

<b>Name of Program/Department:</b>	Mathematics General Education
<b>Year:</b>	<b>2020-21</b>
<b>Name of Preparers:</b>	<i>Drs. Thomas Fitzkee, Kevin LoPresto, Nicole Panza, George Schnibben, and Sophia Waymyers</i>

### ***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 4: 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 1-2), 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 3), and SLO 4.0 (Outcomes 4) are tabulated from online student surveys.

Academic year 2020-21 assessments show targets were achieved in 10 of 15 outcomes, an increase by one outcome from last year. Direct assessment SLO 2.2<sup>†</sup> achieved its target for the first time. Also, SLO 3.1, SLO 4.2, and SLO 4.3 achieved their targets for the first time last year and again this year. The indirect assessments continued to achieve their targets implying that students are confident in their mathematical abilities.

Targets were not achieved in 5 of 15 assessed outcomes. Progress has been made in these direct assessments (SLO 1.1, SLO 1.2, SLO 2.3, SLO 3.2, and SLO 4.1). The scores are at the highest level in three years. Three out of the five benchmarks not achieved in the 2020-21 academic year were achieved in Spring 2021.

Assessment results for the fall and spring semesters are displayed in two columns in Table 1.0. A noticeable increase in direct assessments from fall to spring started last year in 2019-20 and continued this year in 2020-21. In fact, scores from Fall 2020 to Spring 2021 showed an increase in every outcome except indirect assessments SLO 2.4 and SLO 4.3. This increase could be related to a number of factors. Students were allowed to withdraw without penalty in Fall 2019 and Fall 2020 through the last day of class. Consequently more students withdrew in the fall semesters and a larger proportion of student in Math 111 were repeating the course in the spring. Also, instructors have become more experienced with instructional technology based on experiences in Spring 2020 and Fall 2020 semesters with distance learning. Many have incorporated successful strategies, such as flipped classroom, screen casting lessons, and Zoom office hours, in Spring 2021.

<sup>†</sup> SLO 2.2 is an abbreviated notation for SLO 2.0 Outcome 2.

## *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.

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 SLO 1.1 - SLO 1.3, SLO 2.1 – SLO 2.3, SLO 3.1 – SLO 3.2, and SLO 4.1 – SLO 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 direct student assessments.

For indirect assessments of SLO 1.4, SLO 2.4, SLO 3.3, and SLO 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 353 student work samples in Fall 2020 and 240 samples in Spring 2021. Indirect assessments were calculated from 31 survey responses in Fall 2020 and 42 responses in Spring 2021.

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.

*Outcome 1 did not achieve the benchmark.*

*Outcome 2 did not achieve the benchmark.*

*Outcome 3 did achieve the benchmark.*

*Outcome 4 did achieve the benchmark.*

*SLO 1.0's overall benchmark 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.

*Outcome 1 did achieve the benchmark.*

*Outcome 2 did achieve the benchmark.*

*Outcome 3 did not achieve the benchmark.*

*Outcome 4 did achieve the benchmark.*

*SLO 2.0's overall benchmark 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 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.

*Outcome 1 did achieve the benchmark.*

*Outcome 2 did not achieve the benchmark.*

*Outcome 3 did achieve the benchmark.*

*SLO 3.0's overall benchmark 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.

*Outcome 1 did not achieve the benchmark.*

*Outcome 2 did achieve the benchmark.*

*Outcome 3 did achieve the benchmark.*

*Outcome 4 did achieve the benchmark.*

*SLO 4.0's overall benchmark was not achieved.*

**Table 1.0: Assessment Results**

Assessment Problem	Fall 2018	Spring 2019	2018-19	Fall 2019	Spring 2020	2019-20	Fall 2020	Spring 2021	2020-21
Goal 1.0 Outcome 1	69.0	65.8	67.3	62.4	68.4	65.1	62.1	77.3	68.3
Outcome 2	65.5	63.5	64.4	56.2	64.1	59.7	62.2	76.7	68.1
Outcome 3	82.8	86.1	84.6	86.7	90.2	88.3	85.8	87.7	86.6
Outcome 4	2.08	2.00	2.06	2.13	2.21	2.14	2.29	2.31	2.30
Goal 2.0 Outcome 1	75.0	74.5	74.8	77.2	88.0	82.0	77.3	85.0	80.4
Outcome 2	61.1	55.1	57.9	59.6	77.9	67.7	70.0	81.3	74.6
Outcome 3	54.1	55.3	54.7	46.1	64.6	54.3	54.7	65.5	59.1
Outcome 4	2.40	2.07	2.33	2.34	2.34	2.34	2.32	2.31	2.32
Goal 3.0 Outcome 1	62.9	65.1	64.1	58.0	85.5	70.1	75.1	85.8	79.4
Outcome 2	49.3	51.4	50.5	54.9	60.6	57.4	63.0	68.1	65.1
Outcome 3	2.27	2.00	2.15	2.26	2.24	2.24	2.32	2.36	2.34
Goal 4.0 Outcome 1	52.0	54.4	53.3	53.7	83.5	66.9	61.3	77.4	67.8
Outcome 2	49.1	58.5	54.1	63.4	87.1	73.9	72.4	77.4	74.4
Outcome 3	51.9	50.0	50.9	58.6	84.4	70.0	72.1	69.7	71.1
Outcome 4	2.00	2.20	2.02	2.17	2.07	2.15	2.23	2.40	2.33

**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.

*Progress has been made. Instructors will continue presenting graphs of functions stressing the definition of the graph of a function as the collection of coordinate pairs  $(x,y)$ , where  $x$  is the input and  $y$  is the output, which 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.

*Progress has been made. 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 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.

*Progress has been made. 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.

*Progress has been made. 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.*

*Last year's action item for direct assessments was 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 was not accomplished but will be considered at the beginning of the Fall 2021 semester.*