MATH 1109. Math for Business: Calculus. (3 Credits)
This course provides business majors with an introduction to differential and integral calculus. Topics include differentiation, integration, and their applications, in particular derivatives of polynomials, rational, exponential and logarithmic functions; curve sketching, optimization problems; and the definite integral. Applications are drawn from business and economics. This course is open only to students in the Gabelli School of Business.

MATH 1198. Honors Business Math. (4 Credits)
Topics covered in this course include elements of multivariable calculus, solutions of systems of linear equations, discrete and continuous probability, and applications to business. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

MATH 1200. Topics in Finite Mathematics. (1 Credit)
This course covers basic concepts of finite mathematics: counting techniques including Venn diagrams, permutations, combinations, probability, and Bayes’ theorem.

MATH 1203. Applied Calculus I. (3 Credits)
This calculus course is designed for students who do not require Calculus 2 or other upper-level math courses as part of their major. Topics include derivatives of polynomial, rational, exponential, and logarithmic functions; curve sketching; and optimization problems.
Attributes: ENVS, MCR, NEUR.

MATH 1204. Applied Calculus II. (3 Credits)
A continuation of MATH 1203. Topics include derivatives of trigonometric functions, methods of integration and applications, calculus of functions of several variables, Lagrange multipliers.
Prerequisite: MATH 1203.

MATH 1205. Applied Statistics. (3 Credits)
This course is designed for students in fields that emphasize quantitative methods. It includes calculus-based preliminary probability material followed by an introduction to basic statistical methods such as estimation, hypothesis testing, correlation, and regression analysis. Examples from a variety of fields and practical experience with statistical software are also provided.
Attribute: ENVS.
Prerequisites: MATH 1203 or MATH 12AB or MATH 12BC.

MATH 1206. Calculus I. (4 Credits)
This calculus course is intended for science and math majors. Topics include limits; continuity; intermediate value theorem; derivatives; mean value theorem; applications such as curve sketching, optimization, related rates, linear approximation, and differentials; antiderivatives; Riemann sums; definite integrals; the Fundamental Theorem of Calculus; substitution rule; inverse functions and their derivatives; and logarithmic and exponential functions. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attributes: ENVS, MCR, NEUR.
MATH 1207. Calculus II. (4 Credits)
This calculus course is a continuation of Calculus I. Topics include inverse trigonometric and hyperbolic functions and their derivatives; techniques of integration, such as integration by parts, partial fractions, trigonometric integrals and substitutions; approximate integration; improper integrals; volumes; arc length; surface area; parametric curves; area and length in polar coordinates; sequences and series; convergence and divergence tests; power series; and Taylor and Maclaurin series. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 1206 or MATH 12AB or MATH 12BC.

MATH 1700. Mathematical Modelling. (4 Credits)
This course shows how discrete and continuous mathematical models can be built and used to solve problems in many fields. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attributes: ENVS, MCR, NEUR.
Prerequisites: MATH 1206 or MATH 1207 or MATH 12AB or MATH 12BC.

MATH 1800. Internship. (1 Credit)
In this student-initiated program, the student may earn one additional credit by connecting a service experience to a course with the approval of the professor and the service-learning director.

MATH 2001. Discrete Mathematics. (4 Credits)
This course introduces students to the language and writing of mathematical proofs in the context of discrete structures. Topics include elementary logic; basic proof techniques such as direct proof, proof by contradiction, contraposition, case division, induction; division, the Euclidean algorithm, modular arithmetic; set theory, relations and equivalence, functions. Additional topics may include cardinality of sets, combinatorics, and graphs. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 1206 or MATH 1207 or MATH 12AB or MATH 12BC.

MATH 2006. Linear Algebra I. (4 Credits)
Topics covered in this course include systems of linear equations, real and complex vector spaces, linear independence, dimension, linear transformations, matrix representations, fundamental theorem of linear algebra, determinants, and eigenvalues. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 1206 or MATH 1207 or MATH 12AB or MATH 12BC.

MATH 2004. Multivariable Calculus I. (4 Credits)
Topics covered in this course include vectors and the three-dimensional coordinates methods of solid geometry, vector-valued functions, functions of several variables, partial derivatives, gradients, Lagrange multipliers, and multiple integrals. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 1207.

