

MATHEMATICS (MATH)

MATH-0800 Developmental Special Topics in Mathematics **1-3 Credits**

Study of selected developmental topics or current issues in mathematics. Provides student an opportunity to explore various topics in greater detail. Repeatable for different topics. May not be applied toward elective and/or program graduation degree requirements.

Lecture: 1-3 hours

Prerequisite(s): Faculty counterparts determine appropriate prerequisite/corequisite for each topic.

MATH-0812 Special Topics in Prestatistics **3 Credits**

This course introduces the fundamental algebraic topics necessary to complete a college-level statistics course. Topics include operations with rational numbers, sets of numbers, order of operations, operations with real numbers, solving linear equations, introduction to problem-solving, graphing equations, simplifying exponential expressions, function notation and radical and exponential functions.

Lecture: 3 hours

Prerequisite(s): MATH-0910 Basic Arithmetic and Pre-Algebra, or sufficient score on math placement test, or departmental approval.

MATH-0910 Basic Arithmetic and Pre-Algebra **3 Credits**

Includes real numbers (integers, fractions, signed fractions, and signed decimals) and operations (addition, subtraction, multiplication, and division) along with the use of order of operations, ratio rates, proportion, percent, English system of measurement, introduction to basic algebra and solving basic algebraic equations, and perimeter and area of basic geometric shapes. Includes applications and activities to build skills in estimation and problem solving. Grading for Math 0910 is P for Pass or NP for No Pass.

Lecture: 3 hours

Prerequisite(s): Sufficient score on assessment test, or departmental approval.

MATH-0955 Beginning Algebra **6 Credits**

First of two developmental mathematics courses. Topics include simplifying basic algebraic expressions in one variable, solving one variable linear equations, literal equations, linear inequalities in one variable, graphing linear inequalities in one variable, compound inequalities, graphing compound inequalities, determining relation, domain, range of functions graphically and algebraically, performing operations on functions, introducing the rectangular coordinate system, determining equations of lines, graphing lines and two variable inequalities, solving systems of two variable equations and inequalities, performing algebraic operations and simplifying of polynomials involving rules of exponents, and scientific notation. Includes applications and activities to build skills in problem solving.

Lecture: 6 hours

Prerequisite(s): MATH-0910 Basic Arithmetic and Pre-Algebra, or sufficient score on math placement test, or departmental approval.

MATH-0965 Intermediate Algebra **6 Credits**

Second of two developmental mathematics courses. Topics include factoring; solving quadratic equations utilizing the methods of the zero product property, square root property, completing the square, and the quadratic formula; solving rational and radical equations, and systems of three linear equations in three variables; simplifying and evaluating rational, radical and exponential expressions; graphing quadratic and radical functions; introduction to exponential and logarithmic functions and their graphs; applications and activities to build problem-solving skills.

Lecture: 6 hours

Prerequisite(s): MATH-0955 Beginning Algebra, or sufficient score on math placement test; or departmental approval. MATH-0960 and MATH-0980 taken prior to Fall 2016 will also meet the prerequisite requirement for this course. Please note: MATH-0965 Intermediate Algebra will NOT count as a college-level course (MATH-1270 or MATH-1280) due to the State of Ohio's new definition of a credit-bearing math course. Although credit is earned for 0 level courses, the credit does not apply to meet completion requirements of any certificate or degree at Cuyahoga Community College.

MATH-0990 Math Literacy for College Students **4 Credits**

Course integrates numeracy, proportional reasoning, algebraic reasoning, and functions. Students will develop conceptual and procedural tools that support the use of key mathematical concepts in a variety of ways. Contexts include personal finance, medical literacy, and citizenship.

Lecture: 4 hours

Prerequisite(s): MATH-0910 Basic Arithmetic and Pre-Algebra; or sufficient score on placement test; or departmental approval.

MATH-1100 Mathematical Explorations **3 Credits**

Survey of mathematical topics to develop a broader appreciation of mathematics by exploring ways in which the artistic, aesthetic, and intellectual aspects of mathematics are as important as its utility. Students will have the opportunity to study basic concepts and skills of problem solving, set theory, logic and number theory with the purpose of introducing them to the nature of mathematics as it applies to both the practical and the abstract. This course is designed for students whose majors do not require courses in Statistics or STEM and will count towards the requirements for Associate's degrees requiring a 1000-level math.

