

MATHEMATICS

The Associate of Science in Mathematics Degree is designed for students who wish to pursue an eventual career in the field of mathematics. Upon transfer to a baccalaureate institution, students will be well prepared for careers as secondary school mathematics instructors, actuaries, mathematicians and statisticians, operations research analysts, or to further with their education at the graduate school level. Students are advised that entry-level positions within this career require a minimum of a baccalaureate degree.

MATHEMATICS (MATH)

This program is designed to prepare graduates for transfer in mathematics at a baccalaureate institution. Since many of these classes are two-semester sequential courses, it is recommended that students start this program in the fall.

Year 1		Credits
Fall		
MAT 211	Calculus I	4
PHY 120	Physics for Engineering and Science I	4
ENG 101	College Writing I	3
Social Science Elective ¹		3
Spring		
MAT 212	Calculus II	4
MAT 180	Discrete Mathematics	3
PHY 121	Physics for Engineering and Science II	4
ENG 102	College Writing II	3
Philosophy Elective (see list below)		3
Year 2		
Fall		
MAT 213	Calculus III	4
MAT 220	Linear Algebra	4
CIS 150	Computer Science I	3
Literature Elective (see list below)		3
Social Science Elective ¹		3
Spring		
MAT 230	Ordinary Differential Equations	4
Science Elective (see list below) ²		3-4
Humanities Elective ³		3
Restrictive Elective ⁴		3-4
Total Credits:		61-63

¹ Social Science Electives: See Elective Courses by Abbreviation (<http://catalog.mwcc.edu/associatedegreesandcertificatelistandotheroptions/#electivecoursesbyabbreviationtext>).

² Science Elective (3-4 credits)

³ Humanities Electives: See Elective Courses by Abbreviation (<http://catalog.mwcc.edu/associatedegreesandcertificatelistandotheroptions/#electivecoursesbyabbreviationtext>).

Students considering transfer to Fitchburg State under Mass Transfer for the Math program should take SPC 113. Otherwise, students should meet with their advisor or the Math Chair to choose an appropriate course to best meet their transfer or career needs.

⁴ Students transferring through the Mass Transfer program for Mathematics, should take a Social Science elective. Students transferring to WPI, should take MAT143.

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Science Electives

		Credits
BIO 101	Introduction To Nutrition	3
BIO 103	Human Health And Disease	3

BIO 109	Concepts in Biology	4
BIO 116	Ecology	4
BIO 119	Biology II	4
BIO 128	Plants And Society	3
BIO 152	Essentials of Anatomy and Physiology	4
BTC 101	Introduction To Biotechnology I	4
CHE 107	General Chemistry I	4
CHE 108	General Chemistry II	4
CHE 120	Environmental Chemistry	4
EAS 110	Introduction to Environmental Science	3
EAS 115	Paleontology: Evolution of Life	4
EAS 125	Physical Geology of the Earth	4
EAS 126	Weather and Climate	4
EAS 127	Introduction to Astronomy	3

Philosophy Electives

		Credits
PHL 201	Introduction To Philosophical Issues	3
PHL 209	Symbolic Logic	3
PHL 250	Moral Philosophy	3

Literature Electives

		Credits
ENG 213	American Literature I	3
ENG 214	American Literature II	3
ENG 221	Women's Literature	3
ENG 224	Mystery Fiction	3
ENG 235	Children's Literature	3
ENG 236	Modern Drama	3

See Mathematics program student learning outcomes and technical standards.

Campus

The Mathematics Degree is offered on the Gardner campus only.

Transfer Options

For transfer options, please click here (<http://catalog.mwcc.edu/academicresources/#transferinformationtext>). It is recommended that you also consult with your academic advisor.

MASSTRANSFER

Students who plan to transfer to a Massachusetts State University or a University of Massachusetts campus may be eligible to transfer under the MassTransfer agreement, which provides transfer advantages to those who qualify.

Please click here for MassTransfer information (<http://www.mass.edu/masstransfer/>)

PROGRAM STUDENT LEARNING OUTCOMES FOR MATH

Upon graduation from this program, students shall have the ability to:

1. Develop mathematical critical thinking skills that promote mastery of complex mathematical formulations.
2. Display the ability to propose a variety of alternative pathways to the solution of a specific problem.
3. Predict accurate solutions to complex problems in advance of actual calculations in demonstration of previous mathematical learning.
4. Present evidence of proficiency in mathematical reasoning.
5. Recognize mathematical applications in real world problems.
6. Illustrate the process of making real world problems precise.
7. Demonstrate synthesis of mathematical ideas across the curriculum.

