

Mathematics

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The major purposes of the Mathematics Department are to help students increase their knowledge and understanding of mathematical concepts, develop their reasoning ability and problem-solving skills, and improve their ability to apply mathematics in a variety of areas. The department prepares students to become teachers of mathematics; to enter careers in actuarial science, business, industry, and government; and to pursue graduate study in mathematics and related areas.

The student expecting to major in Mathematics should have four years of high school mathematics, including two years of high school algebra, geometry, trigonometry and preferably calculus. In the freshman year, students planning to major in mathematics and those preparing for scientific work, including engineering, should be qualified to begin with MAT 151 or MAT 230.

Students interested in actuarial science should major in Mathematics-Interdisciplinary with a minor in Accounting, Economics, or Finance, or they should major in Mathematics/Systems. They should take MAT 352, MAT 382, and MAT 385 as preparation for the first two actuarial exams. Students can also receive VEE credit (Validation by Educational Experience) from the Society of Actuaries with grades of B- or higher in ECO 201, ECO 202, and FIN 361. See the guidelines from the Society of Actuaries webpage for further details.

The department offers four majors: Mathematics, Mathematics/Systems, Mathematics Education, and Mathematics-Interdisciplinary.

Each year the Mathematics Department offers at least four sanctioned events such as special lectures or colloquiums. All majors are required to attend a total of at least 12 sanctioned events before taking the MAT 493 course.

Mathematics (BA)

The Bachelor of Arts degree with a major in Mathematics two years of one foreign language and 46-47 hours (42-43 math hours) and is designed for students planning to attend graduate school. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 245	4	Linear Algebra
MAT 255	3	Justifications in Mathematics
MAT 340	4	Advanced Calculus
MAT 352	4	Mathematical Statistics
MAT 392	1	Mathematics Seminar
MAT 455	3	Abstract Algebra
MAT 461	3	Real Analysis
MAT 493	3	Senior Capstone

Select one course from the following:

MAT 251	4	Differential Equations
MAT 310	3	Mathematical Modeling with Numerical Analysis
MAT 382	3	Advanced Statistical Methods
MAT 385	3	Mathematics of Finance

Electives

Select 3 hours of mathematics electives—MAT 215 or higher, excluding MAT 301, 302, 309

Additional Major Requirements

Select one course in chemistry or physics from:

CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Mathematics/Systems (BS)

The Bachelor of Science degree with a major in Mathematics/Systems requires a minimum of 46-48 hours (42-43 math hours) in the major and curriculum requirements in systems analysis. *All major courses, including systems curriculum courses, must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 245	4	Linear Algebra
MAT 255	3	Justifications in Mathematics
MAT 340	4	Advanced Calculus
MAT 352	4	Mathematical Statistics
MAT 382	3	Advanced Statistical Methods
MAT 392	1	Mathematics Seminar
MAT 393	3-4	Practicum
MAT 455	3	Abstract Algebra
MAT 493	3	Senior Capstone

Additional Major Requirements

Select one course in chemistry or physics from:

CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Electives

Select 3 hours of mathematics electives—MAT 215 or higher, excluding MAT 301, 302, 309

Systems Curriculum Requirements

MAT 151	4	Calculus I
MAT 382	3	Advanced Statistical Methods
MAT 393	3-4	Practicum
SYS 101	3	Introduction to Systems
SYS 120	4	Introduction to Problem Solving
SYS 330	3	Human Relations in Organizations
SYS 390	3	Information Systems Analysis
SYS 392	1	Systems Seminar
SYS 394	3	Information Systems Design
SYS 403	3	Operations Management

Select one course from the following:

COS 121	4	Foundations of Computer Science
COS 143	3	Interactive Webpage Design

Select one course from the following:

MAT 210	4	Introductory Statistics
MAT 352	4	Mathematical Statistics (required for major)

Select one course from the following:

SYS 401	3	Operations Research
SYS 402	3	Modeling and Simulation

Mathematics Education (BS)

The Bachelor of Science degree in Mathematics Education requires 50-51 hours in addition to education courses. *All major courses, including education curriculum courses, must be completed with a grade of C- or better and are included in the major GPA.*

Mathematics Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 245	4	Linear Algebra
MAT 255	3	Justifications in Mathematics
MAT 280	3	Mathematics in the Junior High/Middle School
MAT 312	4	College Geometry
MAT 340	4	Advanced Calculus
MAT 352	4	Mathematical Statistics
MAT 392	1	Mathematics Seminar
MAT 455	3	Abstract Algebra
MAT 493	3	Senior Capstone

