

# MATHEMATICS

## The Programs

The Department of Mathematics offers:

- Mathematics Post-Baccalaureate Certificate (<https://catalog.millersville.edu/graduate/college-science-technology/mathematics/mathematics-post-baccalaureate-certificate/>)
- Mathematics, M.Ed. (<https://catalog.millersville.edu/graduate/college-science-technology/mathematics/mathematics-med/>)

Courses are designed to be of optimum value and relevance to teachers of mathematics in secondary schools. Mathematics teachers who are not pursuing a degree may enroll as nondegree students and elect any course in mathematics or mathematics education for which they have the prerequisites.

## Admission Requirements

Admission to the M.Ed. program in mathematics education is granted to those applicants whose mathematical preparation fulfills the mathematical proficiency requirement (see I below). Conditional admission is granted to those applicants who have satisfactorily completed the following Millersville University undergraduate mathematics courses or their equivalents: MATH 161 Calculus 1, MATH 211 Calculus 2, MATH 311 Calculus 3 and MATH 322 Linear Algebra 1. Such persons are granted full admission status upon fulfillment of the mathematical proficiency requirement.

**Buchanan, J;** Professor  
College of Science and Technology  
B.S., Davidson College, 1983; M.S., North Carolina State University, 1985; Ph.D., Ibid., 1993

**Cardwell, Antonia;** Associate Professor  
College of Science and Technology  
B.S., University of the Witwatersrand (Johannesburg), 1998; M.A., Kent State University, 2001; Ph.D., Ibid., 2005

**Dever, Lindsay;** Assistant Professor  
College of Science and Technology  
B.S., The College of New Jersey, 2015; M.A., Bryn Mawr College, 2019; Ph.D., Bryn Mawr College, 2022

**Fenwick, James;** Professor  
College of Science and Technology  
B.S., Clarion State College, 1980; M.S., University of Vermont, 1983; Ph.D., University of Wyoming, 1985

**Garber, Diana;** Instructor  
College of Science and Technology  
B.A., Millersville University, 1991; M.Ed., Ibid., 1997

**Han, Zhigang;** Associate Professor  
College of Science and Technology  
B.A., Fudan University (China), 1997; Ph.D., Stony Brook University, 2006

**Heitmann, Noel;** Associate Professor  
College of Science and Technology  
B.S., The Pennsylvania State University, 1989; B.S., University of Pittsburgh, 1996; M.A., Ibid., 1998; Ph.D., Ibid., 2003

**Ma, Baoling;** Associate Professor

College of Science and Technology  
B.S., Ocean University of China, 2007; Ph.D., University of Louisiana-Lafayette, 2012

**Mikula, Richard;** Professor  
College of Science and Technology  
B.S., Temple University, 1998; Ph.D., Rutgers, The State University of New Jersey, 2006

**Moss, Erin;** Professor  
College of Science and Technology  
B.A., University of North Carolina at Asheville, 2001; M.S., University of Connecticut, 2003; Ph.D., Purdue University, 2009

**Robinson, Kevin;** Associate Professor  
College of Science and Technology  
B.A., Messiah College, 1993; M.S., University of Florida, 1995; Ph.D., Ibid., 2000

**Stewart, Patrick;** Assistant Professor  
College of Science and Technology  
B.S., Marshall University, 2011; M.A., Ibid., 2014; M.S., Virginia Polytechnic Institute and State University, 2015; Ph.D., Bowling Green State University, 2020

**Taylor, Cynthia;** Professor  
College of Science and Technology  
B.S., Indiana University of Pennsylvania, 1988; M.S., Rensselaer Polytechnic Institute, 2002; Ph.D., University of Missouri, 2011

**Washington, H;** Associate Professor  
College of Science and Technology  
B.S., Fayetteville State University, 1998; M.S., North Carolina State University, 2001; Ph.D., Ibid., 2012

**White, Janet;** Professor  
College of Science and Technology  
B.A., Grove City College, 1988; M.Ed., Millersville University, 1994; Ph.D., American University, 2002

**Wisner, Michael;** Assistant Professor  
College of Science and Technology  
B.A., Messiah College, 1987; M.A., West Chester University, 1991; Ph.D., University of Delaware, 1997

**Zhan, Mingquan;** Professor  
College of Science and Technology  
B.S., Nanjing Normal University, 1990; M.S., Ibid., 1997; Ph.D., West Virginia University, 2003

**MATH 500: 3-12 s.h.**

**Co-Op Ed Experience in Math**  
Co-Op Ed Experience in Math

**MATH 502: 4 s.h.**

**Linear Algebra**

Systems of linear equations, matrix algebra and determinants; real vector spaces, linear independence, basis and dimension; real inner product spaces, Gram-Schmidt orthogonalization; eigen theory and diagonalization; linear transformations and matrix representation. Prereq or Coreq: MATH 311; MATH 310/520 recommended.

