

<b>Name of Program/Department:</b>	Mathematics General Education
<b>Year:</b>	<b>2018-19</b>
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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 to 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 use fundamental mathematics skills and principles in various applications.
2. Student should be confident in their abilities to use mathematics to solve various problems.

## *Executive Summary*

A primary goal of the Department of Mathematics at Francis Marion University is to offer a well-balanced curriculum of undergraduate education in mathematics. One of the core courses of the department that is also representative of the standards for undergraduate mathematics education is Math 111, (College Algebra II). In this course students are assessed on four overall student learning outcomes divided into fifteen measureable outcomes.

Based on research of student enrollment, most students, 73.4% of students enrolled in Fall 2015, have taken or will take Math 111 to satisfy a General Education Requirement in mathematics. The course is taught in both the structured-learning and lecture modes.

The Department of Mathematics uses several direct and indirect assessments. The direct assessments of Student Learning Outcome (SLO) 1.0 (Outcomes 1-3), SLO 2.0 (Outcomes 1-3), SLO 3.0 (Outcomes 1, 3), and SLO 4.0 (Outcomes 1-3) are scaled 0-100 based on the algebra performance rubric. The indirect assessments of SLO 1.0 (Outcome 4), SLO 2.0 (Outcome 4), SLO 3.0 (Outcome 4), and SLO 4.0 (Outcomes 4) are tabulated from online student surveys.

Fall 2018 assessments of Student Learning Outcomes (SLO) showed benchmarks were achieved in six of 15 outcomes, namely SLO 1.3<sup>†</sup>, SLO 1.4, SLO 2.1, SLO 2.4, SLO 3.4, and SLO 4.4. Six assessments (SLO 1.1, SLO 1.2, SLO 2.2, SLO 2.3, SLO 3.1, and SLO 4.1) of the nine assessments that did not meet the targets had scores that stayed about the same or increased compared to Fall 2017 and Spring 2018. Spring 2019 saw the benchmarks achieved in the same SLOs. Five assessments (SLO 1.1, SLO 1.2, SLO 2.2, SLO 2.3, and SLO 4.3) of the nine assessments that did not meet the benchmark decreased from fall to spring.

Assessment values changed slightly in both semesters and the academic year. Overall action item for direct assessments is to closely examine 2 or 3 class sets of student work. The intent is to look for specific errors students are making and work to revise instruction so the errors are lessened. This also provides us with specific actions we can work on semester to semester. Overall action item for indirect assessment is to discuss with faculty ways to increase the response rate of student surveys.

<sup>†</sup> SLO 1.3 is an abbreviation for SLO 1.0 Outcome 3.

## *Student Learning Outcomes*

SLO 1.0: Students will be proficient in the techniques for evaluating functions and graphs.

Outcome 1: Students will demonstrate competence to evaluate a function from its graphical representation.

Outcome 2: Students will demonstrate competence to evaluate an exponential function.

Outcome 3: Students will demonstrate competence to evaluate a rational function.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to evaluate functions and graphs.

SLO 2.0: Students will be proficient in the techniques for solving polynomial equations.

Outcome 1: Students will demonstrate competence to solve a polynomial equation with rational solution(s).

Outcome 2: Students will demonstrate competence to solve a quadratic equation with irrational solutions.

Outcome 3: Students will demonstrate competence to solve a geometric word problem leading to a quadratic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve polynomial equations, predominantly quadratic equations.

SLO 3.0: Students will be proficient in the techniques for solving rational equations.

Outcome 1: Students will demonstrate competence to solve a rational equation.

Outcome 3: Students will demonstrate competence to solve a word problem involving distance, rate, and time.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve rational equations.

SLO 4.0: Students will be proficient in the techniques for solving exponential, radical, and logarithmic equations.

Outcome 1: Students will demonstrate competence to solve an exponential equation.

Outcome 2: Students will demonstrate competence to solve a radical equation.

Outcome 3: Students will demonstrate competence to solve a logarithmic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve exponential, radical, and logarithmic equations.

## ***Assessment Methods***

SLO 1.0: Students will be proficient in the techniques for evaluating functions and graphs.

SLO 2.0: Students will be proficient in the techniques for solving polynomial equations.

SLO 3.0: Students will be proficient in the techniques for solving rational equations.

