

Mathematics

Mathematics is a discipline with ancient origins in early Greek thought, and has been the indispensable language and tool of science. In our major program and in our service to other departments, the Mathematics Department at Covenant College seeks to provide solid grounding in the discipline of mathematics as well as providing a greater appreciation for logic and precise language. In our major program we seek to prepare students for graduate school, technical jobs or for teaching in secondary school. In our service programs we aim to prepare pre-engineering students for the dual degree program and to prepare students majoring in other disciplines which require mathematics. We also hope to impart:

1. an appreciation for the wisdom of God as it is manifested in the logic and orderliness of His creation,
2. an appreciation for the goodness of God in both structuring much of creation to be amenable to mathematical description and in structuring our thought processes to be able to understand the mathematics that describe the creation,
3. an appreciation of absolute truth in the limited context of a mathematical system and at the limited understanding of fallen man.

Requirements for a Major in Mathematics

The core requirements are the same as those listed for baccalaureate degrees (see page 24) with the exception that a course other than PHI 357. Formal Logic must be completed to fulfill the humanities distribution requirement. Mathematics courses required for the major will also satisfy the mathematics core requirement.

Core requirements	55
Electives	22

Major and Supporting Course Requirements

COS 130. Computer Programming Methodology	4
MAT 145-146. Calculus I, II	8
MAT 247. Calculus III	4
MAT 250. Probability	3
MAT 258. Differential Equations	4
MAT 290. Proofs and Exposition ‘W’	3
MAT 310. Linear Algebra	3
MAT 350. Modern Algebra	3
MAT 460. Real Analysis	3

MAT 492. Senior Integration Paper ‘S’	2
Mathematics electives: MAT 270. Discrete Math, or MAT 360. Modern Geometry I, or MAT 361. Modern Geometry II, or MAT 470. Topology, or MAT 480. Advanced Topics in Mathematics, or PHY 405. Mathematical Methods in Physics	9
PHI 357. Formal Logic or MAT 410 Mathematical Logic..	3
Total hours for the major	49
Total degree hours.....	126

Requirements for Minor in Mathematics

MAT 145-146. Calculus I, II	8
MAT 247. Calculus III	4
MAT 258. Differential Equations.....	4
Any course offered by the Mathematics Department that is from either the core electives of the mathematics major, or STA 251, or STA 364.....	3-4
Total hours for the minor	19-20

Requirements for Major in Mathematics Education with Georgia Secondary School Certification in Mathematics (grades 6-12)

Students interested in secondary-level certification should consult with the Chair of the Education Department and should also refer to the Education Department’s section of this catalog.

Core Requirements

BIB 111. Old Testament Introduction	3
BIB 142. New Testament Introduction.....	3
BIB 277-278. Christian Doctrine I, II.....	6
COR 100. The Christian Mind	2
COR 225-226. Cultural Heritage of the West I, II.....	6
COR 325. Global Trends for the Twenty-First Century	3
COR 337. Intercultural Experience	1
COR 340. Christ and Culture Seminar	1
ENG 111. English Composition	3
Must be completed during first year at Covenant. Exemption permitted with credit from AP language/ composition.	
HIS 325. Twentieth-Century World History	3
PE 151. Concepts in Physical Education.....	2
PE 152. Personal Aerobics and General Fitness.....	1

See the Core and Distribution Requirements section for descriptions of requirements and lists of courses.

Fine Arts Distribution Requirement.....	3
Foreign Language.....	8
Proficiency in one year of an elementary-level foreign language. (Note: Students who have taken two years of the same foreign language in high school and attained an average grade of 2.67 or higher on a 4.0 scale are exempted from the foreign language requirement.)	
Humanities Distribution Requirement.....	3
Natural Science Lab Distribution Requirement	4
Social Science Distribution Requirement.....	3
General education core subtotal.....	55

Teaching Field

COS 130. Computer Programming Methodology.....	4
MAT 145-146. Calculus I, II.....	8
MAT 247. Calculus III.....	4
MAT 258. Differential Equations	4
MAT 290. Proofs and Expositions.....	3
MAT 310. Linear Algebra.....	3
MAT 350. Modern Algebra	3
MAT 360. Modern Geometry I.....	3
MAT 492. Senior Integration Paper ‘S’	2
STA 251. Elementary Statistical Methods	4
Teaching field subtotal	38

