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1 General Information

1.1 Purpose

The purpose of the Advanced Writing Requirement in Mathematics is to nurture the development of the mathematical writing of our students in order to deepen their understanding of mathematics and to enable them to communicate mathematical ideas to a range of audiences. This experience also helps prepare students for the writing necessary in their professional careers.

1.2 Honesty Policy

Papers should be prepared in compliance with the statement on Academic Honesty in the Student Handbook. Students are expected to work independently. Papers which are substantially identical will be rejected. Infractions of the code will be referred to the Office of Academic Affairs and First Year Studies.

2 Criteria for Good Writing in Mathematics

The Mathematics Department has determined and prioritized the criteria that we believe characterize good writing in a mathematical paper.

1. Accuracy: The paper is free of mathematical errors, and the writing conforms to good practice in the use of language, notation, and symbols.

2. Organization: The paper is organized around a central idea. There is a logical and smooth progression of the content and a cohesive paragraph structure.

3. Clarity: Explanations of mathematical concepts and examples are easily understood by the intended audience. The reader can readily follow the paper's development.

4. Insight: The paper demonstrates originality, depth, and independent thought.

5. Mechanics: The paper is free of grammatical, typographical, and spelling errors. The mathematical content is formatted and referenced appropriately.

These criteria serve as the foundation for evaluation of student writing in mathematics at all levels, though there is the expectation that the depth of mastery increases with each year in the program. Thus, the focus of writing assignments changes from expository to increasingly professional and independent writing.

In the sophomore year, proficiency in expository writing in mathematics is the goal of the requirement. Such writing should incorporate all of the criteria above.

At the junior level, proficiency in technical or analytical writing is the goal of the requirement. In addition to the criteria above, there are two advanced expectations for this year:

- Advanced Proof/Analysis: Formal proofs and analyses are an essential part of the student's writing. The student pays careful attention to the precision and significance of formal arguments.
- Professional Writing: Papers and reports written by the student follow a professional format or organization as required by the Department. (See §5.)

Each senior is expected to build upon her writing experience while working independently on a sustained project–the senior comprehensive paper–that demonstrates the depth of her knowledge on a topic of her choice.

3 Mechanics of Completing the Requirement

3.1 The Portfolio

To demonstrate proficiency in mathematical writing, the student will prepare a portfolio consisting of three papers as described below. In each case, the paper must be approved by a committee of the Mathematics Department.

1. Achievement of proficiency in mathematical writing at the sophomore level is to be demonstrated by a paper from a sophomore math course: usually, Math 225, 231, 326 or 345.
2. Achievement of proficiency in mathematical writing at the junior level is to be demonstrated by a paper from a junior course: usually, Math 332, 339, 341-342, 345-346, 353-354, 361, or 372.
3. Achievement of proficiency in mathematical writing at the senior level is to be demonstrated by the senior comprehensive paper, completed as part of the senior comprehensive project.

3.2 The Process of Preparing the Portfolio

3.2.1 The sophomore and junior years

Essential parts of the writing process include writing for an audience of peers, acting as a peer editor, and revising papers in accordance with the suggestions made by the teacher and a peer editor. These aspects of the writing process will be incorporated into some class assignments.

At the end of the fall semester, each sophomore and junior will submit a selection of her best writing from her mathematics classes. The precise nature of the selection is determined by the teachers of her courses, who will meet over the semester break to determine how each student is progressing in her writing. Each student will receive a written evaluation of her writing, noting, in particular, the aspects which need improvement. (See §4 for a complete description of this evaluation.) She should devote particular attention to solving these problems as she prepares her spring semester writing assignments.

At the end of the spring semester, each sophomore and junior will submit a selection of her best writing for that year. The writing committee will meet again to evaluate the student's writing and to determine which students have met the departmental standards for that year. Each student will receive an evaluation of her writing, indicating if she has met the Department's standards as well as aspects of her writing which need improvement. The student will be notified of the decision by June 1. If a student's work is judged to be satisfactory, a sample will be placed in her portfolio. Any student whose writing is not yet satisfactory will be instructed either to revise an assignment completed during that year or to complete another assignment deemed appropriate by the instructors. Final submissions must be accepted by the following fall break.

