of time so they can be communicated with the students. Best practice is to schedule your office hours at slightly staggered times so that all students are likely to be free during some office hour. During your scheduled office hours, you are expected to be in the scheduled location.

## Departmental Tutorials

The department offers help sessions in the Math Learning Center for our 100-level and 200-level courses. Staffing these help sessions is part of the AI assignment for Assisting and Recitation assignments. Your help sessions will be on a regular schedule set (with your input) by the Math Learning Center Coordinator at the beginning of the semester.

## Books

Books for your AI/GA duties can be obtained from the Receptionist at the front desk by completing a short form.

## Private Tutor List

Students must be in good academic standing to be included on the departmental private tutor list and cannot tutor in any subject in which they are currently teaching, assisting, or grading. Students must also ensure the tutoring work does not adversely affect their own appointment, coursework, and studies.

First year Ph.D. students can be included on the list for their first year of graduate studies. However, if after the January Tier 1 exams they have not passed both Tier 1 exams, then beginning summer of their first year they cannot be included on the private tutor list until they have passed both Tier 1 exams. This rule does not apply to Ph.D. students who do not pass the Tier 1 exams after their fourth attempt (January of their second year) and are therefore leaving with a M.A. degree. Those can be included on the private tutor list for the spring semester of their second year. Students pursuing a M.A. degree can be included provided they remain in good standing.

# Academic Misconduct

Academic integrity is fundamental to all of scientific inquiry, and the Department of Mathematics takes it very seriously. As such, we expect instances of academic misconduct to be reported according to campus procedures and proportional sanctions to be imposed. The following is a very brief overview of academic misconduct and campus procedures; see <http://studentcode.iu.edu/responsibilities/academic-misconduct.html> for more information.

## Types of Academic Misconduct

The official policy at IU on academic misconduct is described in the *IU Code of Student Rights, Responsibilities, & Conduct* (<http://studentcode.iu.edu/>), where academic misconduct is defined as “any activity that tends to undermine the academic integrity of the institution.” Some specific classifications are identified there:

- Cheating: “an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment”
- Plagiarism: “presenting someone else’s work, including the work of other students, as one’s own”
- Violation of Course Rules: to “violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course”
- Facilitating Academic Dishonesty: to “intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct” or “allow another student to use his or her work or resources to commit an act of misconduct”
- Fabrication: to “falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information”
- Interference: to “steal, change, destroy, or impede another student’s work” or to “unjustly attempt, through a bribe, a promise of favors or threats, to affect any student’s grade or the evaluation of academic performance”

Incidences of cheating and plagiarism are the most common and are discussed in more detail below. For more information on what does or does not constitute academic misconduct, talk with your professor (in the context of a course), your advisor (in the context of research), your supervisor (in the context of your AI/GA assignment), or the DGS.

## Cheating

**Cheating is not permitted at IU.** If any of your students cheat, you or your supervisor must report the incident following campus procedure and impose an appropriate sanction. Graduate students in the Department of Mathematics who are caught cheating are subject to disciplinary measures and risk losing their funding or being expelled from the program.



The most common type of cheating is using “outside assistance” on an exam or assignment that is not allowed by the rules of the exam or assignment. In a take-home exam, if the rules say not to use sources other than your text books or notes, then looking up the problem on the internet or talking about it with your officemate is cheating. In an in-class exam, copying from another person or using notes (when not explicitly allowed) is cheating. In our undergraduate classes, sometimes calculators are allowed and sometimes they are not; if you are proctoring an exam where calculators are not allowed, and one of the students is using a calculator, then that is cheating.

In your AI/GA duties, it is important to understand and enforce uniformly the rules set in place by the teacher of the course. It is better and easier to try to prevent cheating than to respond to it. When you proctor, you need to pay attention to the students; if the students see that you are paying attention that will discourage them from trying to cheat. If you see a student has materials not allowed on the exam (like notes or a calculator), ask them to put them away before the exam starts. Have all students set their cell phones to silent and put them away before an exam. Before a proctoring assignment, discuss with your supervisor what you should do if you do catch someone cheating. At a minimum be able to identify the students involved afterward.

## Plagiarism

Plagiarism occurs when the form or structure of your writing implies that an idea presented there is your own when in fact it comes from another source. There is a wide spectrum of examples of different kinds of plagiarism and students who are not careful about quotation and attribution or who summarize source material too closely are in danger of committing plagiarism whether or not they have intent of dishonesty.

