

Name of Program/Department:	Mathematics Program
Year:	2016-2017
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Program Mission Statement

A primary purpose of the Department of Mathematics at Francis Marion University is to offer all University students a varied and well-balanced curriculum of undergraduate education in mathematics. In the liberal-arts tradition, the courses in the curriculum teach students to think logically, to analyze problems, and solve them appropriately, and to communicate their ideas clearly.

The Department also provides a broad range of entry-level courses in order to meet the needs of students with widely varying mathematical backgrounds and provide them with skills appropriate for their selected majors. The mathematics courses that satisfy the General Education requirement in mathematics are designed to help students achieve *Goal 5: The ability to use fundamental mathematical skills and principles in various applications.*

Equally important, the curriculum provided by the Department leads to baccalaureate degrees in two distinct but overlapping areas: mathematical sciences and teacher licensure in mathematics. These courses prepare students for careers in education, business, industry, and government. They also prepare those students of sufficient interest and ability for further study of mathematics at the graduate level.

Program Learning Outcomes

1. Students should be able to analyze problems involving various applications and solve them using appropriate mathematical skills, principles, and technology.
2. Students should be able to present oral and written solutions in a structured format that can be understood by a general audience.
3. Students should recognize and appreciate the applicability, beauty, and power of mathematics.
4. Students should be confident in their abilities to use mathematics to solve various problems.

Executive Summary

The Department of Mathematics uses several assessment tools, such as a calculus performance rubric, an elementary proof performance rubric, a technology usage performance rubric, a communication performance rubric, and a senior survey. Values for Student Learning Outcome (SLO) 1.0 (Outcomes 1-4), SLO 2.0 (Outcomes 1-2), SLO 3.0 (Outcomes 1-2), and SLO 5.0 (Outcomes 1-3) are the percentages of students who met or exceeded faculty expectations. Values for SLO 1.0 (Outcome 5), SLO 2.0 (Outcome 3), SLO 3.0 (Outcome 3), SLO 4.0 (Outcomes 1-2), and SLO 5.0 (Outcome 4) are percentages of students who are confident in their skills and abilities or have an appreciation for the beauty of mathematics as a singular discipline and its applications. Baselines for SLOs were calculated from available student work samples from semesters prior to the 2015-16 academic year.

Academic year 2016-17 assessments show targets were achieved in 11 of 16 assessed outcomes of the SLOs pertaining to mathematical proofs, use of technology, appreciation for the beauty of mathematics, and communication of mathematics. Outcome 3 of SLO 5.0 was not assessed this academic year because there was no student participation in student teaching. Since assessments of student confidence in their skills and abilities or appreciation for the beauty of mathematics as a singular discipline and its applications have exceeded the target for this year and last year, the target goals for these outcomes will be increased to 90% in 2017-18.

Targets were not achieved in 5 of 16 assessed outcomes. The assessment of writing elementary proofs increased but did not achieve the target. With continued devotion of instructional time, we expect student performance to increase and achieve the target next year. The four assessments of elementary computational techniques in the calculus course sequence were not as high as expected for a second year in a row. While instructional time will continue to be devoted to computational techniques in the calculus sequence, the assessment process of these outcomes will be reviewed to see if it accurately measures student performance by considering factors such as the quantity of problems in each outcome, the timing of the assessment of student performance during the semester, and the suitability of the calculus performance rubric.

Student Learning Outcomes

SLO 1.0: Students in Math 201, 202, 203, 306, and 499 will be proficient in the elementary computational techniques in the calculus course sequence. Students in Math 499 will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence.

Outcome 1: Students will demonstrate competence to calculate derivatives and use them in various applications, such as optimization or related rates problems (Math 201/499).

Outcome 2: Students will demonstrate competence to calculate integrals and use them in various applications, such as area, volume, or average value of a function over an interval (Math 202/499).

Outcome 3: Students will demonstrate competence to calculate convergence of series and use them in various applications, such as polynomials to approximate functions (Math 203/499).

