MATHEMATICS (MATH)

Courses

MATH-015 ARITHMETIC AND PRE-ALGEBRA 3 Credits
Preparation for MATH 023 and MATH 025. Arithmetic with whole numbers, signed numbers, fractions, and decimals. Order of operations, variables, simplifying of algebraic expressions. Concrete representations of arithmetic operations and algebraic concepts are emphasized. Particularly appropriate for students who experience anxiety when learning mathematics. Course fee.

MATH-023 BASIC ALGEBRA FOR MATH AS A LIBERAL ART 3 Credits
Brief review of integer arithmetic, fraction arithmetic, percent and order of operations. Evaluating formulas. Units and unit analysis. Solving equations in one variable and using equations in one variable to solve application problems. Graphing linear equations, intercepts, slope, writing the equation of a line. Introduction to functions. Average rate of change, introduction to linear and exponential models. Simplifying exponential expressions, scientific notation, introduction to logarithms. Introduction to sets, counting methods, and discrete probability. Pre-requisite: A grade of C or better in Math-015 or satisfactory placement score. Course fee.

MATH-025 BASIC ALGEBRA 3 Credits
Brief review of prealgebra. Solving equations and inequalities in one variable; applications. Evaluating formulas; unit analysis. Graphing linear equations, intercepts, slope, writing the equation of a line, introduction to functions. Average rate of change and linear models. Graphing linear inequalities. Systems of linear equations; applications. Exponent rules and scientific notation. Addition, subtraction, multiplication, and factoring of polynomials in one variable. Using the zero product property to solve quadratic equations in one variable. Pre-requisite: A grade of 'C' or better in MATH-015 or satisfactory placement score.

MATH-123 MATH IN MODERN SOCIETY 3 Credits
This course introduces students to the form and function of mathematics as it applies to liberal-arts studies with a heavy emphasis on its applications. Topics covered include ratios, rates and proportions; properties of linear equations; graphing linear equations; constructing and using linear models; exponential and logarithmic equations and models; financial applications; and elementary probability and statistics. Pre-requisite: MATH-023, MATH-025, MTHPT-103 or MTHPT-120 with a grade or 'C' or better, or permission of the instructor.

MATH-123P MATH IN MODERN SOCIETY--SUPPLEMENT 2 Credits
This course provides just-in-time preparation for the mathematical skills necessary to be successful in MATH-123 with an emphasis on problem-solving and college-readiness skills. Topics will include order of operations, fraction and decimal arithmetic, percent, scientific notation, interval notation, lines, calculator use, and mathematical modeling. Must be taken concurrently with MATH-123.

MATH-130 FINITE MATHEMATICS 4 Credits
Systems of linear equations and inequalities, elementary matrix algebra, introduction to linear programming, elementary discrete probability and statistics. Emphasis on applications to business, economics and social sciences. Pre-requisite: A grade of 'C' or better in MATH 025 or MTHPT 103 or satisfactory placement score.

MATH-140 ALGEBRAIC REASONING AND PROBLEM-SOLVING 3 Credits
Algebraic Reasoning and Problem-Solving builds on the fundamental concepts introduced in Basic Algebra. This course emphasizes the concepts of function, domain, range, and zeros and includes the study of linear, quadratic, logarithmic, exponential, radical, and rational expressions, equations, and functions. Students will learn to use critical thinking and problem-solving skills as they engage with applications of these concepts. Pre-requisites: A grade of 'C' or better in MATH-025 or satisfactory placement score.

MATH-140T CE:ALGEBRAIC REASONING AND PROBLEM- SOLVING 3 Credits

MATH-143 PRECALCULUS I: ALGEBRA 3 Credits
Emphasis on the concept of real-valued functions and their applications, including domain, range, algebraic operations, composition, inverses, and graphing. Topics include polynomial functions, division of polynomials, roots of polynomials, theory of equations, complex numbers, fundamental theorem of algebra, rational functions and asymptotes, logarithmic and exponential functions, transformations, solving systems of linear and nonlinear equations, and matrices. Students will engage in multi-step algebraic manipulation of complicated functional expressions. Pre-requisite: A grade of 'C' or better in MATH-140 or MTHPT-137 or satisfactory placement score.

MATH-144 PRECALCULUS II: TRIGONOMETRY 2 Credits
This course introduces right-triangle and circular function approaches to trigonometry. Topics include plane trigonometry, trigonometric identities, graphs of trigonometric functions, amplitude, frequency, phase shift, inverse trigonometric functions and their graphs, polar coordinates, and polar representation of complex numbers. Pre-requisite: A grade of 'C' or better in MATH-143 or satisfactory placement score.