Additional Major Requirements

Select one course from the following:

MAT 251	4	Differential Equations
MAT 285	3	Technology for Mathematics Education
MAT 310	3	Mathematical Modeling with Numerical Analysis
MAT 370	3	Selected Topics (<i>approved by advisor</i>)
MAT 385	3	Mathematics of Finance
PHY 341	3	Math Methods in Physics and Engineering
SYS 120	4	Introduction to Problem Solving

Select 3 hours of mathematics electives—MAT 215 or higher, excluding MAT 301, 302, 309

Select one of the following chemistry or physics courses:

CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Professional Education

EDU 150	3	Education in America
EDU 222	2	Reading in the Content Area for Secondary Teachers
EDU 260	3	Educational Psychology
EDU 307	2	Discipline and Classroom Management for Secondary Teachers
EDU 309	1	Teaching in Secondary, Junior High/Middle Schools— Special Methods
EDU 328	2	Assessment for Student Learning
EDU 332	2	The Junior High/Middle School
EDU 384	1	Perspectives on Diversity
EDU 431	15	Supervised Internship in Secondary Schools
MAT 309	2	Teaching Math in Secondary Schools
SED 220	3	Exceptional Children

Select one course from the following:

EDU 344	1	Educational Technology in Secondary Education
MAT 285	3	Technology for Mathematics Education

Additional Education Requirements

CAS 110	3	Public Speaking
PSY 340	3	Adolescent Psychology

Mathematics—Interdisciplinary (BS)

The Bachelor of Science degree with a major in Mathematics—Interdisciplinary requires a minimum of 51-57 hours and the completion of a minor (or major) in Accounting, Biology, Chemistry, Computer Engineering, Environmental Science, Engineering, Computer Science, Economics, Finance, or Physics. Minor (or major) requirements are listed under the offering department. The practicum may be in a supporting area (major or minor) instead of mathematics. *All major courses must be completed with a grade of C- or better and are included in the major GPA; courses from other major (or minor) are not included in this major GPA unless also required for this major.*

Major Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 245	4	Linear Algebra
MAT 251	4	Differential Equations
MAT 255	3	Justifications in Mathematics
MAT 310	3	Mathematical Modeling with Numerical Analysis
MAT 352	4	Mathematical Statistics
MAT 382	3	Advanced Statistical Methods
MAT 392	1	Mathematics Seminar
MAT 393	2-4	Practicum
MAT 493	3	Senior Capstone

Select one course from the following:

MAT 340	4	Advanced Calculus
MAT 455	3	Abstract Algebra

Additional Major Requirements

Select one course from the following:

COS 120	4	Introduction to Computational Problem Solving
COS 130	3	Computational Problem Solving for Engineers
SYS 120	4	Introduction to Problem Solving

Electives

Select 3 hours of mathematics electives—MAT 215 or higher, excluding MAT 301, 302, 309

Select one of the following chemistry or physics courses:

CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Mathematics Minor

A Mathematics minor requires a minimum of 23-25 hours. *All minor courses must be completed with a grade of C- or better and are included in the minor GPA.*

Minor Requirements

MAT 230	4	Calculus II
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Select one option from the following:

MAT 151	4	Calculus I
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MAT 145 [†]	3	Introduction to Functions and Calculus
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MAT 146 [†]	3	Functions and Calculus
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[†]MAT 145 & 146 count as one option

Select an additional 15 hours of mathematics elective hours above MAT 151. MAT 205, 301, 302, and 309 do not count toward the minor.

Mathematics Courses

MAT 100 1 hour

Mathematics Fundamentals

A study of the basic arithmetic operations, exponents, ratios, linear and quadratic equations, graphs, and story problems. This course is specifically designed to assist those students who need help for the mathematics proficiency examination. *Pass/fail only. Does not count toward a mathematics major or minor.*

NOTE: MAT 100 or proficiency by an approved exam is a prerequisite to all other Mathematics courses.

