MATH F051 Math Skills Review
1 Credit
Offered As Demand Warrants
Develops and reviews basic mathematical terminology, theory and operations as outlined by the Alaska State Mathematics Standards. Mathematics topics focus on reviewing the six basic 'strands' of mathematical content: numeration, measurement, estimation and computation, function and relationship, geometry, and statistics and probability. Approaches to problem solving will emphasize the process of mathematical thinking, communication and reasoning. It is an appropriate course for those preparing for the High School Qualifying Exam in Alaska or those needing a review of basic math skills in preparation for a math placement test at UAF. May be repeated for a total of three credits.
Lecture + Lab + Other: 1 + 0 + 0

MATH F053 SAT/ACT Math Prep and Review
1 Credit
Offered As Demand Warrants
This course will review basic concepts and practice math test taking skills to help prepare for the ACT and SAT tests.
Lecture + Lab + Other: 1 + 0 + 0

MATH F054 Prealgebra
3 Credits
Offered As Demand Warrants
Basic concepts of prealgebra mathematics. Topics include operations and applications of whole numbers, integers, fractions, decimals, ratios and proportions, percents, geometry and measures, evaluation of algebraic expressions and applications.
Prerequisites: DEVS F111 (may be taken concurrently); and appropriate placement scores.
Lecture + Lab + Other: 3 + 0 + 0

MATH F054A Modularized Mastery Math: Prealgebra Module A
1 Credit
Offered As Demand Warrants
This course covers one credit of MATH F054 Prealgebra and includes the following topics: identifying and solving basic linear equations involving whole numbers, integers, decimals and fractions, solving ratio and proportion problems, solving percent problems, and solving applied problems. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Appropriate placement test score within one calendar year; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0

MATH F054B Modularized Mastery Math: Prealgebra Module B
1 Credit
Offered As Demand Warrants
This course covers one credit of MATH F054 Prealgebra and includes the following topics: identifying and solving basic linear equations involving whole numbers, integers, decimals and fractions, solving ratio and proportion problems, solving percent problems, and solving applied problems. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F054A; or appropriate placement test scores taken within one calendar year; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0

MATH F054C Modularized Mastery Math: Prealgebra Module C
1 Credit
Offered As Demand Warrants
This course covers one credit of MATH F054 Prealgebra and includes the following topics: identifying and solving basic linear equations involving whole numbers, integers, decimals and fractions, solving ratio and proportion problems, solving percent problems, and solving applied problems. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting. Prerequisite courses and/or placement exams must be taken within one calendar year.
Prerequisites: Grade of B or better in MATH F054A; or appropriate placement test scores; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0

MATH F055 Elementary Algebra
3 Credits
Offered As Demand Warrants
Topics include evaluation and simplifying algebraic expressions, polynomials, factoring, integer exponents, rational expressions, solutions of linear equations and inequalities, graphing lines, solving systems of linear equations, solving quadratic equations by factoring, and some rational equations. Prerequisite courses and/or placement exams must be taken within one calendar year prior to commencement of the course.
Prerequisites: DEVS F111 (may be taken concurrently); and grade of C or better in MATH F054 or ABUS F155, or appropriate placement scores.
Lecture + Lab + Other: 3 + 0 + 0

MATH F055D Modularized Mastery Math: Elementary Algebra Module D
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH F055 Elementary Algebra course and includes the following topics: simplifying algebraic expressions, solving linear equations in one variable, solving linear and compound inequalities in one variable, applications of linear equations and solving formulas. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F054, or ABUS F155; or appropriate placement test scores; permission of instructor required; prerequisite courses and/or placement exams must be taken within one calendar year.
Lecture + Lab + Other: 1 + 0 + 0
MATH F055E  Modularized Mastery Math: Elementary Algebra Module E
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH F055 Elementary Algebra course and includes the following topics: linear equations in two variables, graphing linear equations, find the slope of linear equations, writing equations of lines, exponential rules and operations on polynomials. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F055D taken within one calendar year; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0

