

# MATHEMATICS (MATH)

## Courses

MATH 109 Precalculus Algebra Fundamentals Credits: 2

This course is required for students not meeting full placement requirements for MATH 110 (Precalculus Algebra) in order to concurrently enroll in MATH 110. Fundamental topics and skills that are necessary for success in MATH 110 will be developed in close alignment with the material covered in MATH 110 over the course of the semester. Students enrolling in this co-requisite course must remain enrolled in both courses for the semester. Students will not be permitted to withdraw from one of the courses (either MATH 109 and MATH 110) and not the other. Grades are not counted toward GPA. Does not count toward graduation.

**Prerequisites:** ALEKS Score of 35 or higher; or MyMathTest Intermediate Algebra Score of 50% or higher; or ACT Math Sub-score of 18 or higher; or SAT Math Sub-score of 500 or higher.

**Co-requisites:** MATH 110.

MATH 110 Precalculus Algebra Credits: 3

This course is designed to prepare students to take courses, such as trigonometry and calculus, in which algebraic reasoning is required. Topics of study include the foundational concepts of functions and their graphs, use and analysis of linear, exponential, polynomial, and rational functions, and solving systems of equations and inequalities.

**Prerequisite:** ALEKS Score of 51 or higher; or MyMathTest Intermediate Algebra Score of 70% or higher; or ACT Math Sub-score of 22 or higher; or SAT Math Sub-score of 540 or higher; or concurrent enrollment in MATH 109; or completion of three or more units of high school Algebra I and higher mathematics courses and a high school GPA of 3.0 or higher.

MATH 110 - MOTR MATH 130: Pre-Calculus Algebra



MATH 116 Mathematics For Liberal Arts Credits: 3

A survey of elementary mathematics covering such topics as: logic, sets, counting methods, introduction to probability theory, introductory statistics, plane and coordinate geometry. The course will emphasize mathematical concepts and does not require the level of computational skill of College Algebra. Topics from the history of mathematics will be presented as well as the influence of mathematics on a variety of disciplines. Recommended preparation: Three units of high school mathematics Algebra I and higher.

MATH 116 - MOTR MATH 120: Mathematical Reasoning Modeling



MATH 120 Precalculus Credits: 5

This course combines the content of the courses Math 110 (Precalculus Algebra) and Math 125 (Trigonometry), to serve as a complete prerequisite for calculus courses as required in STEM fields and other areas such as advanced finance. Topics include the foundational concepts of functions, use and analysis of linear, exponential, polynomial, and rational functions, and solving systems of equations and inequalities, and trigonometric functions and their relationships to geometry and periodic phenomena. Credit will be given for either MATH 110 or MATH 120, and for either MATH 120 or MATH 125.

**Prerequisites:** ALEKS Score of 56 or higher; or MyMathTest College Algebra Score of 60% or higher; ACT Math Sub-score of 24 or higher; or SAT Math Sub-score of 580 or higher.

MATH 120 - MOTR MATH 150: Pre-Calculus



MATH 125 Trigonometry Credits: 2

This course studies the tapestry of trigonometric functions and their interrelationships, from their genesis in right triangles through their critical applied interpretation as periodic functions in the plane. Credit will be given for either MATH 120 or MATH 125.

**Prerequisites:** MATH 110 with a grade of C- or higher; or ALEKS Score of 63 or higher; or MyMathTest College Algebra score of 70% or higher; or ACT Math Sub-score of 28 or higher; or SAT Math Sub-score of 660 or higher.

MATH 206 Brief Calculus And Matrix Algebra Credits: 3

Brief review of selected topics in algebra. Introduction to matrix algebra. Introduction to differential calculus and optimization. Applications to problems in business.

**Prerequisites:** MATH 110 with a grade of C- or higher; or MATH 120 or higher with a grade of C- or higher; or ALEKS Score of 63 or higher; or MyMathTest College Algebra score of 70% or higher.

**MATH 210 Calculus I Credits: 4**

This course introduces the theory of calculus for functions of one variable, with focus on rational, trigonometric, exponential and logarithmic functions. The central object of study is the concept of derivative of a function and its applications, and is followed by an introduction to the theory of integration, with applications to area and rectilinear motion.

**Prerequisites:** MATH 120 with a grade of C- or higher; or both MATH 110 and MATH 125 both with a grade of C- or higher; or ALEKS score of 76 or higher; or MyMathTest Pre-Calculus Score of 70% or higher.

**MATH 220 Calculus II Credits: 4**

This is a second course in the calculus of functions of one variable. It continues to develop the theory of integration introduced in the first course, addresses physical applications, and covers the topic of infinite series, including power series. The theory of calculus is further studied in the context of parametric equations and polar coordinates.

**Prerequisites:** MATH 210 or MATH 216 or MATH 266.

**MATH 250 Calculus III Credits: 4**

This is the third and final course of a standard three-semester calculus sequence. It covers solid analytic geometry, multiple-variable and vector-valued functions, partial derivatives, Lagrange multipliers, multiple integrals, Jacobians, line and surface integrals, Green's Theorem, the Divergence Theorem, and Stokes' Theorem.

**Prerequisites:** MATH 220 or MATH 268.

**MATH 266 Accelerated Calculus I Credits: 4**

An accelerated first course in calculus focusing on application of differential calculus and basic vector and matrix calculations. Enrollment in this course requires permission from the School of Science and Engineering.

**Prerequisites:** MATH 120 with a grade of B or higher; or both MATH 110 MATH 125 with a grade of B or higher; or ALEKS assessment score of 76% or higher.

**MATH 268 Accelerated Calculus II Credits: 3**

An accelerated second course in calculus focusing on application of integral calculus, analytic geometry, and vector analysis.

