Mathematics, B.S.

Learning Outcomes
Math majors will be able to demonstrate the ability to:

- give correct, logical mathematical proofs using mathematical terminology and hypotheses;
- reason logically and quantitatively using algebraic, analytic, and numerical methods;
- incorporate mathematical ideas and reasoning into well-written English; and
- model and analyze problems in pure mathematics and in other disciplines.

Overview
Bachelor of Science students majoring in mathematics enroll in one of three programs: Program A is for students who plan to work in business or government or pursue graduate study in mathematics; program B is for students who seek secondary school teaching licensure; and program C is for those seeking specialization in a mathematics-related area, such as actuarial science, biomathematics, business, computer science, economics, physics, statistics, and so forth. Program C may be especially appropriate for students who plan to seek a mathematics-related job after earning a bachelor’s degree, rather than going on to graduate study.

B.S. with Second Major
Students majoring in mathematics may choose to earn a second major in computer science, statistics, actuarial science, or other disciplines. They must satisfy all requirements of program A, program B, or program C in mathematics as well as all requirements for the second major. For more information, consult an advisor and see Declaring or Changing a Major on the College of Liberal Arts and Sciences website.

Transfer from Engineering to Mathematics

Requirements
The Bachelor of Science with a major in mathematics requires a minimum of 120 s.h., including at least 44-47 s.h. (13-14 courses) of work for the major. Total credit for the major depends on a student’s choice of program A, B, or C. Students must maintain a g.p.a. of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences GE CLAS Core.

All students complete the post-calculus mathematics requirement, the upper-level mathematics requirement, and the requirements for program A, B, or C.

For policies concerning transfer credit, correspondence credit, credit by examination, cumulative grade-point average, general rules relating to regression and duplication, and so forth, see For Current Students on the College of Liberal Arts and Sciences website. For more information on admission, financial support, employment opportunities, the faculty, facilities, and other topics, visit the University of Iowa and Department of Mathematics website.

The B.S. with a major in mathematics (program A, B, or C) requires the following course work.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Program Requirements (semester hours vary in program A, B, or C selection)</td>
<td>44-56</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>44-56</td>
</tr>
</tbody>
</table>

Post-Calculus Mathematics Requirement
Students majoring in mathematics must earn at least 15 s.h. in post-calculus mathematical sciences courses offered by the University of Iowa; students may not count transfer courses or credit by exam toward this requirement. At least 12 s.h. of the required 15 s.h. in post-calculus courses must be earned in Department of Mathematics courses (prefix MATH) or in courses cross-listed with the department.

Post-calculus courses in the Department of Mathematics are numbered 2000 or above, excluding these:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:3700</td>
<td>Introduction to Matrix Theory</td>
<td>3</td>
</tr>
<tr>
<td>MATH:3750</td>
<td>Classical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH:3995</td>
<td>Topics in Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH:3996</td>
<td>Individual Study and Honors in Mathematics</td>
<td>arr.</td>
</tr>
<tr>
<td>MATH:3997</td>
<td>Readings in Mathematics</td>
<td>arr.</td>
</tr>
<tr>
<td>MATH:4010</td>
<td>Basic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH:4020</td>
<td>Basic Abstract Algebra</td>
<td>3</td>
</tr>
</tbody>
</table>

Post-calculus courses offered by the Department of Computer Science, and the Department of Statistics and Actuarial Science must have a calculus prerequisite.

Upper-Level Mathematics Requirement
Mathematics majors must take at least two upper-level mathematics courses for the B.S. degree. Upper-level mathematics courses include MATH:3900 Introduction to Mathematics Research and courses numbered 4000 or above, excluding these:
No courses from other departments can be counted as upper-level mathematics courses, unless they are cross-listed with an upper-level mathematics course (prefix MATH).

**Program A**

Program A is primarily for students who plan to work in business or government or to pursue graduate study in mathematics.

**Program A: Core Courses**

Students must complete a two-semester sequence of calculus I-II. Advanced placement credit, CLEP credit, and credit granted through the Mathematics Incentive Program is accepted for all or part of the calculus requirement.