Professional Education

EDU 121. Introduction to Teaching	3
EDU 215. Technology for Educators	3
EDU 222. Educational Psychology	3
EDU 234. Teaching in a Pluralistic Society	3
EDU 322. Nature and Needs of the Early Adolescent Learner.....	3
EDU 340. Curriculum and Methods in the Secondary School.....	4
EDU 361. Education of Exceptional Children	3
EDU 370. History and Philosophy of American Education ‘W’	3
EDU 411. Educational Assessment.....	1
EDU 491. Student Teaching Seminar	1
EDU 497-498. Teaching Practicums I & II, Secondary ‘S’	15
Professional education subtotal	42
Total degree hours	135

Note: COR 337. Intercultural Experience may be taken for 0-3 credit hours. It is also possible to be exempt from taking foreign language and/or math based on high school grades or placement scores. If either of these adjustment occur, one or more elective hours may need to be taken in order earn a minimum of 126 hours required for graduation

Mathematics Courses

Placement in mathematics courses for those with no previous college mathematics credit is determined on the basis of high school mathematics credit, high school mathematics GPA, mathematics scores on the SAT or ACT and scores on the mathematics placement test given at registration time each semester.

040. Intermediate Algebra

A review of elementary and intermediate algebra designed to assist students in developing the skills necessary for taking MAT 122. Fundamentals of Mathematics or MAT 141. College Algebra. Prerequisite: placement level 0 (zero). Four hours institutional credit (institutional credit is not applicable to the 126 hours required for graduation). Only offered on a credit/no credit basis.

111-112. Mathematics for Educators I, II

These courses are a two-course sequence of mathematics content course (not method course) designed to prepare students to teach elementary and middle school mathematics for understanding, as envisioned by the National Council of Teachers of Mathematics, and as described in their document Principles and Standards for School Mathematics. The courses will examine deeply those topics in mathematics which are relevant for elementary and middle school teaching. MAT 111 focuses on the problem solving and arithmetic including why standard algorithms work, properties of arithmetic, and applications of elementary mathematics. MAT 112 focuses on the problem solving and geometry including why various standard formulas and properties in geometry are valid. Prerequisite: MAT 040 or placement level 2 for MAT 111 and MAT 111 for MAT 112. MAT 111 is three hours and MAT 112 is three hours for early grade majors and four hours for middle grade majors. (Note. (1) These courses only fulfill the general education core mathematics requirement for elementary and middle grade education majors. (2) These courses are not equivalent to either MAT 122 or MAT 141.)

122. Concepts in Mathematics

This course will introduce a variety of topics chosen from the following: Number systems, finite and infinite sets, geometry, topology, chaos theory, probability, and game theory. This course aims to help students to develop an appreciation for the beauty of mathematics, and for the usefulness of mathematical thinking, by examining particularly surprising results in classical and contemporary mathematics. Prerequisite: MAT 040 or placement level 1. (Note: This course fulfills the core requirement in mathematics, but does not serve as a prerequisite for any other course.) Three hours.

141. College Algebra

The course will cover complex numbers, solution of equations and inequalities, techniques of graphing, and the study of various functions: linear, quadratic, polynomial, rational, exponential, and logarithmic. Designed for those who have had two years of high school algebra, but need more depth in algebraic topics to prepare for enrollment in MAT 142, 144 or STA 251. Prerequisite: MAT 040 or placement level 2; not open to students with credit for any mathematics course (or equivalent) numbered 142 or higher unless special permission is granted by the instructor. Four hours.

142. Precalculus Mathematics

The course will cover analytical trigonometry, systems of equations, matrices and determinants, linear programming, solution of polynomial equations, conic sections, mathematical induction, the binomial theorem, permutations and combinations, and introductory probability. Designed to meet the requirements of various major programs (including biology, business and elementary education/middle grades certification), and to provide preparation for the calculus sequence. Prerequisite: MAT 141 or placement level 3; not open to students with credit for any mathematics course (or equivalent) numbered 145 or higher unless special permission is granted by the instructor. Four hours.

144. Finite Mathematics and Brief Calculus for Business Majors

The course will cover systems of linear equations, matrices, linear programming, mathematics of finance and elementary differential and integral calculus. Emphasis will be placed on applications to finance and management problems. Prerequisite: MAT 141 or placement level 3. Four hours.