MATH F055F  Modularized Mastery Math: Elementary Algebra Module F
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH F055 Elementary Algebra course and includes the following topics: factoring polynomials, solving quadratic equations by factoring, simplifying rational expressions, operations with rational expressions, complex fractions, solving rational equations and applications of quadratic and rational equations. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F055E taken within one calendar year; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0

MATH F056  Math Fast Track: Prealgebra/Elementary Algebra Review
1 Credit
Offered As Demand Warrants
A 20-hour intensive review of math concepts available prior to each semester. Covers prealgebra and elementary algebra topics to prepare qualified students to potentially improve their math course placement. Students should have a history of being successful in equivalent levels of math, although they may not recall enough information to place well on the placement test. Students who are successful in this class have the possibility of advancing through one or two semesters of development math.
Prerequisites: Placement into MATH F054 or MATH F055.
Lecture + Lab + Other: 1 + 0 + 0

MATH F061  Review of Elementary Algebra
1 Credit
Offered As Demand Warrants
Designed to assist students in reviewing material covered by MATH F055. Individuals who have not previously taken an elementary algebra course are recommended to enroll in MATH F055. Available via UAF eCampus only.
Lecture + Lab + Other: 1 + 0 + 0

MATH F062  Alternative Approaches to Math: Elementary Algebra
3 Credits
Offered As Demand Warrants
Algebraic topics. Includes operations with polynomial expressions, first- and second-degree equations, graphing, integral and relational exponents, and radicals using alternative teaching styles.
Prerequisites: Grade of C- or better in MATH F054; or ABUS F155; or appropriate placement test scores; prerequisite courses and/or placement exams must be taken within one calendar year prior to commencement of the course.
Lecture + Lab + Other: 3 + 0 + 0

MATH F065  Mathematics Skills
1-3 Credits
Offered As Demand Warrants
Designed to assist students in reviewing and reinforcing course concepts covered by MATH F054, MATH F055, MATH F062, MATH F105 and MATH F105N. Consists of instruction which may include lab instruction, individual student work or group work. May be repeated.
Special Notes: Recommended for students who need more time and help to master the material in developmental math courses.
Lecture + Lab + Other: 1-3 + 0 + 0

MATH F066  Advanced Math Fast Track: Elementary/Intermediate Algebra Review
1 Credit
Offered As Demand Warrants
A 20-hour intensive review of math concepts available prior to each semester. Covers elementary and intermediate algebra topics to prepare qualified students to potentially improve their math course placement. Students should have a history of being successful in equivalent levels of math, although they may not recall enough information to place well on the placement test. Students who are successful in this class have the possibility of advancing through one or two semesters of development math.
Prerequisites: Placement into MATH F055 or MATH F105 or MATH F105N.
Lecture + Lab + Other: 1 + 0 + 0

MATH F068  Math Essentials
4 Credits
Offered As Demand Warrants
Teaches the concepts of basic arithmetic and introductory algebra. Includes operations and properties on real numbers; ratios; proportion; percent; scientific notation; variation; topics from consumer mathematics; evaluation of literal expressions; solution and graphs of linear equations and inequalities; radicals and exponents; polynomials; factoring and special products; fundamental operations with algebraic fractions; solution of quadratic equations; and elementary systems of equations. Geometric formulae are presented on a case-to-case basis as needed. Student success strategies and college readiness skills are emphasized.
Prerequisites: Appropriate placement scores required.
Lecture + Lab + Other: 4 + 0 + 0