MAT 110 3 hours

Finite Mathematics

A study of selected topics from set theory, matrices, systems of linear equations and inequalities, linear programming, counting and probability, statistics, and mathematics of finance. *Prerequisite: A good understanding of algebra. Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement.*

MAT 120 3 hours

Investigations in Mathematics

A course designed to engage students in relevant college-level mathematics and its connection to the Christian faith and everyday life. Students will experience interesting questions and real-life applications of mathematics from a variety of contexts while using appropriate technology. Emphasis will be on thinking, reasoning, and exploring patterns as well as communicating mathematical ideas. Topics will be chosen from data analysis, modeling, probability, statistics, mathematics of finance, logic, infinity, geometric applications, and fundamentals of problem solving. *Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement.*

MAT 140 3 hours

Fundamental Calculus for Applications

An introductory study of derivatives, series, and integrals with a wide range of applications, including maximum and minimum problems. *Prerequisite: A good understanding of algebra. Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement.*

MAT 145 3 hours

Introduction to Functions and Calculus

The MAT 145-146 sequence aims to provide a deep understanding of topics from precalculus and calculus as well as a strong sense of their usefulness. Fundamental ideas of calculus, specifically rates of change, are introduced early and used to provide a framework for the study of mathematical modeling involving algebraic, exponential, and logarithmic functions. Applications to business, economics, and science are emphasized. *Meets foundational core mathematics requirement. MAT 145-146 may be taken as a two-semester substitute for MAT 151.*

MAT 146 3 hours

Functions and Calculus

MAT 146 is the second of a two-course sequence which begins with MAT 145, and continues the investigation of functions, including trigonometric functions, and their rate of change. Students are introduced to integrals and methods of integrations with applications. Further topics, such as infinite series and differential equations are included. *Prerequisite: MAT 145. MAT 145-146 may be taken as a two-semester substitute for MAT 151.*

MAT 151 4 hours

Calculus I

A study of functions, including algebraic and trigonometric functions. An introduction to the algebraic, numerical, and graphical approaches to calculus, including limits, continuity, derivatives, integrals, and applications. *Prerequisite: A good understanding of algebra and trigonometry. Meets foundational core mathematics requirement. MAT 145 and 146 may be taken as a two-semester substitute for MAT 151.*

MAT 170 1-4 hours

Selected Topics

A course offered on a subject of interest but not listed as a regular course offering.

MAT 180 3 hours

Problem Solving

An introduction to the mathematical sciences through the study of problem solving. An overview of various methods of problem solving to discover patterns, construct and modify conjectures and develop proofs of those conjectures. There will be an emphasis on developing creativity, confidence, and concentration. Content areas studied will include algebra, combinatorics, number theory and calculus, all from a problem-solving point of view. *Prerequisite: MAT 151 or one semester of high school calculus. Meets foundational core mathematics requirement.*

MAT 205 2 hours

Explorations in Elementary School Mathematics

An introductory math course for elementary education majors that focuses on helping prospective teachers develop an understanding of the topics of algebra, probability, and data analysis as they relate to the elementary school curriculum. *Two hours of lecture and one hour of lab.*

MAT 210 4 hours

Introductory Statistics

A study of basic statistical methods with a focus on applied data analysis in a group setting using statistical software. Develops proficiency in the use of descriptive methods, sampling, linear regression and correlation, probability theory and distributions, statistical inference techniques for estimation and hypothesis testing and experimental design. *Meets foundational core mathematics requirement.*

MAT 215 3 hours

Discrete Mathematics for Computer Science

Discrete mathematics concepts are studied that are foundational for further study in computer science. Topics include propositional logic and quantifiers, proofs with emphasis on induction, design and optimization of combinatorial circuits, Boolean algebra, solution of certain classes of recurrence and equivalence relations and modulo arithmetic with application to RSA cryptography. *Prerequisites: COS 120 or COS 130 or SYS 120; and MAT 146 or 151.*

MAT 220 4 hours

Ways of Knowing

Topics studied include number, logic, Euclidean and non-Euclidean geometry, algebraic structures, dimension, and infinity. A study is made of the deductive method in mathematics and its relationship to ways of knowing in other areas. There is an emphasis on the beauty of mathematics and the relationship of mathematics to science and other forms of culture including the arts and religion. *Course is offered within the Honors Guild. Meets foundational core mathematics requirement.*

MAT 230 4 hours

Calculus II

A study of analytic geometry, functions, limits and derivatives, differentiation and integration of algebraic functions and elementary transcendental functions, applications of the derivative, the definite integral, sequences, series, Taylor's formula, and special techniques of integration. *Prerequisite: MAT 146 or 151.*

MAT 240 4 hours

Calculus III

A study of parametric equations, polar coordinates, vectors, three-dimensional geometry, partial derivatives, multiple integration, and vector analysis. *Prerequisite: MAT 230.*

MAT 245 4 hours

Linear Algebra

A course on matrix theory, linear equations and linear dependence, vector spaces and linear transformations, characteristic equation, quadratic forms, and the singular value decomposition. *Prerequisite: MAT 240. Offered spring semester of even years.*

