

## DEPARTMENT OF MATHEMATICS

**200 Albert W. Brown Building**  
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**[www.brockport.edu/math](http://www.brockport.edu/math)**

*Chair and Associate Professor:* Mihail Barbosu, PhD, Paris Observatory and Paris VI University; *Professor:* Sanford S. Miller, PhD, University of Kentucky; *Associate Professors:* Dawn M. Jones, PhD, Western Michigan University; Gabriel T. Prajitura, PhD, University of Tennessee-Knoxville; Howard J. Skogman, PhD, University of California at San Diego; Charles J. Sommer, PhD, SUNY Buffalo; *Assistant Professors:* Jason R. Morris, PhD, University of Pittsburgh; Bogdan Petrenko, PhD, University of Illinois at Urbana-Champaign; Rebecca Smith, PhD, University of Florida; Pierangela Veneziani, PhD, Rutgers University; Ruhan Zhao, PhD, University of Joensuu, Finland.

An in-depth understanding of mathematics is of great importance to many careers in our technologically complex society. Moreover, the study of mathematics promotes analytical and critical thinking skills, and therefore is a valuable part of any program of study. The major and minor programs in mathematics are designed to provide the knowledge and skills necessary to pursue graduate study or to support career goals in a range of professions. Recent graduates who have majored in mathematics have found rewarding careers in business, teaching, computing, government, law, engineering, actuarial science and medicine. A major or minor in mathematics is a natural adjunct to the study of physics, chemistry, biology, earth science, business, economics, computer science, computational science, or the social sciences.

The department offers a major in mathematics, a minor in mathematics, and a minor in mathematics/statistics. In addition, it supports a double major in mathematics and computer science. To complete a major in mathematics, students take 10 required courses that provide a thorough foundation in several central areas of mathematics, a computer science course that emphasizes the design of algorithms, and a minimum of three advanced courses chosen to give special depth in at least one area. The two minor programs require students to take six mathematics courses that coherently complement their particular major. It is expected that the program will soon feature several specialized tracks and minors (in actuarial science, for example). Please consult the current *Math Major Handbook* for the most current information.

Because of the sequential nature of the study of mathematics, students should meet with the department's advisement coordinator as soon as possible to declare a major or minor, be assigned a departmental advisor, and plan an academic program.

*Please note that the information in this document is subject to change. For the latest information on our program and our courses, please contact the department.*

### Major in Mathematics (46 credits)

Students must complete a minimum of 42 credits in mathematics and four credits in computer science, as follows:

1. Required courses (33 credits)		Credits
MTH 201, 202, 203	Calculus I, II, III	12
MTH 255	Differential Equations	3
MTH 281	Discrete Mathematics I	3
MTH 324	Linear Algebra	3
MTH 346	Probability and Statistics I	3
MTH 425	Abstract Algebra	3
MTH 457	Real Analysis	3
MTH 432	College Geometry <sup>(a)</sup>	3
<b>OR</b>		3
MTH 430	Topology <sup>(a)</sup>	

<b>2. Elective courses (9 credits)</b>	9
Nine credits in mathematics, by advisement, from courses numbered MTH 400 or higher. CSC 483 may be substituted for one of these math courses.	
<b>3. Program corequisite (computer science course):</b>	
CSC 203      Fundamentals of Computer Science I	4
<b>Total:</b>	<b>46</b>

**Notes:**

- Students pursuing adolescence education certification are required by the New York State Department of Education to complete a geometry course, thus such students are recommended to select the option MTH 432 College Geometry.
- At least three 400-level MTH courses must be taken at The College at Brockport, including at least one of the following: MTH 425, 446, or 457.
- Students receiving elementary certification may substitute MTH 314 for one of the mathematics electives.
- If a student wishes to fill some requirement of the major through coursework at an institution other than The College at Brockport, then the student must first obtain the approval of the department chairperson.

Students who have successfully completed a calculus course in high school may qualify for college credit for MTH 201. Qualifying students must contact the department before they register for their first calculus course at the College.

More details concerning the mathematics major, including sample programs of study and information on advisement for majors, student awards, computing facilities, library holdings, the Mathematics Club, and the Student Chapter of the Mathematical Association of America, can be found in the *Mathematics Major Handbook* or on the department Web site. Copies of the handbook are available in the department office.