MATH F071  Review of Intermediate Algebra
1 Credit
Offered As Demand Warrants
Course reviews material covered by MATH F105. Individuals who have not taken an intermediate algebra course on the high-school level are recommended to enroll in MATH F105. Available via UAF eCampus only.
Lecture + Lab + Other: 1 + 0 + 0
MATH F105 Intermediate Algebra
3 Credits
Offered As Demand Warrants
Topics include expressions, equations and applications involving linear, absolute value, radical, quadratic, rational and radical functions; graphs of absolute value, radical, quadratic, exponential and logarithmic functions; functions and their inverses; and introduction to exponential and logarithmic functions. To matriculate to MATH F151X from MATH F105, students must earn a grade of B or higher.
Prerequisites: Grade of C or better in MATH F055, MATH F062, MATH F068, or appropriate placement test scores; prerequisite courses and/or placement exams must be taken within one calendar year prior to commencement of the course.
Lecture + Lab + Other: 3 + 0 + 0
MATH F105G Modularized Mastery Math: Intermediate Algebra Module G
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH F105 Intermediate Algebra course and includes the following topics: solving systems of equations and applications, simplifying radicals and expressions with rational exponents, performing operations on radical expressions, solving radical equations and performing operations on complex numbers. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting. Prerequisite courses and/or placement exams must be taken.
Prerequisites: Grade of C or better in MATH F055 or MATH F069 or appropriate placement test scores; prerequisite courses and/or placement exams must be taken.
Lecture + Lab + Other: 1 + 0 + 0
MATH F105H Modularized Mastery Math: Intermediate Algebra Module H
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH F105 Intermediate Algebra course and includes the following topics: review of solving quadratic equations by factoring, solving quadratic equations that are not factorable, relations and functions, graphs and transformations of functions, quadratic functions and their graphs, performing operations on functions, compositions of functions and applications of quadratic equations and functions. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F105G taken within one calendar year; permission of instructor is required.
Lecture + Lab + Other: 1 + 0 + 0
MATH F105J Modularized Mastery Math: Intermediate Algebra Module J
1 Credit
Offered As Demand Warrants
This course covers one credit of the MATH Intermediate Algebra course and includes the following topics: solving absolute value equations and inequalities, solving linear and compound linear inequalities, solving quadratic and rational inequalities, inverse functions, exponential and logarithmic functions, properties of logarithms and solving exponential and logarithmic equations. Topics are split into mini-modules and worked until mastery is achieved. Some mini-modules may be skipped if a student already demonstrates mastery of them. Computers will be used within a structured and independent learning setting.
Prerequisites: Grade of B or better in MATH F105H taken within one calendar year; permission of instructor required.
Lecture + Lab + Other: 1 + 0 + 0
MATH F105N Intensive Intermediate Algebra
4 Credits
Offered As Demand Warrants
Includes exponents, radicals, graphing, systems of equations, quadratic equations and inequalities, logarithms and exponentials and complex numbers using alternative teaching styles.
Prerequisites: MATH F055, MATH F055F, MATH F062, MATH F068, MATH F105, MATH F105J, or appropriate placement scores; prerequisite courses and placement scores must be taken within one calendar year.
Lecture + Lab + Other: 4 + 0 + 0
MATH F113X Numbers and Society (m)
3 Credits
Offered Fall and Spring
Numbers and data help us understand our society. In this course, we develop mathematical concepts and tools to understand what numbers and data can tell us. Topics may include the mathematics of elections and voting, modeling population growth, financial mathematics, polls and surveying, and introductory probability and descriptive statistics.
Prerequisites: An appropriate score on the math placement test, or MATH F105, MATH F105N or MATH F105J.
Special Notes: This course may be taken independently from MATH F114X, and both courses can be taken for credit in either order.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 3 + 0 + 0
MATH F114X Patterns and Society
3 Credits
Offered Fall and Spring
Patterns are present in every aspect of daily life. In this course, we develop mathematical concepts and tools to understand what patterns can tell us. Topics may include dividing things fairly; determining efficient routes and schedules; analyzing networks and their properties; the mathematics of symmetry, fractal geometry, and patterns in nature.
Prerequisite: An appropriate score on the math placement test, MATH F105, MATH F105N or MATH F105J.
Special Notes: This course may be taken independently from MATH F113X, and both courses can be taken for credit in either order.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 3 + 0 + 0
MATH F122X  Essential Precalculus with Applications Skills Workshop
1 Credit
Offered Fall and Spring
Directed study of topics in MATH F122X; emphasis will be placed on problem solving and mathematical communication. Also included will be instruction on how to be successful in precalculus and mathematics-based courses.
Prerequisites: Previous W or grade below C- in MATH F122X; or placement into MATH F122X; or departmental recommendation.
Corequisite: MATH F122X.
Special Notes: Credit may be earned for taking MATH F122R or MATH F122S, but not for both.
Lecture + Lab + Other: 0.5 + 1.5 + 0

