MATHEMATICS

The program in mathematics offers training for students planning to work in mathematics and computation for industry, to continue their studies in graduate school, or to enter secondary education teaching. Students may satisfy the major requirements in several ways, which are designed to meet these various career objectives.

Student Learning Outcomes

Our graduates will

- Understand the fundamentals of a broad range of areas of mathematics, including algebra, analysis, discrete mathematics, geometry, and numerical analysis.
- Demonstrate problem solving skills, critical thinking, and analytical reasoning as applied to mathematical problems and modeling.
- Construct and effectively communicate rigorous arguments to demonstrate mathematical facts in oral, written, and electronic formats.
- Participate in meaningful learning experiences, recognize the central role of mathematics in our society, and develop an appreciation for mathematics as a fundamental intellectual pursuit.

Curriculum

As majors in the College of Liberal Arts and Sciences, Math students must meet College of Liberal Arts and Sciences (http://catalog.iastate.edu/collegeofliberalartsandsciences/#lascollegerequirementstext) and University-wide requirements (http://catalog.iastate.edu/collegescurricula/) for graduation in addition to those stated below for the major.

Mathematics Core

All Math majors are required to earn credit for the following core courses:

MATH 1010	Orientation in Mathematics	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
MATH 2010	Introduction to Proofs	3
MATH 2650	Calculus III	4
One of the following:		3-4
MATH 3170	Theory of Linear Algebra	
MATH 4070	Applied Linear Algebra	
Total Credits		**19-20**

To complete the major, leading to a Bachelor of Science degree, students must choose from one of the following four pathways:

Standard Mathematics Major

This degree program is designed for students planning to work in industry or those who plan to continue their studies mathematics at the graduate level. Students are required to earn credit for the following courses:

One of the following:		3-4
MATH 2660	Elementary Differential Equations	
MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 3010	Abstract Algebra I	3
MATH 4140	Analysis I	3
Additional MATH courses at the 3000, 4000, or 5000 level		15
Total Credits		**24-25**

Additionally, the courses must include one of the following sequences:

MATH 3010 & MATH 4030	Abstract Algebra I and Intermediate Abstract Algebra	6
MATH 3040 & MATH 3140	Combinatorics and Graph Theory	6
MATH 3730 & MATH 4810	Introduction to Scientific Computing and Numerical Methods for Differential Equations	6
MATH 4140 & MATH 4150	Analysis I and Analysis II	6
MATH 4350 & MATH 4360	Geometry I and Geometry II	6

Mathematics Major with Actuarial Science Certificate

This degree program is designed for students pursuing a career as an actuary or in the financial sector. Students are required to earn credit for the following courses:

MATH 2400	Mathematics of Investment and Credit	3
MATH 3410	Introduction to the Theory of Probability and Statistics I	4
MATH 4140	Analysis I	3
MATH 4410	Life Contingencies I	3
MATH 4420	Life Contingencies II	3
Total Credits		**16**

Additionally, students must meet the requirements for the Actuarial Science Certificate (see www.catalog.iastate.edu/collegeofbusiness/actuarialscience/#certificatetext (http://catalog.iastate.edu/collegeofbusiness/actuarialscience/#certificatetext)).

Mathematics Major with Applications

This degree program is for students who want to specialize in the application of mathematics to an area of study. It is recommended for those who plan to work in industry or those who plan to continue studying their specialization area at the graduate level. Students are required to earn credit for the following courses:

One of the following:		3-4
MATH 2660	Elementary Differential Equations	
MATH 2670	Elementary Differential Equations and Laplace Transforms	
Four of the following:		12-13
MATH 3010	Abstract Algebra I	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3410	Introduction to the Theory of Probability and Statistics I	
MATH 3500	Number Theory	
MATH 3650	Complex Variables with Applications	
MATH 3730	Introduction to Scientific Computing	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4140	Analysis I	
MATH 4210	Logic for Mathematics and Computer Science	
MATH 4230	Mathematical Modeling in Biology	
MATH 4240	Introduction to High Performance Computing	
MATH 4690	Introduction to Discrete Mathematics	
MATH 4810	Numerical Methods for Differential Equations	
Courses at the 3000, 4000, or 5000 level from the following designations: AERE ABE, ASTRO, BBMB, BCB, BCBIO, BIOL, BME, BMS, CHE, CHEM, CE, CPRE, COMS, CONE, DS, ECON, EE, EM, ENSCI, FIN, GEN, GEOL, IE, MATE, ME, MIS,MTEOR, MICRO, NUCE, PHIL, PYSCH, PHYS, SE, SOC, STAT		12
Total Credits		**27-29**

Mathematics Major for Teacher Preparation

This degree program prepares students for a career in secondary education.