Students complete the following core courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1850 &amp; MATH:1860</td>
<td>Calculus I-II</td>
<td>8</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH:3600</td>
<td>Introduction to Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH:3720</td>
<td>Introduction to Abstract Algebra I</td>
<td>4</td>
</tr>
<tr>
<td>MATH:3770</td>
<td>Fundamental Properties of Spaces and Functions I</td>
<td>4</td>
</tr>
</tbody>
</table>

More advanced courses may be substituted for the core courses, with Department of Mathematics approval.

**Program A: Electives**

Students complete six electives (18-24 s.h.), including at least three upper-level mathematics courses.

**Mathematics**

Students may choose from mathematics courses numbered MATH:2150 Foundations of Geometry, MATH:3800 Elementary Numerical Analysis or courses above MATH:3800, excluding MATH:4010 Basic Analysis and MATH:4020 Basic Abstract Algebra.

**Computer Science**

Students may choose computer science courses numbered CS:1210 through CS:4740, excluding CS:3210 Programming Languages and Tools, CS:3910 Informatics Project, CS:3980 Topics in Computer Science I, and CS:3990 Honors in Computer Science or Informatics.

**Statistics and Actuarial Science**


Among the courses listed above, only one of the following three courses, STAT:2020, STAT:3100, or STAT:3120 can be counted; although none of these courses can be counted if taken after STAT:4100.

Students may choose actuarial science courses numbered ACTS:3080 Mathematics of Finance I and ACTS:4130 through ACTS:4380.

Consult the department’s Handbook for Undergraduate Majors for a complete list of electives in computer science, and statistics and actuarial science.

**Program B**

Program B is intended for students seeking secondary school teaching licensure. Students who wish to earn teaching licensure in addition to earning a Bachelor of Science with a major in mathematics also must complete the Teacher Education Program (TEP); see “Teacher Licensure” below.

**Program B: Core Courses**

Students must complete a two-semester sequence of calculus I-II. Advanced placement credit, CLEP credit, and credit earned through the Mathematics Incentive Program is accepted for part or all of the calculus requirement. Students complete the following core courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1850 &amp; MATH:1860</td>
<td>Calculus I-II</td>
<td>8</td>
</tr>
<tr>
<td>MATH:2150</td>
<td>Foundations of Geometry</td>
<td>3</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH:3720</td>
<td>Introduction to Abstract Algebra I</td>
<td>4</td>
</tr>
<tr>
<td>MATH:3770</td>
<td>Fundamental Properties of Spaces and Functions I</td>
<td>4</td>
</tr>
<tr>
<td>MATH:4050</td>
<td>Introduction to Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>or MATH:4060</td>
<td>Discrete Mathematical Models</td>
<td></td>
</tr>
<tr>
<td>CS:1210</td>
<td>Computer Science I: Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>STAT:3120</td>
<td>Probability and Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

More advanced courses may be substituted for the core courses, with Department of Mathematics approval.

**Program B: Electives**

Students in Program B must take at least three additional Department of Mathematics post-calculus courses (9-12 s.h.), including two chosen from MATH:3900 Introduction to Mathematics Research and courses numbered 4000 or above, excluding MATH:4010 Basic Analysis and MATH:4020 Basic Abstract Algebra. The post-calculus courses must be chosen avoiding duplication and regression with the core math courses, particularly when engineering mathematics courses are considered. With the department’s approval, capable students are encouraged to substitute more advanced courses in the same subject area for any of the electives. The Handbook for Undergraduate Majors offers advice on course selection.

**Teacher Licensure**

Mathematics majors interested in earning licensure to teach in elementary and/or secondary schools must complete the College of Education’s Teacher Education Program (TEP) in addition to the requirements for the major and all
requirements for graduation. The TEP requires several College of Education courses and student teaching. Contact the Office of Student Services for details.

Students must satisfy all degree requirements and complete TEP licensure before degree conferral.

Students who wish to earn teacher licensure should choose program B; see "Program B" above.

