Department of Mathematics and Statistics
Program for the Next Two Years (2025–27)

January 2025

Applying to the Department

If you're considering a major or minor in the department, you should attend the departmental sophomore meeting early in the spring semester. You should also enter your information into the Major-Minor Portal and choose "Mathematics" as one of your majors or "Mathematics" or "Statistics" as one of your minors. You'll then be assigned a Sophomore Plan Advisor in the department. Prospective majors should discuss their proposed major with this advisor; prospective minors are encouraged, but not required, to meet with this advisor.

The Course Major

The Department offers three different pathways to a course major: a course major without special emphasis, a course major with an emphasis in statistics, and a course major with an emphasis in applied mathematics.

Acceptance as a Course Major

The normal preparation for a major in mathematics is to have obtained credit for, or placement out of, at least four of the following five course groups by the end of the sophomore year:

- Calculus I (Math 15)
- Calculus II (Math 25)
- Linear Algebra (Math 27 or 28)
- Several Variable Calculus (Math 33, 34, or 35).
- Discrete Mathematics (Math 39, previously called Math 29)

All majors must complete Linear Algebra and Several Variable Calculus by the end of the first semester of the junior year.

The requirements to be accepted as a course major are the following:

1. A grade point average of at least C+ in courses taken in the department to date, including courses in the fall term of the first year, for which we have shadow grades.
2. At least one grade in courses taken in the department to date at the B level.

Students should be aware that upper-level courses in mathematics are typically more demanding and theoretical than the first- and second-year courses. This is an important factor in considering borderline cases. In some cases, applicants may be deferred pending successful work in courses to be designated by the department.

Graduation Requirements for ALL Course Majors (*see additional requirements below*)

- At least 10 credits in mathematics and statistics courses. (Certain courses – mostly numbered under 10 – do not count toward any of the three pathways to the major. These are so indicated under the course listings in the College Bulletin.)
- Credit for, or placement out of, the following courses:
  15; 25; 27 or 28; 33, 34, or 35
- Credit for, or placement out of, Introduction to Real Analysis (Math 63)

- Senior Conference (Math 97), the department's comprehensive requirement. Students must take this zero-credit course in both of their last two semesters on campus, typically the fall and spring of their senior year. This comprehensive will have students engage with mathematics and statistics via lectures, meeting with visiting scholars, participating in various events, and in a range of other departmental activities.

In the multivariate group {33,34,35}, it is *strongly preferred* that candidates for the major take 34 or 35, which are the versions that assume a background in linear algebra.

Note that placement out of a course does not add to a student's credit total; students need to earn 10 credits of coursework in the department. If you believe you are eligible for credit for courses taken before Swarthmore (because of AP or IB scores) but these credits are not showing on your transcript, please address this matter immediately with the registrar; your application to our department may be held up otherwise.

Each of the three pathways to the course major (without special emphasis; emphasis in Statistics; emphasis in Applied Mathematics) has its own additional requirements, which are detailed below.

Course Majors without special emphasis must also:

- Earn credit for, or placement out of, Introduction to Modern Algebra (Math 67)
- Earn at least 5 credits in mathematics and statistics courses for courses numbered over 38.[1] At most one of these courses may be taken CR/NC. No course numbered over 100 may be taken CR/NC.
- Take at least one of Math 63 or Math 67 at Swarthmore.

The departmental schedule offers the two *required core courses*, Introduction to Real Analysis (Math 63) and Introduction to Modern Algebra (Math 67), in alternate semesters (Math 63 in the fall and Math 67 in the spring). Because Math 63 is only guaranteed to be offered in the fall, students should plan to take it before the spring semester of their senior year.

Course Majors with an emphasis in Statistics must also:

- Earn credit for, or placement out of:
    - Introduction to Computer Science (CS 21)
    - Statistical Methods II (Stat 21)
    - Probability (Stat 51)
    - Mathematical Statistics I (Stat 61)
    - Mathematical Statistics II (Stat 111)

- Earn at least 5 credits in mathematics and statistics courses numbered over 38 **OR** earn credit (not placement) for Stat 21 and at least 4 credits in math/stat courses numbered over 38[1]. At most one of these five credits may be taken CR/NC. No course numbered over 100 may be taken CR/NC.
- Take Stat 111 and at least one of Stat 51 or Stat 61 at Swarthmore.

Course majors with an emphasis in Applied Mathematics must also:

- Earn credit for, or placement out of:
    - Introduction to Computer Science (CS 21)
    - Stochastic and Numerical Methods (Math 66)
    - Differential Equations (Math 43 or Math 44)

[1] Note that Math 39 was previously called Math 29, and now counts as an upper-level course for the course major.

    - At least one of
        - Partial Differential Equations (Math 54)
        - Modeling (Math 56)
    - At least one additional course from the following:
        - Partial Differential Equations (Math 54)
        - Modeling (Math 56)
        - Probability (Stat 51)
        - Complex Analysis (Math 83[2])
- Earn at least 5 credits in math/stat courses numbered over 38[1]. At most one of these 5 credits may be taken CR/NC. No course numbered over 100 may be taken CR/NC.
- Take Math 66 at Swarthmore.
- On occasion, Math 53/73 (Topics in Analysis) will have a topic that is appropriate for this emphasis (e.g. Functional Analysis or Harmonic Analysis). In this case, Math 53/73 will be considered as part of the list for "at least one additional course from the following". However, as the topic for Math 53/73 is not decided in advance, students should make a plan that does not include Math 53/73 and discuss alterations with their advisor later.