MAT 251 4 hours

Differential Equations

A course on the solution of differential equations of the first order and first degree, linear differential equations with constant coefficients, nonhomogeneous equations by undetermined coefficients and variation of parameters, systems of differential equations, nonlinear differential equations, and an introduction to series solutions. Numerical methods and qualitative analysis are also used. Differential equations are used to model physical problems, including vibration problems and electrical circuits. *Prerequisite: MAT 240. Offered spring semester.*

MAT 255 3 hours

Justifications in Mathematics

The focus of the course is for students to acquire the ability to create and express mathematical arguments through the exploration of mathematical ideas. In addition to gaining an understanding and appreciation for interesting mathematics, students will develop an ability to think creatively, to analyze critically, and to communicate appropriately mathematical reasoning and argumentation. Topics include proof techniques, logic, sets, functions, number theory, infinity, and graph theory. *Prerequisite: MAT 151. Offered fall semester.*

MAT 261 1 hour

Special Problems

Selected topics in mathematics. *Prerequisite: Consent of the department chair.*

MAT 262 1 hour

Special Problems-TEMP

Selected topics in mathematics.

MAT 270 1-4 hours

Selected Topics

A course offered on a subject of interest but not listed as a regular course offering.

MAT 280 3 hours

Mathematics in the Junior High/Middle School

An integrated content-methods course for middle school and introductory high school preparation. This course includes the mathematical strands of reasoning and algebra, rational numbers, geometry/measurement, and data analysis and probability, interwoven with the connections to appropriate pedagogical strategies for middle grades' teaching and learning. Includes a field-based teaching lab. *Math and elementary education majors only or permission of the instructor.*

MAT 285 3 hours
Technology for Mathematics Education
The course will cover effective use of technology in a mathematics classroom and the inextricable connection between technology, pedagogy, and content knowledge. Students will also explore and think critically about how technology use relates to their faith. The course will focus on free, web-based technologies and pedagogical principles that are relevant regardless of the technology used. All student artifacts (e.g., homework, lesson plans, and personal statement of technology) will be collected into a digital portfolio for future use. *Meets foundation core computation requirement. Prerequisites: MAT 151 and EDU 150; or permission of instructor.*

MAT 301 3 hours
Number Concepts for Elementary Teachers
A junior-level integrated content-methods course for elementary teacher preparation. The course includes a study of number systems and operations with emphasis on current standards and research-based pedagogical practices which focus on communication, reasoning, and representation standards. Each student will also participate in corresponding field experience (JuMP practicum). *Prerequisite: approval into the teacher education program. Does not count toward a mathematics major or minor. Open to majors in elementary education. The MAT 301-302 sequence meets the mathematics foundational core requirement.*

MAT 302 3 hours
Geometry and Measurement for Elementary Teachers
A junior-level integrated content-methods course for elementary teacher preparation. The course utilizes a problem-solving approach to the study of geometry and measurement with emphasis on current standards and research-based pedagogical practices which focus on communication, reasoning, and representation. Each student will also participate in a corresponding field experience (JuMP practicum). *Prerequisite: approval into the teacher education program and MAT 301. Does not count toward a mathematics major or minor. Open to majors in elementary education. The MAT 301-302 sequence meets the mathematics foundational core requirement.*

MAT 309 2 hours
Teaching Math in Secondary Schools
This course is designed to assist teacher candidates in developing their pedagogical content knowledge in the area of mathematics. It addresses such topics as lesson planning, higher-order thinking, professional development, content-appropriate teaching strategies, standards-based instruction, assessment of student learning, educational technology, motivational techniques, and instructional resources. National and state math standards are examined as a basis for reflective teaching and best practices. This junior-level course should be taken the spring semester before student teaching. *Prerequisites: EDU 150 and EDU 260.*

MAT 310 3 hours
Mathematical Modeling with Numerical Analysis
An introduction to modeling and the methods, techniques, and pitfalls in scientific computing and numerical analysis. The course will emphasize projects, writing, technology, and applications. Topics include iterative and algorithmic processes, error analysis, numerical integration and differentiation, curve fitting, and numerical solutions to different equations. *Required for mathematics majors with a concentration in computer science and for computer science majors with a concentration in scientific computing. Fulfills elective requirements in the systems curriculum and for majors in mathematics in environmental science and mathematics in secondary education. Prerequisites: COS 120 or COS 130 or SYS 120; and MAT 240. Offered fall semester of even years.*