145-146. Calculus I, II

The course will cover analytic geometry, functions and limits, the derivative and its applications, antiderivatives, indefinite integrals, transcendental functions, the definite integral and its application, methods of integration, polar coordinates and infinite series. These courses are prerequisites to all courses numbered above 200. Prerequisite: MAT 142 or placement level 4 for MAT 145; MAT 145 or placement level 5 for MAT 146. Four hours each.

247. Calculus III

A continuation of MAT 145-146. The course will cover vectors, parametric equations, solid analytic geometry, partial differentiation, multiple integration, line and surface integrals. Prerequisite: MAT 146. Four hours.

250. Probability

An introduction to the theory of probability. The course will cover combinatorics, laws of probability, discrete and continuous random variables and distributions, expectation,

variance, and if time permits, other topics. Prerequisite: MAT 247. Three hours.

258. Differential Equations

The course will cover first order differential equations, second and higher order linear equations, series solutions, the Laplace transform, systems of first order equations, linear second order boundary value problems. Both analytic and numerical techniques are studied. Prerequisite: MAT 146. Four hours.

270. Discrete Mathematics

The course will cover counting, permutations, combinations, discrete probability distributions, generating functions, Ramsey Theory, the pigeonhole principle, induction, various algorithms, topics in graph theory including: connectivity, trees, Euler tours, Hamilton cycles, edge and vertex coloring, planar graphs and graph algorithms. Prerequisite: MAT 145. Three hours.

290. Proofs and Exposition

Proofs in mathematics are both intimidating and mysterious to most people. This course hopes to dispel some of that mystery as well as equip students to both read and write mathematical proofs. Besides a review of logic and mathematical nomenclature, students will be required to tackle proofs from a variety of different fields of mathematics. Prerequisite: MAT 146. Three hours. 'S' 'W'

310. Linear Algebra

This course will develop the algebra of vectors and matrices, including finding the inverse of a matrix, subspaces, basis and dimension of vector spaces, linear transformations, isomorphisms. Inner and cross products will be treated. Special types of matrices will be discussed, such as the Jordan Normal form. Eigenvalues and eigenvectors will be treated. Prerequisite: MAT 146. Three hours.

350. Modern Algebra

The course will cover integral domains, rings, fields, groups, elementary number theory, and other selected topics. Prerequisite: MAT 290 or permission of instructor for Math Edu majors. Three hours.

360-361. Modern Geometry I, II

The objective of this course is to teach students axiomatic reasoning without the aid of diagrams, explore what can be deduced from neutral geometry (without the Euclidean Fifth Postulate, or, equivalently, the Hilbert Parallel Axiom for Euclidean Geometry), explore aspects of Euclidean Geometry, then, replace the Euclidean Fifth Postulate with the Hyperbolic Parallel Postulate, and show that Hyperbolic Geometry is as self-consistent as Euclidean Geometry. The historical developments, philosophical implications and Hyperbolic Trigonometry should be of particular use to future secondary education mathematics instructors.

Prerequisite: MAT 290 or permission of instructor for Math Edu majors for MAT 360; MAT 360 for MAT 361. Three hours each.

410. Mathematical Logic

The course will cover truth functions and tables, rules of logic, predicate calculus, first order arithmetic, formal set theory, consistency, completeness, recursive functions, and if time permits, Godel Numbers, Godel's Incompleteness Theorem, algorithms, computability, Church's Thesis, Turing machines, undecidability of formal systems and the halting problem. Prerequisite: MAT 290. Three hours.

460. Real Analysis

The course will cover set theory, the real number system, functions, sequences, limits, convergence, uniform convergence, Bolzano-Weierstrass Theorem, functions of a real variable, open and closed sets, continuity, uniform continuity, connectivity of the real numbers, the intermediate value theorem, completeness, compactness, the mean value theorem, differentiation, Riemann integration, and if time permits, other topics. Prerequisite: MAT 290 and 258. Three hours.

470. Topology

Review of set theory and logic, defining axioms of topological spaces, bases for topological spaces, order, product and subspace topology, closed sets and limit points, continuous functions, metric topology, connectivity, compactness, the Tychonoff Theorem, and if time permits, other topics. Prerequisite: MAT 290. Three hours.

480. Advanced Topics in Mathematics

Topics are considered in number theory, operations research, mathematical statistics, or advanced calculus, depending on student demand. Prerequisite: MAT 290. Three hours per semester. 'S' 'W'

492. Senior Integration Paper

See page 26. 'S'