Outcome 4: Students will demonstrate competence to calculate gradients and partial derivatives and use them in various applications (Math 306/499).

Outcome 5: Students will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence (Math 499).

SLO 2.0: Students in Math 230 and 311 will develop the ability to understand and construct elementary proofs. Students in Math 499 will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs.

Outcome 1: Students will be able to read and understand elementary proofs and be able to determine what constitutes a mathematical proof (Math 230/311).

Outcome 2: Students will be able to write elementary proofs (Math 230/311).

Outcome 3: Students will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs (Math 499).

SLO 3.0: Students in Math/CS 212 will be able to use appropriate technology to solve mathematical problems. Students in Math 499 will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems.

Outcome 1: Students will be able to read computer programs that model various mathematical applications (Math/CS 212).

Outcome 2: Students will be able to write computer programs that model various mathematical applications (Math/CS 212).

Outcome 3: Students will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems (Math 499).

SLO 4.0: Students in Math 499 will appreciate the beauty of mathematics as a singular discipline and its applications.

Outcome 1: Students will respond to a statement concerning their appreciation for the beauty of mathematics as a singular discipline (Math 499).

Outcome 2: Students will respond to a statement concerning their understanding of the importance of mathematics in real world applications (Math 499).

SLO 5.0: Students in Math 499 and Student Teaching will be able to effectively communicate mathematics in written form and oral presentations.

Outcome 1: Students will communicate mathematics in a written presentation (Math 499).

Outcome 2: Students will communicate mathematics in an oral presentation (Math 499).

Outcome 3: Secondary education students will demonstrate applications of various strategies and tools in the teaching of mathematical concepts (Student Teaching).

Outcome 4: Students will respond to a statement concerning their confidence in their ability to develop and effectively communicate mathematics in written form and oral presentations (Math 499).

Assessment Methods

SLO 1.0: Students in Math 201, 202, 203, 306, and 499 will be proficient in the elementary computational techniques in the calculus course sequence. Students in Math 499 will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence.

For outcomes 1-4, instructors of Calculus sequence courses (Math 201, 202, 203, 306) and Mathematics Capstone Course (Math 499) will provide samples of student solutions to problems or other work that call for students to demonstrate proficiency of basic computational techniques in the calculus sequence. Student solutions will be evaluated based on a calculus performance rubric (1 = does not meet faculty expectations; 2 = meets faculty expectations; 3 = exceeds faculty expectations). The target is for 70% of students to meet or exceed faculty expectations. For outcome 5, students will complete a senior survey in the Mathematics Capstone Course (Math 499) with responses of disagree, agree, and strongly agree. The target is for 80% of students to agree or strongly agree.

SLO 2.0: Students in Math 230 and 311 will develop the ability to understand and construct elementary proofs. Students in Math 499 will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs.

For outcomes 1-2, instructors of Discrete Mathematics I (Math 230) and Transition to Higher Mathematics (Math 311) will provide samples of student solutions or relevant problems of other work to demonstrate the ability to understand and construct elementary proofs. Student solutions will be evaluated based on a proof performance rubric (1 = does not meet faculty expectations; 2 = meets faculty expectations; 3 = exceeds faculty expectations). The target is for 70% of students to meet or exceed faculty expectations. For outcome 3, students will complete a senior survey in the Mathematics Capstone Course (Math 499) with responses of disagree, agree, and strongly agree. The target is for 80% of students to agree or strongly agree.

SLO 3.0: Students in Math/CS 212 will be able to use appropriate technology to solve mathematical problems. Students in Math 499 will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems.

For outcomes 1-2, instructors of Introduction to FORTRAN (Math/CS 212) will provide samples of student solutions to relevant problems or other work to demonstrate the ability to use appropriate technology to solve mathematical problems. Student solutions will be evaluated based on a programming performance rubric (1 = does not meet faculty expectations; 2 = meets faculty expectations; 3 = exceeds faculty expectations). The target is for 70% of students to meet or exceed faculty expectations. For outcome 3, students will complete a senior survey in the Mathematics Capstone Course (Math 499) with responses of disagree, agree, and strongly agree. The target is for 80% of students to agree or strongly agree.

