Mathematics, B.S.

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, biostatistics, business, computer science, economics, engineering, finance, 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.

**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.

**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 44-56 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 Undergraduate Students on the College of Liberal Arts and Sciences website.

For information about duplication, regression, and use of the second-grade-only option for mathematics courses, contact the Department of Mathematics or visit the Department of Mathematics website. The website also provides details about schedule planning and career options for mathematics students. For more information on admission, financial support, employment opportunities, the faculty, facilities, and other topics, visit the Department of Mathematics or the University of Iowa website.

The B.S. with a major in mathematics (Program A, B, or C) requires the following coursework.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Requirements (semester hours vary in Program A, B, or C selection)</td>
<td>44-56</td>
<td></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>4</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 (three in Program A) for the B.S. degree. Upper-level mathematics courses include MATH:3900 Introduction to Mathematics Research and courses numbered 4000 or above, excluding these:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>MATH:4120</td>
<td>History of Mathematics</td>
<td>3</td>
</tr>
</tbody>
</table>

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 are 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 of Mathematics website 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 are 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 Department of Mathematics website offers advice on course selection.

Teacher Licensure
Students interested in teaching in elementary and/or secondary schools should seek admission to the Teacher Education Program (TEP) in the College of Education.

To qualify for licensure in secondary teaching, students in the TEP complete a degree in education as well as a related College of Liberal Arts and Sciences degree. See Teacher Education Program Application and Admission on the College of Education website for details on requirements and deadlines for applying to the College of Education and about TEP choices of majors leading to licensure.

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 website 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 are 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>One additional &quot;proofs&quot; course such as MATH:3720 or MATH:3770</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Some subtracks require additional core courses from other departments; consult 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 website.

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 at the University of Iowa 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 Department of Mathematics website.

Combined Programs
B.S./M.S. in Business Analytics (Career Subprogram)
Students majoring in mathematics who are interested in earning a master's degree in business analytics with a career subprogram may apply to the combined B.S./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to begin the study of business analytics before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For information about the business analytics program, see the M.S. in business analytics (career) in the Tippie College of Business section of the Catalog.

B.S./M.S. in Finance
Students majoring in mathematics who are interested in earning a master's degree in finance may apply to the combined B.S./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to begin the study of finance before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For information about the finance program, see the M.S. in finance (Tippie College of Business) section of the Catalog.

Honors
Honors in the Major
Students majoring in mathematics have the opportunity to graduate with honors in the major. Students must maintain a cumulative University of Iowa g.p.a. of at least 3.33, as required by the College of Liberal Arts and Sciences; additionally, students must maintain a cumulative g.p.a. of at least 3.40 in the major, a g.p.a. set by the Department of Mathematics.

To graduate with honors in the major, students also must complete one of the options below.

Option 1
Students complete four of the courses below, including a two-course sequence; and at least one 5000 level course, 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:3900</td>
<td>Introduction to Mathematics Research</td>
<td>3</td>
</tr>
<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:4610</td>
<td>Continuous Mathematical Models</td>
<td>3</td>
</tr>
<tr>
<td>MATH:4750</td>
<td>Introduction to Mathematical Biology</td>
<td>3</td>
</tr>
</tbody>
</table>
### Mathematics, B.S.

**MATH:4820** Optimization Techniques 3

**MATH:5000 & MATH:5010** Abstract Algebra I-II 8

**MATH:5200 & MATH:5210** Introduction to Analysis I-II 8

**MATH:5400 & MATH:5410** Fundamental Groups and Covering Spaces - Introduction to Smooth Manifolds 8

**MATH:5600 & MATH:5700** Nonlinear Dynamics with Numerical Methods - Introduction to Partial Differential Equations 8

**MATH:5750 & MATH:5760** Mathematical Biology I-II 8

**MATH:5800 & MATH:5810** Fundamental Groups and Covering Spaces - Introduction to Smooth Manifolds 8

**MATH:5000 & MATH:5010** Abstract Algebra I-II 8

**MATH:5200 & MATH:5210** Introduction to Analysis I-II 8

**MATH:5400 & MATH:5410** Fundamental Groups and Covering Spaces - Introduction to Smooth Manifolds 8

**MATH:5600 & MATH:5700** Nonlinear Dynamics with Numerical Methods - Introduction to Partial Differential Equations 8

**MATH:5750 & MATH:5760** Mathematical Biology I-II 8

**MATH:5800 & MATH:5810** Fundamental Groups and Covering Spaces - Introduction to Smooth Manifolds 8

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

**Total Hours** 68

### Option 2

Students 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.

### Career Advancement

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

### 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.

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:** coursework 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 coursework 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>RHET:1030</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>
</tbody>
</table>

**Hours** 14-15

**Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHET:1030</td>
<td>Rhetoric or The Interpretation of Literature</td>
<td>3 - 4</td>
</tr>
<tr>
<td>MATH:1860</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>GE CLAS Core: Diversity and Inclusion</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Elective course</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Hours** 15-16
### Second Year

#### Fall
- **GE CLAS Core: World Languages First Level**
  - Proficiency or elective course  
  - Hours: 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  
  - Hours: 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  
  - Hours: 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** 3
- **Elective course** 1

**Hours:** 16-18

#### Spring
- **GE CLAS Core: World Languages Fourth Level**
  - Proficiency or elective course  
  - Hours: 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
- **Elective course** 3

Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)

**Hours:** 15

**Total Hours:** 123-131

---

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

**b** 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.

**c** 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.

**d** 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.

**e** Students must earn at least 15 s.h. in post-calculus mathematical sciences courses offered by the University of Iowa. Post-calculus courses are numbered 2000 or above, excluding: MATH:3700, MATH:3750, MATH:3995, MATH:3996, MATH:3997, MATH:4010, and MATH:4020. Required mathematical electives must include at least three upper-level math courses (prefix MATH). Some statistics, actuarial science and computer sciences courses can be included among post-calculus electives only. See advisor for list of acceptable courses in MATH, STAT, ACTS, and CS.

**f** Required mathematical electives must include at least three upper-level math courses. These include: MATH:3900 and math courses (MATH prefix) numbered 4000 and higher, but not MATH:4010, MATH:4020 and MATH:4120. Each upper-level math course is offered at most once per year; choose when to complete the upper-level requirement according to spring or fall offerings for desired courses.

**g** Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.

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**Program B**

This sample plan is currently being updated and will be added at a later date.