

<b>Name of Program/Department:</b>	Mathematics General Education
<b>Year:</b>	<b>2017-2018</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, 70.2% 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 self-paced and lecture modes. The assessment problems are included in various graded assignments throughout the semester.

The Department of Mathematics uses two assessment tools, namely an algebra performance rubric and a student survey. Values for 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. Values for SLO 1.0 (Outcome 4), SLO 2.0 (Outcome 4), SLO 3.0 (Outcome 4), and SLO 4.0 (Outcomes 4) are percentages of students who are confident in their abilities to evaluate functions and graphs or solve algebraic equations based on a student survey.

Fall 2017 assessments of Student Learning Outcomes (SLO) showed benchmarks were achieved in five of 15 outcomes, namely SLO 1.3<sup>†</sup>, SLO 1.4, SLO 2.4, SLO 3.4, and SLO 4.4. Spring 2018 assessments showed benchmarks were achieved in the same five of 15 outcomes, namely SLO 1.3, SLO 1.4, SLO 2.4, SLO 3.4, and SLO 4.4.

Since the benchmark was not achieved in several SLOs, the program made changes to bring improvements. Instructors will continue actions taken last year, such as 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, presenting exponential functions as modeling real world data, and focusing on solving quadratic equations by using the quadratic formula, to try to sustain the increases that occurred from Fall 2016 to Spring 2017.

Student assessments still fell below the benchmark in outcomes related to word problems and to rational, logarithmic, and radical equations. This is not surprising since students often do well with polynomial expressions and equations but have trouble with applications and with non-polynomial equations. Instructors need to devote more time to linking key words in word problems with mathematical operations.

<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 2: Students will demonstrate competence to solve a word problem involving distance, rate, and time.

Outcome 3: 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.

Instructors of College Algebra II (Math 111) courses will provide samples of solutions from students 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 solutions will be evaluated based on an algebra performance rubric on a scale from 0 – 100 for each outcome. The target is a 70 for the average of student assessments. For 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 target is a 2.0 for the average of student responses. The course instructors will review the data and make recommendations.

## ***Assessment Results***

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.

*In Fall 2017, SLOs 1.1-1.2 were below target of 70. SLO 1.3 was above target of 70, and SLO 1.4 was at target of 2.0. In Spring 2018, SLOs 1.1-1.4 were yet again below the target with SLO 1.1, 1.3, and 1.4 increasing and SLO 1.2 decreasing.*

*SLO 1.0's overall target was not achieved in Fall 2017 and Spring 2018.*

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.

*In Fall 2017 SLOs 2.1-2.3 were below target of 70. SLO 2.4 was above target of 2.0. In Spring 2018 SLOs 2.1-2.4 were yet again below the target with SLOs 2.1-2.3 decreasing slightly.*

*SLO 2.0's overall target was not achieved in Fall 2017 and Spring 2018.*

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

Outcome 3: Students will respond to a statement concerning their confidence in their ability to solve rational equations.

*In Fall 2017, SLOs 3.1-3.2 were below target of 70, and SLO 3.3 was above target of 2.0. In Spring 2018 SLOs 3.1-3.3 were yet again below the target with respect to target values with SLOs 3.1-3.2 increasing.*

*SLO 3.0's overall target was not achieved in Fall 2017 and Spring 2018.*

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.

*In Fall 2017, SLOs 4.1-4.3 were below target of 70, and SLO 4.4 was above target of 2.0. In Spring 2018 SLOs 4.1-4.4 were yet again below the target with SLOs 4.2-4.3 increasing.*

*SLO 4.0's overall target was not achieved in Fall 2017 and Spring 2018.*

**Table 1.0: Assessment Results**

Assessment Problem	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018
Goal 1.0 Outcome 1		57.0	74.8	64.9	68.0
Outcome 2	64.8	64.0	74.6	65.6	58.7
Outcome 3	71.3	76.2	87.2	74.4	79.8
Outcome 4	73.1	2.17	2.15	2.0	2.02
Goal 2.0 Outcome 1	1.97				
Outcome 2	78.4	78.6	92.6	67.6	66.4
Outcome 3	66.1	67.6	70.4	59.8	52.9
Outcome 4	60.3	58.9	55.5	52.0	46.3
Goal 3.0 Outcome 1	2.19	2.47	2.31	2.4	2.23
Outcome 2	59.7	65.0	67.0	55.5	62.6
Outcome 3	56.3	53.2	54.9	45.5	51.9
Goal 4.0 Outcome 1	2.10	2.25	2.34	2.2	2.05
Outcome 2	66.2 <sup>1</sup>	56.2 <sup>1</sup>	72.6	47.3	46.9
Outcome 3			59.4	48.5	62.0
Outcome 4	1.84	2.25 <sup>2</sup>	66.0	54.9	55.4

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.*