MATHEMATICS

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Faculty
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Lecturers
Keith G. Calkins
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Emeriti
Kenneth L. Franz
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Academic Programs	Credits
BS: Mathematics	39
BS: Mathematics Education	30
Major in Mathematical Studies	30
Minor in Mathematics	20
Minor in Mathematics Education	20

Mathematics is foundational to physics, engineering, and computer science, and is increasingly important in many fields of study such as finance, accounting, economics, biology, medicine, and environmental science. Students majoring in these and other fields will find that acquiring an additional major in mathematics or mathematical studies greatly enhances the marketability of their degree.

Undergraduate Programs

BS: Mathematics—39
MATH141, 142, 215, 240, 286, 315; STAT340 and at least 15 credits in additional courses chosen in consultation with a Mathematics Department advisor from MATH271, 355, 389, 405, 408, 425, 431, 432, 441, 442, 475, 487, 495.
Cognate Course: CPTR125

Major in Mathematical Studies—30
MATH141, 142, 215, 240 and at least 15 credits in additional courses chosen in consultation with a Mathematics Department advisor from STAT340, CPTR125, MATH271, 286, 315, 355, 389, 405, 408, 425, 431, 432, 441, 442, 475, 487, 495. This major is available only as a second major, to those taking a major in another field.

Minor in Mathematics—20
MATH141, 142, 215 and at least 9 credits in additional courses chosen in consultation with a departmental advisor from MATH240, 286, 315, 355, 389, 405, 408, 425, 431, 432, 441, 442, 475, 487, 495; STAT340.

BS: Mathematics Education—30
MATH141, 142, 215, 240, 355, 475; STAT285, 340 and one additional course chosen in consultation with a Mathematics Department advisor from MATH286, 405, 425. This major is available only to those who are obtaining elementary or secondary teacher certification. Cognate Course: CPTR125.

Minor in Mathematics Education—20
(pending Michigan Department of Education approval)
MATH145, 167, 182, 215, 355, 475, STAT285. This minor is available only to those obtaining elementary teacher certification. The regular minor listed above will also suffice for elementary certification.

SPECIAL REQUIREMENTS AND PLACEMENT TEST
Sequential Course Numbering. All courses with more than one course number must be taken sequentially.

Non-overlapping Credit Restrictions. Because there is substantial overlap in material covered in the following groups of courses, no student is granted credit (other than general elective credit) in more than one course from each group:
1. MATH141, 182 (Calculus I, Calculus with Applications)
2. MATH145, 166 (Reasoning with Functions, Precalculus Algebra)
Minimum grade for prerequisites, except for MATH141, is C-.

Mathematics Placement Examination (MPE). With exceptions specified below, all undergraduate students must take the Mathematics Placement Examination, which tests arithmetic and algebra skills. This is an Andrews University examination and no other placement test results are recognized. The examination takes one hour, no calculators are allowed, and there is an $11.00 fee which may be charged to the student's account. The MPE is given at Fall registration, at other convenient times throughout the academic year, and at participating Seventh-day Adventist academies each spring. Sample questions and other information about the MPE may be found at http://www.math.andrews.edu.

A score of at least P2 on the MPE will fulfill the skills part of the Mathematics General Education requirement. This score is also the prerequisite for MATH145, which fulfills the reasoning part of the requirement. Students scoring lower than P2 must pass MATH107 before enrolling in MATH145. An appropriate MPE score is a prerequisite for several mathematics and statistics courses, and some courses in other departments.

It is **extremely** important that students take the MPE immediately upon enrolling, because the information it gives is essential to planning the college experience. The General Education Mathematics requirement should be satisfied within the first year of residence, and in no case should be extended beyond the second year of residence.

Students who transfer a college course which satisfies the General Education Mathematics requirement, are not required to take the MPE, except in special cases where the Department needs the information to properly advise a student.

Graduate Programs

The Mathematics Department collaborates in the Master of Science: Interdisciplinary Studies (Mathematics and Physical Sciences). See the Interdisciplinary Studies section, p. 128.