MATH F122X  Essential Precalculus with Applications (m)
3 Credits
Offered Fall and Spring
A study of various classes of functions, exploring their numeric, algebraic and graphical aspects. Function classes include linear, quadratic, rational, exponential and logarithmic. This course is appropriate for students in programs relating to business and economics or life sciences or students intending to take MATH F230X.
Prerequisites: Appropriate placement score, MATH F105, MATH F105N or MATH F105J.
Special Notes: Credit may be earned for MATH F151X or MATH F122X, but not for both.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 3 + 0 + 0

MATH F151S  College Algebra for Calculus Skills Workshop
1 Credit
Offered Fall and Spring
Directed study of topics in MATH F151X. Emphasis will be placed on problem-solving and mathematical communication. Also included will be instruction on how to be successful in College Algebra for Calculus and mathematics-based courses.
Prerequisites: Previous W or grade below C- in MATH F151X; or placement into MATH F151X; or departmental recommendation.
Corequisites: MATH F151X.
Special Notes: Credit may be earned for taking MATH F151R or MATH F151S, but not for both.
Lecture + Lab + Other: 0.5 + 1.5 + 0

MATH F151X  College Algebra for Calculus (m)
4 Credits
Offered Fall and Spring
Study of algebraic, logarithmic and exponential functions; systems of equations; applications.
Prerequisites: Appropriate score on the math placement test, B or better in MATH F105, B or better in MATH F105J or C or better in MATH F105N.
Special Notes: Credit may be earned for MATH F151X or MATH F122X, but not for both; Only eight credits total may be earned from MATH F151X, MATH F152X and MATH F156X.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 4.5 + 0 + 0

MATH F152X  Trigonometry (m)
3 Credits
Offered Fall and Spring
A study of trigonometric functions including graphing, identities, inverse trigonometric functions, solving equations and polar coordinates; applications.
Prerequisites: MATH F151X (may be taken concurrently) or placement.
Special Notes: Only eight credits total may be earned from MATH F151X, MATH F152X and MATH F156X.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 3 + 0 + 0

MATH F156S  Precalculus Skills Workshop
1 Credit
Offered Fall and Spring
Directed study of topics in precalculus. Emphasis will be placed on problem-solving and mathematical communication. Also included will be instruction on how to be successful in precalculus and mathematics-based courses.
Prerequisites: Previous W or grade below C- in MATH F156X; or placement into MATH F156X; or departmental recommendation.
Corequisites: MATH F156X.
Special Notes: Credit may be earned for taking MATH F156R or MATH F156S, but not for both.
Lecture + Lab + Other: 0.5 + 1.5 + 0

MATH F156X  Precalculus (m)
4 Credits
Offered Fall and Spring
Various classes of functions and their graphs are explored numerically, algebraically and graphically. Function classes include polynomial, rational, exponential, logarithmic and trigonometric. Skills and concepts needed for calculus are emphasized. This class is intended for students intending to take MATH F251X.
Prerequisites: Placement into MATH F156X.
Special Notes: Only eight credits total may be earned from MATH F151X, MATH F152X and MATH F156X.
Attributes: UAF GER Mathematics Req
Lecture + Lab + Other: 4 + 1 + 0

MATH F211  Mathematics for Elementary School Teachers (m)
3 Credits
Offered Fall
Elementary set theory, numeration systems, and algorithms of arithmetic, divisors, multiples, integers and introduction to rational numbers. Emphasis on classroom methods. Restricted to Elementary Education majors; others by permission of instructor.
Prerequisites: MATH F122X; or MATH F151X; or MATH F156X; or placement.
Lecture + Lab + Other: 3 + 1 + 0