MATH-147 PRECALCULUS 5 Credits
The course emphasizes functions, circular trigonometry and multilevel problem solving as preparation for calculus. Functions are treated as mathematical entities, including domain, range, algebraic operations, composition, inverses, and graphing. Polynomial, logarithmic, exponential, trigonometric, inverse trigonometric, radical and rational functions are explored. Algebraic techniques include division of polynomials, roots of polynomials, theory of equations and inequalities, complex numbers and DeMoivre's Theorem, the Fundamental Theorem of Algebra, solving systems of linear and nonlinear equations, and matrices. Trigonometric identities are derived, proven, and applied. Polar coordinates, vectors and oblique triangles are introduced and used in a variety of applications. Analytic geometry focuses on circles, parabolas, distance and midpoints. MATH-147 is equivalent to MATH-143 plus MATH-144. Pre-requisite: A grade of 'C' or better in MATH-140 or MTHPT-137 or satisfactory placement score.

MATH-153 STATISTICAL REASONING 3 Credits
This course introduces students to problem solving and decision making using single and multivariable statistical models. The course focuses on conceptual understanding of randomness, variability, statistical models, and inference through exploration of data. The use of technology for analysis of data is integrated throughout. Topics include descriptive statistics, probability, hypothesis testing, confidence intervals, likelihood ratios, correlation, and regression. Pre-requisite: A grade of 'C' or better in MATH-023, MATH-025, or appropriate math placement score.

MATH-153P SUPPLEMENTAL INSTRUCTION FOR MATH 153 1 Credit
This course provides just-in-time preparation of the mathematical skills necessary to be successful in MATH-153 with an emphasis on problem-solving and college-readiness skills. Topics may include order of operations, fraction and decimal arithmetic, percent, scientific notation, interval notation, lines, calculator use, and use of statistical software. Pre-requisite: This course must be taken concurrently with MATH-153. MATH-015 with a grade of C or better, or satisfactory placement score.

MATH-157 MATHEMATICS FOR ELEMENTARY TEACHERS I 4 Credits
This course provides an overview of some of the mathematics taught in grades K-8 with an emphasis on conceptual understanding and communication of mathematical principles. This is the first course in a two-course sequence of mathematics content courses which is not intended to be a methods of teaching course. Topics may include numbers and the base-ten system; fractions and problem-solving; addition, subtraction, multiplication, and division of real numbers; ratio and proportional relationships; and number theory. Pre-requisite: A grade of 'C' or better in MATH-140 or MTHPT-137 or satisfactory placement score or placement into MATH-157P to be taken concurrently with MATH-157.

MATH-157P SUPPLEMENTAL INSTRUCTION FOR MATH 157 1 Credit
This course provides just-in-time preparation of the mathematical skills necessary to be successful in MATH-157 and MATH-257 with an emphasis on problem-solving and college-readiness skills. Topics may include accuracy vs precision, order of operations, number theory, fraction and decimal arithmetic, percent, properties of real numbers, conversions and unit analysis, geometry and measurement, factoring, mental math, exponents and scientific notation, lines and graphing, probability, and statistics. This course must be taken concurrently with MATH-157. Prerequisite: MATH-023 or MATH-025 with a grade of C or better or satisfactory placement score.

MATH-170 CALCULUS I 4 Credits
Definitions of limit, derivative, antiderivative, definite integral. Computation of the derivative, including logarithmic, exponential, and trigonometric functions. Applications of the derivative, optimization, mean value theorem. The fundamental theorem of calculus, brief introduction to applications of the integral and to computation of antiderivatives. Intended for students in engineering, mathematics, and the sciences. Pre-requisites: A grade of "C" or better in MATH-147 or MATH-143 and MATH-144 or satisfactory placement score.

MATH-175 CALCULUS II 4 Credits
Applications of the integral, symbolic and numerical techniques of integration, inverse transcendental functions. Sequences and series, with an emphasis on power series and approximation. Pre-requisite: A grade of 'C' or better in MATH-170.

MATH-186 DISCRETE MATHEMATICS 3 Credits
Topics such as sets, functions, algorithms, logic, Boolean algebra are included. This course consists of numerous topics which are particularly valuable to students pursuing a computer science minor. Pre-requisite: A grade of 'C' or better in MATH-143 or MATH-147, or satisfactory placement score.

MATH-190 DIRECTED STUDY IN MATH 1-12 Credits

MATH-192 SPECIAL TOPICS IN MATHEMATICS 1-12 Credits

MATH-195 PRACTICUM IN MATHEMATICS 1-2 Credits
Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

MATH-253 STATISTICAL METHODS FOR THE SCIENCES 3 Credits
Introduction to statistical methods for scientists. Includes design of statistical studies, basic sampling methods, descriptive statistics, probability and sampling distributions, inference regression, and analysis of variance. Also includes an introduction to software packages used in Statistics. Pre-requisite: A grade of 'C' or better in MATH-143 or MATH-147 or satisfactory placement score.

