# **MATHEMATICS (MT)**

## MT-123 College Algebra (3 credits)

The student develops conceptual understanding of algebra as a language to model real-world problems together with algebraic skills to solve those problems. Students develop competence in algebra skills related to solving equations and graphing in the Cartesian plane and study elementary functions and their graphs (including polynomial,rational, exponential, and logarithmic functions). Students develop analytic and problem-solving abilities while working to formulate and solve problems, applying skills to solve standard and novel mathematical problems. *Prerequisite(s)*: MP Level 1 or higher or QL-122 completed.

### MT-124 Trigonometry (2 credits)

The student learns to use the right triangle and unit circle definitions of trigonometric functions, together with their graphs, to reason about the behavior of the functions and solve applied problems. Students develop analytic and problem-solving abilities using trigonometric functions to model realistic periodic phenomena.

Prerequisite(s): MP level 1 or higher or QL-122 completed.

## MT-148 Functions & Modeling (3 credits)

Offered Spring Term & Summers only. The student builds on their previous algebra knowledge (solving equations, elementary functions and their graphs)to develop deeper knowledge of mathematical functions and to use them to crate quantitative models of phenomena in science, business, and everyday life. Emphasis is placed on the use of technology tools to understand, use, and apply the function concept. Problem-solving and analytical abilities are developed throughout the work of the course. This course prepares the science or mathematics major for calculus. For the elementary education student pursuing a mathematics support, this course helps her to integrate her algebra knowledge and serves as the bridge to further mathematics courses.

Prerequisite(s): MT-123 completed or Math placement level 2 or higher.

## MT-152 Calculus 1 (4 credits)

The student studies functions and their rates of change in the context of applied problems, using the ideas and techniques of differential calculus. Topics include derivatives of elementary functions (polynomial, exponential, rational, logarithmic, trigonometric) and their compositions in a variety of representations (graphical, numeric, and symbolic); limits; differential equations as mathematical models for changing phenomena; and antidifferentiation. The student develops her problem-solving, analytic, and communication skills by working both independently and collaboratively to understand, formulate, and solve problems from a variety of disciplines such as physics, chemistry, biology, social science, and management. Computers and calculators are used as tools to computation, communication, and exploration of mathematical ideas. *Prerequisite*(s): MT-148 completed or MP Level 3 or higher.

#### MT-212 Business Math (3 credits)

In every aspect of business, numbers tell a story. They are critical to understand the context of a business situation and to know how to use them when solving problems and making decisions. In this course, students will be introduced to common mathematical concepts necessary to analyze and solve different business problems throughout an organization. Such concepts as basic mathematical modeling, reasoning and logic, data relationships and statistical analysis will be applied in different business contexts. Students will use technology to apply the mathematical concepts for solution. They will learn various methods to strengthen their understanding of the numbers and data through the study of the language, developing visualization techniques, and performing relationship diagrams to be able to tell the story with the numbers and data in their solutions. Students will begin to understand how quantifying their decisions strengthens the validity of those decisions along with their own credibility as a professional. Prerequisite(s): QL-156

#### MT-221 Discrete Structures & Algorithms (3 credits)

Course Offered Fall Term only. The student explores the mathematics of discrete finite systems, employing algorithms for problem solving in these systems. Topics include set theory, equivalence relations, congruence relations, graph and tree theory, combinatories, logic, and recurrence relations. Coursework integrates an introduction to a variety of mathematical proof techniques, including proof by mathematical induction.

Prerequisite(s): MT-123 completed or Math Placement Level 2 or higher.

### MT-253 Calculus 2 (4 credits)

The student extends their knowledge of calculus by exploring the ideas and techniques of integral calculus. Topics include differential equations as mathematical models of changing phenomena, the definite integral and its standard applications, techniques of antidifferentiation, Taylor polynomial approximations, improper integrals, and representations of functions by infinite series. The student builds knowledge and skill using technology tools to solve problems. *Prerequisite(s):* MT-152

## MT-254 Calculus 3 (4 credits)

Offered Fall Term only. The student studies the calculus of multivariate functions with emphasis on functions of two independent variables and their three-dimensional graphs. Further topics include parametric equations; conic sections; polar, cylindrical, and spherical coordinate systems; the calculus of vectors and vector-valued functions; multiple integrals; and line integrals. Students continue to develop analytic and problem-solving abilities, working purposefully on generalization skills, algorithm and formula development, and understand and apply theorems. In individual and group work, students solve applied problems that arise from the areas of physics, chemistry, biology, management, and mathematics itself.

Prerequisite(s): MT-253 completed or Math Placement Level 4.