As an AI/GA, you will most commonly encounter plagiarism in one of the following two clear forms: (1) the student has copied an answer from a solutions manual or from a Web page, or (2) two or more students have very close solutions where it is unlikely to be coincidental. When this happens, be sure to let your supervisor know and get instructions for how the situation should be dealt with. (These can be examples of cheating or violation of course rules in addition to plagiarism, depending on the rules of the assignment.)

In your own assignments, to avoid plagiarism, always write your answers or essays in your own words. Keep in mind that the intent of the assignment will typically not be to show that you can locate information in a book or article (or on the Internet), but rather will be to show that you *understand* that material. You should write your answer or essay in a way that clearly shows your understanding and interpretation; this is what is meant by “in your own words.” In particular, “in your own words” does not mean that you've changed the notation or wording; it means that you have understood the content and written from your understanding rather than from the original source. Quoting from a source (using quotation marks for an inline quotation or indentation for block quotation) with proper attribution avoids plagiarism, but may not fulfill the intent of the assignment, and it is better to give your own interpretation.

In your writing, any fact or idea that is not common knowledge needs to be acknowledged and sourced, even if that source is in not in writing, such as a conversation with another mathematician. What counts as common knowledge is very context dependent, as is how formal or detailed the citation must be. If you are in doubt ask your professor or advisor.

# Procedures

The expectation of the Department of Mathematics is that all cases of academic misconduct get reported to the [Office of Student Conduct](#); any case when sanctions are imposed (e.g., a zero on the paper, or a grade penalty in the class) must be reported. In most cases, for first offenses, the Office of Student Conduct will not impose additional sanctions, but these reports give a way of tracking repeat offenders. The Office of Student Conduct describes its role as follows:

We are not here to punish students for poor choices. We are here to help you take responsibility for your actions, learn from poor decisions, and move forward in your Hoosier experience. We can help you become a contributing member of the IU community. A community dedicated to honesty, integrity, and high ethical standards. (<https://studentaffairs.indiana.edu/student-conduct/index.shtml>)

If you are working in an Assist, Recitation, or Grading AI/GA job, it will typically be the responsibility of your supervisor to follow these procedures in cases of academic misconduct you discover, but we include a brief outline of the procedures so that you know what to expect, as your involvement may be required in some of the steps.

The first step is an in-person private meeting with the student. The purpose of the meeting is for the instructor to make a clear statement of the misconduct allegation and to give the student the opportunity to respond to it. Any evidence of the misconduct needs to be disclosed to the student (but should be retained by the instructor). It is important to take good notes of the meeting as you may be required to recall details later in case of an appeal.

The next step is to decide whether it appears that misconduct has occurred, based on the evidence and the student's response to it. If there appears to be a preponderance of evidence of academic misconduct, a report should be filed and a proportional sanction should be imposed. The report needs to be filed within two weeks of the meeting. However, if there does not appear to be a preponderance of evidence of academic misconduct after the meeting with the student, a report should not be filed and no sanction may be imposed.

Additional steps may occur if the student appeals the finding of academic misconduct. See the Bloomington Campus [Academic Misconduct Procedures](#) page for more details.

# Enrolling in M 599 Colloquium

All graduate students are strongly encouraged to attend the Mathematical Colloquium. However, the course M 599 can only be taken for credit (1 credit hour per semester) after having passed the Tier 3 exam. Moreover, as part of the degree requirements for the PhD, at least two semesters of M 599 must be taken.

# Enrolling in M 800 Reading Courses

A student may not enroll in an M 800 Reading Course before they pass the Tier 1 exams, except during summer terms. Exceptions to this rule may be granted with the permission of the Director of Graduate Studies.

After passing both Tier 1 exams, the student may take one course M 800 per semester. After passing the Tier 3 exam, there are no restrictions regarding enrolling in M 800 courses.

# Tiers

## The Tier Exams

The Department of Mathematics has a three-tiered system of milestones whose purpose is to confirm you are on track in our Ph.D. program. The main rules are outlined in the [Graduate Bulletin](#); the following are additional guidelines.

## Tier 1 Qualifying Exams

The Tier 1 Qualifying Exams make sure you have adequate background preparation in Algebra and Analysis. The exams are administered twice a year during the week before classes begin. They consist of two four-hour exams, one each in Algebra and Analysis, at the advanced undergraduate level. The exams can contain some of the more challenging problems in a rigorous, proof-based Analysis or Algebra course, so most students find that some review and practice is necessary to pass. Past years exams are available on our [Web site](#).

