Assessment Plan for Graduate Program in Mathematics

Department: Mathematics

Assessment Coordinator: Victor Chan

Departmental Mission: In accordance with the mission of Western Washington University and the College of Science and Engineering, we aim to provide high quality education in mathematics meeting the needs of students and the state at both the undergraduate and graduate levels, providing a wide range of effective courses for math majors and students in other units; to equip our students with the conceptual understanding and computational skills to use quantitative reasoning and analysis effectively in their personal and professional lives; and to contribute to the mathematical profession through productive scholarship and active participation in the community and professional organizations.

Departmental Student Learning Outcomes: Upon graduation, Master’s students in Mathematics will have developed the following skills:

1. [Core Math] Solid command of undergraduate mathematics in the areas of calculus, linear algebra and differential equations, and of mathematical analysis and advanced linear algebra at the graduate level.

2. [Breadth] Knowledge and understanding at the graduate level of key concepts and techniques in at least three of the following six areas: analysis, applied mathematics, computational mathematics, discrete mathematics, geometry and topology, and probability and statistics.

3. [Depth] In-depth understanding and mastery of an advanced topic in mathematics earned through a graduate project or thesis and through successful completion of at least four advanced mathematics courses that cover materials beyond beginning-graduate-level classes accessible to senior undergraduates.

4. [Rigor] Ability to construct formal and correct proofs and critically examine the correctness of mathematical arguments in at least two different areas.

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<th>Student Learning Outcome</th>
<th>Assessment Measures</th>
<th>Use of Information</th>
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| 1. Core Math             | • Performance in the graduate Qualifying Exam  
                          • Grades in Math 504 (Abstract Linear Algebra) and Math 521 (Methods of Mathematical Analysis I) | The data collected will be reported to the Chair/assessment coordinator, and, if warranted, used to provide appropriate student advising and/or to improve course instruction. |
2. Breadth

- *[Every other year] In-class performance of one of two courses, from the list of pairs of courses below; each pair (area) is rotated in a repetitive cycle.

  - Math 527, Math 528 (analysis)
  - Math 510, Math 515 (applied math)
  - Math 573, Math 575 (computational math)
  - Math 505, Math 551 (algebra/discrete math)
  - Math 525, Math 562 (geometry/topology)
  - Math 541, Math 542 (probability/statistics)

  At the beginning of the year, the instructor of the course will choose the course objectives to evaluate and will decide on objective-related exam questions or homework problems or a class project to measure student in-class performance.

  Course code:
  - Math 505: Algebraic Geometry
  - Math 510: Mathematical Modeling
  - Math 515: Mathematical Biology
  - Math 525: Topology
  - Math 527: Real Analysis
  - Math 528: Functional Analysis
  - Math 541: Probability
  - Math 542: Mathematical Statistics
  - Math 551: Number Theory
  - Math 562: Differential Geometry
  - Math 573: Numerical Linear Algebra
  - Math 575: Numerical Analysis

- Count the number of different areas successfully completed (B or better) by graduating Master’s students among the following six: {analysis, applied mathematics, computational mathematics, discrete mathematics, geometry and topology, probability and statistics}.

  The data will be summarized and reported to the Chair/assessment coordinator, and, if warranted, used as a basis for further action.
3. Depth

- Evaluation of student’s performance in the oral exam on the subject of her/his project or thesis according to the three categories: “highly satisfactory,” “satisfactory,” “unsatisfactory.”

- Grades in one of the courses within a group from the list of four below; each group is rotated on a yearly basis: *
  - Math 503, Math 564, Math 566 (algebra)
  - Math 523, Math 524, Math 539 (analysis)
  - Math 545, Math 570 (decisions)
  - Math 511, Math 533, Math 577 (applied)

Course code:
- Math 503: Topics in Abstract Algebra
- Math 511: Advanced Modeling
- Math 523: Adv. Calculus of Several Variables
- Math 524: Topics in Analysis
- Math 539: Topics in Complex Analysis
- Math 545: Topics in Probability
- Math 564: Graph Theory
- Math 566: Topics in Combinatorics
- Math 570: Topics in Optimization
- Math 577: Topics in Numerical Analysis

* If none of the courses in a group is offered during its year in the rotation, an equivalent course may be used as a substitute.

4. Rigor

*[Every other year] In-class performance of one of the following three two-course combinations, in a repetitive cycle:

Math 522 – Math 502
Math 522 – Math 528
Math 522 – Math 538

Course code:
- Math 502: Abstract Algebra
- Math 522: Methods of Math Analysis II (core course)
- Math 528: Functional Analysis
- Math 538: Complex Variables

The instructors of the two courses in the combination will each count the number of students rated according to the three performance categories (“above par,” “on par,” “below par”) with regard to their ability to correctly prove a mathematical result not previously seen. The manner in which the rating is done is up to the instructor.

The data will be summarized and reported to the Chair/assessment coordinator, and, if warranted, used as a basis for further action.
Students are asked to rate their ability and knowledge, with respect to each of the four SLO’s. The data are collected and analyzed, and, if necessary, used as a basis for further action.

## Schedule for Assessment

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<tbody>
<tr>
<td>Breadth</td>
<td>Count</td>
<td>Math 527/528, Count</td>
<td>Count</td>
<td>Math 510/515, Count</td>
<td>Count</td>
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