## MT-255 Linear Algebra (4 credits)

The student studies the mathematics of matrix algebra; the structure and operations of vector spaces, including use of determinants, eigenvalues, and eigenvectors; and linear transformations. Students learn the basic concepts and computational procedures associated with these structures, including the use of computer and calculator technology. Linear algebra is applied to problems in areas including linear programming, graph theory, theory of games, least squares regression, linear economic models, traffic flow, and scheduling. *Prerequisite*(s): MT-152 MT-148 or MP-3

# MT-256 Probability and Statistics (4 credits)

The student engages in the systematic collection, presentation, and characterization of statistical information for the purpose of decision making. Students develop the mathematical skills and knowledge necessary for problem solving in statistical contexts. Both descriptive and inferential statistics are studied. Knowledge of the mathematics of probability support conceptual understanding of statistical methods. Data analysis, graphical representation, correlation, regression, and reliability and validity issues are considered. Technology tools are used.

## MT-260 Introduction/Mathematical Problem Solvng (2 credits)

Offered Fall term only. Students will work together to solve various open ended problems. Through this problem solving process, they will develop sophisticated ways to solve challenging problems. *Prerequisite*(s): QL-156 or MP-1 completed.

## MT-268 Intro to Python Programming (4 credits)

Offered Fall term only. This course teaches the programming language Python. It was created to solve real world problems, but, at the same time, be easy to learn and use. Python is designed to process large amounts of data where critical understanding of the latest research can be found, whether it be in Chemistry, Biology, or Business Analytics. It is considered the best programming language choice for computational chemistry, an essential part of the tool kit for biologists of all types, and as the language with the flexibility and speed needed for business analytics to make sense of big data and answer business' most important guestions.

## MT-297 Independent Study (1 credit)

Under the approval and direction of a faculty member, independent study is available to students.

# MT-301 Communication (0 credits)

This required interactive course prepares participants for clinical practice by providing an opportunity to learn and practice skills in an interprofessional environment. Students will practice interprofessional communication in a simulated health care team to prepare for actively contributing to enhanced patient safety and attainment of quality outcomes in the practice setting.

## MT-340 History of Mathematics (2 credits)

Offered Spring Term only. The student studies the history of mathematics as it is embedded in the development of world cultures. Contemporary mathematical events and trends are placed in historical context. The student spends significant time analyzing problem-solving methods and using them to solve problems from given times and cultures. *Prerequisite(s):* This class will be offered online remote synchronous.

## MT-345 College Geometry (3 credits)

In this course, the student works with Euclidean geometry in two dimensions and uses visualization, spatial reasoning, and geometric modeling to solve problems. Technology tools are employed to explore ideas and generate conjectures, leading to mathematical proofs. *Prerequisite(s):* MT placement Level 3 or higher or MT Majors: MT-152 completed. For MTM or MTE supports: MT-148 & MT 244 completed., Offered in Fall in even numbered years.

## MT-347 Modern Algebra (3 credits)

Course Offered Fall Term alternate years only. The student learns to identify abstract algebraic structures such as groups, rings, and fields and to use their defining axioms. Students explore the properties of these systems and examine others, applying the properties. Foundational work involves sets, mappings, and relations. The student gains experience reading and applying theorems, examining proofs for understanding, and constructing individual proofs.

*Prerequisite(s):* MT-253 completed or Math Placement Level 4 completed. , Offered in Fall in odd numbered years.

## MT-350 Differential Equations (3 credits)

The student learns about differential equations as descriptions of changing phenomena. Students study solutions from several perspectives, surveying basic analytic methods for solving differential equations, learning to use graphical and qualitative approaches to analyze behavior of solutions, and using the computer to obtain numerical solutions. Students work to interpret mathematical results in realistic contexts.

*Prerequisite(s):* Math Placement level 4 or MT-253 completed., Offered in Spring in odd numbered years.

## MT-354 Machine Learning (3 credits)

MT-355 Probability (3 credits)

## MT-356 Advanced Statistics (3 credits)

## MT-368 Think Like A Data Scientist (4 credits)

Offered Spring term only. This course introduces students to the discipline of Data Science that focuses on the processes and systems that enable us to extract knowledge or insight from data in various forms and translate it into action. Students are taught the importance of gathering, cleaning, normalizing, visualizing, and analyzing data to drive informed decision-making, no matter the field of study. Students will learn to use a combination of tools and techniques, including spreadsheets, SQL and Python to work on real-world datasets using a combination of procedural and basic machine learning algorithms. They will also learn to ask exploratory questions and develop metrics demonstrating the ability to draw effective conclusions and interpretations to drive decision-making action.

