

LING 373 **TESOL Field Experience** (2, F)
 Taken concurrently with TESOL Methods: ELA, this weekly practicum experience working in a non-formal setting with adult learners of English as a second language provides students completing the Intercultural Studies TESOL Concentration or TESOL Minor an opportunity to put their learning into practice. Prerequisites: LING 220, LING/EDUC 351 and LING 350, or permission of instructor.

LING 295, 395, 495 **Special Topics** (1-4, OD)
 These offerings will take advantage of faculty expertise to focus on advanced linguistic topics of interest to the student body. The first offering will be during the Houghton in Tanzania program, focusing on African language structure. The course may be repeated for different topics. Prerequisites to be determined at the time of offering.

LING 291, -2; 391, -2; 491, -2 **Independent Study** (1, 2, 3 or 4)

Mathematics (major and minor)

Department of Mathematics and Computer Science: Kristin A. Camenga, chair.
 Keith A. Horn, Associate Dean

Faculty: Kristin A. Camenga, Wei Hu, Richard A. Jacobson, Jill E. Jordan, Rebekah B. Yates

Web site: www.houghton.edu/academics/programs/math-computer-science

Phone: 585.567.9280

The mathematics major comprises coursework in mathematical concepts and computation with growing attention to the centrality of mathematical reasoning and proof. The major prepares students to work both collaboratively and independently and works to develop facility with both oral and written communication of mathematics. This combination of content, reasoning, and communication skills prepares students for a wide variety of vocations, including careers in education, industry, actuarial science, finance, computer science, health professions, and linguistics. Many students pursue advanced degrees in diverse areas such as mathematics, applied mathematics, education, architecture, law, health professions, and computer science.

Major: (36 hours)

Required courses

MATH 181	Calculus I	4
MATH 182	Calculus II <i>or</i>	
MATH 183	Science Honors Calculus	4
MATH 210	Introduction to Proofs	2
MATH 261	Linear Algebra	4
MATH 361	Abstract Algebra I	4
MATH 325	Real Analysis I	4
MATH 482	Senior Capstone: Mathematics Seminar	4

Mathematics electives (above 210) at least 4 hours must be at 300-or 400-level10

Co-requisites:

Choose cognate course(s) to equal 4 hours from Investment management (BADM 302), Marketing research (BADM 319), Financial management (BADM 406), General Chem I (CHEM 151), Programming I (CSCI 211), Intro to Economics *and* Principles of Microeconomics *or* Principles of Macroeconomics (ECON 201, ECON 210, ECON 211), Advanced French Grammar and Composition (FREN 350), Intro to Linguistics (LING 220), Music Fundamentals Review *and* Musicianship Development: Intro to Tonality (MTH 225, MTH 226), Logic and Critical Thinking (PHIL 222), History and Philosophy of Science (PHIL 360), General Physics I (PHYS 151), or Advanced Spanish Grammar and Composition (SPAN 350). Students are encouraged to select additional courses from the cognate list.

It is highly recommended that teachers of math choose

MATH 281	History of Mathematics
MATH 333	Probability and Statistics I
MATH 351	Modern Geometries

Often, math majors will take more math courses than the preceding minimum requirement. This is especially true for those planning to go to graduate school.

Teaching Mathematics – Inclusive Childhood (Elementary) or Adolescence (Secondary): See Education.

Minor: (16 hours numbered 180 or above)

COURSE DESCRIPTIONS

MATH 111 Math for the Liberal Arts (4, S)
A survey course intended to introduce students to several ideas of mathematics, their historical context, and their applications and significance in society. The course will cultivate an appreciation of the significance of mathematics and develop student's mathematical reasoning through selected topics in logic, set theory, probability, statistics, number theory, graph theory, the real number system, and problem solving. Creation: Math.

MATH 115 Introduction to Calculus (4, F, S, M)
A contemporary approach to the basic ideas of calculus, beginning with a discussion of topics that precede calculus, including linear, polynomial, and exponential functions. The calculus portion discusses velocity, tangent lines, and areas. Incorporates peer group work with a strong emphasis on graphing technology. With this course, students will become acquainted with calculus, the math that helped create the industrial revolution and is the driving force behind modern technology. Enrollment by permission only. Creation: Math.