All students preparing to become teachers need to complete the core Math classes required of all Math majors, the courses laid out below, and the requirements of the Secondary Major in Education (http://catalog.iastate.edu/collegeofhumansciences/educationsecondary/#curriculumtext) including Student Teaching. Note: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

COMS 1070	Windows Application Programming	3-4
or COMS 2070	Fundamentals of Computer Programming	
or COMS 2270	Object-oriented Programming	
STAT 2010	Introduction to Statistical Concepts and Methods	4
MATH 2660	Elementary Differential Equations	3-4
or MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 3010	Abstract Algebra I	3
MATH 3410	Introduction to the Theory of Probability and Statistics I	4
MATH 4140	Analysis I	3
MATH 4350	Geometry I	3
MATH 4360	Geometry II	3
MATH 3970	Teaching Secondary Mathematics Using University Mathematics	3
MATH 4970	Teaching Secondary School Mathematics	3
Total Credits		**32-34**

Complementary Coursework for Teacher Preparation

In addition to the courses required for the Math Major and those required for the Secondary Major in Education, (http://catalog.iastate.edu/collegeofhumansciences/educationsecondary/#curriculumtext) the complementary coursework below is required for those seeking licensure in mathematics. Some of these courses, and some of the required coursework for the Secondary Major in Education (http://catalog.iastate.edu/collegeofhumansciences/educationsecondary/#curriculumtext), can also apply to LAS general education requirements.

PSYCH 2300	Developmental Psychology	3
or HDFS 1020	Human Development	
EDUC 2800J	Pre-Student Teaching Experience I: Mathematics Clinic	1
EDUC 4800C	Pre-Student Teaching Experience III: Mathematics	0.5-2
And one course in American History or Government		3
Total Credits		**7.5-9**

University and College Requirements

In addition to the core and pathway courses, students are also required to earn credit for the following courses:

Courses from General Education Area I - Arts and Humanities [1]	12
Courses from General Education Area IIB - Natural Sciences [1]	8
Courses from General Education Area III - Social Sciences [1]	9

LAS Career Proficiency Requirement (LAS 2030)		1
Courses meeting the international perspectives requirement [2]		3
Courses meeting the U.S. diversity requirement [2]		3
LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition [3]	3
One of the following: [4]		3
ENGL 3020	Business Communication	
ENGL 3030	Free-Lance Writing for Popular Magazines	
ENGL 3050	Creative Writing: Nonfiction	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MATH 4910	Undergraduate Thesis [5]	

[1] Possible choices can be found here: https://las.iastate.edu/students/academics/general-education/

[2] Courses used to meet the U.S. Diversity and International Perspectives requirements can also be used to fulfill general education requirements.

[3] Students must earn a grade of C or better.

[4] Students must earn a grade of C- or better.

[5] With departmental approval.

Furthermore, students must earn a minimum of 120 credits, including a minimum of 45 credits at the 3000 or 4000 level, and including at least 8 credits in the major at the 3000/4000 level with a grade of C or better. At least 55 of these credits must be earned at a four-year institution, and the last 32 credits must be earned at Iowa State University. A maximum of 16 technical credits are allowed, and a maximum of 9 P-NP credits of free electives may apply. Students must also meet the LAS World Language requirement and have a minimum 2.00 ISU cumulative Grade Point Average.

Four Year Plans

Mathematics Major

Freshman

Fall	Credits	Spring	Credits
MATH 1010	1	MATH 1660	4
MATH 1650	4	Arts & Humanities Choice	3
ENGL 1500	3	Natural Science Choice	4
LIB 1600	1	Social Science Choice	3
Natural Science Choice	4		
Electives	3		
	16		**14**

Sophomore

Fall	Credits	Spring	Credits
MATH 2010	3	MATH 2660 or 2670	3-4
MATH 2650	4	MATH 3170	4
Arts & Humanities Choice	3	ENGL 2500	3
Social Science Choice	3	Social Science Choice	3
Electives	3	LAS 2030	1
	16		**14-15**

Junior

Fall	Credits	Spring	Credits
MATH Sequence Course I	3	MATH Sequence Course II	3
MATH 3010 or 4140	3	MATH 4140 or 3010	3
Arts & Humanities Choice	3	Communication Choice	3
Electives/World Language	6	Electives/World Language	6
	15		**15**

Senior

Fall	Credits	Spring	Credits
MATH 3000+	3	MATH 3000+	6
Arts & Humanities Choice	3	Electives	9
Electives	9		
	15		**15**

Total Credits: 120-121

Mathematics Major with Actuarial Science Certificate

Freshman

Fall	Credits	Spring	Credits
MATH 1010	1	MATH 1660	4
MATH 1650	4	ECON 1020	3
ENGL 1500	3	STAT 2260	3
LIB 1600	1	ACCT 2840	3
ECON 1010	3	Electives	3
Electives	3		
	15		**16**

Sophomore

Fall	Credits	Spring	Credits
MATH 2010	3	MATH 2400	3
MATH 2650	4	MATH 3170	4
FIN 3010	3	ENGL 2500	3
Arts & Humanities Choice	3	FIN 3200	3
Electives	3	Arts & Humanities Choice	3
LAS 2030	1		
	17		**16**

Junior

Fall	Credits	Spring	Credits
STAT 3410	4	FIN 4240	3
STAT 3010 or 3260	3-4	STAT 3420	4
Natural Science Choice	4	Communication Choice	3
Electives/World Language	3	Natural Science Choice	4
		Electives/World Language	3
	14-15		**17**

