MATHEMATICS
The primary objective of the Mathematics program is to provide an appropriate mathematical background to all University students, focusing on the ability to think critically and solve problems through oral and written communication, in order to foster quantitative literacy.

In addition, the Mathematics program is designed to:

- Provide Mathematics majors with the basic undergraduate mathematical knowledge necessary for graduate studies, a teaching career or a variety of statistical or business careers.
- Provide Science and professional majors with the mathematical and statistical background for their fields and highlight the wide applicability of mathematics.
- Provide Business majors with a foundation in finite mathematics, statistics, and calculus and demonstrate the relevance of mathematics to increasing complexities of the business world.
- Provide Liberal Arts majors with an introduction to mathematical ideas and promote an appreciation and understanding of the important role of mathematics.

The strengths of the department include small class sizes in developmental and major courses, emphasis on student/faculty interaction and classroom and online instruction utilizing relevant software and technology.

Sacred Heart University is an institutional member of the Mathematical Association of America, as well as the American Mathematical Society.

Faculty
BERNADETTE BOYLE, PH.D.
Assistant Professor
ROSEMARY DANAHER, M.S., M.B.A.
Instructor
HEMA GOPALAKRISHNAN, PH.D.
Associate Professor
GEORGE GOSS, M.S.
Instructor
ANDREW LAZOWSKI, PH.D.
Assistant Professor
PETER THOTH, PH.D.
Professor
JASON MOLITIENRO, PH.D.
Associate Professor, Chair
PHANI PAPACHRISTOS, M.S.
Instructor
JULIANNA STOCKTON, PH.D.
Assistant Professor
MICHAEL WARD, M.S.
Instructor

Major in Mathematics
The Mathematics major requires the completion of 43 mathematics credits plus a two-semester sequence of supporting courses.

REQUIRED COURSES
MA 151 Calculus I
MA 152 Calculus II
MA 253 Calculus III
MA 261 Linear Algebra
MA 301 Mathematical Structures and Proofs
MA 331 Probability and Statistics I
MA 362 Abstract Algebra
MA 371 Real Analysis
MA 398 Senior Seminar in Mathematics

**ELECTIVES**
In addition to the required courses, the Mathematics major must choose four additional mathematics courses numbered 250 or above.

**REQUIRED SUPPORTING COURSES**
The Mathematics major must choose one of the following two-semester course sequences:

- **Biology**
  BI 111/113 & BI 112/114

- **Chemistry**
  CH 151/153 & CH 152/154

- **Physics**
  PY 111/113 & PY 112/114

- **Economics**
  EC 202 & EC 203

- **Computer Science**
  CS 111 & CS 112

**Minor in Mathematics**
The minor in Mathematics requires the completion of the following 18 credits:

**REQUIRED COURSES**
MA 151 Calculus I
MA 152 Calculus II

**ELECTIVES**
In addition to the required courses, the Mathematics minor must choose three additional mathematics courses numbered 250 or above, at least one of which must be MA 253 or MA 261.

**Associate in Arts General Studies**

**REQUIREMENTS (16 CREDITS)**
MA 151 Calculus I
MA 152 Calculus II
MA 253 Calculus III
MA 261 Linear Algebra

**Course Descriptions**
† Elective Core Course

**†MA 101 Modern College Mathematics**
3 CR
Intended for the liberal arts major, the goal of this course is to give students an understanding of the wide variety of ideas in contemporary mathematics. Topics may include set theory, finite mathematical systems, number theory, symbolic logic, graph theory, voting theory and the art of problem solving.
Prerequisite: Placement by Mathematics Department

**†MA 105 Mathematical Applications for Health Sciences**
3 CR
Designed exclusively for Nursing students. Topics include college-level algebra, graphing, basic trigonometric functions and appropriate applications for the health sciences. It is a problem-solving approach to mathematics.
Prerequisite: Placement by Mathematics Department

**†MA 106 College Algebra**
3 CR
This is one-semester course is designed to improve algebraic skills. Topics include:
functions, equations and inequalities in one variable; linear, quadratic, polynomial and rational functions, exponential and logarithmic functions; systems of linear equations in two variables. Algebraic techniques and applications are stressed.