Lecture: 3 hours

Prerequisite(s): MATH-0910 Basic Arithmetic and Pre-Algebra or appropriate score on Math placement test to enroll in MATH-0955 Beginning Algebra and ENG-0995 Applied College Literacies, or appropriate score on English placement test to enroll in ENG-1010 College Composition I; or MATH-0955 Beginning Algebra; or MATH-0990 Math Literacy for College Students; or sufficient score on Math assessment test; or departmental approval: equivalent coursework. Note: MATH-0950 Beginning Algebra I taken prior to Fall 2016 will also be accepted to meet the prerequisite requirement for this course. ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1190 Algebraic and Quantitative Reasoning

3 Credits

Applications and appreciation of quantitative literacy. Interpreting information from real-world sources to solve problems using numerical, algebraic, and graphical knowledge. Various uses of mathematical models are explored, and statistical thinking is developed. Contexts include financial, environmental, social, and public and personal health.

Lecture: 3 hours

Prerequisite(s): MATH-0955 Beginning Algebra; or MATH-0990 Math Literacy for College Students; or sufficient score on Math Placement Test; or departmental approval.

OAN Approved: Ohio Transfer 36 TMM011.

MATH-1240 Contemporary Mathematics

3 Credits

Applications of mathematics in contemporary life. Introduction to financial literacy, dimensional analysis as applied to measurement and unit conversions, graph theory, topics in probability and descriptive statistics.

Lecture: 3 hours

Prerequisite(s): MATH-0955 Beginning Algebra, or sufficient score on Math assessment test; or departmental approval: equivalent coursework. Note: MATH-0960 or MATH-0980 taken prior to Fall 2016 will also be accepted to meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1370 Mathematics for Elementary and Middle School Teachers I

4 Credits

First of two semester sequence designed for elementary and middle school education majors. Emphasis on understanding ideas and concepts. Includes sets and numeration, whole numbers, number theory, fractions, decimals, integers, rational and real numbers, problem solving strategies, and historical topics. Highlights applications to classroom, projects, and use of current technology, including scientific/graphing calculators and computers.

Lecture: 4 hours

Prerequisite(s): MATH-0965 Intermediate Algebra, or sufficient score on Math placement test, or departmental approval: equivalent coursework. Note: MATH-1200 or 1280 taken prior to Fall 2016, or MATH-1270 taken prior to Summer 2017 will also be accepted to meet prerequisite requirements for this course.

MATH-1380 Mathematics for Elementary and Middle School Teachers II

4 Credits

Second of two-semester sequence designed for elementary and middle school education majors. Emphasis on understanding ideas and concepts. Includes statistics, probability, measurement, geometric shapes, Euclidean geometry, coordinate geometry, transformational geometry, problem-solving strategies, and historical topics. Highlights applications to classroom, projects, and use of current technology, including scientific/graphing calculators and computers.

Lecture: 4 hours

Prerequisite(s): MATH-1370 Mathematics for Elementary and Middle School Teachers I, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1410 Elementary Probability and Statistics I

3 Credits

First of two-semester introductory sequence in probability and statistics. Intended for students majoring in liberal arts, business, sciences, engineering, and education. Includes study of descriptive statistics, elementary probability, probability distributions, normal distribution, binomial distribution, sampling concepts, sampling distribution of sample mean, estimation, and hypothesis testing.

Lecture: 3 hours

Prerequisite(s): MATH-0965 Intermediate Algebra or MATH-1240 Contemporary Mathematics, or sufficient score on Math Placement Test, or departmental approval: equivalent coursework. Note: MATH-1200, 1250, or 1280 completed prior to Fall 2016 or MATH-1270 completed prior to Summer 2017 will also meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMM010.

MATH-1420 Elementary Probability and Statistics II

3 Credits

Second of two-semester introductory sequence in probability and statistics. Intended for students majoring in liberal arts, business, sciences, engineering, and education. Includes study of Chi-square distribution and F distribution and their applications, inferences on variances and proportions, comparing two means, categorical data, correlation, simple and multiple regression, analysis of variance, nonparametric tests and use of statistical software packages.

Lecture: 3 hours

Prerequisite(s): MATH-1410 Elementary Probability and Statistics I, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1470 Modern Mathematics for Business and Social Science I

4 Credits

First of two-semester sequence. Topics include functions, mathematics of finance, linear systems, matrix algebra and linear programming with applications in business and social sciences.

Lecture: 4 hours

Prerequisite(s): MATH-0965 Intermediate Algebra, or appropriate score on Math Placement Test, or departmental approval: equivalent coursework. Note: MATH-1200 or 1280 completed prior to Fall 2016, or MATH-1270 completed prior to Summer 2017 will also meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1480 Modern Mathematics for Business and Social Sciences II

4 Credits

Second of a two-semester sequence. Topics include the fundamentals of differential and integral calculus, with applications in business and social sciences.

