introduction to the grammar and syntax of German for the purpose of translating written German into English. May count toward a general elective only.

**INLS575** (1-3)

*Topics in _______*

A study of selected topics in language, literature, or civilization. Topics and credits to be announced. Repeatable with different topics.

**INLS590** (1-3)

*Directed Study/Reading/Research/Project*

Studies in the area of French/Spanish language, literature, or civilization, as determined in consultation with the instructor.

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**MATHEMATICS**

Haughey Hall, Room 121
(269) 471-3423
dhr@andrews.edu
http://www.math.andrews.edu

**Faculty**

Donald H. Rhoads, *Chair*
Shandelle M. Henson
Ronald D. Johnson
Joon Hyuk Kang
Lynelle M. Weldon

**Lecturers**

Keith G. Calkins
Shirleen Luttrell

**Emeriti**

Kenneth L. Franz
Theodore R. Hatcher
Kenneth E. Thomas
Edward J. Specht

<table>
<thead>
<tr>
<th>Academic Programs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS: Mathematics</td>
<td>39</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td></td>
</tr>
<tr>
<td>Preparation for Secondary School Mathematics Teaching</td>
<td></td>
</tr>
<tr>
<td>Preparation for Graduate Study in Mathematics</td>
<td></td>
</tr>
<tr>
<td>BS: Mathematics Education</td>
<td>30</td>
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<tr>
<td>Major in Mathematical Studies</td>
<td>30</td>
</tr>
<tr>
<td>Minor in Mathematics</td>
<td>20</td>
</tr>
<tr>
<td>Minor in Mathematics Education</td>
<td>20</td>
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</tbody>
</table>

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.

**BEHAVIORAL NEUROSCIENCE**

The Department of Mathematics is a participant in the Behavioral Neuroscience program funded by the National Science Foundation. For more details, see p. 108.

**Undergraduate Programs**

**BS: Mathematics—39**

MATH141, 142, 215, 240, 286, 315, 355; STAT340 and at least 12 credits in additional courses chosen in consultation with a Mathematics Department advisor from MATH271, 389, 405, 408, 426, 431, 432, 441, 442, 475, 487, 495, CPTR436. Students in the secondary teacher certification program are required to take MATH475 Geometry.

*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, 426, 431, 432, 441, 442, 475, 487, 495, CPTR436. 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, 426, 431, 432, 441, 442, 475, 487, 495; STAT340, CPTR436.

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, 426. 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, 220, 355, 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, 168 (Reasoning with Functions, Precalculus Algebra, Precalculus)

Minimum grade for prerequisites, except for MATH141, is C-.


Graduate Programs
The Mathematics Department collaborates in the Master of Science: Mathematics and Physical Science. See the Interdisciplinary Studies section, p. 140.

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 (269) 471-3465, burton@andrews.edu; Lynelle Weldon (269) 471-3866, weldon@andrews.edu; or Judy Wheeler (269) 471-7725 ext. 302, jwheele@remc11.k12.mi.us.

Courses
(Credits)
See inside front cover for symbol code.

DEVELOPMENTAL COURSES
MATH091 and MATH092 are provided for students not achieving a score of at least P2 on the Mathematics Placement Examination (MPE).

Students complete the sequence MATH091/092 by passing a set of proficiency tests in arithmetic and algebra, at which time a P2 score is awarded. When this occurs, the student has completed the Math Skill part of the General Education requirement, and is considered ready to take MATH 145, 166, 168, or STAT285. Depending on the diligence and previous preparation of the student, this may occur at any time in the MATH091/092 sequence.

MATH091
Arithmetic and Algebra Review I
Individualized review of arithmetic and algebra skills. Provides computer-generated drill problems, instant scoring and explanation, with conceptual instruction as required. Students completing the sequence requirements while enrolled in MATH091 are not required to take MATH092. Fall, Spring

MATH092
Arithmetic and Algebra Review II
Continuation of MATH091. Students not completing the sequence requirements but fulfilling attendance, participation, and progress requirements may receive an R grade requiring re-registration the next semester. Prerequisite: Math 091. Fall, Spring

UNDERGRADUATE COURSES
MATH141
Calculus I
Real functions and relations, differentiation and applications. Introduction to integration. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE=P5 or MATH167 or MATH168 with grade no lower than C. Fall, Spring

MATH142
Calculus II
Continuation of Calculus I; integration of functions with applications; convergence of series. Prerequisite: MATH141. Fall, Spring

MATH145
Reasoning with Functions
Logic, sets; functions given by tables, formulas, graphs; inverse functions; linear, quadratic, exponential and trigonometric functions; rates of change and applications to science and business. Additional topics may be selected by the instructor. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P2. Fall, Spring
MATH165 (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. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P2.

