Student Learning Outcomes – Mathematics

1. Students will demonstrate proficiency in oral mathematical communication
2. Students will demonstrate proficiency in written mathematical communication
3. Students will engage in the mathematical processes of creative problem solving, pattern recognition, and conjecture forming.
4. Students will reflect on their process of productive struggle in mathematics
5. Students will produce and evaluate the quality of mathematical arguments
6. Students will apply analytical and procedural skills in a variety of contexts
7. Students will synthesize various mathematical strategies to tackle authentic problems in novel settings

Mathematics Course

**L.MAT-091: Intermediate Algebra**

This course is designed to prepare the student for college-level (100-level) coursework in mathematics. The course covers arithmetic, pre-algebra, and elementary and intermediate algebra, including linear equations and linear functions and applications, and exponents. 4 credits.

**L.MAT-105: Math of Games-QR**

In this class, students will learn how to view and think about the world through the lens of mathematics. Students will form their own mathematical conjectures about games they play and determine how to test the correctness of their conjectures. The class mainly consists of collecting data while playing games during the day, and writing analytic papers about the day’s experience in the evening. In this way they will learn how to reason from data and make arguments based on data. 3 credits.

**L.MAT-107: Patterns and Perspective: Math in Art and Music-EC**

This course uses the axiomatic and functional lenses of mathematics to both analyze and create art and music. In particular, we use projective geometry to develop axioms for perspective art, and we explore how mathematicians and artists tend to apply and manipulate those axioms differently. We use modular arithmetic and function transformations as a basis for understanding musical chords and counterpoint and compare that with a more conventional music theory approach. We also view and interpret fractals as structural objects from mathematical, artistic, and musical perspectives. **Prerequisite:** 3 years of high school mathematics, including a year of Algebra II or a grade of C- or higher in L.MAT-091. 3 credits. January term.
LMAT-110: Math for K-8 Teachers I
This course begins to develop the solid foundation in K-8 mathematics needed by future elementary and middle school teachers. The focus of this course is on Numbers and Operations. In addition, this course will introduce students to professional recommendations and state requirements for mathematics instruction and provide students with a global perspective on mathematics achievement. This course does not fulfill mathematical modeling general education requirements. Approved for Community Based Learning. 4 credits.

LMAT-111: Math for K-8 Teachers II
This course provides further instruction on K-8 mathematics for prospective elementary and middle school teachers. L.MAT-111 focuses on the content domains of Geometry, Measurement, Probability, and Algebraic Thinking. The course topics are taught using teaching techniques appropriate for elementary and middle school, including guided discovery and other student-centered approaches. 
Prerequisite: L.MAT-110. 4 credits.

LMAT-114: Problems in Quantitative Reasoning and Statistical Thinking-QR
In this course, students will grapple with problems from current events dealing with the communication and understanding of common statistical and mathematical models. Students will explore the difficulties of collecting data, calculate summary statistics, develop intuition about confidence intervals and hypothesis testing, and work with linear and exponential functions. Prerequisite: a grade of C- or better in L.MAT-091 or placement into L.MAT-114. 3 credits.

LMAT-115: Statistics-FM, QR
Basic statistical concepts and methods. Descriptive statistics and probability, distribution and sampling theory, hypothesis testing and analysis of variance, correlation and regression. Prerequisite: a grade of C- or better in L.MAT-091 or placement into L.MAT 115. 4 credits.

LMAT-117: Pre-Calculus-FM
This course provides a one semester preparation for calculus while presenting an introduction to mathematical modeling. Topics include: linear, quadratic, exponential, and trigonometric models. Prerequisite: a C- or better in L.MAT-114 or placement into L.MAT 117. 4 credits.

LMAT-150: Calculus of One Variable I-FM
A study of the basic concepts and techniques of analytic geometry, differential and integral calculus of functions of one variable, and applications to calculus-based models. Prerequisite: Demonstrated competency in L.MAT-117 or equivalent or placement into L.MAT 150. 4 credits.

LMAT-160: Calculus of One Variable II
Further study of the integral calculus of functions of one variable and an introduction to sequences, series, and differential equations. Prerequisite: L.MAT-150 or equivalent. 4 credits.

LMAT-220: Introduction to Probability & Statistics-QR
A study of the fundamental techniques used in descriptive statistics as applied to real-world data and the processes associated with the design and analysis of experiments; application of theories from calculus to the construction of cumulative distributions for continuous random variables and computation of associated probabilities, expected values and variances. Prerequisites: L.MAT-150, and one of L.MAT-160, L.CSC-115, or L.EGR-116. 3 credits.

LMAT-230: Discrete Mathematics
This course introduces the ideas and methods of logic and proofs. Topics include: set theory, logic, functions, proof types and elementary number theory. Prerequisite: L.MAT 150 and one of L.MAT-160, L.CSC-115, or L.EGR-116 (these last three can be taken as a co-requisite). 4 credits.
L.MAT-250: Linear Algebra
A course which introduces abstract vector spaces, matrices and linear transformations. Prerequisite: L.MAT-150 and one of L.MAT-160, LCSC-115, or LEGR-116 (these last three can be taken as co-requisite). 3 credits.

L.MAT-260: Analytic Geometry & Calculus III
A study of partial differentiation and multiple integration, elementary vector analysis and applications of these concepts. Prerequisite: L.MAT-160 or placement into L.MAT-260. 4 credits.