**Minor in Mathematics**

Students must complete a minimum of six courses in mathematics, as follows:

- Required courses:** MTH 201 Calculus I and MTH 202 Calculus II.
- Elective courses:** Four courses in mathematics, chosen from MTH 203, MTH 255, MTH 243 or higher. Students must choose these electives only after consultation with their mathematics department advisor.

**Note:** At least nine credits toward the minor must be completed at The College at Brockport. If a student wishes to fill some of the requirements of the minor through coursework at an institution other than the College, then the student must first obtain the approval of the department chairperson.

**Minor in Mathematics/Statistics**

Students must complete either sequence A or B below.

**Sequence A**

MTH 201	Calculus I
MTH 202	Calculus II
MTH 203	Calculus III
MTH 281	Discrete Mathematics I
MTH 346	Probability and Statistics I
MTH 446	Probability and Statistics II

**Sequence B**

MTH 201	Calculus I
MTH 202	Calculus II
MTH 281	Discrete Mathematics I
MTH 346	Probability and Statistics I
MTH 441	Statistical Methods I
MTH 442	Statistical Methods II

**Notes:**

- a) MTH 281 Discrete Mathematics I can be replaced with MTH 245 Finite Mathematics.
- b) At least nine credits toward the minor must be completed at The College at Brockport.
- c) If a student wishes to fill some of the requirements of the minor through coursework at an institution other than the College, then the student must first obtain the approval of the department chairperson.

**Certification in Mathematics**

Students who wish to teach mathematics can pursue a program at The College at Brockport that leads to provisional certification. The program requires completion of a major in mathematics, and a prescribed group of professional courses offered chiefly by the Department of Education and Human Development. Students seeking certification should contact the Department of Education and Human Development as soon as possible.

## MATHEMATICS COURSES

**MTH 110 Introduction to Mathematics (A).** (Placement for students with weak backgrounds in mathematics. Closed to students who have passed MTH 111 or 121 or higher or any statistics course.) Places major emphasis on algebraic skills, basic operations on signed numbers (decimal and fractional forms); percents; techniques for solving linear and quadratic equations and systems of equations using two variables; algebraic operations on polynomials, roots and radicals. 3 Cr. Every Semester.

**MTH 111 College Algebra (A).** *Prerequisite:* Two years of good high school mathematics, with a sufficiently high score on the Regents Math AR Exam. Closed to students who have completed more than three years of high school mathematics or MTH 122 or a calculus course. Covers algebra at the intermediate level, including operations on polynomials and algebraic fractions, solution of first- and second-degree equations, graphs of functions, logarithms and exponential functions. 3 Cr. Every Semester.

**MTH 112 College Mathematics (A).** *Prerequisite:* MTH 111 (Placement for most students with good high school mathematics background. Meets Brockport General Education Mathematics course requirement.) Develops college-level skills in algebra, geometry, data analysis, and quantitative reasoning. Practice with linear and non-linear equations, geometric problem-solving, probability, algorithms, tabular and graphic techniques, modeling real world problems. Must pass final comprehensive examination to pass course. 3 Cr. Every Semester.

**MTH 122 Pre-Calculus (A).** *Prerequisite:* Any of the following: MTH 111, MTH 112, MTH 121, or a sufficiently high score on the Regents Math B exam or on the SAT. (Closed to students who have credit for MTH 201.) Designed to prepare students for the study of calculus. Covers algebraic, exponential, logarithmic, and trigonometric functions. 3 Cr.

**MTH 201 Calculus I (A).** *Prerequisite:* MTH 122 or a sufficiently high score on the Regents Math B exam. Covers limits and continuity; derivatives and integrals of algebraic, trigonometric, exponential, and logarithmic functions; and applications of the derivative. 4 Cr.

**MTH 202 Calculus II (A).** *Prerequisite:* MTH 201 or one year of high school calculus with an appropriate AP test score. Covers techniques and applications of integration, approximation methods, Taylor polynomials, improper integrals and L'Hospital's rule, and an introduction to infinite series. 4 Cr.

**MTH 203 Calculus III (A).** *Prerequisite:* MTH 202 or two years of high school calculus with an appropriate AP test score. Covers polar coordinates, vectors and 3-space, functions of several variables, applications of partial derivatives, and multiple integrals. 4 Cr.

**MTH 221 Calculus for Business, Social and Life Sciences I (A).** *Prerequisite:* MTH 111 or MTH 121 or Regents Math above Math AR. Closed to students who have completed MTH 201 with a grade of "C" or better. Provides an introduction to calculus, with an emphasis on its applications to business and the behavioral sciences. Covers derivatives of functions of one and several variables, applied maximization and minimization problems, exponential growth and decay models, the natural logarithm function, and an introduction to integration. 3 Cr.

