Mathematics, BS

Requirements

The Bachelor of Science with a major in mathematics requires a minimum of 120 s.h., including at least 41–56 s.h. of work for the major. Total credit for the major depends on a student's choice of Program A, B, C, or a related specialization (business, data sciences, or physical sciences). Students must maintain a grade-point average 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, or a related specialization. Students must complete a two-semester sequence of MATH:1850 Calculus I and MATH:1860 Calculus II. Students in certain subtracks or Program C may be able to substitute another two-course calculus sequence; see information for specific specializations below. Advanced placement credit, CLEP credit, and credit granted through the Mathematics Incentive Program are accepted for all or part of the calculus requirement.

Students may count up to 56 s.h. of Department of Mathematics coursework (prefix MATH) toward credit required for the Bachelor of Science degree. 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 BS with a major in mathematics requires the following coursework.

Requirements	Hours
Post-Calculus Mathematics Courses	
Upper-Level Mathematics Courses	
Program Requirements	41-56

Post-Calculus Mathematics Courses

At least 15 s.h. of post-calculus mathematics courses (prefix MATH) applied toward the major must be completed at the University of Iowa; students may not count transfer courses or credit by exam toward this requirement.

Post-calculus courses in the Department of Mathematics are numbered 2000 or above, excluding MATH:3700, MATH:3996, MATH:3997, MATH:4010, and MATH:4020.

Upper-Level Mathematics Courses

Students must take at least two upper-level mathematics courses (three in Program A) for the BS degree. Upper-level mathematics courses include MATH:3900 Introduction to Mathematics Research and courses numbered 4000 or above, excluding MATH:4010, MATH:4020, and MATH:4120.

No courses from other departments can be counted as upper-level mathematics courses unless they are cross-referenced 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 complete the following core courses.

Course #	Title	Hours
MATH:1850 & MATH:1860	Calculus I and Calculus II	8
MATH:2700	Introduction to Linear Algebra	4
MATH:2850	Calculus III	4
MATH:3600	Introduction to Ordinary Differential Equations	3
MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis	4

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 four courses in the Department of Mathematics (prefix MATH). Of these four courses, at least three must be upper-level mathematics courses.

Mathematics

Students may choose from mathematics courses numbered MATH:2150, MATH:3800, or courses above MATH:3800, excluding MATH:4010 and MATH:4020.

Computer Science

Students may choose computer science courses numbered CS:1210 through CS:4740, excluding CS:3210, CS:3910, CS:3980, and CS:3990.

Statistics and Actuarial Science

Students may choose statistics courses numbered STAT:2020, STAT:3100 through STAT:4740, or STAT:5100 through STAT:5120, excluding STAT:3510, STAT:4143, and STAT:4200.

Among the courses previously listed, only one of the following three courses can be counted toward the elective requirement: STAT:2020, STAT:3100, or STAT:3120. None of these courses can be counted as credit earned toward graduation if taken after STAT:4100 owing to regression policies.

Students may choose actuarial science courses numbered ACTS:3080 and ACTS:4130 through ACTS:4380.

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 must also complete the Teacher Education Program (TEP); see the section titled "Teacher Licensure."

Program B: Core Courses

Students complete the following core courses.

Course #	Title	Hours
MATH:1850 & MATH:1860	Calculus I and Calculus II	8
MATH:2150	Foundations of Geometry	3
MATH:2700	Introduction to Linear Algebra	4
MATH:2850	Calculus III	4
MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis	4
MATH:4050	Introduction to Discrete Mathematics	3
or MATH:4060	Discrete Mathematical Models	
CS:1210	Computer Science I: Fundamentals	4
STAT:3120	Probability and Statistics	4

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 and courses numbered 4000 or above, excluding MATH:4010 and MATH:4020. Post-calculus courses must avoid 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 Apply 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.

Program in Math With a Related Specialization

The Department of Mathematics encourages students of other majors to take more mathematics courses and attempt a BA or BS secondary major, or a secondary degree if their first major is outside CLAS, in mathematics. The program in math with a related specialization offers a curricular path to achieve this goal. Students complete core courses, mathematics electives, and subtrack requirements.