SLO 4.0: Students will be proficient in the techniques for solving exponential, radical, and logarithmic equations.

For direct assessments, instructors of College Algebra II (Math 111) will collect student work samples of various graded assignments throughout the semester to assess problems that call for students to demonstrate proficiency in basic computational techniques listed in SLOs 1.1-1.3, 2.1-2.3, 3.1-3.2, and 4.1-4.3. Student samples will be evaluated based on an algebra performance rubric on a scale from 0 – 100 for each outcome. The target is a mean score of 70 of all student assessments.

For indirect assessments of SLOs 1.4, 2.4, 3.3, and 4.4 students will have the opportunity to complete a survey on which they will state their confidence (1 = not confident, 2 = confident, and 3 = very confident) in their ability to evaluate or solve the listed equation type(s). The surveys are completed at the end of the semester but before course grades are calculated. The target is mean score of 2.0 of all student responses.

## ***Assessment Results***

Direct assessment results were calculated from 271 student work samples in Fall 2018 and 312 samples in Spring 2019. Indirect assessments were calculated from 37 survey responses in Fall 2018 and 15 responses in Spring 2019.

Results are listed in Table 1.0.

SLO 1.0: Students will be proficient in the techniques for evaluating functions and graphs.

Outcome 1: Students will demonstrate competence to evaluate a function from its graphical representation.

Outcome 2: Students will demonstrate competence to evaluate an exponential function.

Outcome 3: Students will demonstrate competence to evaluate a rational function.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to evaluate functions and graphs.

*Assessment values of SLOs 1.1-1.2 changed slightly and stayed in the mid to upper 60s in the both semesters and the academic year. SLOs 1.1-1.2 were below target of 70. SLO 1.3 changed slightly and stayed in the lower to mid 80s in both semesters and the academic year. SLO 1.3 was above target of 70. SLO 1.4 changed slightly and was at or above the target of 2.00.*

*SLO 1.0's overall target was not achieved.*

SLO 2.0: Students will be proficient in the techniques for solving polynomial equations.

Outcome 1: Students will demonstrate competence to solve a polynomial equation with rational solution(s).

Outcome 2: Students will demonstrate competence to solve a quadratic equation with irrational solutions.

Outcome 3: Students will demonstrate competence to solve a geometric word problem leading to a quadratic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve polynomial equations, predominantly quadratic equations.

*Assessment values of SLO 2.1 were almost constant in the mid 70s in the both semesters and the academic year. SLO 2.1 was above the target of 70. SLOs 2.2-2.3 ranged from the mid 50s to lower 60s in both semesters and the academic year. SLOs 2.2-2.3 were below the target of 70. SLO 2.4 reached 2.40 in the fall which resulted in a value of 2.33 for the academic year. SLO 2.4 was above the target of 2.00. SLO 2.0's overall target was not achieved.*

SLO 3.0: Students will be proficient in the techniques for solving rational equations.

Outcome 1: Students will demonstrate competence to solve a rational equation.

Outcome 3: Students will demonstrate competence to solve a word problem involving distance, rate, and time.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve rational equations.

*Assessment values of SLO 3.1 stayed in the mid 60s in the both semesters and the academic year. SLO 3.1 was below the target of 70. SLO 3.3 stayed near 50 in both semesters and the academic year. SLO 3.3 was below the target of 70. SLO 3.4 reached 2.27 in the fall which resulted in a value of 2.15 for the academic year. SLO 3.4 was above the target of 2.00. SLO 3.0's overall target was not achieved.*

SLO 4.0: Students will be proficient in the techniques for solving exponential, radical, and logarithmic equations.

Outcome 1: Students will demonstrate competence to solve an exponential equation.

Outcome 2: Students will demonstrate competence to solve a radical equation.

Outcome 3: Students will demonstrate competence to solve a logarithmic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve exponential, radical, and logarithmic equations.