L.MAT-310: Ordinary Differential Equations
Theory, solution and applications of ordinary differential equations including Laplace transform methods. Prerequisite: L.MAT-160. 3 credits.

L.MAT-370: Numerical Analysis
A study of some of the standard numerical algorithms used to solve real-world problems arising in engineering and the sciences, and use of a computer to implement these algorithms; pitfalls in computation, error analysis, solving linear systems, interpolation and approximation. Prerequisites: L.MAT-160 and LCSC-115. 3 credits.

L.MAT-380: Modern Geometry
Both Euclidean and non-Euclidean geometries are studied from an axiomatic viewpoint. Traditional high school geometry concepts are presented in a rigorous fashion so as to expand one’s depth of understanding of traditional geometry. Prerequisite: L.MAT-230 or permission of the instructor. 3 credits.

L.MAT-391: Guided Research
A course where students experience and learn mathematics beyond that contained in usual coursework. Participants carry out research in an area of mathematics of interest to them with a faculty mentor. Each student gives at least one presentation on their topic and make definite progress toward the completion of the senior paper and presentation. Prerequisite: L.MAT-260, and 230; L.MAT-250 can be taken as a co-requisite. 1 credit (may be repeated).

L.MAT-390: Mathematics Seminar
A course where students experience and learn mathematics beyond that contained in usual coursework. Participants carry out research in an area of mathematics of interest to them with a faculty mentor. Each student gives at least one presentation on their topic and make definite progress toward the completion of the senior paper and presentation. Prerequisite: L.MAT-260, and 230; L.MAT-250 can be taken as a co-requisite. 1 credit (may be repeated).

L.MAT-450: Modern Algebra
A course which covers basic ideas on groups, rings, integral domains, fields, and polynomials over a field. Prerequisite: L.MAT-230, and L.MAT-250 can be taken as a pre-requisite or co-requisite, or permission of instructor. 3 credits.

L.MAT-460: Real Analysis
Further work in calculus, including the properties of the real number system, limits and continuity, differentiation and integration, sequences and series. Prerequisite: L.MAT-160 or 170, and L.MAT-230 (or permission of instructor); L.MAT-250 can be taken as a pre-requisite or co-requisite. 3 credits.

L.MAT-490: Math Portfolio-PJ
Students will assemble a portfolio that provides evidence of appreciable growth in their understanding of mathematics, and reflect on the relevance of the Loras College dispositions and lifelong learning skills to their development in the major and as a person. This course satisfies the general education portfolio requirement. Prerequisite: Declared Mathematics major, completion of three of the five advanced general education courses, L.MAT-230, 250, and 260, L.MAT-391 or at least two semesters of L.MAT-390. 1 credit.

L.MAT-495: Topics in Mathematics
Selected topics of current interest to students. Prerequisite: Permission of instructor. Credits arranged.
Loras College Mathematics Degree Requirements:

The mathematics major allows students to tailor their major to their goals and careers after graduation.

A minimum grade of a C (2.000) received in each of Reqs 1 through 5, and average of a C (2.000) in all courses applied to the student’s major is required. All majors must also take L.MAT-490, the capstone experience for mathematics majors in which students produce a portfolio linking experiences obtained in their major with the general education curriculum (the exception for students receiving licensure at the secondary level from the Education division is that they will take L.EDU-490 in place of L.MAT-490). Requirements #1-6 identified below comprise the mathematics core.

A minimum grade of C- is required in each course for the minor.

Requirements for the major in Mathematics (B.S.):

<table>
<thead>
<tr>
<th>Req</th>
<th>Course</th>
<th>Cr's</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>L.MAT-150: Calc of One Variable I</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>L.MAT-160: Calc of One Variable II</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
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<td>4</td>
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<tr>
<td>4</td>
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<td>3</td>
</tr>
<tr>
<td>5</td>
<td>L.MAT-260: Analytic Geometry and Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>LCSC-115: Introduction to Programming</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one from Req 7

7   LCSC-225: Data Structures & Algorithms | 4
7   LPHY-223: Physics Scientist/Engineers I-QR | 5
7   LEDU-353: Special Sec Methods: Mathematics | 3

Select either all three of Req 8a, or Req 8b

8a  L.MAT-390: Seminar                  | 1
8a  L.MAT-390: Seminar                  | 1
8a  L.MAT-390: Seminar                  | 1
8b  L.MAT-391: Guided Research          | 3

Select four from Req 9a-9b; of those, at least one from 9b

9a  L.MAT-220: Introduction to Probability & Statistics-QR | 3
9a  L.MAT-310: Ordinary Differential Equations | 3
9a  L.MAT-370: Numerical Analysis           | 3
9a  L.MAT-380: Modern Geometry              | 3
9a  L.MAT-395: Topics                      | 3
9b  L.MAT-450: Modern Algebra              | 3
9b  L.MAT-460: Real Analysis               | 3
9b  L.MAT-495: Topics                      | 3
10  L.MAT-490: Mathematics Portfolio       | 1

42 to 44 total required credits

Requirements for the minor in Mathematics:

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</tr>
<tr>
<td>3</td>
<td>L.MAT-220+: Additional L.MAT</td>
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<tr>
<td>5</td>
<td>L.MAT-220+: Additional L.MAT</td>
<td>3</td>
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</tbody>
</table>

18 total required credits