TECHNICAL STANDARDS FOR MATH ¹

Students entering this program must be able to demonstrate the ability to:

- Comprehend textbook material at a college level.
- Communicate and assimilate information either in spoken, printed, signed, or computer voice format.
- Gather, analyze, and draw conclusions from data.
- Read from a computer screen or calculator.
- Operate a computer.
- Perceive, interpret and use data in its entirety from a computer/calculator screen.
- Possess manual dexterity to operate computer devices such as a keyboard and mouse.
- Work at a computer for a minimum of two hours.
- Clearly convey solutions to complex mathematical problems.

¹ For general information about technical standards and accommodation, see Technical Standards. (<http://catalog.mwcc.edu/academicresources/academicandgradingpolicies/technicalstandards/>)

MAT 092. Foundations of Mathematics. 4 Credits.

This course is designed for students who need college preparatory mathematics. Topics studied include: whole numbers, order of operations, prime factorization, fractions, decimals, percent, rates, ratios, proportions, signed numbers, variables, algebraic expressions, formulas and equations, graphing linear equations, exponents, scientific notation, and an introduction to polynomials. Students must earn an overall average of "C" in the class for successful course completion. Prerequisites: Math placement.

MAT 093. Statway. 1 Credit.

This course is designed for students who need support to succeed in MAT 143. Topics studied include: points and intervals on the number line, the distance between two points on the number line, powers of a number, the square root of a number, summation notation, set notations, Venn diagrams, the union and intersection of sets and the complement of a set, graphing points and lines in two dimensions, understanding slope as the change in y associated with a 1-unit change in x, the equation of a line and the graph of the line, and the vertical distance between a point and a line. This course is required for students who are taking MAT 143 and who successfully completed MAT 092. Prerequisites: MAT 092; MAT 143 (corequisite). A GRADE OF "C" OR HIGHER IS REQUIRED FOR PASSING.

MAT 096. Intermediate Algebra. 4 Credits.

This course completes the college preparatory mathematics curriculum and prepares the student for College Algebra. Topics include: Review of Real Numbers, Equations and Inequalities, Polynomials and Exponents, Factoring Polynomials, Rational Expressions, Radical Expressions, Absolute Values and Quadratic Equations. A final grade of "C" or higher is required for advancement to next course. Prerequisites: Appropriate score on Accuplacer Arithmetic Test or appropriate GPA.

MAT 097. Stemway. 2 Credits.

This course completes the college preparatory math curriculum and prepares students for the credit-bearing course MAT 162. Topics include: simplifying algebraic expressions, evaluating expressions and equations, working with exponents and scientific notation, performing operations on polynomials and rational expressions, including factoring polynomials, simplifying radical expressions and

converting between radical expressions and rational exponents. Institutional credit only. Courses that earn institutional credit do not apply towards graduation. A GRADE OF "C" OR HIGHER IS REQUIRED FOR PASSING. Prerequisite: MAT 092.

MAT 126. Topics In Mathematics. 3 Credits.

This course explores a number of important ideas and practical applications in contemporary mathematics. Required topics include: problem solving strategies; measurement and the metric system; set theory; equations and inequalities; graphing and linear functions; consumer applications such as interest, annuities and present value; and basic statistics. Teachers will select one or two additional topics (as time permits), such as, history of math, voting and apportionment, logic, probability, or geometry. This course meets the Quantitative Reasoning requirement. Prerequisite: MAT 092 or MAT 096 or placement.

MAT 140. Elements Of Mathematics I. 3 Credits.

This course provides a comprehensive, conceptually-based study of the rational and real number systems, along with fundamental concepts of number theory, in order to develop deep levels of understanding of these concepts. Topics include: numeration systems; place value; algorithms for the addition, subtraction, multiplication and division of whole numbers, integers, fractions, and decimals; factors and multiples; greatest common factor and least common multiple; ratio, percent and scientific notation; rational numbers. Inquiry based instruction, problem solving skills, project work, and the appropriate use of mathematical models are emphasized. This course is recommended for Early Childhood and Elementary Education majors only. No calculators allowed. Prerequisite: MAT 092 or MAT 096 or placement.

MAT 142. Mathematics for Healthcare. 3 Credits.

This course focuses on applications of mathematics in healthcare/allied health/medical related fields. Topics include: Computations with fractions, decimals, percentages, ratios and proportions, solving math-based health applications, conversions within and between metric, household, and apothecary systems, dosage calculations and dimensional analysis, basic IV therapy calculations and infusion rates, time and total volume calculations, concentration and dilution calculations, and an introduction to statistics. A grade of 'C+' is required in the class, for passing. Prerequisite: MAT 092 or higher; or placement.

MAT 143. Statistics. 3 Credits.