Lecture: 4 hours

Prerequisite(s): MATH-1470 Modern Mathematics for Business and Social Sciences I or MATH-1530 College Algebra or MATH-153H Honors College Algebra or MATH-1580 Precalculus or a sufficient score on the math placement test or department approval for equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM013.

MATH-1490 Business Probability and Statistics I**3 Credits**

First of a two-semester introductory sequence in business probability and statistics. Intended for students majoring in business. Application of statistical methods to business and economic problems. Topics include study of descriptive statistics, elementary probability, random variables and probability distributions, binomial distribution, normal distribution, sampling concepts, sampling distribution of sample mean, interval estimation for population means and proportions, hypothesis testing, correlation and simple linear regression models.

Lecture: 3 hours

Prerequisite(s): MATH-1470 Modern Mathematics for Business and Social Science I, or MATH-1530 College Algebra, or MATH-153H College Algebra, or MATH-1580 Precalculus, or appropriate score on Math Placement Test; or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMMSL and Transfer Assurance Guide OBU013.

MATH-1500 Business Probability and Statistics II**3 Credits**

Second of two-semester introductory sequence in probability and statistics, intended for students majoring in business. Includes study of inferences on means and proportions, analysis of variance, correlation, simple and multiple linear regression models, business applications and decision making, and the use of statistical software.

Lecture: 3 hours

Prerequisite(s): MATH-1490 Business Probability and Statistics I, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMMSL.

MATH-1530 College Algebra**4 Credits**

Topics include extensive function (linear, quadratic, polynomial, radical, roots, power, piece-wise, exponential, logarithmic) representation including verbal, numeric, graphic, and algebraic, identifying properties of the different function types, transformation of functions, solve linear, polynomial, rational, absolute value, exponential and logarithmic equations. Solve quadratic, polynomial and rational inequalities in one variable. Determine and graph conic sections, solve non-linear systems of equations and inequalities and solve systems of equations using matrices, arithmetic and geometric sequences and series. Includes applications and activities to build skills in problem solving.

Lecture: 4 hours

Prerequisite(s): MATH-0965 Intermediate Algebra or sufficient score on math placement test; or departmental approval for equivalent coursework. Note: MATH-1200 or MATH-1280 taken prior to Fall 2016 or MATH-1270 taken prior to Summer 2017 will also be accepted to meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMM001 and TMM002 (1 of 2 courses, both must be taken).

MATH-153H Honors College Algebra**4 Credits**

Topics include extensive function (linear, quadratic, polynomial, radical, roots, power, piece-wise, exponential, logarithmic) representation including verbal, numeric, graphic, and algebraic, identifying properties of the different function types, transformation of functions, solve linear, polynomial, rational, absolute value, exponential and logarithmic equations. Solve quadratic, polynomial and rational inequalities in one variable. Determine and graph conic sections, solve non-linear systems of equations and inequalities and solve systems of equations using matrices, arithmetic and geometric sequences and series. Includes applications and activities to build skills in problem solving.

Lecture: 4 hours

Prerequisite(s): MATH-0965 Intermediate Algebra or sufficient score on math placement test; or departmental approval: equivalent coursework. Note: MATH-1200 or 1280 taken prior to Fall 2016, or MATH-1270 taken prior to Summer 2017 will be accepted to meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMM001 and TMM002 (1 of 2 courses, both must be taken).

MATH-1540 Trigonometry**3 Credits**

This course is part of a two semester sequence. Topics include trigonometric functions and their values for all angles, vectors and oblique triangles, graphs of trigonometric functions, trigonometric identities and equations. Applications and activities to build skills in problem solving included.

Lecture: 3 hours

Prerequisite(s): MATH-1530 College Algebra or sufficient score on math placement test; or departmental approval: equivalent coursework. Note: MATH-1275 MATH-1280, MATH-1521, or MATH-152H taken prior to Fall 2016 will be accepted to meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMM003 and TMM002 (2 of 2 courses, both must be taken).

MATH-154H Honors Trigonometry**3 Credits**

Topics include trigonometric functions and their values for all angles, vectors and oblique triangles, graphs of trigonometric functions, trigonometric identities and equations. Applications and activities to build skills in problem solving included. Emphasis on more challenging trigonometric concepts in real-world settings are found in the form of projects and in-class presentations.