Notes for all course majors:

- *Transfer credits.* Courses taken elsewhere may count for the major. However, the number of upper-level transfer credits for the major is limited. Normally, *at least 3 of the 5 upper-level courses used to fulfill the major must be taken at Swarthmore*. Exceptions should be proposed and approved during the sophomore paper process, not after the fact. Also, the usual College rules for transfer credit apply. You must see the professor in charge of transfer twice: in advance to obtain pre-authorization, and afterwards to get final approval and a determination of credit. If your course elsewhere turns out not to cover the entire syllabus of a course required for the major, you will not get full credit (even though the transfer course was authorized beforehand) and you will not complete the major until you have demonstrated knowledge of the missing topics in such a course. Similarly, for honors preparations you are responsible for the syllabi we use; we will not offer special honors exams based on work done at other institutions.

- *Off-campus study*. Students planning to study abroad should obtain information well in advance about the courses available at the institution they plan to attend and check with the department about selecting appropriate courses. It may be difficult to find courses abroad equivalent to our core upper-level courses, or to our honors preparations, since curricula in other countries are often organized differently.

- Mathematics majors are encouraged to study in some depth an additional discipline that makes use of mathematics. We also strongly recommend that they acquire some facility with coding.

The Course Minor

The department offers two types of course minor: a course minor in mathematics and a course minor in statistics. There are two pathways to the course minor in mathematics: a minor without special emphasis and a minor with an emphasis in applied mathematics. Students may not have more than one minor in the department.

Acceptance as a Course Minor

The requirements for acceptance into any course minor are the same as for acceptance into the major.

[2] Previously called Math 103, this will now be a course and not a seminar.

Graduation Requirements for all Course Minors (*see additional requirements below*)

- At least 6 credits in mathematics and statistics courses. Those courses offered by the department that do not count towards the course major also do not count towards the course minor.
- Credit for, or placement out of, the following courses:
  15; 25; 27 or 28; 33, 34, or 35

Course Minors in Mathematics with no emphasis must also:

- Earn at least 3 credits in mathematics and statistics courses for courses numbered 44 or above. (Note the difference from the course major requirement, which is 5 courses numbered 39 or above.)
  - At least 2 of these 3 credits must be taken at Swarthmore.
  - One of these 3 credits must be either Introduction to Real Analysis (Math 63) or Introduction to Modern Algebra (Math 67)
  - At most one of these 3 credits may be taken CR/NC. No course numbered over 100 may be taken CR/NC.

Course Minors in Mathematics with an emphasis in Applied Mathematics must also:

- Earn credit for, or placement out of, each of the following: CS 21, Math 43 or 44, and Math 66; and at least one additional course from the following: Math 54, Math 56, and Stat 51.
- Take Math 66 at Swarthmore.
- Earn at least 3 credits in mathematics and statistics courses numbered over 40.
  - At most one of these 3 credits may be taken CR/NC. No course numbered over 100 may be taken CR/NC.

Course Minors in Statistics must also:

- Earn credit for, or placement out of, each of the following: CS 21, Stat 21, Stat 51, and Stat 61
- Take at least one of Stat 51 or Stat 61 at Swarthmore College.
- Earn at least 3 credits in mathematics and statistics courses numbered over 40 **OR** earn credit (not placement) for Stat 21 and at least 2 credits in math/stat courses numbered over 40. (Note the difference from the course major requirement, which is 5 courses numbered over 38.)
  - At most one of these 3 credits may be taken CR/NC. No course numbered over 100 may be taken CR/NC.

The Honors Program

All current sophomores who wish to apply for Honors should indicate this in the Sophomore Portal and should work out a tentative Honors program with their departmental advisor.

The Honors Major

Acceptance as an Honors Major

The requirements to be accepted as an honors major are the same as those to be accepted as a course major except that such students should have a grade point average in mathematics and statistics courses to date of at least B+.

Graduation Requirements: Honors Major

- At least 10 credits in mathematics and statistics courses
- Credit for, or placement out of, the following courses:
  15; 25; 27 or 28; 33, 34 or 35
- Three preparations of two credits each, for a total of six distinct credits, in the following areas:
  - Real Analysis (Math 63 and 101)
  - Modern Algebra (Math 67 and 107)
  - One of:
    - Geometry (Math 65 and Math 105)
    - Statistics* (Stat 61 and 111)
    - Topology (Math 64 and 104[3])
- At most one of the courses in the three preparations may be taken CR/NC. No course numbered over 100 may be taken CR/NC.

* Students who are doing an Honors math major with the Statistics preparation are required to have credit or placement for a data-driven statistics course as well (e.g., Stat 11 or 21).