SLO 4.0: Students in Math 499 will appreciate the beauty of mathematics as a singular discipline and its applications.

Students will complete senior surveys in the Mathematics Capstone Course (Math 499) with responses of disagree, agree, and strongly agree to statements concerning their appreciation for the beauty of mathematics and their understanding of the importance of mathematics. The target is for 80% of students to agree or strongly agree.

SLO 5.0: Students in Math 499 and Student Teaching will be able to effectively communicate mathematics in written form and oral presentations.

For outcomes 1-3, instructors of the Mathematics Capstone Course (Math 499) and supervisors of student teachers will provide samples of student work and will attend presentations that call for students to effectively communicate mathematics. Student work and presentations will be evaluated based on a communication performance rubric (1 = does not meet faculty expectations; 2 = meets faculty expectations; 3 = exceeds faculty expectations). The target is for 70% of students to meet or exceed faculty expectations. For outcome 4, students will complete a senior survey in the Mathematics Capstone Course (Math 499) with responses of disagree, agree, and strongly agree. The target is for 80% of students to agree or strongly agree.

Assessment Results

SLO 1.0: Students in Math 201, 202, 203, 306, and 499 will be proficient in the elementary computational techniques in the calculus course sequence. Students in Math 499 will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence.

Outcome 1: About one-third of the students did demonstrate competence to calculate derivatives and use them in various applications, such as optimization or related rates problems (Math 201/499). Therefore, this target was not achieved.

Outcome 2: Just over half of the students did demonstrate competence to calculate integrals and use them in various applications, such as area, volume, or average value of a function over an interval (Math 202/499). Therefore, this target was not achieved.

Outcome 3: Almost half of the students did demonstrate competence to calculate convergence of series and use them in various applications, such as polynomials to approximate functions (Math 203/499). Therefore, this target was not achieved.

Outcome 4: About two-thirds of the students did demonstrate competence to calculate gradients and partial derivatives and use them in various applications (Math 306/499). Therefore, the target was not quite achieved.

Outcome 5: Students did respond that they were confident in their computational techniques in the calculus course sequence (Math 499). Therefore, this target was achieved.

SLO 1.0 Outcomes 1,3,and 4 were below the target of 70% but showed considerable improvement.

SLO 1.0 Outcome 2 was below the target of 70% and decreased slightly.

SLO 1.0 Outcome 5 showed complete student confidence.

SLO 1.0's overall target was not achieved.

SLO 2.0: Students in Math 230 and 311 will develop the ability to understand and construct elementary proofs. Students in Math 499 will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs.

Outcome 1: Most students did show ability to read and understand elementary proofs and be able to determine what constitutes a mathematical proof (Math 230/311). Therefore, this target was achieved.

Outcome 2: More than half of the students did show ability to write elementary proofs (Math 230/311). Therefore, this target was not achieved.

Outcome 3: Students did respond that they were confident in their ability to understand and construct elementary proofs (Math 499). Therefore, this target was achieved.

SLO 2.0 Outcome 1 was above the target of 70% and showed considerable improvement.

SLO 2.0 Outcome 2 was below the target of 70% but showed considerable improvement.

SLO 2.0 Outcome 3 showed complete student confidence.

SLO 2.0's overall target was not achieved.

SLO 3.0: Students in Math/CS 212 will be able to use appropriate technology to solve mathematical problems. Students in Math 499 will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems.

Outcome 1: Almost three-quarters of the students did show ability to read computer programs that model various mathematical applications (Math/CS 212). Therefore, this target was achieved.

Outcome 2: Almost three-quarters of the students did show ability to write computer programs that model various mathematical applications (Math/CS 212). Therefore, this target was achieved.