MATH 2005. Multivariable Calculus II. (4 Credits)
This is a continuation of MATH 2004. Topics covered in this course include vector fields and their derivatives, multiple integrals, line and surface integrals, and the theorems of Gauss, Green and Stokes. One or more of the following additional topics may be covered, as time permits: differential forms, functions of a complex variable, fluid mechanics, or geometry of surfaces. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 2004.
MATH 3005. Abstract Algebra I. (4 Credits)
Topics include well ordering and induction, unique factorization, modular arithmetic, groups, subgroups, Lagrange's theorem, normality, homomorphisms of groups, permutation groups, simple groups.
Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 2001 and MATH 2006.

MATH 3006. Probability. (4 Credits)
Topics include discrete and continuous probability models in one and several variables, expectation and variance, limit theorems, applications. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 2004.

MATH 3007. Statistics. (4 Credits)
Topics include sampling distributions, estimation, testing hypotheses, analysis of variance, regression and correlation, nonparametric methods, time series. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 3006.

MATH 3008. Number Theory. (4 Credits)
Topics include divisibility and related concepts, congruencies, quadratic residues, number theoretic functions, additive number theory, some Diophantine equations. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 2001.

MATH 3009. Mathematics of Finance. (4 Credits)
The market for options, a type of contract in finance, has grown quickly in the past fifty years. In this course we will explore the Nobel Prize-winning Black-Scholes-Merton model for valuing these contracts. We will introduce basic notions of probability (such as Brownian motion) as well as basic notions from finance (such as the No Arbitrage Principle) and use these to derive and solve the Black-Scholes equation. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 3006.

MATH 3010. Scientific Communication. (4 Credits)
In this course, students develop skills in written and oral communication needed to produce scientific articles, monographs, and presentations that are accomplished in both form and content. The course covers both the use of LaTeX to produce work that meets the highest standards of design and typography, and the techniques of writing, organization, and scholarly citation needed to ensure that this work accurately embodies, effectively communicates, and professionally documents the author's scientific thought. Students will learn the ins and outs of generating and using copyright material, and how to present data in forms of pictures, tables, graphs, or schematics. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

MATH 3012. Math of Infinity. (4 Credits)
Topics covered in this course include elementary set and function theory; the notion of counting infinite sets, including Hilbert's infinite hotel; cardinality and infinite cardinals; and Cantor's work on infinite sets. Additional topics may include well-ordered sets and math induction; prime number generators; the Riemann zeta function; logic and meta-mathematics. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

MATH 3800. Internship. (3 Credits)
MATH 4001. Mathematical Ethics Practicum. (4 Credits)
In this class, which fulfills the Senior Values seminar requirement of the Core Curriculum and serves as a capstone to both the pure and applied tracks of the Mathematics major, students will learn the ethical responsibilities of mathematicians, both as interpreters and as creators of mathematics. The course will combine historical and contemporary case studies with practical training in the skills and disciplines students must master to assume full ownership of their mathematics. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attributes: EP4, VAL.

MATH 4004. Topology. (4 Credits)
Topics include open sets and continuity in metric spaces and topological spaces, subspaces and quotient topologies, compact sets, connected sets. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

MATH 4006. Numerical Analysis. (4 Credits)
In this course, students analyze and implement numerical algorithms used to efficiently solve problems coming from science and engineering, such as root finding, systems of equations, approximation of functions, integration, differential equations, and direct and iterative methods in linear algebra. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 2004 and MATH 2006.

MATH 4009. Topics in Geometry. (4 Credits)
In this course, students focus on the study of Euclidean and non-Euclidean geometries using an axiomatic approach. We study propositions from Euclid's Elements before focusing on more advanced results in Euclidean geometry and their proofs. We follow the history of the parallel postulate, the discovery of non-Euclidean geometry, and the attendant philosophical implications. We build models and prove theorems from incidence, neutral, and hyperbolic geometries. Some properties may be investigated through the use of interactive geometry software. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 2004.

MATH 4020. Differential Geometry. (4 Credits)
This course introduces the geometry of curved spaces in many dimensions, which are the basis of subjects such as Einstein's theory of gravitation. Topics include manifolds, tangent spaces, the Gauss map, the shape operator, curvature, and geodesics. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: (MATH 2004 and MATH 2006).
MATH 4022. Partial Differential Equations. (4 Credits)
This course provides students with an introduction to partial differential equations. Topics include first-order, diffusion, wave, and Laplace equations; Fourier series; Green’s functions; and finite difference methods. Partial differential equations are a fundamental tool in physics and find application in machine learning and finance. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: MATH 2005 or (MATH 2006 and MATH 3002).

MATH 4999. Independent Study. (1 to 4 Credits)