MATH F212  Mathematics for Elementary School Teachers II (m)
3 Credits
Offered Spring
A continuation of MATH F211. Real number systems and subsystems, logic, informal geometry, metric system, probability and statistics. Emphasis on classroom methods.
Prerequisites: MATH F211.
Lecture + Lab + Other: 3 + 1 + 0
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH F230S</td>
<td>Essential Calculus with Applications Skills Workshop</td>
<td>1 Credit</td>
<td>Fall and Spring</td>
<td>Directed study of topics in MATH F230X; emphasis will be placed on problem-solving and mathematical communication. Also included will be instruction on how to be successful in calculus and other mathematics-based courses. Prerequisites: Previous W or grade below C- in MATH F230X; or placement into MATH F230X; or department recommendation. Corequisites: MATH F230X. Special Notes: credit may be earned for taking MATH F230R or MATH F230S, but not for both. Lecture + Lab + Other: 0.5 + 1.5 + 0</td>
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<tr>
<td>MATH F230X</td>
<td>Essential Calculus with Applications</td>
<td>3 Credits</td>
<td>Fall and Spring</td>
<td>An introduction to the key ideas of differential and integral calculus, and their uses in business, economics and the life sciences. This course emphasizes a solid conceptual understanding, along with calculation techniques for basic applications. MATH F230X cannot serve as a prerequisite for MATH F252X. Prerequisites: MATH F122X; or MATH F151X; or MATH F156X; or placement. Special Notes: Credit cannot be earned for both MATH F230X and MATH F251X. Attributes: UAF GER Mathematics Req Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>MATH F251L</td>
<td>Calculus I Recitation</td>
<td>0 Credit</td>
<td>Fall and Spring</td>
<td>Recitation section for Calculus I. Activities may include worksheets, quizzes and problem sessions associated with corresponding lecture material from MATH F251X. Corequisites: MATH F251X. Lecture + Lab + Other: 0 + 1 + 0</td>
</tr>
<tr>
<td>MATH F251S</td>
<td>Calculus I Skills Workshop</td>
<td>1 Credit</td>
<td>Fall and Spring</td>
<td>Directed study of topics in MATH F251X, emphasis will be placed on problem-solving and mathematical communication. Also included will be instruction on how to be successful in Calculus I and mathematics-based courses. Prerequisites: Previous W or grade below C- in MATH F251X; or placement into MATH F251X; or departmental recommendation. Corequisites: MATH F251X. Special Notes: Credit may be earned for taking MATH F251R or MATH F251S, but not for both. Lecture + Lab + Other: 0.5 + 1.5 + 0</td>
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<tr>
<td>MATH F251X</td>
<td>Calculus I (m)</td>
<td>4 Credits</td>
<td>Fall and Spring</td>
<td>A first course in single-variable calculus. Topics include limits; continuity and differentiation of functions; applications of the derivative to graphing, optimization, and rates of change; definite and indefinite integration; and the Fundamental Theorem of Calculus. Prerequisites: Appropriate score on the math placement test; or MATH F151X and MATH F152X; or MATH F156X. Corequisites: MATH F251L. Special Notes: Credit may not be earned for both MATH F251X and MATH F230X. Attributes: UAF GER Mathematics Req Lecture + Lab + Other: 4 + 0 + 0</td>
</tr>
<tr>
<td>MATH F252L</td>
<td>MATH F252X Recitation</td>
<td>0 Credit</td>
<td>Fall and Spring</td>
<td>Co-requisites: MATH F252X. Lecture + Lab + Other: 0 + 0 + 0</td>
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<tr>
<td>MATH F252X</td>
<td>Calculus II (m)</td>
<td>4 Credits</td>
<td>Fall and Spring</td>
<td>Further topics in single-variable calculus, including techniques of integration; applications of integration; convergence of sequences and series; parameterized curves; and polar coordinates. Prerequisites: MATH F251X. Co-requisites: MATH F252L. Attributes: UAF GER Mathematics Req Lecture + Lab + Other: 4 + 1 + 0</td>
</tr>
<tr>
<td>MATH F253X</td>
<td>Calculus III (m)</td>
<td>4 Credits</td>
<td>Fall and Spring</td>
<td>Multivariable calculus. Topics include vectors in 2- and 3-dimensions; differential calculus of functions of several variables; multiple integration; vector calculus, including Green's and Stokes' Theorem; and applications. Prerequisites: MATH F252X. Attributes: UAF GER Mathematics Req Lecture + Lab + Other: 4 + 0 + 0</td>
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<tr>
<td>MATH F265</td>
<td>Introduction to Mathematical Proofs (m)</td>
<td>3 Credits</td>
<td>Spring</td>
<td>Emphasis on proof techniques with topics including logic, sets, cardinality, relations, functions, equivalence, induction, number theory, congruence classes and elementary counting. In addition, a rigorous treatment of topics from calculus or a selection of additional topics from discrete mathematics may be included. Prerequisites: MATH F252X (may be taken concurrently). Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>MATH F302</td>