Outcome 3: Students did respond that they were confident in their ability to use appropriate technology to solve mathematical problems (Math 499).

SLO 3.0 Outcomes 1 and 2 were above the target of 70%.

SLO 3.0 Outcome 3 showed complete student confidence.

SLO 3.0's overall target was achieved.

SLO 4.0: Students in Math 499 will appreciate the beauty of mathematics as a singular discipline and its applications.

Outcome 1: Students did respond that they had an appreciation for the beauty of mathematics as a singular discipline (Math 499). Therefore, this target was met.

Outcome 2: Students did respond that they had an understanding of the importance of mathematics in real world applications (Math 499). Therefore, this target was achieved.

SLO 4.0 Outcomes 1-2 showed complete student appreciation and understanding.

SLO 4.0's overall target was achieved.

SLO 5.0: Students in Math 499 and Student Teaching will be able to effectively communicate mathematics in written form and oral presentations.

Outcome 1: More than four-fifths of the students did communicate mathematics effectively in a written presentation (Math 499). Therefore, this target was achieved.

Outcome 2: More than four-fifths of the students did communicate mathematics effectively in an oral presentation (Math 499). Therefore, this target was achieved.

Outcome 3: No students participated in student teaching.

Outcome 4: Students did respond that they were confident in their ability to develop and effectively communicate mathematics in written form and oral presentations (Math 499). Therefore, this target was achieved.

SLO 5.0 Outcomes 1 and 2 were above the target of 70%.

SLO 5.0 Outcome 4 showed complete student confidence.

SLO 5.0's overall target was achieved.

Table 1.0: Assessment Results

Assessment	2013-14	2014-15	Baseline	2015-16 ⁴	2016-17
SLO 1.0 Outcome 1			70.6	24.5 ³	34.3
Outcome 2			61.1	64.3 ³	58.7
Outcome 3	*1	*1		34.5 ³	48.1
Outcome 4				40.0 ³	68.8
Outcome 5				100.0	100.0
SLO 2.0 Outcome 1			71.4	53.8	86.4
Outcome 2	*1	*1	57.1	53.8	63.6
Outcome 3				100.0	100.0
SLO 3.0 Outcome 1				75.0	73.9
Outcome 2	*1	*1		50.0	73.9
Outcome 3				100.0	100.0
SLO 4.0 Outcome 1				100.0	100.0
Outcome 2	*1	*1		100.0	100.0
SLO 5.0 Outcome 1				100.0	81.8
Outcome 2				100.0	81.1
Outcome 3	*1	*1		*2	*2
Outcome 4				100.0	100.0

*1 Assessment initiated in Spring 2016.

*2 No students participated in student teaching during the academic year.

3. Outcomes 1-4 of SLO 1 were mistakenly not assessed in Math 499.

4. Data is only from Spring 2016.

Action Items

SLO 1: Students in Math 201, 202, 203, 306, and 499 will be proficient in the elementary computational techniques in the calculus course sequence. Students in Math 499 will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence.

Outcome 1: Students will demonstrate competence to calculate derivatives and use them in various applications, such as optimization or related rates problems (Math 201/499).

Outcome 2: Students will demonstrate competence to calculate integrals and use them in various applications, such as area, volume, or average value of a function over an interval (Math 202/499).

Outcome 3: Students will demonstrate competence to calculate convergence of series and use them in various applications, such as polynomials to approximate functions (Math 203/499).

Outcome 4: Students will demonstrate competence to calculate gradients and partial derivatives and use them in various applications (Math 306/499).

Outcome 5: Students will respond to a statement concerning their confidence in their computational techniques in the calculus course sequence (Math 499).

Instructors of single variable calculus courses (outcomes 1-3) will allocate more instructional time to elementary computational techniques by including more in-depth content and assessment. Instructors of the multivariable calculus course (outcome 4) will devote more instructional time to partial derivatives and gradients. The assessment process of these outcomes will be reviewed to see if it accurately measures student performance by considering factors such as the quantity of problems in each outcome, the timing of the assessment of student performance during the semester, and the suitability of the calculus performance rubric. The target of Outcome 5 will be increased to 90.0.