*Assessment values of SLO 4.1 stayed in the low 50s in the both semesters and the academic year. SLO 4.1 was below the target of 70. SLO 4.2 increased 9.4 from fall to spring which resulted in a value 54.1 for the academic year. SLO 4.2 was below the target of 70. SLO 4.3 stayed in the low 50s for both semesters and the academic year. SLO 4.3 was below the target of 70. SLO 4.4 reached 2.20 in the spring which resulted in a value of 2.02 for the academic year. SLO 4.4 was above the target of 2.00. SLO 4.0's overall target was not achieved.*

**Table 1.0: Assessment Results**

Assessment Problem	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	2018-19
Goal 1.0 Outcome 1	57.0	74.8	64.9	68.0	69.0	65.8	67.3
Outcome 2	64.0	74.6	65.6	58.7	65.5	63.5	64.4
Outcome 3	76.2	87.2	74.4	79.8	82.8	86.1	84.6
Outcome 4	2.17	2.15	2.0	2.02	2.08	2.00	2.06
Goal 2.0 Outcome 1	78.6	92.6	67.6	66.4	75.0	74.5	74.8
Outcome 2	67.6	70.4	59.8	52.9	61.1	55.1	57.9
Outcome 3	58.9	55.5	52.0	46.3	54.1	55.3	54.7
Outcome 4	2.47	2.31	2.4	2.23	2.40	2.07	2.33
Goal 3.0 Outcome 1	65.0	67.0	55.5	62.6	62.9	65.1	64.1
Outcome 3	53.2	54.9	45.5	51.9	49.3	51.4	50.5
Outcome 4	2.25	2.34	2.2	2.05	2.27	2.00	2.15
Goal 4.0 Outcome 1	56.2 <sup>1</sup>	72.6	47.3	46.9	52.0	54.4	53.3
Outcome 2		59.4	48.5	62.0	49.1	58.5	54.1
Outcome 3		66.0	54.9	55.4	51.9	50.0	50.9
Outcome 4	2.25 <sup>2</sup>	2.14	2.1	2.06	2.00	2.20	2.02

1: Scores for Outcomes 1-3 of Goal 4 were recorded as one value and not separate values for each outcome.

2: Student surveys were completed after semester grades were posted and include 36 responses out of approximately 340 students.

### Action Items

SLO 1.0: Students will be proficient in the techniques for evaluating functions and graphs.

Outcome 1: Students will demonstrate competence to evaluate a function from its graphical representation.

Outcome 2: Students will demonstrate competence to evaluate an exponential function.

Outcome 3: Students will demonstrate competence to evaluate a rational function.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to evaluate functions and graphs.

*Instructors will continue presenting graphs of functions stressing the definition of the graph of a function as the collection of coordinate pairs  $(x,y)$  that satisfy the function rule.*

SLO 2.0: Students will be proficient in the techniques for solving polynomial equations.

Outcome 1: Students will demonstrate competence to solve a polynomial equation with rational solution(s).

Outcome 2: Students will demonstrate competence to solve a quadratic equation with irrational solutions.

Outcome 3: Students will demonstrate competence to solve a geometric word problem leading to a quadratic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve polynomial equations, predominantly quadratic equations.

*Instructors will continue focusing on solving quadratic equations by using the quadratic formula. To help students formulate word problems, instructors will link key words in word problems with mathematical operations.*

SLO 3.0: Students will be proficient in the techniques for solving rational equations.

Outcome 1: Students will demonstrate competence to solve a rational equation.

Outcome 3: Students will demonstrate competence to solve a word problem involving distance, rate, and time.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve rational equations.

*Instructors will refocus efforts to help students understand common denominators in rational expressions. Instructors will focus on distance, rate, and time problems using tactics such as table entries.*

SLO 4.0: Students will be proficient in the techniques for solving exponential, radical, and logarithmic equations.

Outcome 1: Students will demonstrate competence to solve an exponential equation.

Outcome 2: Students will demonstrate competence to solve a radical equation.

Outcome 3: Students will demonstrate competence to solve a logarithmic equation.

Outcome 4: Students will respond to a statement concerning their confidence in their ability to solve exponential, radical, and logarithmic equations.

*Instructors will continue presenting exponential functions as modeling real world data. Instructors will explain that steps leading to a solution of an equation involve the inverse operations of the operations used in the equation.*

*Overall action item for direct assessments is to closely examine 2 or 3 class sets of student work. The intent is to look for specific errors students are making and work to revise instruction so the errors are lessened. This also provides us with specific actions we can work on semester to semester.*

*Overall action item for indirect assessment is to discuss with faculty ways to increase the response rate of student surveys.*