MATH 131 Principles of Statistics (4, S)
This course introduces students to basic concepts and applications of probability theory and statistics. Students will learn how to collect, describe, understand, use, and interpret data in meaningful ways. Topics will include sampling procedure & bias, summary statistics, graphical displays, probability and probability distributions, statistical inference, correlation and linear regression. This course does not satisfy requirements for any major. Creation: Math

MATH 181 Calculus I (4, F&S)
Single variable calculus of algebraic and trigonometric functions. Applications involving maximum, minimum, and related rates. Intensive use of graphing calculators and computer software. Prerequisite: MATH 115 or equivalent proficiency. Creation: Math.

MATH 182 Calculus II (4, F&S)
Areas, volumes, centroids, integration techniques, calculus of transcendental functions, polar coordinates, parametric equations, infinite series. Prerequisite: 181. Creation: Math.

MATH 183 Science Honors Calculus (4, F)
An accelerated study of calculus using a historical perspective. Investigates problems of motion, curvature, area and volumes, and the infinite that were first posed by the ancient Greeks. Explores the tools of limits, derivatives, integrals, and the infinite series that mathematicians developed to solve these problems in the late 1600s and 1700s. Reserved for first-year Science Honors students. Creation: Math.

MATH 210 Introduction to Proofs (2, F)
Introduces the central idea of proof in mathematics and some standard proof formats that are used throughout the math major. The course includes propositional logic, an introduction to predicate logic, direct proof, proof by contradiction, and mathematical induction.

MATH/CSCI 214 Discrete Mathematics (2, F11, F13)
Topics include: sets, functions, relations (incl. Partial order), methods of propositional logic, introduction to predicate logic, counting, recurrence relations, asymptotic analysis, proof (incl. Induction), introduction to probability, graphs.

MATH 225 Multivariate Calculus (4, F11, S13)
Infinite series, space geometry, vectors, vector function, function of several variables, partial differentiation, multiple integration. Prerequisite: MATH 182.

MATH 241 Differential Equations (4, S12, F12)
Methods of solution and applications of principle types of differential equations. Prerequisite: MATH 182.

