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Mathematics PhD Requirements

Written Exams

The Math Department offers written exams covering core mathematics content. These exams are offered twice a year, at the end of summer and at the beginning of the spring semester.

Mathematics (PhD) students must pass exams for THREE of the following five core subjects, one of which must be either Algebra or Analysis:

- **Algebra**: a single 3-hour exam based on material covered in Math 510a and Math 510b
- **Analysis**: two 90-minute exams, one based on material covered in Math 525a and another based on material covered in Math 520
- **Ordinary and Partial Differential Equations**: two 90-minute exams, one based on material covered in Math 555a and another based on material covered in Math 565
- **Geometry and Topology**: a single 3-hour exam based on material covered in Math 535a and Math 540
- **Probability and Statistics**: two 90-minute exams, one based on material covered in Math 507a and another based on material covered in Math 541a

All 10 classes listed above are commonly referred to as a “qual class.”

Screening Procedure

To complete the screening procedure, Mathematics (PhD) students must pass:

1. Algebra OR Analysis before January of their 2nd year
2. ALL three subject exams within 5 semesters (before January of their 3rd year)

**NOTE:** Students may attempt each of the exams at most three times.

Advisors

All students are assigned a temporary advisor, in the general area of their interests. You should try to find a regular advisor by the end of your 2nd year, and certainly by December of your 3rd year. To find an advisor, you should go to classes taught by various faculty, attend the area seminars, or discuss their advisor with older PhD students. You can also go to a faculty member and ask to do a reading course on a topic not covered in a scheduled class. Officially this is Math 590 Directed Research. There is no one way to find an advisor.
Qualifying Exam and Committees

After completion of the screening procedure, the student must form a qualifying exam committee. The committee must consist of an adviser and four other faculty members, including at least one from another department (“outside member”).

The qualifying exam consists of written and oral components. The written part consists of a 10-page research proposal that should be submitted to the qualifying exam committee at least one week before the oral part. The oral part consists of a presentation by the student defending/discussing this proposal and an examination by the committee. The qualifying exam should be taken within 6 months after finishing the written exams. It must be taken by the end of the 7th semester at the latest.

Steps to complete the qualifying exam:

1. In addition to your advisor, find four other faculty members for your qualifying exam committee. One of your committee members must come from outside the Math department.
2. Download the “Appointment or Change of Qualifying Exam” form. Request signatures from all committee members who agree to be on your committee.
3. Send the completed form to Ligaya Lee (ligayale@usc.edu). They will help obtain signatures from the Program Director and Dean, then return the completed form to you. Please save the copy.
4. Send the written proposal to your committee at least one week before the oral exam date.
5. Defend/discuss your proposal on the oral exam date with your committee.
6. Your committee will complete and sign the “Report on PhD Qualifying Exam” form to indicate if you passed.
7. The Committee Chair sends the “Report on PhD Qualifying Exam” form to Ligaya Lee, who will help obtain signatures from the Dean and Program Director. A copy of the completed form will be given to you. Please save it for your records.
8. After passing the Ph.D Qualifying Exam, you must register in Math 794a if you pass before the add/drop deadline of the semester. If you pass after the semester’s add/drop deadline, you must register in Math 794a the following semester.
9. Registration in Doctoral Dissertation courses (Math 794a, 794b, 794c, 794d, 794z) is required until the dissertation is submitted and processed by USC’s Thesis Center.
Dissertation and Defense

Following completion of the screening procedure and approval of a dissertation topic by the chair of the student’s qualifying exam committee, the student proceeds with research towards the dissertation. The student must form a dissertation committee. The Ph. D. thesis, based on a substantial amount of original research conducted by the student, must be defended, and approved by the dissertation committee.