MATH-257 MATHEMATICS FOR ELEMENTARY TEACHERS II 4 Credits
This course is a continuation of MATH-157 and continues an overview of some of the mathematics taught in grades K-8 with an emphasis on conceptual understanding and communication of mathematical principles. This is the second course in a two-course sequence of mathematics content courses which is not intended to be a methods of teaching course. Topics may include algebra; geometry; measurement; area of shapes; circumference; the number pi; construction proofs of the Pythagorean theorem; solid shapes and their volumes and surface areas; geometry of motion and change; statistics; and probability. Pre-requisite: MATH-157 with a grade of C or better.

MATH-267 MATHEMATICS FOR MIDDLE SCHOOL TEACHERS 4 Credits
This course is designed to prepare teachers of middle school mathematics. The course provides an overview of some of the mathematics taught in grades 6-10 with an emphasis on conceptual understanding and communication of mathematical principles through reasoning and problem-solving. Topics will include transformational geometry; counting and probability; and statistics. Additional topics may include set theory; graph theory; number theory; coding; intuitive calculus; introduction to linear algebra; basic topology; and discrete mathematics. Pre-requisite: MATH-143 or MATH-147 with a grade of C or better, or satisfactory placement score.

MATH-275 CALCULUS III 4 Credits
Vector algebra and geometry, functions of several variables, partial and directional derivatives, gradient, chain rule, optimization, multiple and iterated integrals. Parametric curves and surfaces in 3-space, vector fields, divergence and curl, line and surface integrals. Green's, Stokes' and divergence theorems. Pre-requisite: A grade of 'C' or better in MATH-175.

MATH-285 EUCLIDEAN GEOMETRY 3 Credits
This course is designed to prepare teachers of middle and high school geometry. The course emphasizes classic geometric proof and application of geometric theorems. Topics include parallel lines, triangles, quadrilaterals, circles, and polygons. Pre-requisite: A grade of 'C' or better in MATH-147A, MATH-157, or MATH-186, or satisfactory placement score.

MATH-290 DIRECTED STUDY IN MATHEMATICS 1-3 Credits
Pre-requisite: A grade of 'C' or better in MATH 170 or permission of the division.

MATH-291 WORKSHOP IN MATHEMATICS 1-3 Credits

MATH-292 SPECIAL TOPICS IN MATHEMATICS 1-3 Credits

MATH-295 PRACTICUM IN MATHEMATICS 1-2 Credits
Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

MATH-299 RESEARCH ASSISTANTSHIP 1-12 Credits

MATH-300 INTRODUCTION TO MATHEMATICAL REASONING 3 Credits
Introductory topics in mathematics- logic, set theory, properties of the real line- number theory, induction, mappings, rigorous treatment of limits of sequences. Emphasis is on the concept of theorem and proof. Pre-requisite: A Grade of "C" or better in MATH 175.

MATH-313 NUMBER THEORY 3 Credits
Modular arithmetic, Pythagorean triples, prime numbers, quadratic reciprocity, Diophantine approximation, elliptic curves, and public key encryption systems. Pre-requisite: MATH-175.

MATH-320 PROBABILITY AND STATISTICS 3 Credits
Sample spaces, random variables, central limit theorems, stochastic processes, estimation and testing of hypotheses. This course includes an introduction to software packages used in Statistics. Pre-requisites: A grade of 'C' or better in MATH-175 and MATH-253.

MATH-340 LINEAR ALGEBRA 3 Credits
Systems of linear equations, vector spaces, linear independence, basis, dimension, inner products, transformation, injectivity and surjectivity, orthogonal projections, orthonormal bases. Eigenvalues and eigenvectors. Positive definite matrices. Pre-requisite: A grade of 'C' or better in MATH-175 or CS-211.

MATH-345 ORDINARY DIFFERENTIAL EQUATIONS 3 Credits
Separation of variables, variations of parameters- methods of characteristic roots, undetermined coefficients- systems of differential equations. Laplace transform, and power series. Pre-requisite: A Grade of "C" or better in MATH-175.

MATH-364 PRINCIPLES OF OPTIMIZATON 3 Credits
In this course, students will learn the optimization techniques used to model and solve problems from various disciplines such as business, engineering, sciences, sports, etc. This course introduces students to optimization methods for linear, nonlinear, and integer programming. Emphasis will be on techniques that expand student understanding of Calculus and Linear Algebra concepts as well as how to formulate a model; interpret problems mathematically and geometrically; solution techniques in cases where Calculus cannot be used. Additional emphasis will include the theory behind solution techniques; sensitivity analysis; and how to use Octave/Matlab to solve problems. Pre-requisite: MATH-275 with a grade of C or better, or permission of the instructor.