The program in math with a related specialization enables students to declare a concentration in a mathematics-related area. Options include specializations in business (subtracks in economics, finance, and risk management and insurance), data sciences (subtracks in biostatistics, computer science, data science, and statistics and actuarial science), and physical sciences (subtracks in biochemistry, biomathematics, chemistry, and physics). Students may declare one of these three defined areas of specialization and must complete requirements for one subtrack. They may also propose other plans of study, which would be categorized under Program C. An individualized plan of study must be approved by the Department of Mathematics prior to the start of the student's final year.

Business, Data Sciences, and Physical Sciences: Core Courses

Students complete the following core mathematics courses. Students pursuing the biostatistics subtrack of the data sciences specialization should refer to the following section titled "Biostatistics Subtrack" for additional information about an alternative set of core courses. Students in the biomathematics subtrack of the physical sciences specialization should refer to the following section titled "Biomathematics Subtrack" rather than the list below.

Course #	Title	Hours
One of these sequences:		
MATH:1850 & MATH:1860	Calculus I and Calculus II	8
MATH:1550 & MATH:1560	Engineering Calculus I and Engineering Calculus II	8
Both of these:		
MATH:2700	Introduction to Linear Algebra	4
MATH:2850	Calculus III	4
One of these:		
MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis (students in the biostatistics subtrack must take MATH:3770)	4

If students complete both MATH:3720 and MATH:3770, one may count toward core courses and the other toward the elective requirement described below.

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

Business, Data Sciences, and Physical Sciences: Mathematics Electives

Students must also take four elective courses (3–4 s.h. each), including at least two upper-level math courses. Mathematics elective options include mathematics courses (prefix MATH) numbered MATH:3600–MATH:5810, excluding MATH:3700, MATH:3996, MATH:3997, MATH:4010, MATH:4020, and MATH:4120.

When a subtrack requires post-calculus mathematics courses, those courses may also count as mathematics electives, with the exception of the physics subtrack of the physical sciences

specialization. See the following section titled "Physics Subtrack" for more information.

Business Specialization

Economics Subtrack

The business specialization with an economics subtrack requires the following four courses.

Course #	Title	Hours
All of these:		
CS:1210	Computer Science I: Fundamentals	4
ECON:3100	Intermediate Microeconomics	3
ECON:3150	Intermediate Macroeconomics	3
STAT:3120	Probability and Statistics	4

Finance Subtrack

The business specialization with a finance subtrack requires the following four courses.

Course #	Title	Hours
This course:		
FIN:3000	Introductory Financial Management	3
One of these:		
FIN:3200	Investment Management	3
FIN:3300	Corporate Finance	3
Two of these:		
ACCT:3020	Financial Accounting and Reporting	3
FIN:3200	Investment Management (if not taken for the previous requirement)	3
FIN:3300	Corporate Finance (if not taken for the previous requirement)	3
FIN:3400	Principles of Risk Management and Insurance	3
A 3-4 s.h. finance course (prefix FIN) that counts toward the BBA in finance		3,4

Risk Management and Insurance Subtrack

The business specialization with a risk management and insurance subtrack requires the following four courses.

Course #	Title	Hours
Both of these:		
FIN:3000	Introductory Financial Management	3
FIN:3400	Principles of Risk Management and Insurance	3
Two of these:		
FIN:4420	Property and Liability Insurance	3
FIN:4430	Life and Health Insurance	3
FIN:4440	Employee Benefit Plans	3
FIN:4450	Risk Modeling	3

Data Sciences Specialization

Biostatistics Subtrack

Biostatistics: Alternative Core Courses

Students may complete five core courses as previously listed, or they may complete the six core courses listed below.

Course #	Title	Hours
All of these:		
MATH:1550	Engineering Calculus I	4
MATH:1560	Engineering Calculus II	4
MATH:2550	Engineering Matrix Algebra	2
MATH:2560	Engineering Differential Equations	3
MATH:3550	Engineering Vector Calculus	3
MATH:3770	Foundations of Analysis	4

Biostatistics: Additional Required Courses

The data sciences specialization with a biostatistics subtrack requires the following eight courses.