**MTH 243 Elementary Statistics (A).** Closed to students who have received academic credit for ECN 204, PSH 202, PLS 300, SOC 200, or transfer credit for an elementary statistics course at another institution. Covers the use and limitations of various statistical concepts, including frequency distributions, measures of central tendency and of variation, use of normal curve and t-tables, sampling, estimation, tests of significance for means, and correlation. 3 Cr. Every Semester.

**MTH 245 Finite Mathematics (A).** *Prerequisite:* MTH 111 or MTH 121 or a sufficiently high score on the Regents Math B exam. Closed to students who have successfully completed MTH 281. Covers linear equations, matrix algebra, linear programming, and probability theory. Uses these concepts to build mathematical models to solve problems arising in various disciplines. 3 Cr.

**MTH 255 Differential Equations (A).** *Prerequisite:* MTH 202. Covers first order differential equations and applications, second order and higher order linear differential equations, series solutions about ordinary points and the Laplace Transform. 3 Cr.

**MTH 281 Discrete Mathematics I (A).** *Prerequisite:* MTH 122 or a sufficiently high score on the Regents Math B exam. Provides an introduction to discrete mathematics. Includes these topics: propositional and predicate logic, sets, functions, matrix algebra, algorithms, valid arguments, direct and indirect proofs, mathematical induction, permutations and combinations, and discrete probability. 3 Cr.

**MTH 313 Mathematics for Elementary Teachers I (A).** *Prerequisite:* Any mathematics course that satisfies the College's General Education requirement in College Mathematics. Open only students seeking elementary teaching certification. Includes: sets, relations, number systems, elementary number theory, algebra, and mathematical systems. Uses a problem-solving approach where appropriate. 3 Cr.

**MTH 314 Mathematics for Elementary Teachers II (A).** *Prerequisite:* MTH 313 or any MTH course numbered 201 or higher. Covers various aspects of geometry, including area, volume, coordinate and transformational geometry, probability and statistics. Emphasizes problem solving and the instructional use of calculators and computers. 3 Cr.

**MTH 324 Linear Algebra (A).** *Prerequisite:* MTH 202 and MTH 281. Covers matrices, determinants, vector spaces and subspaces, dimension, linear transformations and Euclidean vector spaces. 3 Cr. Every Semester.

**MTH 346 Probability and Statistics I (A).** *Prerequisites:* MTH 202 and either MTH 245 or MTH 281. Covers random variables and vectors, moments and moment generating functions, discrete and continuous probability distributions, and sampling distributions. 3 Cr.

**MTH 363 Financial Mathematics (A).** *Prerequisite:* MTH 202. Provides fundamental concepts of financial mathematics and prepares students for EXAM FM (Financial Mathematics) of the Society of Actuaries. Students will learn about inflation,

rate of interest, stocks, bonds, and other financial instruments. 3 Cr. Spring.

**MTH 399 Independent Study in Mathematics (A).** To be defined in consultation with the instructor sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. 1-3 Cr.

**MTH 405 Mathematical Problem Solving (A).** *Prerequisite:* MTH 202, MTH 281, and instructor's permission. Develops problem-solving ability in mathematics. Includes how to get started, methods of proof, devising a strategy, and "looking back." Places strong emphasis on critical reasoning and clarity of written expression. 3 Cr.

**MTH 412 History of Mathematics (A,Y).** *Prerequisite:* MTH 202 and either MTH 245 or MTH 281. Covers the history and development of mathematical ideas from primitive origins to the present. Includes topics such as arithmetic, number theory, geometries, algebra, calculus, and selected advanced topics. 3 Cr. Spring.

**MTH 420 Mathematics for Adolescence Teachers (A).** *Prerequisite:* MTH 432. Analyzes the adolescence mathematics curriculum (grades 5-12) from an advanced prospective. Topics include algebra, geometry, data analysis, statistics, trigonometry, discrete mathematics, and calculus. Students will examine their own understanding of these topics as well as examine the theoretical underpinning of each. 3 Cr.

**MTH 421 Number Theory (A).** *Prerequisites:* MTH 202 and MTH 281. Topics include but are not limited to: mathematical induction, divisibility, primes, arithmetic functions, congruencies, modular arithmetic, Diophantine problems and the distribution of primes. 3 Cr.