**MATH 503: 4 s.h.****Probability and Stats for Tchr**

A rigorous one-semester study of probability, distribution theory and the basics of statistical inference. Topics include probability, expectation, discrete and continuous distributions, descriptive statistics and both estimation and hypothesis testing for one- and two-sample problems. Prereq: MATH 311.

**MATH 504: 3 s.h.****Modern Algebra for Teachers**

Algebraic properties of complex number systems, set theory, groups, rings, integral domains and fields. MATH 310/520 and MATH 322/502.

**MATH 505: 4 s.h.****Classical & Modern Geometry**

Study of geometry from both classical and transformational points of view. The classical part will focus on the axiomatic development of various forms of geometry; the transformational part will focus on the study of geometry in terms of two families of transformations: isometries and similarities. Emphasis on investigating geometry using both classical and transformational approaches and their interactions.

**MATH 506: 3 s.h.****Modern Analysis for Teachers**

Real number system, limits of sequences and functions, theory of differentiation, Riemann integration, infinite series. Prereq: MATH 310/520, 311, 322/502. MATH 345/504 recommended.

**MATH 520: 3 s.h.****Logic and Foundations of Math**

Theory of inference, symbolic logic, nature of axiom systems, validity of proofs, consistency, independence, completeness, theory of sets and cardinal numbers.

**MATH 535: 3 s.h.****Statistical Methods 1**

Survey of statistical methods used in research, education, behavioral science and biomedical applications. Experimental designs discussed regarding advantages, disadvantages, sampling problems and analysis. Regression and analysis of variance. Prereq: An elementary probability or statistics course. Offered in fall and periodically in summer.

**MATH 536: 3 s.h.****Statistical Methods 2**

Continuation and extension of statistical methods introduced in Statistical Methods I (Math 535). Advanced topics in analysis of variance, randomized block designs and experimental designs. Prereq: Math 535 or permission of instructor. Offered in spring.

**MATH 536H: 3 s.h.****Hon: Statistical Methods II****MATH 537: 1 s.h.****Statistical Problem Solving Seminar**

Capstone course designed to serve as outcome assessment for math majors enrolled in statistics option. Course involves problem solving, data analysis and statistical consulting. Materials drawn from real-world problems. Prereq: Math 535. Coreq: Math 536. Offered in spring.

**MATH 566: 3 s.h.****Complex Variables**

Complex number system, analytic functions, elementary functions, contour integration, residues and poles, conformal mapping. Prereq: MATH 506 or equivalent. Offered infrequently.

**MATH 577: 3 s.h.****Problems in Applied Math**

An investigation of one or more topics of current interest in applied mathematics. Specific topics to be covered vary but are announced each time the course is offered. Offered infrequently.

**MATH 592: 3 s.h.****Graph Theory**

Finite graphs, multigraphs, digraphs and networks from theoretical, practical and historical perspectives. Specific topics include isomorphisms, graph variants, planarity and nonplanarity, traversability, colorings, flows, matchings and optimization algorithms. Prereq: MATH 502 or equivalent. Offered periodically.

**MATH 592H: 3 s.h.****HNRS: Graph Theory****MATH 602: 3 s.h.****Equity Issues in Math Ed**

Designed for graduate level students with an interest in equity issues in mathematics education. In this course, we examine issues of equity in mathematics education from various theoretical and practical perspectives and long lines of race, gender, culture and socioeconomic status. It is a reading-intensive course that spans such topics as the achievement gap, tracking, culturally-relevant pedagogy, multiculturalism, the nature of mathematics and mathematics for democracy and social justice. Course assignments will be differentiated to ensure they are relevant to the concerns of both practicing teachers as well as students without a teaching background that intend to pursue further graduate study.

**MATH 603: 3 s.h.****History of Mathematics**

Evolution of mathematical concepts from antiquity to the present century. Emphasis on eras of great mathematical activity.