Steps to defend and submit your dissertation:

1. After passing the qualifying exam, complete the Appointment of Dissertation Committee form to reflect the dissertation committee
   a. The committee must have at least three but no more than 5 members. The Committee Chair is your thesis advisor, and you must have one member outside of the Mathematics department
   b. Obtain signatures from all committee members before sending the form to Ligaya Lee. Ligaya will help obtain signatures from the Program Director and Dean, then return the completed form to you.
2. Confirm and schedule the date for your dissertation defense.
3. Create a profile in USC’s Thesis Center and upload the completed Appointment of Dissertation Committee form
4. The morning of your defense, go to the Checklist page in the Thesis Center to generate the electronic Approval to Submit form. Your action will prompt the Thesis Center to send an email containing a link to the form to all your committee members.
5. Defend your thesis. Make any changes to your manuscript that your committee requires. Monitor the progress of the electronic Approval to Submit form through the Checklist page of your Thesis Center Profile to check if all signatures from the committee have been submitted.
6. Upload a PDF of the completion certificate from the Survey of Earned Doctorates (SED)
7. Submit your manuscript.
8. Make any formatting changes requested by the thesis coordinator.
9. Monitor your email for a message from the USC Digital Library. You must respond to the email to finalize publishing information with the USC Digital Library. The deadline for finalizing publishing information is the degree conferral date of the given term. This is the final step required for degree conferral.
Course Requirements

The course requirement includes required and elective courses. The student must complete, with no grade lower than B, a minimum of 60 units of courses carrying graduate credit. Courses outside of the Mathematics Department must be approved by the Graduate Committee.

Required Courses

The following courses must be completed:

- MATH 510a Algebra Units: 3
- MATH 525a Real Analysis Units: 3
- MATH 535a Differential Geometry or MATH 540 Topology Units: 3
- MATH 794a Doctoral Dissertation Units: 2
- MATH 794b Doctoral Dissertation Units: 2

Five additional courses from the following list must also be completed:

- MATH 502a Numerical Analysis Units: 3
- MATH 502b Numerical Analysis Units: 3
- MATH 507a Theory of Probability Units: 3
- MATH 510b Algebra Units: 3
- MATH 520 Complex Analysis Units: 3
- MATH 525b Real Analysis Units: 3
- MATH 532 Combinatorial Analysis Units: 3
- MATH 535a Differential Geometry Units: 3
- MATH 540 Topology Units: 3
- MATH 541a Introduction to Mathematical Statistics Units: 3
- MATH 555a Partial Differential Equations Units: 3
- MATH 565a Ordinary Differential Equations Units: 3

Additional Requirements

Transfer of Credit

No transfer of credit will be considered until the screening examination is passed. A maximum of 30 units of graduate work at another institution may be applied toward the course requirements for the PhD. A grade lower than B will not be accepted and at most two grades of B will be accepted.

Foreign Language Requirement

The student must demonstrate a reading comprehension of mathematics in one language (other than English) in which there is a significant body of research mathematics (such as Chinese, French, German, Japanese and Russian) by passing a written examination, administered by the Mathematics Department, in translation of mathematical content.
Applied Mathematics PhD Requirements

Written Exams

The Math Department offers written exams covering core mathematics content. These exams are offered twice a year, at the end of summer and at the beginning of the spring semester.

Applied Mathematics (PhD) students must pass 90-minute exams for FOUR of the following options:

- **Real Analysis**: based on material covered in Math 525a
- **Statistics**: based on material covered in Math 541a
- **Applied Probability** or **Probability** (select one): based on material covered in Math 505a or Math 507a
- **Numerical Analysis** or **Partial Differential Equations** (select one): based on material covered in Math 502a or Math 555a

All 6 classes listed above are commonly referred to as a “qual class.”

Screening Procedure

To complete the screening procedure, Applied Mathematics (PhD) students must pass:
1. TWO of the required exams before January of their 2nd year
2. ALL four exams within 4 semesters (before January of their 3rd year)

**NOTE:** Students may attempt each of the exams at most three times.

Advisors

All students are assigned a temporary advisor, in the general area of their interests. You should try to find a regular advisor by the end of your 2nd year, and certainly by December of your 3rd year. To find an advisor, you should go to classes taught by various faculty, attend the area seminars, or discuss their advisor with older PhD students. You can also go to a faculty member and ask to do a reading course on a topic not covered in a scheduled class. Officially this is Math 590 Directed Research. There is no one way to find an advisor.