**MTH 425 Modern Algebra (A).** *Prerequisites:* MTH 203 and MTH 324. Provides a study of algebraic systems, with special attention to groups and their classification properties. Emphasizes theory and proofs, but clarifies the ideas by means of specific examples involving modular arithmetic, real and complex numbers, permutations, and matrices. Requires extensive writing. 3 Cr. Every Semester.

**MTH 426 Modern Algebra II (A).** *Prerequisite:* MTH 425. Covers topics such as rings, ideals, fields and further group theory. Course requires extensive proof writing. 3 Cr.

**MTH 429 Topics in Algebra (A).** *Prerequisite:* Instructor's permission. Addresses specific topics in abstract algebra not covered in other courses. A list of topics to be covered will be announced before course is offered. 3 Cr.

**MTH 430 Topology (A).** *Prerequisite:* MTH 281. Provides a study of topologies on various spaces.

Emphasizes theory, abstraction, proof techniques and clarifies these by means of many specific examples. Bridges topics such as geometry, analysis and algebra. Topics include, but are not limited to set theory, continuous functions, connectedness, compactness, and separation. 3 Cr. Spring.

**MTH 432 College Geometry (A).** *Prerequisite:* MTH 324. Provides a study of geometry from the synthetic, analytic, transformational, and vector viewpoints. Includes these topics: axiomatic systems, finite geometries, absolute geometry, Euclidean geometry, non-Euclidean geometries, geometric transformations, and projective geometry. Requires extensive writing. 3 Cr. Fall.

**MTH 439 Topics in Geometry (A).** *Prerequisite:* Instructor's permission. Addresses specific topics in geometry and topology not covered in other courses. A list of topics to be covered will be announced before course is offered. 3 Cr.

**MTH 441 Statistical Methods I (A).** *Prerequisites:* MTH 243 or MTH 346. Covers estimation, hypothesis testing, simple regression, categorical data, and non-parametric methods. Uses statistical analysis software. 3 Cr.

**MTH 442 Statistical Methods II (A).** *Prerequisite:* MTH 441 or instructor's permission. Covers one and two-way analysis of variance, multiple regression, experimental design and linear models. Uses statistical analysis software. 3 Cr. Spring.

**MTH 443 Sampling Methods II (A).** *Prerequisite:* MTH 243 or an equivalent elementary statistics course. Introduces the concepts and techniques in statistical sampling having applications to sample surveys used in a variety of disciplines. Covers the estimation of means, totals and proportions, calculation of variance of estimates and sample size determinations when using simple random sampling, stratified sampling, cluster sampling and systematic sampling methods. 3 Cr. Spring.

**MTH 446 Probability and Statistics II (A).** *Prerequisites:* MTH 203 and MTH 346. Covers the Central Limit Theorem, maximum likelihood estimation, unbiased and sufficient statistics, minimum variance, confidence intervals, Neyman-Pearson Lemma, power calculations, and likelihood ratio tests. 3 Cr. Every Semester.

**MTH 449 Topics in Applied Mathematics (A).** *Prerequisite:* Instructor's permission. Addresses specific topics in probability, statistics, applied analysis, and numerical methods not covered in other courses. A list of topics to be covered will be announced before course is offered. 3 Cr.

**MTH 453 Actuarial Problem Solving (A).** *Prerequisite:* MTH 346 or instructor's permission. Introduces students to Actuarial Science, emphasizes the development of strong problem solving

skills in preparation for the Exam P (Probability) of the Society of Actuaries. 3 Cr.

**MTH 456 Advanced Differential Equations (A).** *Prerequisites:* MTH 255, MTH 324 or some exposure to matrix theory. Covers series solutions about singular points, systems of linear first-order differential equations, plane autonomous systems, Fourier series, Sturm Liouville problems, partial differential equations of physics including the heat, wave and Laplace equation. 3 Cr.

**MTH 457 Real Analysis (A).** *Prerequisites:* MTH 203 and MTH 324. Provides a study of functions of a real variable. Emphasizes theory, proof techniques, and writing skills. Includes: real numbers, denseness of the rational numbers, convergence of sequences of real numbers, Cauchy sequences, Bolzano-Weierstrass theorem, continuous functions, uniform continuity, differentiable functions, and integrable functions. Enhances understanding of the topics through a series of required writing tasks. 3 Cr. Every Semester.