Every Ph.D. student needs to pass both exams within the first two years of the program; this means a maximum of four attempts for each exam. You should try to pass the exams as early as possible to progress in the program and to allow you concentrate on more advanced topics.

## Tier 2 Review

The purpose of the Tier 2 Review is to make sure you are making progress in the program and on track for Tier 3. The Tier 2 Review occurs in May of your second year, or in May of your first year if you pass both Tier 1 exams and opt for early review. (Those who choose an early Tier 2 Review are expected to be able to pass Tier 3 within 18 months.) For the review, you will need to submit a one- or two-page typed statement assessing your studies so far and describing your plans for the next stage in your studies. Your statement should address the following questions:

- In what area or areas do you think you might want to do research?
- What professor or professors would you like to work with or to learn more about their work?
- Have you been taking reading courses already or have you made plans to take them?
- How prepared are you to being working towards taking your Tier 3? What plans do you have to prepare?
- How do you assess your chances of completing a Ph.D.?

Take this exercise as an opportunity to reflect on the next direction your studies will take but also as a warm-up exercise for similar statements you will have to make in your future career as you write research and teaching statements for jobs, apply for grants, etc. Your statement should comment on both strengths and weaknesses. In a separate section, your statement should also comment on the extent to which you have covered the breadth requirements and your plans for completing them, as well as any plans you have toward completing the Ph.D. Minor requirement. (See the [Graduate Bulletin](#) for details on the breadth requirements and the Ph.D. Minor.) Feel free to talk to the DGS if you have any questions.

The Graduate Advisory Committee will examine your progress in the program so far and review in particular:

- Your grades
- Your Tier 1 exam scores
- Evaluations of your AI/GA duties
- Comments from select faculty
- Your personal statement

Based on this information, the committee will determine whether you have made satisfactory progress towards the requirements of the program and are on track to begin working towards Tier 3. They may recommend that you complete a supplementary statement at the end of the following semester or academic year. In some cases, they will make recommendations about how to accelerate your progress. If progress is not deemed satisfactory, then the committee may recommend that you be placed in a probationary status with perhaps reduced or no AI/GA support. Part of passing the Tier 2 review consists of identifying a potential Tier 3 advisor and subject area.

## Tier 3 Oral Exam

The purpose of Tier 3 is to start the transition from taking courses to beginning research. When you and your advisor think you are ready, you need to write a Tier 3 syllabus that lists material for a major and a minor topic. The two topics need to be sufficiently far apart. For instance, using Partial Differential Equations for the major topic and Ordinary Differential Equations for the minor topic will certainly not be approved; Partial Differential Equations for the major topic and Harmonic Analysis for the minor topic will probably still be regarded as too close unless great care is taken to avoid overlap in tools, methods, and background. At the barest minimum, the syllabus for the major topic must cover the equivalent of at least two semesters of introductory level classes in that area, plus at least one research level article or book; the precise level and amount of material are up to your advisor, so please discuss this with him or her early in the process. For the minor topic, a one semester introductory course can be sufficient at minimum. The syllabus should also contain a list of three faculty members who have agreed to be on your Tier 3 committee. Two of them will represent the major area, one the minor area. The syllabus must be approved by the DGS and your committee at least 30 days before you plan to take the exam.

The syllabus should clearly list the topics, the committee members (indicating the major and minor chair), and include a bibliography of the required texts and papers, with complete bibliographic information. It is suggested that you write the syllabus with LaTeX and include the references using BibTeX. This link provides a .zip-file with template files and instructions are included in the pdf file: <https://math.indiana.edu/student-portal/graduate/resources.html>.

The Tier 3 Exam itself is an oral exam that is recorded and will last about two hours. You should talk to your advisor about possible preparation. Often you will be asked to make a presentation on the major and minor topics interrupted by questions from the committee, but other exam formats are possible. Any such presentation must be held without using slides.

In rare cases students sometimes fail the Tier 3 exam; this typically happens under the following circumstances:

- The candidate has significant gaps in the foundational material of major area and fails to answer basic questions, or
- The candidate has started working with the advisor rather late and might not be aware of the expectations.

To pass the exam, the student must demonstrate a level of mathematical ability and maturity sufficient for successfully undertaking a Ph.D. dissertation (normally in the major area of the exam), and identify a faculty member willing to serve as thesis advisor; this faculty member will typically, but not necessarily, be the major chair. If the thesis advisor will be someone other than the major chair, please notify the Graduate Secretary of who is your thesis advisor.