Mathematics Endorsement Program for Middle School Educators. The Mathematics Department collaborates with the School of Education and the Berrien County Intermediate School District to administer the Alternative Certification Experimental Program (Math Endorsement Program) for Middle School Educators. Courses for this Program are listed under "Mathematics Education." Inquiries about this program should be directed to Larry Burton (616) 471-3465, burton@andrews.edu; Lynelle Weldon (616) 471-3866, weldon@andrews.edu; or Judy Wheeler (616) 471-7725 ext. 302, jwheele@remc11.k12.mi.us.

Courses   (Credits)

See inside front cover for symbol code.

MATH105   (2)
Mathematical Skills—Arithmetic
Designed to remedy the deficiencies, diagnosed by the Mathematics Placement Examination, in arithmetic skills, unit conversions, and problem solving.

MATH106   (3)
Mathematical Skills—Algebra
Remediation in algebraic skills. Outcome determines eligibility for entrance into certain first-level mathematics courses. Prerequisite: MPE $\geq$ P0 or MATH105 with grade no lower than C-.

MATH107   (3)
Arithmetic and Algebra Review
Review of arithmetic and algebra skills, for students not achieving an MPE score $\geq$ P2. Class attendance is required, but most work is done on the computer using ALEKS software. The class meets two hours per week. Students meeting attendance and participation requirements and not completing the course in the first semester may receive a grade of R which will require re-registration and completion the following semester. Credit is given only in the semester in which the course is passed. This a mastery learning course, requiring passage of three proficiency tests, one in arithmetic and two in algebra. *Fall, Spring*

MATH141   (4)
Calculus I
Real functions and relations, differentiation and applications. Introduction to integration. Prerequisite: MPE=P5 or MATH167 with grade no lower than C. *Fall, Spring*

MATH142   (4)
Calculus II
Continuation of Calculus I; integration of functions with applications; convergence of series. Prerequisite: MATH141. *Spring*

MATH145   (3)
Reasoning with Functions
Logic, sets; functions, graphing, with examples including quadratic and trigonometric functions; the exponential function and its applications; one additional topic selected by the instructor, such as elementary statistics, probability, rates of change and related topics, the concept of infinity and its applications, or other topic

based on a great mathematical idea. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE $\geq$ P2 or MATH107. *Fall, Spring*

MATH165   H (3)
College Algebra
AU/HSI course. A study of linear equations and inequalities; algebraic, logarithmic, and exponential functions; polynomials and complex numbers. Includes applications in business and science.

MATH166   (2)
Precalculus Algebra
Equations and inequalities; algebraic, logarithmic, exponential, polynomial and rational functions, complex numbers; and selected topics. This course, together with any additional course requiring it as prerequisite, fulfills the General Education Mathematics reasoning requirement. May be taken concurrently with MATH167. Prerequisite: MPE $\geq$ P2 or MATH107. *Fall*

MATH167   (2)
Precalculus Trigonometry
Trigonometric functions and identities, vectors, and selected topics. Fulfills the General Education Mathematics reasoning requirement. May be taken concurrently with MATH166 or MATH145. Prerequisite: MPE $\geq$ P3 or pre-/co-requisite MATH166 or MATH145; and high school geometry. *Fall*

MATH168   H (4)
Precalculus
AU-HSI course. A study of linear equations and inequalities; polynomials and other algebraic functions; exponential and logarithmic functions; complex numbers; trigonometric functions and identities.

MATH182   (3)
Calculus with Applications
Introduction to calculus of functions of one variable, including finding maxima and minima; partial derivatives; applications to problems in business and the social sciences. Prerequisite: MPE $\geq$ P4 or MATH145 or MATH166 or MATH167. *Spring*

MATH215   (3)
Introduction to Linear Algebra
Vectors, matrices, determinants, and eigenvalues, with emphasis on applications and computation. Prerequisite: MATH182 or 141. *Fall*

MATH240   (4)
Calculus III
Curves and surfaces, partial derivatives, multivariable calculus; multiple integrals, line and surface integrals; Stokes', Green's and divergence theorems. Prerequisite: MATH142. *Fall*

