**The Life of a Ph.D. Math Student at U Penn**

**First year:**

Fully-supported Ph.D. students ordinarily receive a [fellowship](https://www.math.upenn.edu/grad/GradRegs.html%22%20%5Cl%20%22fellowships) in their first year, during which they have no teaching responsibilities and may take four courses.

Upon arrival in the [Ph.D. program](https://www.math.upenn.edu/grad/gradprog.html#phd), new students take the [Masters Preliminary Exam](https://www.math.upenn.edu/grad/prelim.html) on key undergraduate mathematics; this serves as a placement exam. Those who pass the exam ordinarily take the [beginning Ph.D. level courses](https://www.math.upenn.edu/grad/1stYearGrad.html) in algebra (Math 602/603), analysis (Math 608/609), geometry-topology (Math 600/601), and an elective. (Exception: Those who enter with a more advanced background have an opportunity to place out of the beginning courses, and instead to move on to more advanced courses.)

Those students who do not pass the Masters Preliminary Exam upon arrival will ordinarily take the Masters Pro seminar (Math 504/505), and possibly one or more of the masters level courses in algebra (Math 502/503), analysis (Math 509/509), and geometry-topology (Math 500/501), instead of the corresponding 600-level courses. These students need to pass the prelim by the end of their first year, to demonstrate their ability to move on to more advanced material.

Students whose native language is not English need to demonstrate their ability to communicate in English, during their first year. Those who cannot do so satisfactorily upon entry will take a special course in their first semester, designed to help them improve their English communication skills.

In addition to attending their courses, first year students are encouraged to attend the Math Department Colloquium, where mathematicians from other universities speak on topics of general mathematical interest, and also the Friday Pizza Seminar, where grad students give the talks and only grad students attend (and during which the Math Department provides pizza and drinks).

Typically first year students spend most of the following summer at Penn, and receive an additional fellowship stipend from the Math Department (with no teaching responsibilities) to enable them to pursue further studies.

**Second year:**

Second year students take more advanced [courses](https://www.math.upenn.edu/grad/courses.html) of their choosing, in areas such as algebraic topology, differential geometry, algebraic geometry, number theory, differential equations, combinatorics, logic, mathematical physics, etc. These courses enable students to begin to specialize, and to find an area in which they will write their Ph.D. thesis. (Exception: Those Ph.D. students who did not take the basic 600-level courses in their first year will need to do so in their second year.)

During the second year, students begin to participate in specialized [seminars](https://www.math.upenn.edu/cgi-bin/calendar/view.pl?item=series) in areas of their mathematical interest. Some of these seminars feature faculty from other universities speaking on their recent research. Others involve graduate students giving talks on research papers they have read.

Second year students typically serve as teaching assistants, with this activity taking the place of one course each semester. TA's most often run recitations of calculus, in which they go over homework that a professor has assigned to undergraduates taking a first or second year calculus course. Some other TA's have different responsibilities, such as running problem sessions for a course in algebra or advanced calculus. Before beginning to serve as TA's, graduate students go through a several-day TA training program run by faculty and advanced graduate students in the Mathematics Department.

In the spring semester of the second year, students will take their Ph.D. Preliminary Exam ("oral exam") in two different mathematical areas of their choosing (e.g. algebraic topology and number theory). Most often, students choose topics in which they have taken a course during their second year. (Exception: Students who took mostly 500-level courses in their first year can defer their oral exam until their third year.) After students pass the exam, they take on a Ph.D. thesis advisor, and they are considered ready to begin choosing a research topic for their Ph.D. thesis. Typically their research topic is in one of the two areas of mathematics included on their oral exam.

Also during the second year, many Ph.D. students choose to write a masters thesis, which is an expository paper of about 30 pages. This provides experience in learning mathematics on one's own, and presenting it in writing -- experience that is valuable later, when writing the Ph.D. thesis. Writing a masters thesis also enables students to obtain a masters degree on the way to the Ph.D. (The masters thesis is also a good idea for students who are uncertain whether to continue to pursue the Ph.D. or whether to graduate with a masters degree.)

Second-year students typically spend much of the following summer at Penn, and often teach an undergraduate course in one of the two six-week summer sessions. (This is voluntary, and provides teaching experience and an additional stipend.) The same is true for third and fourth-year students.

**Third year:**

Third-year students take more advanced courses, typically "topics" courses in areas of their interest that often go beyond what is available in textbooks. They may also take independent study courses, in which they work with a faculty member one-on-one. In their third year, students also participate actively in seminars in their area of mathematics. They also meet regularly with their thesis advisor, who typically gives them research papers to read in order to help them refine their Ph.D. thesis topic. By the end of the third year, students generally have a rather well-defined thesis topic, and may have some preliminary research results. Students spend much of the following summer advancing those results.

Students in their third year years are offered TAships or fellowships, with fellowships depending both on merit and availability of funds.

**Fourth year:**

Fourth-year students no longer officially take courses, but often choose to participate in advanced topics courses in their area of specialization in order to learn material that will be useful to them in their research. They continue to participate in seminars in their area of interest. Their main activity is working on their Ph.D. thesis, and during this year it is important for them to make significant research progress. Some students complete their Ph.D. at the end of the fourth year, though more require a fifth year to complete the degree. The summer after the fourth year is often a time when students find that their key research results come together in almost final form.

Fourth years students are offered fellowships with no teaching or grading responsibility.

**Fifth year:**

Additional financial support, in the form of a TAship or a fellowship, is available for fifth-year students who have made significant progress toward the Ph.D. by the start of that year. During the fall of the fifth year, students work on strengthening their research results. Often they speak on this research in one of the seminars that they participate in. They also apply for jobs in the fall -- either [academic](https://www.math.upenn.edu/grad/acadjobs.html) or in industry, or both. In the spring they finish writing up their thesis, under the guidance of their thesis advisor. During that time they expect to hear back from places to which they have applied for jobs; and they may go on a series of job interviews, often giving talks about their research there. Later in the spring semester they present the key results of their Ph.D. thesis at an oral "defense"; and then they graduate at the end of the semester.

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