The External Examination component of the program is meant to prompt students to learn their core subjects well and to show the examiners that they have done so – that is, show that they deserve Honors. However, no three fields cover everything a student would ideally learn as an undergraduate. Honors majors should consider including in their studies a number of advanced courses and seminars beyond what they present for Honors if their schedules allow it.

Especially strong students who take many advanced courses may petition to substitute an advanced preparation for either Algebra or Analysis. For instance, a student who has taken essentially all our seminars might petition to be examined in Algebra, Topology, and Geometry, omitting an analysis examination. However, all honors students must *take* the algebra sequence and the analysis sequences, even if they are given permission to be examined in something else.

Senior Honors Study or Portfolio is not required or offered.

The Honors Minor

Acceptance as an Honors Minor

The requirements to be accepted as an honors minor are the same as those to be accepted as a course major except that such students should have a grade point average in mathematics and statistics courses to date of at least B.

Graduation Requirements: Honors Minor

- Credit for, or placement out of, the following courses:
  15; 25; 27 or 28; 33, 34 or 35
- Satisfy the requirements for the math minor (either with no emphasis or with an emphasis in applied mathematics) or the stat minor

[3] This seminar was previously offered as a 2-credit seminar but in the future will be a 1-credit seminar.

- One preparation consisting of two credits in one of the following areas:
    - Real Analysis (Math 63 and 101)
    - Modern Algebra (Math 67 and 107)
    - Geometry (Math 65 and 105)
    - Statistics* (Stat 61 and 111)
    - Topology (Math 64 and 104[3])

* Students who are doing an Honors math minor with the Statistics preparation are required to have credit or placement for a data-driven statistics course as well (e.g., Stat 11 or 21).

All prospective minors who are majoring in a subject related to mathematics or statistics are encouraged to consult with a member of the department to see which preparation is most appropriate to their interests.

Program Changes and Late Applications

Students often wish to change their proposals after sophomore spring. Changes in particular courses or honors preparations do not require a new application, but changes in type of program do. For instance, if you wish to change from a course major to an honors major, or you wish to add an honors minor to your course major, you must submit a new application. Such situations require you to adjust the plan you put in the major/minor portal. Please discuss your plans with your departmental advisor.

Progress towards the Degree

The progress of majors and minors in the Department may be reviewed from time to time. Students not making satisfactory progress may be encouraged or required to modify or drop their programs.

Schedule of Upper-Level Mathematics and Statistics courses

Upper-level courses in math/stat follow a two-year periodic schedule, which has recently been adjusted as described below. This means you'll need to take extra care as you plan your schedule, as courses offered in particular semesters in the past may be in different semesters in the future. Please see below for a list of when upper-level courses will be offered during the next two years and make sure you plan a schedule that is consistent with this list.

Two of the courses mentioned in this list are Topics in Analysis and Topics in Algebra. We try to offer at least one of these courses each year. However, there is a 50-level version (which assumes only Math 27 and 34 as prerequisites) and a 70-level version (which assumes one of Math 63 or Math 67 as a prerequisite) of each course, and *which* version will be offered may not be decided until a few months before. Therefore, it is wise to assume that the advanced version will be offered and to base schedules on the assumption that the corresponding core course must be taken first. The department announces which versions of topics courses will be given as soon as it knows.

Schedule of upper-level courses planned during the next two years

Academic Year 2025-2026

Fall Semester		Spring Semester	
Math 39	Discrete Math & Intro to Proof	Math 39	Discrete Math & Intro to Proof
Math 44	Differential Equations	Math 43	Basic Differential Equations
Stat 61	Mathematical Statistics I	Math 44*	Differential Equations
Math 63	Introduction to Real Analysis	Stat 51	Probability
Math 64	Introduction to Topology	Math 56	Modeling
Math 66	Stochastic & Numerical Methods	Math 57/77	Topics in Algebra
Math 83	Complex Analysis**	Math 67	Introduction to Modern Algebra
Math 107	Modern Algebra II	Math 101	Real Analysis II
		Math 104	Topology II
		Stat 111	Mathematical Statistics II

Academic Year 2026-2027

Fall Semester		Spring Semester	
Math 39	Discrete Math & Intro to Proof	Math 39	Discrete Math & Intro to Proof
Math 44	Differential Equations	Math 43	Basic Differential Equations
Math 58	Number Theory	Math 44*	Differential Equations
Stat 61	Mathematical Statistics I	Stat 51	Probability
Math 63	Introduction to Real Analysis	Math 53/73	Topics in Analysis
Math 65	Introduction to Geometry	Math 54	Partial Differential Equations
Math 66	Stochastic & Numerical Methods	Math 67	Introduction to Modern Algebra
Math 107	Modern Algebra II	Math 101	Real Analysis II
		Math 105	Geometry II
		Stat 111	Mathematical Statistics II

* Math 44 is more theoretical and is strongly preferred for majors.
** Math 83 was previously a seminar (Math 103) but will now be a course

Faculty leave schedules
The following continuing faculty members are projected to be on sabbatical during at least part of the next two academic years.

For 2025–26: L. Chen, P. Everson, C. Grood, J. Talvacchia, S. Wang
For 2026–27: V. Barranca, R. Gomez, J. Nakao, I. Whitehead