<td>Differential Equations</td>
<td>3 Credits</td>
<td>Fall and Spring</td>
<td>Nature and origin of differential equations, first order equations and solutions, linear differential equations with constant coefficients, systems of equations, power series solutions, operational methods, and applications. Prerequisites: MATH F253X. Lecture + Lab + Other: 3 + 0 + 0</td>
</tr>
</tbody>
</table>
MATH F305  Geometry  
3 Credits  
Offered Spring Even-numbered Years  
Topics selected from such fields as Euclidean and non-Euclidean plane geometry, affine geometry, projective geometry, and topology.  
Prerequisites: MATH F255; MATH F314.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F307  Discrete Mathematics  
3 Credits  
Offered Spring  
Logic, counting, sets and functions, recurrence relations, graphs and trees. Additional topics chosen from probability theory.  
Prerequisites: MATH F252X.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F314  Linear Algebra  
3 Credits  
Offered Fall and Spring  
Linear equations, finite dimensional vector spaces, matrices, determinants, linear transformations and characteristic values. Inner product spaces.  
Prerequisites: MATH F252X.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F316  Introduction to the History and Philosophy of Mathematics  
3 Credits  
Offered Spring Odd-numbered Years  
Important periods in the history of mathematics, including the mathematics of Ancient Babylon, Mesopotamia, Greece, China and India; mathematics of medieval Europe, the Middle East and the Renaissance; the development of geometry, algebra and calculus. Other areas in the development of mathematics and the philosophy of mathematics will be studied as time permits. For students of mathematics, science, history and philosophy.  
Prerequisites: MATH F253X; MATH F255; MATH F265.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F320  Topics in Combinatorics  
3 Credits  
Offered Fall Odd-numbered Years  
Introduction to some fundamental ideas of combinatorics. Topics selected from such fields as enumerative combinatorics, generating functions, set systems, recurrence relations, directed graphs, matchings, Hamiltonian and Eulerian graphs, trees and graph colorings.  
Prerequisites: MATH F252X.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F321  Number Theory  
3 Credits  
Offered Fall Even-numbered Years  
The theory of numbers is concerned with the properties of the integers, one of the most basic of mathematical sets. Seemingly naive questions of number theory stimulated much of the development of modern mathematics and still provide rich opportunities for investigation.  
Topics studied include classical ones such as primality, congruences, quadratic reciprocity and Diophantine equations, as well as more recent applications to cryptography. Additional topics such as continued fractions, elliptical curves or an introduction to analytic methods may be included.  
Prerequisites: MATH F255.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F371  Probability  
3 Credits  
Offered Fall Odd-numbered Years  
Probability spaces, conditional probability, random variables, continuous and discrete distributions, expectation, moments, moment generating functions and characteristic functions.  
Prerequisites: MATH F253X.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F401  Introduction to Real Analysis (W)  
3 Credits  
Offered Fall  
Completeness of the real numbers and its consequence, convergence of sequences and series, limits and continuity, differentiation, the Riemann integral.  
Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; MATH F253X; MATH F265.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F404  Introduction to Topology  
3 Credits  
Offered Fall Even-numbered Years  
Introduction to topological spaces, set theory, open sets, compactness, connectedness, product spaces, metric spaces and continua.  
Prerequisites: MATH F253X; MATH F265.  
Recommended: MATH F314 and/or MATH F405.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F405  Abstract Algebra (W)  
3 Credits  
Offered Spring  
Theory of groups, rings and fields.  
Prerequisites: WRTG F111X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; MATH F265.  
Recommended: MATH F307 and/or MATH F314.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F408  Mathematical Statistics  
3 Credits  
Offered Spring Even-numbered Years  
Distribution of random variables and functions of random variables, interval estimation, point estimation, sufficient statistics, order statistics, and test of hypotheses including various criteria for tests.  
Prerequisites: MATH F371; STAT F200X or STAT F300.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F410  Introduction to Complex Analysis  
3 Credits  
Offered Spring  
Complex functions including series, integrals, residues, conformal mapping and applications.  
Prerequisites: MATH F302.  
Lecture + Lab + Other: 3 + 0 + 0 