MATH-367 MATHEMATICS FOR MIDDLE/SECONDARY SCHOOL TEACHERS 4 Credits
This course is designed to prepare teachers of middle and secondary school mathematics. The course provides an overview of some of the mathematics taught in grades 6-12 with an emphasis on conceptual understanding and communication of mathematical principles through reasoning and problem-solving. Topics will include transformational geometry; counting and probability; and statistics. Additional topics may include set theory; graph theory; number theory; coding; intuitive calculus; introduction to linear algebra; basic topology; and discrete mathematics. Pre-requisite: MATH-143 or MATH-147 with a grade of C or better, or satisfactory placement score.

MATH-386 MODERN GEOMETRY 3 Credits
Postulates of Euclid and Hilbert, transformational geometry, topics from projective and affine geometry. Understanding of the foundations of high school geometry is emphasized. Pre-requisite: MATH-170 with a grade of C or better.

MATH-390 DIRECTED STUDY IN MATHEMATICS 1-3 Credits

MATH-391 WORKSHOP IN MATHEMATICS 1-3 Credits

MATH-392 SPECIAL TOPICS IN MATHEMATICS 1-12 Credits

MATH-395 PRACTICUM IN MATHEMATICS 1-2 Credits

MATH-399 RESEARCH ASSISTANTSHIP 1-12 Credits

MATH-450 COMPLEX ANALYSIS 3 Credits
Complex numbers and functions, complex derivatives and integrals, residue theory, conformal mappings and uniform convergence. Pre-requisite: A grade of 'C' or better in MATH-300.

MATH-460 ABSTRACT ALGEBRA I 3 Credits
This is the first course in a two-course sequence that provides an introduction to abstract algebra. Topics include groups, subgroups, permutation groups, isomorphisms, homomorphisms, quotient groups, and the fundamental theorem of finite abelian groups. Pre-requisite: MATH-300 with a grade of C or better.

MATH-461 ABSTRACT ALGEBRA II 3 Credits
This is the second course in a two-course sequence that provides an introduction to abstract algebra. Topics include rings, subrings, ideals, quotient rings, polynomial rings, vector spaces, fields, extension fields, and Galois theory. Pre-requisite: MATH-460 with a grade of C or better.

MATH-470 GENERAL TOPOLOGY 3 Credits
An introduction to the fundamental concepts of general topology including set theory, metrics, neighborhoods, bases, subspaces, mappings, continuity, separation axioms, compactness and connectedness. Pre-requisite: A grade of 'C' or better in MATH-300.

MATH-480 REAL ANALYSIS I 3 Credits
This course is the first course in a two-course sequence that provides a theory of the real line, properties of real numbers, and real-valued functions. Topics include convergence of sequences; open and closed sets; density of sets; Cauchy sequences; monotone convergence theorem; pointwise and uniform convergence of functions; continuity; mean value theorem; intermediate value theorem; compactness; and differentiability. Pre-requisite: MATH-300 with a grade of C or better.

MATH-481 REAL ANALYSIS II 3 Credits
This course is the second course in a two-course sequence on the theory of real-valued functions. Topics include sequences and series of functions, Weierstrass M-test, power series, Taylor series, Riemann integrability, metric spaces, convergence in metric spaces, and differentiability of functions with higher dimensional domains. Pre-requisite: MATH-480 with a grade of C or better.

MATH-490 DIRECTED STUDY IN MATHEMATICS 1-3 Credits
Pre-requisite: A grade of 'C' or better in MATH-170 or permission of the division.

MATH-491 WORKSHOP IN MATHEMATICS 1-3 Credits

MATH-492 SPECIAL TOPICS IN MATHEMATICS 1-3 Credits

MATH-494 INTERNSHIP IN MATHEMATICS 1-12 Credits
Internship in Math.

MATH-495 PRACTICUM IN MATHEMATICS 1-2 Credits
Tutoring in the mathematics laboratory or functioning as a teacher's aide in a lower division mathematics course. Pre-requisite: Approval of the division chair. May be repeated for a total of 4 credits.

MATH-499 RESEARCH PROJECT AND SEMINAR IN MATH 1-3 Credits
Students will conduct and communicate the results of a research project in the Natural Sciences Division. Topics may include the historical, philosophical, cultural and environmental aspects, and the processes of natural science. Requirements of students include satisfactory oral presentation and defense of their research and submission of a written report approved by their advisor to the Natural Sciences Division. Prerequisite: NS-398.