MATH286   (3)
Differential Equations
Elementary differential equations, first order equations, higher order linear equations, systems. Prerequisite: MATH142. *Spring*

MATH315   Alt (3)
Linear Algebra
Vector spaces, linear transformations, bilinear and quadratic forms. Prerequisite: MATH215. *Spring*

MATH355 (3)
Discrete Mathematics
Selected topics in discrete mathematics, such as logic, set theory, relations, functions, algebraic structures and graph theory. Prerequisite: MATH141 or 182. *Fall*

MATH389 (0.5)
Mathematics Colloquium
Participation in at least 10 mathematics colloquia or approved colloquia of other departments. Grade is based on attendance and notes taken at the colloquium. Repeatable to 2 credits. S/U. *Fall, Spring*

MATH405 ✦ **Alt (3)**
Applied Mathematics
Solutions of first and second order partial differential equations, and applications. Prerequisites: MATH240, 286. *Fall*

MATH408 ✦ **Alt (3)**
Complex Analysis
Elementary complex analysis, contour integrals, complex series. Prerequisite: MATH240. *Spring*

MATH425 ✦ **Alt (3)**
Numerical Methods and Modeling
Construction of mathematical models. Implementing such models on a computer. Prerequisites: MATH141 and 215; and a knowledge of computer programming. *Spring*

MATH431, 432 ✦ **Alt (3, 3)**
Advanced Calculus
Theorems on continuity, differentiation, integration, and convergence; additional selected topics such as topology, differentiable manifolds, and real analysis. Prerequisite: MATH240. *Fall/Spring sequence*

MATH441, 442 ✦ **Alt (3, 3)**
Algebra
Study of groups, rings, fields, modules, vector spaces, and algebras. Prerequisite: MATH240. *Fall/Spring sequence*

MATH475 ✦ **Alt (3)**
Geometry
Axiomatic development of Euclidean, non-Euclidean, affine, and projective spaces. Relation of these topics to secondary teaching. Prerequisites: MATH142 or either MATH141 or 182 and 355. *Fall*

MATH487 **Alt (1-3)**
Special Topics in Mathematics
Consult the instructor in regard to the topic to be covered. Prerequisite: Consent of teacher.

MATH495 (1-3)
Independent Study
Independent study of selected topics in mathematics to enable advanced students to pursue topics not offered in other scheduled courses. The student will study under the supervision of a mathematics professor whose prior approval is required. Ordinarily a minimum of four hours of study per week is expected for each credit. Grades are assigned on the basis of a instructor-selected procedure such as oral or written exams or reports.

STATISTICS

STAT285 (3)
Elementary Statistics
A study of basic descriptive and inferential statistics, including elementary probability and probability distributions, statistical inference involving binomial, normal, and *t*-distributions, and hypothesis testing. Prerequisite: MPE ≥ P 2 or MATH107. *Fall, Spring*

STAT285 **H (4)**
Elementary Statistics
AU/HSI course—see content above.

STAT340 (3)
Probability Theory with Statistical Applications
Probability theory and statistics for students having preparation in calculus. Topics include probability models, combinatoric problems, random variables, discrete and continuous distributions, expectation, moment generating functions, central limit theorem. Prerequisite: MATH141 or 182. *Spring*

HONORS

MATH271-50 (1)
Honors in Mathematics
The study of mathematical problems where the solution depends more on insight and creativity than on routine computation. Repeatable to 2 credits. Prerequisite: MATH142 and consent of instructor.

GRADUATE

MATH530 (2-3)
Topics in Teaching Mathematics
   A. Algebra
   B. Geometry
   C. Analysis
   D. Applications
Consult with department chair regarding availability in any given year. Repeatable to 6 credits.

MATH540 **Alt (2-3)**
Topics in Mathematics
Consult with the instructor in regard to the topic to be covered. Prerequisite: Consent of the instructor. Repeatable to 6 credits.