**MATH 604: 3 s.h.****Ethnomathematics**

This course aims to introduce Ethnomathematics as a field by examining mathematics across and within cultures. In addition, the course is designed to strengthen and expand students' understanding of mathematical topics (e.g., number systems, geometry, combinatorics, group theory) through study of the mathematics of world cultures. Furthermore, students will discuss ways in which what is done in the course may be used to refresh or augment 7-12 school mathematics courses and develop school materials in Ethnomathematics.

**MATH 606: 3 s.h.****Noyce - Transitioning**

Intended to address topics and concerns relevant to recently-certified NOYCE secondary mathematics teachers as they transition to their first year of teaching in a high-needs school district. Through readings, class discussions, individual presentations, and written assignments, participants reflect on their student teaching experiences, further explore challenges of working with diverse groups of students, and develop strategies to increase their effectiveness as a teacher in the context of a high-needs district. Instructor Permission required.

**MATH 607: 3 s.h.****Noyce - Moving to Tenure**

Intended as an extension to MATH 606 and meant to address topics and concerns relevant to recently-certified NOYCE secondary mathematics teachers as they complete their first year of teaching in a high-needs school district. Through readings, class discussions, individual presentations, and written assignments, participants reflect on their experiences during the first year of teaching, further explore challenges of working with diverse groups of students, and develop strategies to increase their effectiveness as a teacher in the context of a high-needs district. Instructor Permission required.

**MATH 610: 3 s.h.****Problem Solving Seminar**

Develops students' problem-solving abilities in mathematics and teaching of problem solving to high school students. Includes discussion of solutions to problems and the theories of problem solving. For both teachers and nonteachers. Offered periodically.

**MATH 611: 3 s.h.****Learning Mathematics**

Investigation of the learning theory of constructivism and its application to the learning of mathematics. Emphasis on higher-order concept acquisition and schema development, and their relationship to mathematical instruction and teacher decision making. Individual differences in learning styles are also discussed. Prereq: teaching experience or permission of the instructor. Offered periodically.

**MATH 613: 3 s.h.****Elem/Sec Math Connections**

This course is designed for graduate level students and will be of particular interest to practicing mathematics teachers of grades 7-12. In this course, we will explore the foundational concepts of the K-6 mathematics curriculum in significant depth while reflecting on ways to build strong connections between this elementary content and the content in the 7-12 curriculum. The goal is for students to see where their own teaching fits in the broader scheme of K-12 mathematics education so that they can design instruction that builds on their own students' prior understanding and contributes to a more holistic development for mid-level, middle, and high school mathematics learners. Course assignments may involve presentations, discussions, reading, written exams, papers, problem solving, problem posing, and instructional design.

**MATH 614: 3 s.h.****Current Issues in Middle Schl**

Current issues relating to middle school mathematics instruction, including issues associated with teaching strategies as well as curricular issues. Central to this discussion will be the NCTM's Principles and Standards for School Mathematics and the PA Academic Standards for Mathematics. Prereq: teaching experience or permission of the instructor. Offered periodically.

**MATH 615: 3 s.h.****Current Issues in Secndry Schl**

Current issues relating to secondary school mathematics instruction, including issues associated with teaching strategies as well as curricular issues. Central to this discussion will be the NCTM's Principles and Standards for School Mathematics and the PA Academic Standards for Mathematics. Prereq: teaching experience or permission of the instructor. Offered periodically.

**MATH 617: 3 s.h.****Middle/Secdry Schl Innovatns**

Current curricular issues and teaching strategies associated with educational innovations that are invariant with respect to the middle school-secondary school boundary. Central to this discussion will be the NCTM's Principles and Standards for School Mathematics and the PA Academic Standards for Mathematics. Prereq: teaching experience or permission of the instructor. Offered periodically.

**MATH 618: 3 s.h.****7-12 Assessment**

Course for secondary mathematics teachers who wish to explore the nature of the mathematics assessment from a variety of perspectives. The course will examine traditional and non-traditional forms to assessment as well as the purpose of formative and summative assessments - allowing for discussion of the pros and cons to each. The course will also examine the impact of assessment tools on individual classroom instruction as well as within local departments, schools, districts, states and national education issues. The course will seek to actively involve teachers in a productive dialogue about the mathematics that they teach and explore a variety of levels at which the mathematics can be assessed. In order to do this, it will be necessary at times to expand and explore K-16 mathematics assessment at some length.