Prerequisite: Placement by Mathematics Department

†MA 107 Mathematics for Elementary School Teachers
4 CR
This one-semester course is designed specifically for students planning to teach at the elementary school level. Topics include geometry, measurement, rational numbers, ratio, proportion, percents, problem solving, mathematical reasoning and connections, probability and statistics.

Prerequisite: Placement by Mathematics Department

†MA 109 Mathematics for Decision Making
3 CR
Designed specifically for the Business major. Focus is on linear functions, systems of equations, matrices, probability and linear programming.

Prerequisite: Placement by Mathematics Department

†MA 110 Calculus for Decision Making
3 CR
Designed specifically for the Business major. Includes study of limits; differentiation of algebraic, exponential and logarithmic functions; integration; and applications of calculus.

Prerequisite: MA 109 or placement by Mathematics Department

†MA 131 Statistics for Decision Making
3 CR
This course is geared towards liberal arts, science and health science majors. It introduces descriptive statistics, probability distributions: both discrete and normal, confidence intervals, hypothesis testing and correlation. Real world applications are offered and computer statistical software may be used.

Prerequisite: One college-level Mathematics course or placement by Mathematics Department

MA 132 Biostatistics
3 CR
This course is designed for the biologist or health science major who will be engaged in research involving statistical methods and/or will be required to critically evaluate existing research. Topics include sampling techniques, data types, data collection methods, probability, discrete and continuous probability distributions, confidence intervals and hypothesis testing. All topics are covered utilizing biological data.

Prerequisite: One college-level Mathematics course or placement by Mathematics Department

†MA 133 Business Statistics
3 CR
This course is geared towards business majors. It introduces descriptive statistics, probability distributions: both discrete and normal, confidence intervals, hypothesis testing, linear regression and correlation analysis. Business applications are offered and Excel may be used.

Prerequisites: One college-level Mathematics course or placement by Mathematics Department

†MA 140 Precalculus
4 CR
Addresses the algebra of functions, polynomial and rational functions, exponential and logarithmic functions and trigonometric functions, including analytical trigonometry.

Prerequisite: C or better in MA 106 or placement by Mathematics Department
†MA 151 Calculus I
4 CR
Explores limits and approximation, differential and integral calculus of the elementary algebraic and transcendental functions, applications of differentiation and integration.
Prerequisite: C or better in MA 140 or placement by Mathematics Department

†MA 152 Calculus II
4 CR
Covers applications and methods of integration, inverse trigonometric functions, improper integrals, sequences and series, parametric representation and polar coordinates.
Prerequisite: C or better in MA 151 or placement by Mathematics Department

MA 199 Special Topics in Mathematics
3 CR
Designates new or occasional courses on a timely topic or a faculty member’s particular interest. Course title is shown on student’s transcript. Consult the current course schedule for available topics and current prerequisites.

MA 211 Geometry for Educators
3 CR
Designed especially for students interested in education. This course introduces the student to the study of an axiomatic system and to an introduction to proof writing. It includes the study of Euclidean Geometry, non-Euclidean Geometry and Analytic Geometry. Geometers’ Sketchpad will also be used and demonstrated throughout the course as appropriate.