Qualifying Exam and Committees

After completion of the screening procedure, the student must form a qualifying exam committee. The committee must consist of an adviser and four other faculty members, including at least one from another department (“outside member”).
Qualifying Exam and Committees

After completion of the screening procedure, the student must form a qualifying exam committee. The committee must consist of an adviser and four other faculty members, including at least one from another department (“outside member”).

The qualifying exam consists of written and oral components. The student must complete enough research for a partial thesis. They should present their work and their proposal for the rest of their research within 3 semesters of finishing the written exams, or by the end of their 4th year at the latest.

Steps to complete the qualifying exam:
1. In addition to your advisor, find four other faculty members for your qualifying exam committee. One of your committee members must come from outside the Math department.
2. Download the “Appointment or Change of Qualifying Exam” form. Request signatures from all committee members who agree to be on your committee.
3. Send the completed form to Ligaya Lee (ligayale@usc.edu). They will help obtain signatures from the Program Director and Dean, then return the completed form to you. Please save the copy.
4. Send your research and proposal to your committee at least one week before the oral exam date.
5. Defend/discuss your proposal on the oral exam date with your committee.
6. Your committee will complete and sign the “Report on PhD Qualifying Exam” form to indicate if you passed.
7. The Committee Chair sends the “Report on PhD Qualifying Exam” form to Ligaya Lee, who will help obtain signatures from the Dean and Program Director. A copy of the completed form will be given to you. Please save it for your records.
8. After passing the Ph.D Qualifying Exam, you must register in Math 794a if you pass before the add/drop deadline of the semester. If you pass after the semester’s add/drop deadline, you must register in Math 794a the following semester.
9. Registration in Doctoral Dissertation courses (Math 794a, 794b, 794c, 794d, 794z) is required until the dissertation is submitted and processed by USC’s Thesis Center.

Dissertation and Defense

Following completion of the screening procedure and approval of a dissertation topic by the chair of the student’s qualifying exam committee, the student proceeds with research towards the dissertation. The student must form a dissertation committee. The Ph. D. thesis, based on a substantial amount of original research conducted by the student, must be defended, and approved by the dissertation committee. See Page 5 for details.
Course Requirements

The student must complete, with no grade lower than B, a minimum of 60 units of courses carrying graduate credit and approved by the qualifying exam committee.

- These must include
  - MATH 794a Doctoral Dissertation Units: 2
  - MATH 794b Doctoral Dissertation Units: 2

And six courses from the following:

- MATH 502b Numerical Analysis Units: 3
- MATH 504a Numerical Solution of Ordinary and Partial Differential Equations Units: 3
- MATH 504b Numerical Solution of Ordinary and Partial Differential Equations Units: 3
- MATH 505b Applied Probability Units: 3
- MATH 507b Theory of Probability Units: 3
- MATH 509 Stochastic Differential Equations Units: 3
- MATH 520 Complex Analysis Units: 3
- MATH 525b Real Analysis Units: 3
- MATH 530b Stochastic Calculus and Mathematical Finance Units: 3
- MATH 532 Combinatorial Analysis Units: 3
- MATH 541b Introduction to Mathematical Statistics Units: 3
- MATH 542 Analysis of Variance and Design Units: 3
- MATH 545 Introduction to Time Series Units: 3
- MATH 555a Partial Differential Equations Units: 3
- MATH 565a Ordinary Differential Equations Units: 3
- MATH 574 Applied Matrix Analysis Units: 3
- MATH 576 Applied Complex Analysis and Integral Transforms Units: 3
- MATH 580 Introduction to Functional Analysis Units: 3
- MATH 585 Mathematical Theory of Optimal Control Units: 3

Additional Requirements

Transfer of Credit

No transfer of credit will be considered until the screening examination is passed. A maximum of 30 units of graduate work at another institution may be applied toward the course requirements for the PhD. A grade of B (A = 4.0) or lower will not be accepted and, at most, two grades of B will be accepted. A PhD candidate may petition the department for transfer of additional credit, after he or she passes the qualifying examination.