**MATH 619: 3 s.h.****Advanced Perspectives**

Course is for secondary mathematics teachers at the middle or high school level who wish to explore the nature of the mathematics that they teach from a different viewpoint. The course will look at typical secondary mathematics topics including the real number system, polynomials, number theory, trigonometry and Euclidean geometry while examining concept analysis, problem analysis and mathematical connections. The course will actively involve in-service and pre-service teachers in a productive dialogue about the mathematics that they teach, and potential developmental or extensions that could be put into practice at each level. The class will also explore a variety of levels at which it may be appropriate to address these issues with their own students.

**MATH 622: 3 s.h.****21st Century Math**

The intent of the course, Teaching Mathematics in The 21st Century, is to examine, study, and analyze teaching techniques and alternate approaches to teaching and learning mathematics in the 21st century. Students will experiment with a variety of pedagogies that are more in-line with the way in which 21st century students live rather than how they are often taught. Comparisons of multiple pedagogies (current, past and potential future) will be frequently made and discussed.

**MATH 642: 3 s.h.****Linear Algebra**

Vector spaces, linear transformations, matrices, systems of equations, determinants. Prereq: MATH 502 or equivalent. Offered infrequently.

**MATH 650: 3 s.h.****Topics in Geometry**

Topics selected from the parallel postulate and models for Euclidean and non-Euclidean geometries; projective geometry; local geometry of smooth space curves; geometry of smooth surfaces in space; geometry of space-time; finite geometries; representation of a geometry as a group of transformations acting on a set. Prereq: teaching experience or permission of instructor. Offered infrequently.

**MATH 670: 3 s.h.****Operations Research**

Principles of model building; examples from linear optimization, network analysis, dynamic programming, probabilistic decision theory, Markov chains, queuing theory, simulation and inventory models. Applications and theory. Prereq: MATH 642 or equivalent, and a statistics course or equivalent. Offered periodically.

**MATH 672: 3 s.h.****Math Modeling in Secondary Sch**

of the process of mathematical modeling. Creative and empirical model construction, model analysis and model research. Problems taken from a variety of disciplines. Some problems suitable for algebra and geometry students; others require some knowledge of calculus and statistics.

Prereq: MATH 502 or its equivalent. Offered periodically.

**MATH 675: 3 s.h.****Numerical Analysis**

Numerical treatment of equations, matrices and systems of equations; interpolation and approximation by polynomials; numerical integration; method of least squares. Prereq: MATH 502 and MATH 506, or equivalent. Offered in fall.

**MATH 679: 3 s.h.****Technol in Secondary Schl Math**

Introduction to technologies currently available for teaching secondary mathematics. Emphasis on the use of modern graphics calculators, although computer software is also presented. Capabilities of the technologies examined in depth, but emphasis will be on the use of this technology in the classroom. Mathematical topics selected from elementary algebra, geometry, algebra II, precalculus and calculus.

Prereq: secondary teaching experience. Offered periodically.

**MATH 683: 3 s.h.****General Topology**

Set theory, metric and topological spaces, cluster points, closure, interior and boundary, continuity, homeomorphisms, product and quotient spaces, separation, compactness, connectedness, completeness. Prereq: MATH 502, 504 and 506.

**MATH 691: 3 s.h.****Combinatorics**

Counting techniques including the multiplication principle, the addition principle, the pigeon-hole principle, permutations, combinations, the principle of inclusion-exclusion, recurrence relations, generating functions and Polya's Theory of Enumeration. Prereq: MATH 502 or equivalent. Offered periodically.

**MATH 693: 3 s.h.****Number Theory**

The classic higher arithmetic of integers: mathematical induction, divisibility, congruences, prime numbers, diophantine equations. Euler-Fermat Theorem and quadratic reciprocity. Offered periodically.

**MATH 695: 3 s.h.****Topics in Mathematcs**

Investigation of one or more mathematical topics of current interest not covered in regular courses. Topics and methods of instruction may vary according to the needs and interests of students and faculty involved. Offered infrequently.

**MATH 696: 1-3 s.h.****Independent Study**

Selected topics. Prereq: permission of chairperson. Offered infrequently.

**MATH 697: 1-3 s.h.****Topics in Math Education**

Investigation of one or more topics of current concern in mathematics education not covered in regular courses. Course content varies according to the needs and interests of students and faculty involved. Offered infrequently.

**MATH 698: 1-3 s.h.****Independent Study**

Selected topics. Offered infrequently.

**MATH 699: 3-6 s.h.****Thesis:**

Thesis