MATH166 (3)  
Precalculus Algebra  
Equations and inequalities; algebraic, logarithmic, exponential, polynomial and rational functions, complex numbers; and selected topics. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P2. Fall, Spring

MATH167 Alt (2)  
Precalculus Trigonometry  
Trigonometric functions and identities, vectors, and selected topics. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P3 or MATH166 or MATH145. Fall

MATH168 (4)  
Precalculus  
Covers most of the content of MATH166 and MATH167. A study of equations and inequalities; algebraic, logarithmic, exponential, polynomial and rational functions; trigonometric functions and identities, vectors. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P2. Fall, Spring

MATH168 V (4)  
Precalculus  
AU-HSI course—see content above. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P2.

MATH182 Alt (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. Fulfills the General Education Mathematics reasoning requirement. Prerequisite: MPE ≥ P4 or MATH166, 167 or 168 preferred; MATH145 is acceptable. Spring

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

MATH220 Alt (3)  
Geometry and Numbers  
Euclidean geometry and number systems for elementary and middle school teachers. Topics include proofs, algorithms, and historical development. Prerequisite: MATH145. 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. Prerequisites: MATH215 and 355. Spring

MATH355 (3)  
Discrete Mathematics  
Selected topics in discrete mathematics, including logic, set theory, relations, functions, algebraic structures and graph theory. Prerequisites: MATH141 or 182. Spring

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. Prerequisites: MATH240 and 355. Spring

MATH426 Alt (3)  
Mathematical Modeling in Biology  
Theory and application of linear and nonlinear mathematical models of biological processes. Topics selected from discrete- and continuous-time deterministic and stochastic modeling, analytic solution techniques, linearization, bifurcations, chaos, computer simulation, model parameterization, and model validation. Prerequisite: MATH141. Fall

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. Prerequisites: MATH240 and 355. Fall/Spring sequence

MATH441 Alt (3)  
Algebra  
Study of groups, rings, fields, modules, vector spaces, and algebras. Prerequisites: MATH240 and 355.

MATH442 Alt (3)  
Algebra  
Continuation of MATH441. Prerequisite: MATH441.

MATH475 Alt (3)  
Geometry  
Axiomatic development of Euclidean, non-Euclidean, affine, and projective spaces. Relation of these topics to secondary teaching. Prerequisite: MATH355. Fall

MATH487 Alt (1–3)  
Special Topics in  
Consult the instructor in regard to the topic to be covered. Prerequisite: Consent of teacher. Repeatable in different areas.
MATH495
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
Elementary Statistics
A study of basic descriptive and inferential statistics, including elementary probability and probability models, combinatoric problems, random variables, discrete and continuous distributions, expectation, moment generating functions, central limit theorem. Prerequisite: MATH141 or 182. Fall, Spring

STAT285 V
Elementary Statistics
AU/HSI course—see content above. Prerequisite: MPE ≥ P2. Fall

STAT340
Probability Theory with Statistical Applications
Probability theory and statistics for students having preparation in calculus. Topics include probability and 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
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 COURSES

MATH530
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
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 COURSES

MAED505 through MAED625 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
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
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 symbolic 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
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
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 conjecturing, 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
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
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
 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
 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.

MAED 630
 Seminar: ____________________
Seminar in specific topics relevant to mathematics education. Each seminar examines one topic in detail. Repeatable with different topics. May be graded S/U.

MUSIC
Hamel Hall, Room 207
(269) 471-3555; FAX (269) 471-6339
pcooper@andrews.edu

Faculty
Peter J. Cooper, Chair
Lilianne Doukhan
Carlos A. Flores
Claudio Gonzalez
Julia S. Lindsay
Kenneth D. Logan
Alan F. Mitchell
Carla L. Trynchuk
Stephen P. Zork

<table>
<thead>
<tr>
<th>Academic Programs</th>
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<tbody>
<tr>
<td>BA: Music</td>
<td>min. 41</td>
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<tr>
<td>With BBA</td>
<td>min. 110</td>
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<tr>
<td>With Minor in one of the following:</td>
<td>min. 62</td>
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<tr>
<td>Business</td>
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<tr>
<td>Economics</td>
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<tr>
<td>Marketing</td>
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<tr>
<td>BMus (Bachelor of Music)</td>
<td>49</td>
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<tr>
<td>Music Education</td>
<td>min. 26-34</td>
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<tr>
<td>Music Performance</td>
<td>min. 37</td>
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<tr>
<td>Minor in Music</td>
<td>min. 24</td>
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<tr>
<td>Minor in Elementary Music Education</td>
<td>min. 26</td>
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<tr>
<td>MA: Music</td>
<td>min. 32</td>
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<tr>
<td>MA: Music Ministry</td>
<td>min. 40</td>
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<tr>
<td>MMus (Master of Music)</td>
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<tr>
<td>Music Education</td>
<td>min. 35</td>
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<tr>
<td>Performance</td>
<td>min. 34</td>
</tr>
</tbody>
</table>

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.