**MTH 459 Topics in Analysis (A).** *Prerequisite:* Instructor's permission. Addresses specific topics in real and complex analysis not covered in other courses. A list of topics to be covered will be announced before course is offered. 3 Cr.

**MTH 461 Deterministic Mathematical Models (A,Y).** *Prerequisite:* either MTH 245 or MTH 281 or instructor's permission. Teaches applied mathematics techniques to be used in engineering, business, finance and other management fields. Topics covered include linear programming, sensitivity analysis, the simplex method, shortest path method, integer linear programming and network models. 3 Cr.

**MTH 462 Stochastic Mathematical Models (A,Y).** *Prerequisite:* MTH 346. Teaches applied mathematics techniques to be used in engineering, business, finance and other management fields. Topics covered include project scheduling, decision theory, simulation, risk analysis, multicriteria decision problems, inventory and queuing models, forecasting, dynamic programming and Markov analysis. 3 Cr.

**MTH 463 Graph Theory (A).** *Prerequisite:* MTH 324 or instructor's permission. An introduction to graph theory, including distance concepts, symmetry and structure, trees and connectivity, Eulerian and Hamiltonian Graphs, planar graphs and imbeddings, and applications of graphs. 3 Cr.

**MTH 465 Combinatorics (A).** *Prerequisite:* MTH 324. An introduction to combinatorics, including basic counting techniques involving permutations, combinations, compositions, and partitions; binomial coefficients; the twelve-fold way; recursions and generating functions. Other topics may

include a more advanced study of permutations, sequences in combinatorics, magic squares, the probabilistic method, etc. *3 Cr. Spring.*

**MTH 471 Numerical Analysis I (A).** *Prerequisites: MTH 203.* Provides a survey of methods used to numerically approximate the solutions of a variety of mathematical problems. Covers the generation and propagation of round-off errors, convergence criteria, and efficiency of computation. Includes: roots of non-linear equations, systems of linear or non-linear equations, polynomial approximations, and an introduction to numerical differentiation and integration. Mathematical software, such as MAPLE, will be used. *3 Cr.*

**MTH 481 Discrete Mathematics II (A).** *Prerequisites: MTH 201 and MTH 281.* A second course in discrete mathematics. Includes: study of algorithms, recurrence relations, inclusion-exclusion principle, partial order and equivalence relations, graph theory, and trees. *3 Cr. Every Semester.*

**MTH 492 Mathematics Internship (A).** Allows for a supervised experience in applying mathematical skills and techniques in a practical work environment. Requires projects that may include applications in business, the social sciences, or physical sciences. A maximum of three credits can be applied toward the mathematics major. *1-6 Cr.*

**MTH 499 Independent Study in Mathematics (A).** To be defined in consultation with the instructor/sponsor and in accordance with the procedures of the Office of Academic Advisement prior to registration. *1-3 Cr.*

## MEDICAL, DENTAL, VETERINARY AND ALLIED FIELDS; PRE-PROFESSIONAL PREPARATION; MEDICAL TECHNOLOGY — SEE DEPARTMENT OF BIOLOGICAL SCIENCES

## METEOROLOGY — SEE DEPARTMENT OF THE EARTH SCIENCES

## DEPARTMENT OF MILITARY SCIENCE— UNITED STATES ARMY ROTC

**C29 Cooper Hall**  
**(585) 395-2249**

*Chair and Professor:* LTC Tracy A. Davidson, EdD, Pensacola Christian College; *Assistant Professors:* MAJ(P) Patrick M. Clune, BS, New Jersey Institute of Technology; MAJ Nicholas A. Teta, BA, SUNY Albany; MAJ Charles Meyer, MSED, SUNY Oswego; CPT Daniel R. Fletcher, BA, The College at Brockport; *Instructors:* SFC John Leggat and MSG Chester Ciudad; *Support Staff:* Ashley Panzica-Tolbert and Rodney D. Brinkman.

The military science program offers courses of study leading to an academic minor in military science and an officer's commission in the United States Army. Students may enroll in lower-division courses without incurring a military service obligation. The lower-division courses provide theoretical and practical training in leadership and management principles and applications, basic military skills, and officer responsibilities.

The military science program at the upper-division level consists of instruction in military skills, tactics, communications, and practical leadership experience.

Students must receive prior approval from the department chair and agree to contract with the Army before enrolling in any of the upper-division level courses. Contracted students receive a monthly stipend of \$300-\$500 per month up to \$4,500 per academic year.