# PhD Minor in Scientific Computing

Before beginning to pursue a PhD Minor in Scientific Computing, it is necessary to seek advanced approval from two faculty members, one from the Mathematics department (presumably the thesis advisor) and the other a member of the Graduate Committee on Scientific Computing from outside the student's home department. This is to approve the list of four courses meant to fulfill the PhD Minor in Scientific Computing, before the courses are taken.

For details see the information on Scientific Computing in the academic bulletin.



# Eligible Courses for Breadth or Minor Requirements

To fulfill the breadth requirements, 500-level can be used as indicated on the Degree Checklist. 600-level courses can only be used with permission by the Director of Graduate Studies. Permission should generally only be granted if course grades have been determined based on a full evaluation of the students' performance. This means that at least homework assignments have been given on a regular (preferably weekly) basis. In addition to this, the Director of Graduate Studies may require that written exams and/or presentations were part of the course assignments. 700-level courses are generally not permitted to be used to fulfill breadth requirements.

To fulfill the requirements for the PhD minor, 600-level courses can only be used with permission by the Director of Graduate Studies. Permission should generally only be granted if course grades have been determined based on a full evaluation of the students' performance. This means that at least homework assignments have been given on a regular (preferably weekly) basis. In addition to this, the Director of Graduate Studies may require that written exams and/or presentations were part of the course assignments. 700-level courses are generally not permitted to be used to fulfill breadth requirements.

# Final Steps

After your Tier 3 exam, you will generally work on completing all remaining degree requirements, conducting research, writing your thesis, and preparing to defend your thesis.

## G901

After you have fulfilled all degree requirements and completed 90 credit hours of graduate credit, you are eligible to register for G901 for a flat fee of \$150 per semester. You are limited to 6 semesters of G901.

## Nomination to Candidacy

You should submit this [form](#) found on one.iu as soon as your degree requirements have been met but does not require you have met the 90 graduate credits requirement.

## Nomination of Research Committee

You can and should submit this [form](#) found on one.iu as soon as your Nomination to Candidacy is approved. It requires a one to two page prospectus, a proposed thesis title, and a list of your defense committee members. This must be approved **at least 6 months before** your thesis defense so plan to submit the Nomination of Research Committee form about 10 months before you plan to defend. This form does not expire and the information on this form does **not** have to match the final abstract and/or title. The committee can be changed with no waiting period, so there is no reason to delay submitting this form.

## Thesis Announcement

The [defense announcement](#) found on one.iu must be approved **at least 30 days** in advance of your thesis defense. To plan for delays in the approval process, please submit **at least 45 days** before your planned defense date.

## Thesis

Please get your thesis to your committee in time for them to read it before your thesis defense. Consult your committee for deadlines, but expect to need at least 30 days.

## Thesis Defense

Bring your abstract page and acceptance page to your defense as these must have original signatures of your committee members. Both pages must have [signature lines and be a single page](#) each.

## Submitting Your Thesis

Make sure to review the University Graduate School [guidelines](#) regarding the formatting of your final thesis. There is a LaTeX thesis [class](#) available, but it has not been updated in a while and may not meet all the guidelines. If you are an international student, wait to submit your thesis until you are ready for your visa (and employment) to end.

The Department of Mathematics requests a final copy of your thesis bound in black with your name and thesis title on the spine in gold lettering. You can order this when you submit your final thesis to the University Graduate School.

## Applying for Jobs

During your final year, you will want to apply for jobs. Talk with your advisor about the kinds of jobs that are right for you and which jobs you should apply for. Typically you will need a personal statement, teaching statement, CV, and recommendation letters. Ask faculty for recommendation letters well in advance, at least 30 days before the first deadline; it is helpful to have the rest of your materials ready at this time to show to your letter writers. For teaching letters, the same faculty members often handle the vast majority of the letters, so ask about a letter as early as possible.

## Leaving

Please inform the Graduate Office as soon as possible if you decide to leave the program before earning your Ph.D.

If you graduate, your AI/GA employment will end the semester you officially graduate: The University does not allow us to employ you as an AI/GA if you are no longer a student. Please answer the AMS Graduation Survey from the Graduate Secretary to let us know your plans after graduation.

Make sure to return all borrowed books to the Receptionist and keys to the Graduate Secretary.