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- MATH 261 Linear Algebra** (4, S)
Linear algebra: vector spaces, linear mappings, inner products and matrices. Prerequisite: MATH 181.
- MATH 281 History of Mathematics** (4, M12, M14)
A contextual study of the history of mathematics and some of the classical problems. Prerequisite: MATH 182.
- MATH 325 Real Analysis I** (4, S13)
This course develops a rigorous foundation for the fundamental topics covered in calculus: continuity, differentiability, integrability, and convergence based on limits and the axioms of the real number system. Prerequisites: MATH 182, MATH 210 and MATH 261.
- MATH 331 Numerical Analysis** (3, OD)
Representation of numeric data. Error analysis, mathematical basis, and limitations of techniques relating to selection of method. Topics: linear and nonlinear systems, curve fitting, numerical calculus, programming in MatLab. Prerequisite: MATH 181, 182, 261, CSCI 211.
- MATH 333 Probability and Statistics I** (4, F)
This course introduces students to discrete and continuous probability, including conditional probability, random variables, independence, Bayes' Theorem, expected value, variance, distributions, and the Central Limit Theorem. Using the probability covered in the first half of the semester, the course also covers some of the main topics of mathematical statistics, including statistical hypothesis testing, errors, correlation, regression equations, and analysis of variance. Prerequisite: MATH 210; Co-requisite: MATH 225.
- MATH 341 Mathematical Modeling** (2, S13)
A course designed to develop an appreciation for and an understanding of the mathematics of complex systems. Particular problems from the life sciences and social sciences illustrate the principles and process of mathematical modeling and motivate the development of tools and techniques employed throughout applied mathematics. Prerequisites: MATH 182 or 183 and MATH 261 or permission of instructor.
- MATH 351 Modern Geometries** (4, F12)
A survey of geometry including advanced Euclidean geometry and an introduction to non-Euclidean geometries. Prerequisite: MATH 182.
- MATH 361 Abstract Algebra I** (4, F12)
Groups and subgroups, rings and ideals, fields, homomorphisms, and isomorphisms. Prerequisites: MATH 210 and MATH 261.
- MATH 393 Summer Collaborative Research in Mathematics** (1-4, summer)
Summer research in collaboration with a mathematics faculty member, focusing on a current area of mathematical research. Students work intensively with a faculty member over the course of four weeks during the summer. Prerequisites will be according to the chosen area of research.
- MATH 422 Real Analysis** (4, S12)
Structure of the real number system, theory of limit, continuity, differentiation, Riemann integration, and infinite series. Prerequisites: MATH 321 and MATH 261, or permission.
- MATH 433 Probability and Statistics II** (2, S13)
This course covers topics selected from parametric and non-parametric hypothesis testing, ANOVA, partial and multiple correlation methods, regression, curve fitting, and Monte Carlo simulation. Prerequisite: MATH 333.
- MATH 452 Point Set Topology** (4, OD)
Open and closed sets. Connected, compact, and metric topological spaces. Prerequisite: MATH 261.
- MATH 461 Abstract Algebra II** (2, S14)
A continuation of material from Abstract Algebra I. Topics may include advanced group theory and ring theory, Sylow theorems, modules and vector spaces, Galois theory, and finite fields. Prerequisite: Math 361.
- MATH 471 Complex Analysis** (4, OD)
Complex number system, limits, differentiation and integration in the complex plane, complex series. Prerequisites: MATH 321 and MATH 261, or permission.
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- MATH 482 **Senior Capstone: Mathematics Seminar** (4, S)
 A capstone course which draws on many other courses. Emphases on formulating, solving, and explaining challenging problems in both verbal and written form. For seniors, except by permission.
- MATH 391, -2; 491, -2 **Independent Study** (1, 2, 3 or 4)
- MATH 295, -6; 395, -6; 495 **Special Topics in Mathematics** (1, 2, 3 or 4)
 A survey of topics not covered in other mathematics classes, including graph theory, computation theory, infinite cardinalities, and Galois theory. Phi, pi, e and i; mathematical modeling; math and programming.
- MATH 496 **Honors in Mathematics** (4)
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Medical Technology (see Biology)

Ministry — See the following headings: Christian Formation (includes Youth Concentration option); Missions; Religion (includes Ministerial Concentration option); Sports Ministry; Urban Ministry

Missions (minor, see also Intercultural Studies mission concentration)
Department of Intercultural Studies: Marcus W. Dean, chair and Associate Dean
Faculty: Marcus W. Dean, Benjamin Hegeman, Kristina LaCelle-Peterson, Paul W. Shea
Web site: www.houghton.edu/academics/programs/intercultural
Phone: 585.567.9634

Mission preparation takes multiple paths at Houghton because 21st century missions is so diverse. The breadth of liberal arts opens knowledge and skills appropriate for today's world. Our students join the long tradition from here and partner with the expanding global church in serving Christ in today's world. Students who take the missions minor have majored (or double majored) in everything from Bible, music, and psychology to education, pre-med and more. Other minor options for missions careers include International Development, Linguistics, TESOL and Islamic Studies. Everything about Houghton – the faculty, the missions representatives, the students, the programs and general campus and community ethos point to excellent preparation for missions.

Minor: (14-16 hours) Most students who minor in missions will include the highly recommended Cross-Cultural Field Experience in addition to the regular course work.
 Required courses:

- Core courses (8 hours)
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| MISS 241 | History of the Global Christian Movement..... | 4 hrs |
| And | | |
| MISS 242 | The Contemporary Church in Mission | 4 hrs |
- Two electives (6-8 hours) Under advisement chosen from:
 Any prefix MISS, LING, URMN, INCL or other course 3-4 hrs each
 in the curriculum with permission, one of the two being 300 level or above