Consequences of missing the deadline for completion of the requirement: If, by fall break, a student does not meet the requirement outlined in her written evaluation, she will receive a notice of **deficiency in ALL her mathematics courses. If she does not meet the requirement by the end of the fall semester, she receives an incomplete in all her mathematics courses.**

3.2.2 The senior year

The student prepares her paper under the direction of her project advisor. When it is complete and acceptable to this advisor, she prepares three copies for her examining committee. Following the senior comprehensive oral exam, the student will meet with her advisor or all members of the committee (the advisor will choose the most practical route) to find out if the paper requires revision. If it does, the student will make the revisions and give a revised copy to her advisor. The advisor will monitor the revision process and notify the student when her paper is acceptable.

4 Progress Reports

As mentioned in the previous section, at the end of each semester, a student receives from a committee of the Department an assessment of her progress towards completing the appropriate requirement. The assessment consists of two parts: an overall assessment of progress towards completion of the requirement and a list of writing standards which require attention based on her writing samples.

4.1 Overall Assessment

The overall assessment options are the same for both the sophomore and junior years. At mid-year, the overall assessment falls into one of the following categories:

- the student is on track to satisfy the requirement;
- the student should be able to satisfy the requirement if her writing continues to improve;
- the student's writing needs significant improvement; or
- the committee does not have enough samples to evaluate the student's progress.

At the end of the year, the outcomes of the overall assessment by the writing committee are similar.

- One of the student's papers is judged to satisfy the requirement and is added to her portfolio.
- One of her papers is chosen for further revision in order to complete the requirement.
- There are not enough samples of writing to evaluate the student's progress. She is asked to meet with her advisor.
- The student's writing needs significant improvement to demonstrate proficiency. She is asked to meet with her advisor.

4.2 Standards

The standards for writing proficiency for the sophomore year are listed below.

Accuracy:

- Mathematical ideas are described accurately.
- Mathematical language and notation are used correctly.
- The paper is free of mathematical errors.
- The directions for the assignment, including attention to the intended audience, are followed.

Organization:

- Mathematical arguments and analyses flow logically.
- The paper has an effective introduction and conclusion.
- The paragraph structure is cohesive.
- The paper is organized around a central idea.
- The paper is well organized.

Clarity and Insight:

- Mathematical ideas are described clearly and with sufficient detail.
- The wording is smooth and clear; word choice is appropriate.
- Transitions between ideas are clear.
- The development of mathematical ideas shows insight and depth.

Mechanics:

- The paper is free of grammatical, typographical, and spelling errors.
- Appropriate mathematical format is followed.
- Use and format of citations and bibliography are correct.
- Tables and figures are appropriately labeled and formatted.

The standards for the junior year include all the above with the addition of the standards given below:

- The significance of mathematical results is described accurately and clearly.
- Formal proofs and analyses are precise and succinct.
- The appropriate professional format for the paper is followed.

5 Resources for Mathematical Writing

Each discipline has its own requirements and conventions for writing. We describe some references for mathematical writing.

- Stephen B. Maurer, *Undergraduate Guide to Writing Mathematics,* to be published.

  This is the major reference for students, as it is written specifically for undergraduates. It is an excellent source for information on forms of mathematical writing and on stylistic and formatting issues regarding mathematical writing. You should read this book and turn to it **first** when you have a question about formatting or style.

- Leonard Gillman, *Writing Mathematics Well*, The Mathematical Association of America, 1987.

  This is a short guide to writing written mainly for professional mathematicians, but you will find many useful tips in it. It addresses style and formatting issues.

- Norman E. Steenrod, Paul R. Halmos, Menahem M. Chiffer, and Jean A. Dieudonné, *How to Write Mathematics*, American Mathematical Society, 1973.

  This pamphlet contains four essays about writing mathematics. It is of most use to professionals.

- Steven G. Krantz, *A Primer of Mathematical Writing*, American Mathematical Society, 1997.

  While this book is also aimed at professionals, the first three chapters deal with issues of style and formatting.

There are copies in the library of the references.

Format for Mathematical Papers

On the Department website are sample documents that address some of the formatting issues for mathematics. In particular, each includes a discussion of formatting theorems, definitions, corollaries, etc.; numbering such items; displaying expressions, equations, and inequalities; citing references; and formatting a bibliography. You can use these documents as templates to write your own papers.

Department Website: http://home.saintmarys.edu/∼math/