Program C

Program C enables students to specialize in a mathematics-related subtrack, such as the mathematics of making optimal business decisions, risk management and insurance, economics, finance, physics, chemistry, biostatistics, biomathematics, computer science, statistics and actuarial science, or all departments within the College of Engineering. In consultation with the faculty advisor, students build on the Program C core to prepare a subtrack plan of study tailor-made to their interests and academic or career goals. The proposed study plan must be approved by the Department of Mathematics.

Students must file their subtrack plan of study before they begin their senior year; they use the Program C Plan of Study form, available at the Department of Mathematics website. The Handbook for Undergraduate Majors has templates for choosing electives in several areas; students may use these or propose other plans.

Program C: Core Courses

Students must complete a two-semester sequence of calculus I-II. Advanced placement credit, CLEP credit, and credit earned through the Mathematics Incentive Program is accepted for part or all of the calculus requirement. Students complete the following core math courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:1850 &amp; MATH:1860</td>
<td>Calculus I-II</td>
<td>8</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH:3720 or MATH:3770</td>
<td>One additional &quot;proofs&quot; course such as</td>
<td>4</td>
</tr>
</tbody>
</table>

Some subtracks require additional core courses from other departments; consult the Handbook for Undergraduate Majors or the Department of Mathematics website. Additional non-math core courses count toward electives (see "Program C: Electives" below). Students who specialize in engineering should consult the Department of Mathematics.

More advanced courses may be substituted for the core courses, with Department of Mathematics approval.

Program C: Electives

Students choose eight or nine approved electives. All electives must be offered for 3-4 s.h. of credit. At least three of the electives must be post-calculus mathematics courses (prefix MATH). All B.S. mathematics majors must take 15 s.h. of post-calculus mathematics courses and at least two upper-level mathematics courses; see "Post-Calculus Mathematics Requirement" and "Upper-Level Mathematics Requirement" above.

Some subtracks require additional core courses from other departments (see "Program C: Core Courses" above); the additional non-math core courses count toward electives. For a list of suggested subtracks and restrictions on electives in each subtrack, consult the Handbook for Undergraduate Majors or the Department of Mathematics website.

Honors

Honors in the Major

Students majoring in mathematics have the opportunity to graduate with honors in the major. Departmental honors students must complete all requirements for the major and must maintain a g.p.a. of at least 3.40 in the major and overall. To graduate with honors in the major, they must complete one of the options below.

Option 1: complete four of the courses below, including a two-course sequence, with a B average for the four courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH:4090</td>
<td>A Rigorous Introduction to Abstract Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH:4210</td>
<td>Foundations of Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH:5000 &amp; MATH:5010</td>
<td>Abstract Algebra I-II</td>
<td>8</td>
</tr>
<tr>
<td>MATH:5200 &amp; MATH:5210</td>
<td>Introduction to Analysis I-II</td>
<td>8</td>
</tr>
<tr>
<td>MATH:5400 &amp; MATH:5410</td>
<td>General Topology - Introduction to Smooth Manifolds</td>
<td>8</td>
</tr>
<tr>
<td>MATH:5600 &amp; MATH:5700</td>
<td>Nonlinear Dynamics with Numerical Methods - Partial Differential Equations with Numerical Methods</td>
<td>8</td>
</tr>
</tbody>
</table>

Mathematics courses (prefix MATH) numbered 6000 or above, to be approved by the mathematics honors advisor in advance.

Option 2: complete an honors project comparable to taking several of the courses above, approved by the mathematics honors advisor and the thesis supervisor. Students who choose this option typically register for MATH:3996 Individual Study and Honors in Mathematics for 3 s.h. or more. They must find a faculty member willing to supervise their project; contact the department for help finding a project supervisor. Contact the Department of Mathematics honors advisor for more information.

University of Iowa Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the University’s honors program. Honors in mathematics is awarded by the Department of Mathematics and is separate from the University of Iowa Honors Program. Membership in the UI Honors Program is not required to earn honors in the mathematics major. However, honors in mathematics can be applied toward UI Honors Program requirements.
Academic Plans

Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the University's Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Note: Many mathematics courses must be taken in sequence, so students must begin major requirements as early as possible, and individual plans of study must be constructed carefully. The major typically requires 13 or 14 courses.