SLO 2: Students in Math 230 will develop the ability to understand and construct elementary proofs. Students in Math 499 will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs.

Outcome 1: Students will be able to read and understand elementary proofs and be able to determine what constitutes a mathematical proof (Math 230/311).

Outcome 2: Students will be able to write elementary proofs (Math 230/311).

Outcome 3: Students will respond to a statement concerning their confidence in their ability to understand and construct elementary proofs (Math 499).

Due to improved assessment scores of Outcome 1-2, instructors of mathematical proofs courses will continue to allocate instructional time to the construction of elementary proofs by including more in-depth content and assessment. The target of Outcome 3 will be increased to 90.0.

SLO 3: Students in Math/CS 212 will be able to use appropriate technology to solve mathematical problems. Students in Math 499 will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems.

Outcome 1: Students will be able to read computer programs that model various mathematical applications (Math/CS 212).

Outcome 2: Students will be able to write computer programs that model various mathematical applications (Math/CS 212).

Outcome 3: Students will respond to a statement concerning their confidence in their ability to use appropriate technology to solve mathematical problems (Math 499).

Due to achieved targets in Outcomes 1-2, instructors of programming courses will continue to allocate instructional time to the construction of programs by including programming assignments for various mathematical applications. The target of Outcome 3 will be increased to 90.0.

SLO 4.0: Students in Math 499 will appreciate the beauty of mathematics as a singular discipline and its applications.

Outcome 1: Students will respond to a statement concerning their appreciation for the beauty of mathematics as a singular discipline (Math 499).

Outcome 2: Students will respond to a statement concerning their understanding of the importance of mathematics in real world applications (Math 499).

The target of Outcomes 1-2 will be increased to 90.0.

SLO 5.0: Students in Math 499 and Student Teaching will be able to effectively communicate mathematics in written form and oral presentations.

Outcome 1: Students will communicate mathematics in a written presentation (Math 499).

Outcome 2: Students will communicate mathematics in an oral presentation (Math 499).

Outcome 3: Secondary education students will demonstrate applications of various strategies and tools in the teaching of mathematical concepts (Student Teaching).

Outcome 4: Students will respond to a statement concerning their confidence in their ability to develop and effectively communicate mathematics in written form and oral presentations (Math 499).

Instructors will continue to provide assignments for written and oral presentations for Outcomes 1-2. The target of Outcome 4 will be increased to 90.0.

Table 2.0: Closing the loop

Issues of Concern	Actions Taken
<p><i>SLO 1.1[†], 1.3, and 1.4 were below the target of 70% but showed considerable improvement.</i></p> <p><i>SLO 1.2 was below the target of 70% and decreased slightly.</i></p>	<p>Instructors of single variable calculus courses (outcomes 1-3) will allocate more instructional time to elementary computational techniques by including more in-depth content and assessment. Instructors of the multivariable calculus course (outcome 4) will devote more instructional time to partial derivatives and gradients.</p> <p>The assessment process of these outcomes will be reviewed to see if it accurately measures student performance by considering factors such as the quantity of problems in each outcome, the timing of the assessment of student performance during the semester, and the suitability of the calculus performance rubric.</p>
<p><i>SLO 2.2 was below the target of 70% but showed considerable improvement.</i></p>	<p>Instructors of mathematical proofs courses will continue to allocate more instructional time to the construction of elementary proofs by including more in-depth content and assessment.</p>
<p><i>Targets have been achieved for two consecutive years for SLO 1.5, SLO 2.3, SLO 3.3, SLO 4.1-4.2, and SLO 5.4.</i></p>	<p>Targets will be increased to 90.0.</p>

† SLO 1.1 is an abbreviation for SLO 1 Outcome 1.