

# 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-0830 Mastering MATH-0910** **2 Credits**

Discipline specific student success course includes: math study skills, overcoming math anxiety, critical thinking skills, personal self-management, calculator usage and other topics which assist students in identifying and overcoming barriers to success in mathematics. Includes additional instruction and practice in MATH-0910 concepts and skills.

*Lecture: 2 hours*

*Prerequisite(s): Concurrent enrollment in MATH-0910 Basic Arithmetic and Pre-Algebra.*

## **MATH-0855 Mastering MATH-0955** **2 Credits**

Information and methods for student success in developmental mathematics including: learning style preferences, role of memory process in learning mathematics, study skills for mathematics, overcoming math anxiety, goals in mathematics, self-motivation in mathematics, self-management in mathematics, self-esteem in mathematics, and self-evaluation of personal role in learning mathematics.

*Lecture: 2 hours*

*Prerequisite(s): Concurrent enrollment in MATH-0955 Beginning Algebra.*

## **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 equations by factoring, rational expressions, rational equations, systems of three linear equations in three variables, radical expressions, radical equations, expressions with rational exponents, equations with rational exponents, quadratic equations involving the Zero Product Property, Square Root Property, Completing the Square, and the Quadratic Formula, graphing quadratic functions, exponential expressions, and graphing exponential functions. Includes applications and activities to build skills in problem solving.

*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. Introduction to basic concepts of problem solving, set theory, logic, number theory, and college geometry.

*Lecture: 3 hours*

*Prerequisite(s): 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. OAN Approved: 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: 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: 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: TTMSL.*

**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: 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.*

**MATH-1470 Modern Mathematics for Business and Social Science I**  
**4 Credits**

First of two-semester sequence. Includes linear systems, functions, matrix algebra and linear programming techniques as applied to business problems and simplex method. Math of finance and basic theory of probability and statistics.

*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: TMMSL.*

**MATH-1480 Modern Mathematics for Business and Social Sciences II**  
**4 Credits**

Second of two-semester sequence. Includes fundamentals of differential and integral calculus and applications of these topics to business and economics.

*Lecture: 4 hours*

*Prerequisite(s): MATH-1470 Modern Mathematics for Business and Social Sciences I, or departmental approval: equivalent coursework.*

*OAN Approved: TMM013*

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

First of 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, normal distribution, binomial distribution, sampling concepts, sampling distribution of sample mean, estimation, and hypothesis testing.

*Lecture: 3 hours*

*Prerequisite(s): MATH-1470 Modern Mathematics for Business and Social Sciences I, or appropriate score on Math Placement Test; or departmental approval: equivalent coursework.*

*OAN Approved: TMMSL and OBU009 (Course 1 of 2, both must be taken).*

**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: TMMSL and OBU009 (Course 2 of 2, both must be taken).*

**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: 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: TMM001 and TMM002 (1 of 2 courses, both must be taken).*

**MATH-1540 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.

*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: 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: 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 assessment test, or departmental approval: previous trigonometry or algebra/trigonometry course in high school or college.*

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

**MATH-1620 Calculus II****5 Credits**

Second of three-semester sequence. Includes study of logarithmic and exponential functions, trigonometric and inverse trigonometric functions, and hyperbolic and inverse functions; techniques of integration, parametric and polar coordinates, conics, indeterminate forms, improper integrals; and sequences and series.

*Lecture: 5 hours*

*Prerequisite(s): MATH-1610 Calculus I, or departmental approval: equivalent coursework.*  
*OAN Approved: TMM006, and TMM017 (2 of 2 courses, both must be taken).*

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

Second of three-semester sequence designed for mathematics, science, business, and engineering majors. Focuses on conceptual understanding of logarithmic and exponential functions, trigonometric and inverse trigonometric functions, and hyperbolic and inverse hyperbolic functions, develops their properties, characteristics, derivatives, and graphs. Includes techniques of integration, polar coordinates, conic sections, limits of indeterminate forms of quotients of functions, improper integrals, and sequences and series. 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: 5 hours*

*Prerequisite(s): MATH-161H Honors Calculus I, or departmental approval: equivalent coursework.*  
*OAN Approved: 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-0990 Language Fundamentals II or appropriate score on English Placement Test.*

**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 ENG-0990 Language Fundamentals II or appropriate score on English Placement Test, and must have earned an A or B in at least 3 honors course credits.*

**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: 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: TMM018 & 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: TMM018 & 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: TMM019 and OMT019.*

**MATH-2520 Differential Equations**  
**3 Credits**

Includes study of differential equations of first and higher order, simultaneous, linear and homogenous differential equations, solution by power series, Laplace transformations and computer applications.

*Lecture: 3 hours*

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

*OAN Approved: TMM020 & 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-0990 Language Fundamentals II or appropriate score on English Placement Test.*

**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-0990 Language Fundamentals II or appropriate score on English Placement Test, and must have earned an A or B in at least 3 honors courses.*