This course presents students with an understanding of elementary statistics by familiarizing them with basic concepts of measures of central tendency and variability, regression and correlation, probability, discrete and continuous random variables, the Central Limit Theorem, confidence intervals, and hypothesis testing. The collection, organization, and display of data will also be discussed. Students will utilize spreadsheet software to assist with the organization and display of data as well as to perform mathematical calculations and evaluate formulas. MAT 093 is required for students taking this course who tested into and successfully completed MAT 092 with a grade of C or better. Prerequisites: MAT 092 or higher, or placement; MAT 093 corequisite required for students who tested into MAT 092 and have not completed MAT 096 or higher-level math course.

MAT 162. College Algebra. 4 Credits.

This course is a functional approach to algebra, encompassing the study of equations, inequalities, system of equations, functions, and their graphs. The linear, quadratic, piece-wise defined, rational, polynomial, exponential, and logarithmic functions are defined, graphed, and evaluated. The functions will be used as the basis for mathematical models to solve applications that reflect realistic systems. Prerequisite: MAT 096 or placement.

MAT 163. Pre-Calculus. 4 Credits.

This course is a preparation for MAT 211 Calculus I. Topics include: Exponential and Logarithmic Functions and Models; Trigonometric Functions and Models; Trigonometric Identities; Laws of Sines and Cosines, Vectors, Polar Coordinates. Computers and/or graphing calculators are used to enhance the study of mathematics. Prerequisite: MAT 162 or satisfactory placement test scores.

MAT 180. Discrete Mathematics. 3 Credits.

This course is an introduction to discrete mathematics with a primary focus on applications for students majoring in Mathematics or Computer Science. Topics covered include logic, elementary number theory, methods of proof, mathematical induction, set theory, combinatorics, functions, recursion, relations, efficiency of algorithms, graphs and trees. Prerequisite: MAT 162 or higher math placement. Spring.

MAT 211. Calculus I. 4 Credits.

This course is an introduction to the concepts and methods of differentiation and their application in the areas of engineering, economics, and life sciences. The following topics are covered: differentiation of polynomial, rational, trigonometric, and composite functions; a study of limits; related rates; optimization problems; curve sketching; antiderivatives; and indefinite integration. Prerequisite: MAT 163 or placement; Math prerequisite met within 10 years or permission of dean.

MAT 212. Calculus II. 4 Credits.

A continuation of MAT 211 with emphasis on the methods of integration and their applications. Antiderivatives, indefinite integrals will be explored, and the Fundamental Theorem of Calculus will be used to define definite integrals. Topics include; integration of algebraic, trigonometric, inverse trigonometric, logarithmic, and exponential functions; area between two curves, volumes, arc length,

work, fluid pressure, polar coordinates, parametric forms and series and sequences. Prerequisite: MAT 211 with a grade of "C" or higher; Math prerequisite must be taken within last 10 years or permission of dean.

MAT 213. Calculus III. 4 Credits.

A continuation of MAT 212 with emphasis on parametric equations, polar coordinates, vector functions, analytic geometry in space, and multivariable calculus. Topics include: parametric equations, polar coordinates, vectors, dot products and cross products, motion in space, length of curves, planes and surfaces, partial derivatives, max/min problems, Lagrange multipliers, multiple integrals, vector calculus, Green's Theorem, Stokes' Theorem and the Divergence Theorem. Prerequisite: MAT 212 with a grade of "C" or higher; Math prerequisite must be taken within last 10 years or permission of dean. Spring.

MAT 220. Linear Algebra. 4 Credits.

This course emphasizes the techniques of linear algebra and their applications. Topics for this course include matrix operations, determinants, linear equations, vector spaces, linear transformations, eigenvalues and eigenvectors, inner products and norms, orthogonality, and least squares. MATLAB/GNU Octave will be used to explore computational algorithms and numerical applications. Prerequisite: MAT 211 with a grade of "C" or higher; Math prerequisite must be taken within last 10 years or permission of dean. Fall.

MAT 230. Ordinary Differential Equations. 4 Credits.

A first course in ordinary differential equations, including analytical solution methods, elementary numerical methods, and modeling. Topics to be covered include: first-order equations including integrating factors, substitutions, and transformations; second-order equations including variation of the method of undetermined coefficients and parameters; series solutions; elementary numerical methods including Euler's methods, Runge-Kutta methods, and error analysis; Laplace transforms; systems of linear equations; boundary-value problems. Students will use MATLAB/GNU Octave to explore direction fields, phase plane analysis, and nonlinear systems. Prerequisite: MAT 212 with a grade of "C" or higher; Math prerequisite must be met within the last 10 years or permission of the dean. Spring.