*Prerequisite(s):* MT-268 or equivalent computer programming course.

## MT-374 Math Assessment in Effective Citizenship (0 credits) Mathematics Assessment in Effective Citizenship

Prerequisite(s): MT Major; Effective Citizenship Level 3 completed.

## MT-390 Capstone Data Science Support Project (3 credits)

This course is the culmination of the Data Science Minor. Students will complete a data science project, as applied to their field of study or interest, integrating their knowledge from Python programming, data science, probability and statistics, and machine learning. The student will choose their application domain and datasets from their field and determine an initial set of research questions they want answered using that data. The student will use the Data Science Pipeline framework across this project. Choice of datasets and research questions must be endorsed by the instructor to make sure that the datasets are sufficiently complex and the questions are substantive so the analysis will require the application of the methods and techniques introduced in the previous courses in the minor. This includes exploratory data analysis through data visualization, numerical summaries, statistical inference, and machine learning modeling, as well as interpretations of these results in the context of the data and the research questions. The project will end with the student providing a written report and oral presentation, where the student will tell the story of what the data says and explain what techniques were used to support their description. Prerequisite(s): MT-354

#### MT-399 Formal Introduction to Advanced Work (0 credits)

The Advanced-Level Event marks a significant accomplishment as each student proceeds into the work of the major department. When a department determines that a student is ready for advanced work within a discipline, the student is invited to participate in a ceremony that is both a celebration and an explanation of future requirements of the major and support areas. Students register for this experience at a point determined by the major department: for most majors the registration is connected to the taking of a particular course. Students and faculty gather for an afternoon during Mid-semester Assessment Days. Following a general program, students meet in departmental sessions with their faculty to discuss advanced outcomes, department courses, advising procedures, and so on. *Prerequisite(s):* MT-253

#### MT-445 Advanced Topics-Math Elementary Tchg (3 credits)

Course Offered Fall Term only. The mathematics education student develops an in-depth understanding in the area of algebraic thinking, with emphasis given to proportional reasoning. Other middle-school mathematics topics, such as geometry in two and three dimensions and probability and statistics, may be studied. The historical development of the elementary and middle school curriculum is examined, with emphasis on the teaching, learning, and assessment processes highlighted in local, state, and national standards documents.

*Prerequisite(s):* Praxis 1/Core, MT 243 & MT 244 completed. MT-148 or Math placement Level 3 or higher completed.

## MT-449 Mathematical Portfolio (1 credit)

Students will prepare a portfolio that demonstrates that they have met the outcomes for the mathematics major. Students will meet with the mathematics faculty to discuss their portfolio. Taken by Mathematic Majors in their second to last semester. Independent portfolio, no scheduled meeting.

#### MT-460 Introduction to Real Analysis (3 credits)

Offered Spring Term in alternate years. In this course, the student studies functions of real variables from an advanced viewpoint. Students examine the concepts of sequence, limit, continuity, and derivative in a mathematically rigorous setting. Students gain experience in mathematical thinking and writing, developing an appreciation of the nature and role of mathematical proof.

Prerequisite(s): Math Placement Level 4 or MT-253 completed.

## MT-490 Capstone Data Science Project (3 credits)

This course is the culmination of the Data Science Major. Students will complete a data science project, as applied to their field of study or interest, integrating their knowledge from Python programming, data science, probability, advanced statistics, machine learning, calculus, discrete structures and algorithms, database systems, and linear algebra, as applied to their field of study or interest. The student will choose their application domain and datasets from their field and determine an initial set of research questions they want answered using that data. The student will use the Data Science Pipeline framework across this project. Choice of datasets and research questions must be endorsed by the instructor to make sure that the datasets are sufficiently complex and the guestions are substantive so the analysis will require the application of the methods and techniques introduced in the previous courses in the major. This includes exploratory data analysis through data visualization, numerical summaries, advanced statistical and probability inference, machine learning modeling, calculus techniques, discrete structures and algorithms, database skills, and linear algebra knowledge and techniques, as well as interpretations of these results in the context of the data and the research questions. The project will end with the student providing a written report and oral presentation, where the student will tell the story of what the data says and explain what techniques were used to support their description.

Prerequisite(s): MT-354, MT-356, MT-355

#### MT-491 Mathematics Seminar: Probability (2-4 credits)

Students will explore topics in discrete and continuous probability. *Prerequisite(s):* MT-123 MT-256 or MGT-250 or BSC-257 or Math Placement level 2 completed.

## MT-492 Senior Seminar (2 credits)

Senior Seminar in Math

## MT-497 Independent Study (4 credits)

Under the approval and direction of a faculty member, independent study is available to students.