Students must choose program A, B, or C by the end of the third semester and must remain in their chosen program until they graduate in order to stay on track for the four-year graduation plan.

Before the third semester begins: course work in the major through second-semester calculus

Before the fifth semester begins: three or four more courses in the major

Before the seventh semester begins: three or four more courses in the major and at least 90 s.h. earned toward the degree

Before the eighth semester begins: two or three more courses in the major

During the eighth semester: enrollment in all remaining course work in the major, all remaining GE CLAS Core courses, and a sufficient number of semester hours to graduate

Sample Plans of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Mathematics, B.S.

- Program A [p. 4]
- Program B [p. 5]

Program A

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year Fall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RHET:1030 or ENGL:1200</td>
<td>Rhetoric or The Interpretation of Literature</td>
<td>3 - 4</td>
</tr>
<tr>
<td>MATH:1850</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>GE CLAS Core: Values and Culture</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CSI:1600</td>
<td>Success at Iowa</td>
<td>2</td>
</tr>
<tr>
<td>Elective course</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Hours</td>
<td>14-15</td>
<td></td>
</tr>
</tbody>
</table>

Spring

ENGL:1200 or RHET:1030 The Interpretation of Literature 3 - 4
MATH:1860 Calculus II 4
MATH:2700 Introduction to Linear Algebra 4
GE CLAS Core: Diversity and Inclusion 3
Elective course 1

Hours 15-16

Second Year

Fall

GE CLAS Core: World Languages First Level Proficiency or elective course 4 - 5
MATH:3600 Introduction to Ordinary Differential Equations 3
MATH:2850 Calculus III 4
GE CLAS Core: Social Sciences 3
Elective course 2

Hours 16-17

Spring

GE CLAS Core: World Languages Second Level Proficiency or elective course 4 - 5
Major: required post-calculus math elective course 3
MATH:3720 Introduction to Abstract Algebra I 4
GE CLAS Core: Historical Perspectives 3
Elective course 2

Hours 16-17

Third Year

Fall

GE CLAS Core: World Languages Second Level Proficiency or elective course 4 - 5
MATH:3770 Fundamental Properties of Spaces and Functions I 4
Major: required post-calculus math elective course 3 - 4
GE CLAS Core: Natural Sciences with Lab 4
Elective course 1

Hours 16-18

Spring

GE CLAS Core: World Languages Fourth Level Proficiency or elective course 4 - 5
Major: required upper-level math elective course 3
Major: required post-calculus math elective course 3 - 4
GE CLAS Core: Natural Sciences without Lab 3
Elective course 3

Hours 16-18

Fourth Year

Fall

Major: required upper-level math elective course 3
GE CLAS Core: International and Global Issues 3
GE CLAS Core: Literary, Visual, and Performing Arts 3
Elective course 3
Elective course 3

Hours 15

Spring

Major: required upper-level math elective course 3
Elective course 3
Elective course 3
Elective course 3
Program B

Course Title Hours

Academic Career

Any Semester

Program B is intended for students seeking secondary school teaching licensure. Admission to the Teacher Education Program, College of Education, is by competitive application. For information about application requirements, process, and deadlines, please consult an advisor for the College of Education.

First Year

Fall

ENGL:1200 or RHET:1030 The Interpretation of Literature or Rhetoric 3 - 4
GE CLAS Core: World Languages First Level Proficiency or elective course b 4 - 5
MATH:1850 Calculus I c 4
CSI:1600 Success at Iowa 2
Elective course d 2

Hours 15-17

Spring

RHET:1030 or ENGL:1200 Rhetoric or The Interpretation of Literature 3 - 4
MATH:1860 Calculus II 4
GE CLAS Core: World Languages Second Level Proficiency or elective course b 4 - 5
PSQF:1075 Educational Psychology and Measurement 3
GE CLAS Core: Diversity and Inclusion f 3