MATHEMATICS EDUCATION

The following courses are available only to participants in the Alternative Certification Experimental Program (Math Endorsement Program) for Middle School Educators, which is jointly administered by the Andrews University School of Education and the Berrien County Intermediate School District. Applications to this Program are initially screened by the School of Education and the Department of Mathematics, and then go through the regular Andrews admissions process. These courses will be taught in rotation, during the regular school year and during the summer, according to a schedule set by the Administrative Committee for the Program.

MAED505 (2)
Understanding Numbers and Operations for Middle Grades Educators
This course is designed to strengthen middle school teachers' rational number knowledge and number sense. This includes the in-depth study of rational numbers and operations on rational

numbers, the structure of the rational and real number systems, algorithms for computation, estimation strategies, and working with very large and very small numbers. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED510 (3)
Exploring Algebra and Functions for Middle Grades Educators
This course extends the middle school teachers' understanding of algebra as a symbolic language. This course moves beyond symbol manipulation to include modeling of physical situations. Students will explore algebraic, linear, and non-linear functions within the context of the course. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED515 (3)
Data Analysis for Middle Grades Educators
This course presents an integrated approach to data analysis, statistics, and probability for middle grades math teachers. Instruction focuses on specific real-world data sets and statistical investigations. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED521 (2)
Informal Geometry and Measurement for Middle Grades Educators
This course is the first of two which lead prospective mathematics teachers through a series of explorations to develop competence in geometric reasoning, including conjecture, proving, and disproving. Prospective teachers develop a deeper understanding of the role of proof in geometry. The pedagogy of this course models that of effective middle school mathematics teachers.

MAED522 (2)
Formal Geometry for Middle Grades Educators
This course is the second of two which lead prospective mathematics teachers through a series of explorations to develop competence in geometric reasoning, including conjecturing, proving, and disproving. Prospective teachers refine their understanding of the role of proof in geometry. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED600 (2)
Discrete Mathematics and Number Theory for Middle Grades Educators
Students investigate concepts of number theory, discrete mathematics, and logic as they apply to middle grades mathematical education. Each topic includes a study of graphic representation of concepts and applications in technology. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED610 (4)
Mathematical Modeling for Middle Grades Educators
Investigation of concepts and practices of mathematical modeling with an emphasis on application to middle grades education. The pedagogy of the course models that of effective middle school mathematics teachers.

MAED625 (2)
Mathematical Investigations for Middle Grades Classrooms
Participants investigate topics in mathematics, including probability, programming, fractals, and chaos theory. Emphasis is placed on participant understanding of these topics and their appropriate use as investigations with middle grades students. The pedagogy of the course models that of effective middle school mathematics teachers.

MUSIC

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Faculty
Peter J. Cooper, *Chair*
Lilianne Doukhan
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Academic Programs	Credits
BA: Music	min. 41
With BBA	min. 113
With Elective Studies in Business	min. 71
With Minor in one of following:	min. 62
Business	
Economics	
Marketing	
BMus (Bachelor of Music)	49
Music Education	min. 26-34
Music Performance	min. 37
Minor in Music	min. 24
Minor in Elementary Music Education	min. 26
MA: Music	min. 32
MA: Music Ministry	min. 40
MMus (Master of Music)	
Music Education	min. 35
Performance	min. 34

Faculty of the Department of Music are committed to providing a vibrant musical and learning environment to nurture artistic and creative growth in all students of music, to encourage and guide students through dynamic interaction in classroom and practical experiences as they mature into tomorrow's music professionals, and to mentor students in responsible use of their talents for service to Christ and to humanity.

Bachelor of Music curricula provide a comprehensive exposure to and experience with the performance, history, and theory of music. Students receive hands-on supervised teaching experience in studio or classroom teaching. Bachelor of Arts curricula are for students wishing to pursue concerted study in music within a liberal arts context.

Non-music majors may take courses in music or participate in music lessons or ensembles for credit or non-credit. See General Education section and course descriptions below for further clarification.

The Andrews University Department of Music has been a member of the National Association of Schools of Music since 1964. Music majors may choose to join the student chapter of Music Educators National Conference.