Foreign Language Requirement

The student must demonstrate a reading comprehension of mathematics in one language (other than English) in which there is a significant body of research mathematics (such as Chinese, French, German, Japanese and Russian) by passing a written examination, administered by the Mathematics Department, in translation of mathematical content.
The PhD Timeline

**Year 1**
- Fall: Completed Required Courses
- Spring: Screening Exam
- Summer: Remaining Screening Exams
- Fall: Talk with Faculty

**Year 2**
- Fall: Masters Degree
- Spring: Research Qualifying Exam

**Year 3**
- Fall: AMAT Oral Qualifying Exam
- Spring: Prove Amazing New Theorems!

**Year 4**
- Fall: Write Dissertation
- Spring: Defense

**Year 5**
- Fall: requires approval
- Spring: requires approval

**Year 6**
- Fall: requires approval
- Spring: requires approval

**Screening Exam 1**
- Math: 1 Double, 3 Doubles
- AMAT: 2 Singles, 4 Singles

**Oral Qual**
- Math: Expository
- AMAT: Prelim Results

**Required Courses**
- Math: 3 Specific & 5 Chosen
- AMAT: 6 Choices
UNIVERSITY POLICIES YOU NEED TO KNOW

A complete record of university policies can be found in USC’s Catalogue. This handbook highlights a few policies we recommend reviewing every semester.

**Academic Standards**

At no time should the overall GPA drop below 3.0. A minimum grade of B is required in a course to receive degree credit. An overall GPA of at least 3.0 on all units attempted at USC is required for graduation.

If a student’s overall GPA drops below 3.0, they will be contacted by the Math department to discuss an academic plan moving forward. Failure to meet the expectations outlined in the plan may result in dismissal.

**Continuous Enrollment and Leave of Absences**

Students admitted to a graduate degree program are required to be enrolled at USC for fall and spring semesters each year until all degree requirements have been satisfactorily completed within the time limit. Graduate students who fail to register in a fall or spring semester are no longer considered to be enrolled in a graduate degree program. After an unauthorized absence, formal readmission is required.

Students who have been granted a leave of absence do not need to apply for readmission when they return from the approved leave. Students must request a leave of absence by the last day to drop or add courses. The request should include a plan for academic progress upon return. If granted, the period of leave is not counted in the time allowed for the completion of degree requirements. A leave of absence may be allowed for one semester at a time, up to a maximum of four semesters. International students considering a leave of absence should be aware of their visa status implications. For more information, contact USC’s Office of International Services.

A doctoral candidate who is writing a thesis and has completed all course work for the degree must enroll in the appropriate thesis registration (Math 794) until the thesis has been approved. Please note that some courses with no academic credit require payment of tuition. Most classes with course numbers ending in z (e.g., 594z) require payment of 2 units of tuition.
For International Students

International students should contact USC's Office of International Services on all matters related to their international status. Important reminders:

New incoming international students must complete Immigration Status Verification before they can register for classes.

To maintain their visa status, international students must be registered for a full course of study in classes that meet their degree requirements during the fall and spring semesters. A full course of study for doctoral students is 6 units or more. In certain situations, students can apply for a Reduced Course Load (RCL) and register in fewer than 6 units if the RCL application is approved.

International students must be aware of the expiration date on their I-20/DS-2019. If students cannot complete their degree by the expiration date on their I-20/DS-2019, students must request a program extension before the expiration date on the I-20/DS-2019. Students who do not file a program extension on time will be considered out of status. Passports must be valid at all times. If the passport will expire soon, students must renew it through the embassy or consulate of their home country.

CAMPUS RESOURCES

Career Services
- USC Career Center

Student Organizations
- Mathematics Graduate Student Association
- USC Women in Math: Charlotte’s Web
- List of all student clubs on campus

Student Wellness
- Recreational activities
- Counseling services and crisis intervention
- Trojans Care 4 Trojans
- Office of Religious Life
- Office of Student Accessibility Services
- USC LGBTQ+ Center