MATH F412  Differential Geometry  
3 Credits  
Offered Spring Odd-numbered Years  
Introduction to the differential geometry of curves, surfaces, and Riemann manifolds. Basic concepts covered include the Frenet-Serret apparatus, surfaces, first and second fundamental forms, geodesics, Gauss curvature and the Gauss-Bonnet Theorem. Time permitting, topics such as minimal surfaces, theory of hypersurfaces and/or tensor analysis may be included.  
Prerequisites: MATH F314; MATH F401.  
Lecture + Lab + Other: 3 + 0 + 0
Mathematics (MATH)

MATH F426  Numerical Analysis
3 Credits
Offered Fall
Direct and iterative solutions of systems of equations, interpolation, numerical differentiation and integration, numerical solutions of ordinary differential equations, and error analysis.
Prerequisites: MATH F302 or MATH F314.
Recommended: Knowledge of programming.
Lecture + Lab + Other: 3 + 0 + 0

MATH F430  Topics in Mathematics
3 Credits
Offered Spring
An elective course in mathematics for majors. Topics will vary from year to year and may be drawn from mathematical biology, numerical linear algebra, graph theory, logic, or other areas of mathematics. May be repeated with permission of instructor for a total of nine credits.
Prerequisites: MATH F255.
Lecture + Lab + Other: 3 + 0 + 0

MATH F432  Introduction to Partial Differential Equations
3 Credits
Offered Fall
Analysis and solution of partial differential equations. Initial and boundary value problems for parabolic, hyperbolic and elliptic types. Solution methods include separation of variables and Fourier transform.
Prerequisites: MATH F302.
Lecture + Lab + Other: 3 + 0 + 0

MATH F460  Mathematical Modeling
3 Credits
Offered Fall Odd-numbered Years
Introduction to mathematical modeling using differential or difference equations. Emphasis is on formulating models and interpreting qualitative behavior such models predict. Examples will be taken from a variety of fields, depending on the interest of the instructor. Students develop a modeling project.
Prerequisites: COJO F131X or COJO F141X; WRTG F111X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; MATH F252X.
Recommended: one or more of MATH F302, MATH F314, MATH F401, MATH F426, STAT F300 or some programming experience.
Lecture + Lab + Other: 3 + 0 + 0

MATH F490  Senior Seminar  (O)
2 Credits
Offered Spring
Advanced topics selected from areas outside the usual undergraduate offerings. A substantial level of mathematical maturity is assumed.
Prerequisites: COJO F131X or COJO F141X; at least one of MATH F401 or MATH F405; senior standing.
Lecture + Lab + Other: 2 + 0 + 0

MATH F500  Teaching Seminar
1 Credit
Offered Fall
Fundamentals of teaching mathematics in a university setting. Topics may include any aspect of teaching: university regulations, class and lecture organization, testing, book selection, teaching evaluations, etc. Specific topics will vary on the basis of student and instructor interest. Individual classroom visits will also be used for class discussion. May be repeated for credit.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 1 + 0 + 0

MATH F614  Numerical Linear Algebra
3 Credits
Offered Fall Odd-numbered Years
Prerequisites: MATH F314.
Recommended: MATH F401 or MATH F432.
Lecture + Lab + Other: 3 + 0 + 0

MATH F615  Numerical Analysis of Differential Equations
3 Credits
Offered Spring Odd-numbered Years
Review of numerical differentiation and integration, and the numerical solution of ordinary differential equations. Main topics to include the numerical solution of partial differential equations, curve fitting, splines, and the approximation of functions. Supplementary topics such as the numerical method of lines, the fast Fourier transform, and finite elements may be included as time permits and interest warrants.
Prerequisites: CS F201; MATH F314; MATH F410; MATH F426; MATH F432.
Lecture + Lab + Other: 3 + 0 + 0