MAT 312 4 hours
College Geometry
Advanced Euclidean plane geometry with a brief survey of some of the non-Euclidean geometries and vector and transformational geometry. *Prerequisites: MAT 180 or 245. Offered spring semester of odd years.*

MAT 340 4 hours
Advanced Calculus
An introduction to a rigorous development of the fundamental concepts of calculus. The real number system, sequences, series, limits, differentiation, and integration are developed rigorously. *Prerequisites: MAT 240; MAT 180 or 215. Offered spring semester of even years.*

MAT 352 4 hours
Mathematical Statistics
A theoretical, as well as applied, study of counting outcomes, probability, probability distributions, sampling distributions, confidence intervals, tests of hypotheses, linear regression, and correlation. *Prerequisite: MAT 240. Offered fall semester.*

MAT 353 1 hour
Actuarial Exam Preparation (P1)
The focus of the course is to prepare students to take the Society of Actuaries Exam P in probability. Topics include applications of calculus, probability, and statistics to risk management. Sitting for the Society of Actuaries Exam P is required for successful completion of the course. *Prerequisite: MAT 352 or equivalent.*

MAT 360 1-4 hours
Independent Study
An individualized, directed study involving a specified topic.

MAT 370 1-4 hours
Selected Topics
A course offered on a subject of interest but not listed as a regular course offering.

MAT 382 3 hours
Advanced Statistical Methods
Introduction to a variety of topics including nonparametric statistical methods linear models, with simple linear regression, multiple regression, and analysis of variance as special cases of the linear model. The emphasis will be on translating applied questions into an appropriate statistical model, checking model assumptions, and interpreting analyses in applied contexts. A brief introduction to time series is included. *Prerequisites: MAT 210 or 352; and MAT 146 or 151.*

MAT 385 3 hours
Mathematics of Finance
This course is an introduction to the mathematical models used in finance and economics with a focus on interest theory (discrete and continuous). The goal is to provide an understanding of the fundamental concepts of financial mathematics and how those concepts are applied in calculating present and accumulated values for various streams of cash flows. Topics include the mathematical foundations of interest theory, annuities, loans, stocks, financial markets, arbitrage, and financial derivatives. The course can be used as a foundation for the second actuarial exam. *Prerequisites or corequisites: MAT 352; or both MAT 210 and MAT 230. Offered fall semester of odd years.*

MAT 386 1 hour
Actuarial Exam Preparation (FMI)
The focus of the course is to prepare students to take the Society of Actuaries Exam FM in Financial Mathematics. Topics include the fundamental concepts of financial mathematics, calculating present and accumulated values for various streams of cash flows. Sitting for the Society of Actuaries Exam FM is required for successful completion of the course. *Corequisite: MAT 385 or equivalent.*

MAT 392 1 hour
Mathematics Seminar
Each student in the seminar researches a mathematical topic and makes a presentation to the entire group. *Prerequisite: MAT 240. Offered fall semester.*

MAT 393 1-4 hours
Practicum
Supervised learning involving a first-hand field experience or a project. Generally, one hour of credit is awarded for a minimum of 40 hours of practicum experience. *Offered primarily during the summer.*

MAT 450 1-4 hours
Directed Research
Investigative learning involving closely directed research and the use of such facilities as the library or laboratory.

MAT 455 3 hours
Abstract Algebra
The development of the postulates of group theory, rings, integral domains, and fields. Applications to cryptography. *Prerequisites: MAT 180 and 240. Offered spring semester of odd years.*

MAT 456 3 hours
Advanced Algebra
A continued study of Abstract and Linear Algebra. Topics include Galois Theory, cryptography, and field extensions. *Prerequisite: MAT 455.*

MAT 461 3 hours
Real Analysis
An advanced study of the real number system, topology, functions, sequences, limits, continuity, and the theory of differentiation and integration. *Prerequisite: MAT 340. Offered spring semester of odd years.*

MAT 480 1-4 hours
Seminar
A limited-enrollment course designed especially for upper-class majors with emphasis on directed readings and discussion.

MAT 490 1-2 hours
Honors
Individualized study or research of an advanced topic within a student's major. *Open to students with at least a 3.00 GPA in the major field.*

MAT 493 3 hours
Senior Capstone
An overview of mathematics with an emphasis on the integration of all areas in undergraduate mathematics with an exploration of the relationship between mathematics and the Christian faith. *Open to senior status mathematics majors only. Offered during January interterm.*