Lecture: 3 hours

Prerequisite(s): MATH-1530 College Algebra or MATH-153H Honors College Algebra; or departmental approval. Note: MATH-1275 MATH-1280, MATH-1521, or MATH-152H taken prior to Fall 2016 will be accepted to meet prerequisite requirements for this course.

OAN Approved: Ohio Transfer 36 TMM003 and TMM002 (2 of 2 courses, both must be taken).

MATH-1580 Precalculus**5 Credits**

Intensified course designed to prepare students for calculus. Study of real numbers, equations and inequalities, functions and graphs, sequences and series, theory of equations, systems of equations and inequalities, mathematical induction, conic sections, exponential and logarithmic functions, trigonometric functions and complex numbers. Applications and activities to build skills in problem solving also included.

Lecture: 5 hours

Prerequisite(s): Sufficient score on Math assessment test, or departmental approval: previous trigonometry or algebra/trigonometry course in high school or college.

OAN Approved: Ohio Transfer 36 TMM002.

MATH-1610 Calculus I**5 Credits**

First of three-semester sequence designed for math, science, and engineering majors. Includes study of Cartesian coordinates, functions and graphs, limits and continuity, differentiation of algebraic and trigonometric functions, applications of derivative, differentials and antiderivatives, and definite integral and its applications.

Lecture: 5 hours

Prerequisite(s): MATH-1540 Trigonometry or MATH-154H Honors Trigonometry, or MATH-1580 Precalculus, or appropriate score on Math Placement Test, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM005 and TMM017 (1 of 2 courses, both must be taken).

MATH-161H Honors Calculus I**5 Credits**

First of a three-semester sequence designed for math, science, business, and engineering majors. Focus on conceptual understanding of verbal, numerical, visual, and algebraic representations of functions, their graphs, and operations. Includes limits, continuity, rates of change, derivatives, implicit differentiation of algebraic and trigonometric functions, application of differentials, differentiation, integrals, and application of integration. Emphasizes challenging calculus exercises, problems, projects, cooperative group work, students presentation of one of the course projects, and use of technology: graphing calculators and computers.

Lecture: 5 hours

Prerequisite(s): MATH-1540 Trigonometry or MATH-154H Honors Trigonometry or MATH-1580 Precalculus; or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM005 and TMM017 (1 of 2 courses, both must be taken).

MATH-1620 Calculus II**5 Credits**

Second of three-semester sequence. Includes the study of applications of the definite integral, techniques of integration, indeterminate forms, improper integrals, sequences, series, conic sections, parametric equations and polar coordinates.

Lecture: 5 hours

Prerequisite(s): MATH-1610 Calculus I, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM006 and TMM017 (2 of 2 courses, both must be taken).

MATH-162H Honors Calculus II**5 Credits**

Second of three-semester sequence. Topics include applications of the definite integral, techniques of integration, indeterminate forms, improper integrals, sequences, series, conic sections, parametric equations, and polar coordinates. Emphasizes proofs of theorems and solving challenging exercises and application problems.

Lecture: 5 hours

Prerequisite(s): MATH-161H Honors Calculus I, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM006 and TMM017 (2 of 2 courses, both must be taken).

MATH-179H Honors Contract in Mathematics**1 Credit**

Honors Contract complements and exceeds requirements and expected outcomes for an existing 1000-level honors course through formulation of a contract with a faculty mentor. This independent study at the honors level may also be taken with a non-honors course. When taken with a non-honors course the Honors Contract adds an honor experience to that course. In conjunction with a faculty mentor, student will formulate a contract, which upon completion will result in distinctive scholarship. The student is required to meet on a regularly scheduled basis with the instructor for mentor-student tutorial sessions. A maximum of six Honor Contracts (six credit hours) may be taken at the College (includes 179H and 279H).

Lecture: 1 hours

Other Required Hours: 00.

Prerequisite(s): Must be taken concurrently with a 1000-level course whose instructor agrees to mentor the student in this contract. Departmental approval required.

MATH-1800 Special Topics in Mathematics**1-3 Credits**

Study of selected topics or current issues. Provides student an opportunity to explore various topics in greater detail. Repeatable for different topics. No more than six credits of special topics may be applied toward elective and/or program graduation degree requirements.

Lecture: 1-3 hours

Prerequisite(s): Faculty counterparts determine appropriate prerequisite/corequisite for each topic.

MATH-1820 Independent Study/Research in Mathematics**1-3 Credits**

Directed individual study. Study/research title and specific content arranged between instructor and student. May be repeated for a maximum of six credits of different topics.