MATH F617  Functional Analysis
3 Credits
Offered Spring Even-numbered Years
Study of Banach and Hilbert spaces, and continuous linear maps between them. Linear functionals and the Hahn-Banach theorem. Applications of the Baire Category theorem. Compact operators, self adjoint operators, and their spectral properties. Weak topology and its applications.
Prerequisites: MATH F314; MATH F401.
Recommended: MATH F410; MATH F641.
Lecture + Lab + Other: 3 + 0 + 0

MATH F631  Algebra I
4 Credits
Offered Fall Even-numbered Years
Rigorous development of groups, rings and fields.
Prerequisites: MATH F405.
Lecture + Lab + Other: 4 + 0 + 0

MATH F632  Algebra II
3 Credits
Offered Spring Odd-numbered Years
Advanced topics which may be chosen from group theory, Galois theory, commutative or non-commutative algebra, algebraic geometry, homological algebra or other areas.
Prerequisites: MATH F631.
Lecture + Lab + Other: 3 + 0 + 0

MATH F641  Real Analysis
4 Credits
Offered Fall Odd-numbered Years
General theory of Lebesgue measure and Lebesgue integration on the real line. Convergence properties of the integral. Introduction to the general theory of measures and integration. Differentiation, the product measures and an introduction to LP spaces.
Prerequisites: MATH F401.
Lecture + Lab + Other: 4 + 0 + 0
MATH F645  Complex Analysis
4 Credits
Offered Spring Even-numbered Years
Analytic functions, power series, Cauchy integral theory, residue theorem.
Basic topology of the complex plane and the structure theory of analytic
functions. The Riemann mapping theorem. Infinite products.
Prerequisites: MATH F641.
Lecture + Lab + Other: 4 + 0 + 0

MATH F651  Topology
4 Credits
Offered Spring Odd-numbered Years
Treatment of the fundamental topics of point-set topology. Separation
axioms, product and quotient spaces, convergence via nets and filters,
compactness and compactifications, paracompactness, metrization
theorems, countability properties, and connectedness. Set theory as
needed for examples and proof techniques.
Prerequisites: MATH F401 or MATH F404.
Lecture + Lab + Other: 4 + 0 + 0

MATH F658  Topics in Geometry
3 Credits
Offered Fall Even-numbered Years
Elective topics in geometry. Recent offerings include configurations
of points and lines; topology and differential geometry of surfaces;
polyhedra and polytopes.
Prerequisites: Linear algebra; geometry; undergraduate real analysis;
undergraduate abstract algebra.
Lecture + Lab + Other: 3 + 0 + 0

MATH F660  Advanced Mathematical Modeling
3 Credits
Offered Spring Even-numbered Years
The mathematical formulation and analysis of problems arising in the
physical, biological, or social sciences. The focus area of the course may
vary, but emphasis will be given to modeling assumptions, derivation
of model equations, methods of analysis, and interpretation of results
for the particular applications. Examples include heat conduction
problems, random walk processes, molecular evolution, perturbation
theory. Students will develop a modeling project as part of the course
requirements.
Prerequisites: Permission of instructor.
Lecture + Lab + Other: 3 + 0 + 0

MATH F661  Optimization
3 Credits
Offered Fall Odd-numbered Years
Linear and nonlinear programming, simplex method, duality and dual
simplex method, post-optimal analysis, constrained and unconstrained
nonlinear programming, Kuhn-Tucker conditions. Applications to
management, physical and life sciences. Computational work with the
computer.
Prerequisites: Knowledge of calculus, linear algebra and computer
programming.
Lecture + Lab + Other: 3 + 0 + 0

MATH F665  Topics in Graduate Mathematics
3 Credits
Offered As Demand Warrants
Elective courses in graduate mathematics offered by faculty on a rotating
basis. Topics may include, but are not limited to, graph theory, glaciology
modeling, general relativity, mathematical biology, Galois theory and
numerical linear algebra. May be repeated for credit with permission of
instructor.
Lecture + Lab + Other: 3 + 0 + 0

MATH F692  Seminar
1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

MATH F698  Non-thesis Research/Project
1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

MATH F699  Thesis
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 0