Course #	Title	Hours
This course:		
CPH:1400	Fundamentals of Public Health	3
Four of these, with at least two courses numbered 4000 or above:		
MATH:3600	Introduction to Ordinary Differential Equations (if student has not taken MATH:2560 as a core course)	3
MATH:3800	Introduction to Numerical Methods	3
MATH:4220	Fourier Analysis and Applications	3
MATH:4700	Partial Differential Equations and Applications	3
MATH:4820	Optimization Techniques	3
Three of these, with at least one course in biostatistics (prefix BIOS) and at least one course in statistics (prefix STAT):		
BIOS:4120	Introduction to Biostatistics	3
BIOS:5120	Regression Modeling and ANOVA in the Health Sciences	3
BIOS:5310	Research Data Management	3
BIOS:5710	Biostatistical Methods I	4
BIOS:5720	Biostatistical Methods II	4
BIOS:5730	Biostatistical Methods in Categorical Data	3
STAT:2010	Statistical Methods and Computing	3
STAT:3200	Applied Linear Regression	3
STAT:3210	Experimental Design and Analysis	3
STAT:4100	Statistical Inference I	3
STAT:4101	Statistical Inference II	3

Computer Science Subtrack

The data sciences specialization with a computer science subtrack requires four electives in computer science (prefix

CS) numbered CS:1210–CS:4740, excluding CS:2110, CS:3010, CS:3210, CS:3910, CS:3980, CS:3990, and CS:3999.

Data Science Subtrack

The data sciences specialization with a data science subtrack requires the following four courses.

Course #	Title	Hours
Computer Science Electives		
Two of these:		
CS:3330	Algorithms	3
CS:4400	Database Systems	3
CS:4470	Health Data Analytics	3
CS:5430	Machine Learning	3
CS:5630	Cloud Computing Technology	3
May include one of these:		
CS:1210	Computer Science I: Fundamentals	4
CS:2110	Programming for Informatics	4
CS:2230	Computer Science II: Data Structures	4
Statistics Electives		
Two of these:		
STAT:2010	Statistical Methods and Computing	3
STAT:3100	Introduction to Mathematical Statistics I	4
STAT:3200	Applied Linear Regression	3
STAT:3210	Experimental Design and Analysis	3
STAT:4520	Bayesian Statistics	3
STAT:4540	Statistical Learning	3
STAT:4560	Statistics for Risk Modeling I	3
STAT:4580	Data Visualization and Data Technologies	3
STAT:5810	Research Data Management	3

Statistics and Actuarial Science Subtrack

The data sciences specialization with a statistics and actuarial science subtrack requires the following four courses.

Course #	Title	Hours
Four of these:		
ACTS:3080	Mathematics of Finance I	3
ACTS:4130	Quantitative Methods for Actuaries	3
ACTS:4150	Fundamentals of Short-Term Actuarial Mathematics	3
ACTS:4180	Life Contingencies I	3
ACTS:4280	Life Contingencies II	3
STAT:2010	Statistical Methods and Computing	3
STAT:3101	Introduction to Mathematical Statistics II	3
STAT:3200	Applied Linear Regression	3
STAT:3210	Experimental Design and Analysis	3
STAT:3620	Quality Control	3
STAT:4100	Statistical Inference I	3
STAT:4101	Statistical Inference II	3
STAT:4520	Bayesian Statistics	3
STAT:4740	Large Data Analysis	3
STAT:5100	Statistical Inference I	3
STAT:5101	Statistical Inference II	3
STAT:5120	Mathematical Methods for Statistics	3
May count one of these if taken before STAT:4100		
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences	3
STAT:3100	Introduction to Mathematical Statistics I	4
STAT:3120	Probability and Statistics	4

Physical Sciences Specialization

Biochemistry Subtrack

The physical sciences specialization with a biochemistry subtrack requires the following five courses.