**Prerequisites:** MATH 266; School of Science Engineering Student.

**MATH 300 Linear Algebra I Credits: 3**

This course introduces a branch of algebra developed from the theory of finding simultaneous solutions of a collection of linear equations, emphasizing fundamental concepts, calculations, and applications. Topics include matrix algebra, real vector spaces, linear transformations, determinants, the study of eigenvalues and eigenvectors, and the exploration of orthogonality and other applications.

**Prerequisites:** MATH 250, (or MATH 220 and COMP-SCI 191).

**MATH 301 On Solid Ground: Sets and Proof Credits: 3**

This course is a transition from procedural mathematics, such as calculus, to advanced mathematics where proofs are the professional language of discourse. It covers basic set theory and logic, relations and functions, and how to analyze, construct, and write clearly reasoned, well-structured elementary proofs using universal techniques. This course satisfies a state requirement for teacher certification.

**Prerequisites:** MATH 220.

**MATH 314 Graph Theory with Applications Credits: 3**

This course is an introduction to the theory of graphs as mathematical models that encode relationships among data coming from real-world problems.

**Prerequisites:** MATH 301 or COMP-SCI 191.

**MATH 345 Ordinary Differential Equations Credits: 3**

Students will study first order equations, linear second order differential equations, Taylor series and power series solutions, Laplace transforms, elementary systems of differential equations, numerical methods, and Fourier series and boundary value problems.

**Prerequisites:** MATH 250.

**MATH 345L Ordinary Differential Equations Lab Credit: 1**

This laboratory will enable the students to numerically solve first order, second order and systems of ordinary differential equations. Topics include Curve Fitting, Parameter Estimation, Numerical Solutions of Initial and Boundary Value Problems, and Model Specification.

**MATH 401 Data-Driven Modeling Credits: 3**

This course explores data-driven modeling techniques based on connections between the system variables with limited assumptions about the system. The main goals are to extract and recognize patterns in data, interpret observations, test validity of assumptions and predict the outcomes.

**Prerequisites:** STAT 340L or STAT 355L or STAT 360L.

**MATH 402 Advanced Analysis I Credits: 3**

The course develops in detail the deep structure of the mathematics underlying the calculus sequence, from the completeness and topology of the set of real numbers, through the study of numerical sequences and series, followed by limits and continuity of real-valued functions of a single real variable, as well as their differentiation and integration.

**Prerequisites:** MATH 301 (with a grade of B- or better).

**MATH 406 Partial Differential Equations Credits: 3**

This course covers basic concepts and methods for solving partial differential equations in science and engineering. Topics include separation of variables, Fourier series and integrals, wave equation, heat equation, potential equation, and Sturm-Liouville theory.

**Prerequisites:** MATH 345 (or E&C-ENGR 241, or MEC-ENGR 272).

**MATH 407 Introduction to Complex Variables Credits: 3**

This course covers fundamentals of functions of a complex variable. Topics include complex numbers, complex differentiation, harmonic functions, Cauchy's Theorem, Cauchy's integral formula, Taylor series and Laurent series, residue calculus and its applications in science and engineering.

**Prerequisites:** MATH 250 and MATH 300 (or MATH 301 or MATH 345 or E&C-ENGR 241 or MEC-ENGR 272) with a grade of B- or better.

**MATH 410 Abstract Algebra Credits: 3**

This course explores the theory and applications of the algebraic structures known as groups and rings. The language of algebraic structures provides a common framework for studying integers, rational and real numbers, modular arithmetic, polynomials, permutations and symmetries.

**Prerequisites:** MATH 300, MATH 301 (with a grade of B- or better).

**MATH 412 Advanced Analysis II Credits: 3**

The course continues the development in detail of the deep structure of the mathematics underlying the calculus sequence begun in MATH 402, expanding to sequences and series of functions, power series, Fourier series, metric and Euclidean spaces, and other topics as time permits.

**Prerequisites:** MATH 402.

**MATH 420 Linear Algebra II Credits: 3**

The topics of Linear Algebra I (MATH 300) are expanded and presented in the context of vector spaces over a field, with rigorous justification. Topics include vector spaces and linear transformations, determinants, eigenvalues and eigenvectors, inner product spaces and orthogonality.

**Prerequisites:** MATH 300, MATH 301 (with a grade of B- or better).

**MATH 434 Scientific Computing Credits: 3**

This course provides an overview of widely used principles and methods in scientific computing. Emphasis will be given to numerical linear algebra and linear optimization for big data analysis. Recommended preparation: MATH 300.

**MATH 464WI History of Mathematics Credits: 3**

This course traces the history of mathematics from Babylonian times through the invention of Calculus, up to set theory and other topics from the nineteenth century. The emphasis is on historically important mathematical ideas, arguments, and primarily proofs as given in original sources (in translation) from around the world.

**Prerequisites:** MATH 301 and ENGLISH 225.

**MATH 469 Mathematical Modeling Credits: 3**

This course introduces analytical and numerical techniques for modeling and analysis of real-world problems in areas such as economics, engineering, biology and physics. It is designed for students with basic knowledge of linear algebra and differential equations. Interdisciplinary modeling projects are the integral part of this course. Recommended preparation: MATH 300 and MATH 345.

**MATH 490 Special Topics Credits: 1-3**

Selected topics in various fields of mathematics. May be repeated for credit when the topic varies.

**MATH 496 Internship/Practical Training in Mathematics or Statistics Credits: 1-3**

This course provides an internship or other practical training arrangement using mathematics or statistics in an industrial, academic or other professional setting. Department approval of internship experience or practical experience required. Repeatable with up to a combined 3 credits toward the major. Recommended preparation: MATH 250.