Senior

Fall	Credits	Spring	Credits
MATH 4140	3	MATH 4420	3
MATH 4410	3	Social Science Choice	3
Arts & Humanities Choice	3	Electives	9
Electives	6		
	15		**15**

Total Credits: 125-126

Mathematics Major with Applications

Freshman

Fall	Credits	Spring	Credits
MATH 1010	1	MATH 1660	4
MATH 1650	4	Arts & Humanities Choice	3
ENGL 1500	3	Natural Science Choice	4
LIB 1600	1	Social Science Choice	3
Natural Science Choice	4	Specialization Area Prereq.	3
Specialization Area Prereq.	3		
	16		**17**

Sophomore

Fall	Credits	Spring	Credits
MATH 2010	3	MATH 2660 or 2670	3-4
MATH 2650	4	MATH 3170	4
Arts & Humanities Choice	3	ENGL 2500	3
Social Science Choice	3	Social Science Choice	3
Specialization Area Prereq.	3	LAS 2030	1
	16		**14-15**

Junior

Fall	Credits	Spring	Credits
MATH 3000+ or MATH 3040	3	MATH 3000+ or MATH 3140	3
Specialization Area 3000+	3	Specialization Area 3000+	3
Arts & Humanities Choice	3	Communication Choice	3
Electives/World Language	6	Electives/World Language	6
	15		**15**

Senior

Fall	Credits	Spring	Credits
MATH 3000+	3	MATH 3000+	3
Specialization Area 3000+	3	Specialization Area 3000+	3
Arts & Humanities Choice	3	Electives	9
Electives	6		
	15		**15**

Total Credits: 123-124

Mathematics Major for Teacher Preparation

Freshman

Fall	Credits	Spring	Credits
MATH 1010	1	MATH 1660	4
MATH 1650	4	STAT 2010	4
ENGL 1500	3	EDUC 2190	Required
LIB 1600	1	EDUC 2800J	1
PSYCH 2300 or HDFS 1020	3	EDUC 2020	3
Arts & Humanities Choice	3	Arts & Humanities Choice	3
	15		**15**

Sophomore

Fall	Credits	Spring	Credits
MATH 2010	3	MATH 2660 or 2670	3-4
MATH 2650	4	MATH 3170	4
ENGL 2500	3	PSYCH 3330	3
EDUC 2040	3	COMS 1070, 2070, or 2270	3-4
Natural Science Choice	4	Natural Science Choice	4
LAS 2030	1		
	18		**17-19**

Junior

Fall	Credits	Spring	Credits
MATH 3010	3	MATH 3970	3
MATH 3410	4	MATH 4360	3
MATH 4350	3	EDUC 2800A	1-2
EDUC 4060	3	SPED 4010	3
Communication Choice	3	Social Sciences Choice	3
		Arts & Humanities Choice	3
	16		**16-17**

Senior

Fall	Credits	Spring	Credits
MATH 4140	3	EDUC 4170C	16
MATH 4970	3		
EDUC 3950	3		
EDUC 4800C	0.5-2		

Arts & Humanities Choice	3	
	12.5-14	**16**

Total Credits: 125.5-130

Undergraduate Minor

The department offers a minor in mathematics. The minor requires at least 16 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. At least 9 credits must apply exclusively towards the minor and cannot be used to meet any other department, college, or university requirement. Students are required to earn credit for the following courses:

MATH 2010	Introduction to Proofs	3
MATH 2650	Calculus III	4
One of the following:		3-4
MATH 2660	Elementary Differential Equations	
MATH 2670	Elementary Differential Equations and Laplace Transforms	
One of the following:		3-4
MATH 3170	Theory of Linear Algebra	
MATH 4070	Applied Linear Algebra	
One of the following:		3-4
MATH 3010	Abstract Algebra I	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3410	Introduction to the Theory of Probability and Statistics I	
MATH 3500	Number Theory	
MATH 3650	Complex Variables with Applications	
MATH 3730	Introduction to Scientific Computing	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4140	Analysis I	
MATH 4210	Logic for Mathematics and Computer Science	
MATH 4230	Mathematical Modeling in Biology	
MATH 4350	Geometry I	
MATH 4360	Geometry II	
MATH 4690	Introduction to Discrete Mathematics	
Total Credits		**16-19**

Graduate Study

The department offers programs leading to a Master of Science or Doctor of Philosophy degree in mathematics or applied mathematics, as well as minor work for students whose major is in another department.

Students desiring to undertake graduate work leading to the M.S. or Ph.D. degree should prepare themselves by taking several upper division mathematics courses.

The M.S. degree requires a student to take at least 30 credit hours and to write a creative component or thesis. Additionally, students must pass a comprehensive oral examination over their coursework and their creative component or thesis. See the online Mathematics Graduate Handbook for specific requirements.

The Ph.D. degree requires a student to take 42 credit hours of coursework in addition to research hours, pass written qualifying examinations, pass an oral preliminary exam, and perform an original research project culminating in a dissertation which is defended by an oral exam. Ph.D. candidates must have at least one year of supervised teaching experience. See the online Mathematics Graduate Handbook for specific requirements.