†MA 253 Calculus III
4 CR
Introduces three-dimensional analytic geometry, multivariable calculus, real-valued functions of several variables, limits and continuity, partial derivatives, multiple integration and vector calculus.
Prerequisite: C or better in MA 152

MA 261 Linear Algebra
4 CR
Focuses on matrix theory, systems of linear equations, linear transformations, vector spaces and subspaces, determinants, eigenvalues, inner product spaces and orthogonality.
Prerequisite: C or better in MA 152

MA 280 History of Mathematics
3 CR
This course considers the evolution of mathematical ideas over time and the context in which these ideas developed, in various civilizations around the world. Students will gain an understanding of the process of development of mathematical ideas, awareness that it is an ongoing and creative process and a deeper understanding of mathematical topics by pushing beyond the traditionally presented “polished form” we see in today's textbooks. Selection of topics varies by semester.
Prerequisite: C or better in MA 152 or permission of the department chair

MA 299 Special Topics in Mathematics
3 CR
Designates new or occasional courses on a timely topic or a faculty member’s particular interest. Course title is shown on the student’s transcript. Consult the current course schedule for available topics and current prerequisites.

MA 301 Mathematical Structures and Proofs
3 CR
Introduces students to the understanding and creation of rigorous mathematical arguments and proofs. Includes methods of proof, set theory, relations and functions, properties of the integers, real and complex numbers and polynomials.
Prerequisite: Sophomore standing and C or better in MA 152

**MA 314 Geometry and Topology**  
3 CR  
This course covers advanced theories of Euclidean geometry and introduces non-Euclidean geometries such as spherical and hyperbolic. Basic topology is also introduced. Writing mathematical proofs will be an essential part of this course.  
Prerequisite: C or better in MA 301.

**MA 320 Graph Theory**  
3 CR  
Focuses on structures and properties of graphs and their applications. Topics include: traversability, trees, connectivity, network flow, graph coloring, chromatic number and planarity. Discussion of application of graph theory to computer science, transportation, scheduling, communication, chemistry and a variety of other fields. Writing mathematical proofs will be an essential part of this course.  
Prerequisite: C or better in MA 301

**MA 325 Number Theory**  
3 CR  
This course is designed to give students a basic understanding of the properties of numbers, mainly the integers and rational numbers and their applications. Topics covered include primes and divisibility, congruence modulo n, Euler’s Phi function and continued fractions. Applications discussed include check digit schemes and cryptology. Writing mathematical proofs will be an essential part of this course.  
Prerequisite: C or better in MA 301

**MA 331 Probability and Statistics I**  
3 CR  
Addresses probability, discrete random variables and their distributions, mathematical expectations, sampling distributions and multivariate distributions.  
Prerequisite: C or better in MA 152

**MA 332 Probability and Statistics II**  
3 CR  
Addresses statistics with an emphasis on the underlying mathematical theory. Topics include point estimation and its properties, interval estimation, correlation, regression and hypothesis testing involving parametric as well as non-parametric methods.  
Prerequisites: MA 253 and MA 331

**MA 354 Differential Equations**  
3 CR  
Focuses on equations involving functions and one or more of its derivatives. Examines first-order differential equations, numerical and qualitative techniques for solving differential equations, linear systems, geometry of linear systems and applications to forcing/resonance. If time permits, the course will address the Laplace Transform, convolutions and advanced numerical methods for solving differential equations.  
Prerequisite: C or better in MA 152

**MA 362 Abstract Algebra**  
3 CR  
Explores algebraic systems, group theory, quotient structures, isomorphism theorems, ring theory and ideals, as well as integral domains and fields. Writing mathematical proofs will be an essential part of this course.  
Prerequisite: C or better in MA 301

**MA 371 Real Analysis**  
3 CR  
Addresses real numbers, cardinality, metric spaces, convergence, topology, continuity, differentiability and Riemann integration. Writing mathematical proofs will be an essential part of this course.  
Prerequisites: C or better in MA 301
MA 372 Complex Analysis
3 CR
Examines the algebra and geometry of complex numbers, analytic functions, integration, Taylor and Laurent series, contour integration and conformal mapping.
Prerequisite: MA 253

MA 398 Senior Seminar
3 CR
Capstone course for the mathematics major. Each student works on a research project leading to an oral presentation and the writing of a formal paper.
Prerequisite: Senior standing