Lecture: 1-3 hours

Prerequisite(s): Departmental approval, and instructor approval, and ENG-0995 Applied College Literacies, or appropriate score on English Placement Test. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

MATH-182H Honors Independent Study/Research in Mathematics
1-3 Credits

Honors-level directed individual study in Math. Study/research title and specific content arranged between instructor and student (see Credit Schedule of classes for current offerings). May be repeated for a maximum of six credits of different topics.

Lecture: 1-3 hours

Prerequisite(s): Departmental approval and instructor approval, and ENG-0995 Applied College Literacies, or appropriate score on English Placement Test; and must have earned an A or B in at least 3 honors courses. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

MATH-2010 Introduction to Discrete Mathematics
4 Credits

Foundation course in discrete mathematics with applications. Topics include logic, methods of proof, elementary number theory, set theory, functions, efficiency of algorithms, and mathematical induction.

Lecture: 4 hours

Prerequisite(s): MATH-1530 College Algebra or MATH-153H College Algebra or MATH-1580 Precalculus; or sufficient score on assessment test; or departmental approval: equivalent coursework.
OAN Approved: Ohio Transfer 36 TMMSL.

MATH-2310 Calculus III
4 Credits

Third of three-semester sequence. Includes vectors, parametric equations, analytic geometry of space, partial differentiation, and multiple integrals, line and surface integrals.

Lecture: 4 hours

Prerequisite(s): MATH-1620 Calculus II, or departmental approval: equivalent coursework.
OAN Approved: Ohio Transfer 36 TMM018 and Transfer Assurance Guide OMT018.

MATH-231H Honors Calculus III
4 Credits

Third of three-semester sequence designed for mathematics, science, business, and engineering majors. Focuses on conceptual understanding of vectors, parametric equations, analytic geometry of space, partial differentiation, and multiple integrals, line and surface integrals. Emphasizes proofs of theorems and solving challenging examples, exercises, and application problems. Stresses development of research projects. Underscores cooperative work, students' presentation of one of the course projects, and use of technology: graphics calculators and computers.

Lecture: 4 hours

Prerequisite(s): MATH-162H Honors Calculus II, or high school Honors Calculus II, or departmental approval: equivalent coursework.
OAN Approved: Ohio Transfer 36 TMM018 and Transfer Assurance Guide OMT018.

MATH-2410 Introduction to Linear Algebra
3 Credits

Includes study of vector spaces, linear transformations and matrices, determinants, invariant subspaces, eigenvalues and eigenvectors, and applications.

Lecture: 3 hours

Prerequisite(s): MATH-1620 Calculus II, or departmental approval: equivalent coursework.
OAN Approved: Ohio Transfer 36 TMM019 and Transfer Assurance Guide OMT019.

MATH-2520 Differential Equations
3 Credits

Study of first- and higher-order differential equations focusing on using linear and nonlinear first-order differential equations, homogeneous and nonhomogeneous linear equations, simultaneous systems, linear and nonlinear differential equations, power series, Laplace and inverse Laplace transforms to solve various application problems.

Lecture: 3 hours

Prerequisite(s): MATH-1620 Calculus II, or departmental approval: equivalent coursework.

OAN Approved: Ohio Transfer 36 TMM020 and Transfer Assurance Guide OMT020.

MATH-2800 Special Advanced Topics in Mathematics
1-3 Credits

Study of selected advanced topics or current issues. Provides student an opportunity to explore various topics in greater detail. Repeatable for different topics. No more than six credits of special topics courses may be applied toward elective and/or program graduation degree requirements.

Lecture: 1-3 hours

Prerequisite(s): Faculty counterparts determine appropriate prerequisite/corequisite for each topic

MATH-2820 Independent Advanced Study/Research in Mathematics
1-3 Credits

Directed individual advanced study. Study/research title and specific content arranged between instructor and student. May be repeated for a maximum of six credits of different topics.

Lecture: 1-3 hours

Prerequisite(s): Departmental approval, and instructor approval, and ENG-0995 Applied College Literacies, or appropriate score on English Placement Test. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

MATH-282H Advanced Honors Independent Study/Research in Mathematics
1-3 Credits

Honors-level directed individual study. Must meet criteria set forth in the Honors Course Checklist used to approve regular honors courses. Study/research title and specific content arranged between instructor and student. May be repeated for a maximum of six credits of different topics.

Lecture: 1-3 hours

Prerequisite(s): Departmental approval and instructor approval, and ENG-0995 Applied College Literacies, or appropriate score on English Placement Test; and must have earned an A or B in at least 3 honors courses. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.