Hours 17-19

Summer

Exam: PRAXIS test for Teacher Education Program g

Hours 0

Second Year

Fall

GE CLAS Core: World Languages Second Level Proficiency or elective course b 4 - 5
MATH:2700 Introduction to Linear Algebra h 4
MATH:2850 Calculus III 4
EPLS:3000 Foundations of Education e 3
Elective course d 1

Admission Application: Teacher Education Program i

Hours 16-17

Spring

MATH:2150 Foundations of Geometry j 3
EDTL:3091 Secondary Education Program Orientation and Classroom Management k, l 3
EDTL:3095 Teaching Reading in Secondary Content Areas k, l 1
EDTL:3002 Technology in the Classroom k, l 2
GE CLAS Core: World Languages Fourth Level Proficiency or elective course b
GE CLAS Core: Social Sciences 3

Hours 16-17

Third Year

Fall

MATH:3720 Introduction to Abstract Algebra I 4
MATH:4050 Introduction to Discrete Mathematics m 3
EDTL:3532 Introduction and Practicum: Mathematics f 3
EDTL:4900 Foundations of Special Education e 3
GE CLAS Core: Historical Perspectives f 3

Hours 16

Spring

MATH:3770 Fundamental Properties of Spaces and Functions I 4
STAT:3120 Probability and Statistics 4
EDTL:3534 Methods: Middle School Mathematics l 3
EPLS:4180 Human Relations for the Classroom Teacher l 3
Elective course d 1

Hours 15

Fourth Year

Fall

GE CLAS Core: Literary, Visual, and Performing Arts f 3
GE CLAS Core: Natural Sciences with Lab f 4
Major: required post-calculus math elective course n 3 - 4
EDTL:4535 Methods: High School Mathematics 3
Major: required upper-level math elective course o 3 - 4

Hours 16-18

Spring

CS:1210 Computer Science I: Fundamentals h 4
GE CLAS Core: Natural Sciences without Lab f 3
GE CLAS Core: International and Global Issues $^{f}$ 3
Major: required upper-level math elective course $^{o}$ 3 - 4
Elective course $^{d}$ 2

Hours 15-16

**Fifth Year**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDTL:4087</td>
<td>Seminar; Curriculum and Student Teaching</td>
<td>3</td>
</tr>
<tr>
<td>EDTL:4091</td>
<td>Observation and Laboratory Practice in the Secondary School</td>
<td>6</td>
</tr>
<tr>
<td>EDTL:4092</td>
<td>Observation and Laboratory Practice in the Secondary School</td>
<td>6</td>
</tr>
</tbody>
</table>

| Total Hours 141-150 |

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a Completion of the Mathematics Program B.B.S. major requirements (41-42 s.h.), the Teacher Education Program requirements (39 s.h.), and all general education requirements (including World Languages) (48-52 s.h.) exceeds the minimum 120 s.h. expected for a bachelor's degree in CLAS. Students pursuing this program of study should expect to take higher than average number (15 s.h.) of semester hours per term, take summer classes, and/or extend graduation time frame beyond four years.

b Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.

c Enrollment in math courses requires completion of a placement exam.

d Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.

e Course required for the Teacher Education Program and may be completed prior to admission to the College of Education.

f GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.

g Required for admission into the Teacher Education Program.

h Course may also be offered in the summer session.

i Application deadlines can be found on the College of Education's website. Admission is selective and a priority deadline exists.

j Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.

k Course must be completed during the first semester of enrollment in the Teacher Education Program.

l Course required for the Teacher Education Program and may only be completed after admission to the College of Education.

m Students must complete MATH:4050, a fall-only course, or MATH:4060, a spring-only course.

n Post-calculus courses are numbered 2000 or above, excluding: MATH:3700, MATH:3750, MATH:3995, MATH:3996, MATH:3997, MATH:4010, and MATH:4020.

o Upper-level electives include MATH:3900 or any MATH prefix courses numbered 4040 or higher.

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**Career Advancement**

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.