Course #	Title	Hours
Both of these:		
MATH:3600	Introduction to Ordinary Differential Equations	3
BMB:4240	Biophysics and Advanced Biochemistry	3
Three electives from these:		
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
BMB:4310	Computational Biochemistry	3
May include one of these:		
CHEM:4430	Principles of Physical Chemistry	3
CHEM:4431	Chemical Thermodynamics	3
CHEM:4432	Quantum Mechanics and Chemical Kinetics	3
Up to 3 s.h. from this course:		
BMB:4999	Advanced Undergraduate Biochemistry Research (requires departmental approval in advance)	arr.

Biomathematics Subtrack

Biomathematics: Core Courses

Students in the biomathematics subtrack should complete one of the two sets of core courses below for a total of at least 23 s.h.

Course #	Title	Hours
Option 1		
One of these sequences:		
MATH:1850 & MATH:1860	Calculus I and Calculus II	8
MATH:1550 & MATH:1560	Engineering Calculus I and Engineering Calculus II	8
All of these:		
MATH:2700	Introduction to Linear Algebra	4
MATH:2850	Calculus III	4

MATH:3600	Introduction to Ordinary Differential Equations	3
MATH:3770	Foundations of Analysis	4

Course #	Title	Hours
Option 2		
All of these:		
MATH:1550	Engineering Calculus I	4
MATH:1560	Engineering Calculus II	4
MATH:2550	Engineering Matrix Algebra	2
MATH:2560	Engineering Differential Equations	3
MATH:3550	Engineering Vector Calculus	3
MATH:3770	Foundations of Analysis	4
An additional post-calculus mathematics course (prefix MATH) as previously defined in this section of the catalog, excluding MATH:2550, MATH:2560, MATH:2700, MATH:2850, MATH:3550, MATH:3600, MATH:3770, MATH:3800, MATH:4060, and MATH:4750		3-4

Biomathematics: Additional Required Courses

The physical sciences specialization with a biomathematics subtrack requires the following eight courses.

Course #	Title	Hours
Required Courses		
All of these:		
MATH:3800	Introduction to Numerical Methods	3
MATH:4060	Discrete Mathematical Models	3
MATH:4750	Introduction to Mathematical Biology	3
STAT:3120	Probability and Statistics	4
Elective Courses		
Two electives from these, with at least one course numbered 3000 or above:		
BIOL:2512	Fundamental Genetics	4
BIOL:2673	Ecology	3
BIOL:3233	Introduction to Developmental Biology	3
BIOL:3253	Neurobiology I	4
BIOL:3254	Neurobiology II	4
BIOL:3314	Genomics	3
BIOL:3343	Animal Physiology	3
BIOL:3713	Molecular Genetics	4
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
BMB:4240	Biophysics and Advanced Biochemistry	3
BME:2500	Biomaterials and Biomechanics	4
CHEM:2210	Organic Chemistry I	3
At most one of these (if selected, courses in this area may not count as an additional elective):		
BIOL:3172	Evolution	4
BIOL:3373	Human Population Genetics and Variation	3
At most one of these (if selected, courses in this area may not count as an additional elective):		
BIOL:2753	Introduction to Neurobiology	3
PSY:2701	Introduction to Behavioral Neuroscience	4
At most one of these (if selected, courses in this area may not count as an additional elective):		
BIOL:4213	Bioinformatics	4
BIOL:4386	Introduction to Scientific Computing for Biologists	3
BMB:3310	Practical Data Science and Bioinformatics	3
BMB:4310	Computational Biochemistry	3
Additional Elective		
One of these:		
A previously listed elective option numbered 3000 or above, if not used to satisfy the preceding requirement.		3-4
Computer science course (prefix CS) taken for at least 3 s.h. and numbered 2000 or above		3-4
Mathematics course (prefix MATH) numbered MATH:3000-MATH:5899, excluding MATH:3550, MATH:3600, MATH:3700, MATH:3770, MATH:3800, MATH:3996, MATH:3997, MATH:4010, MATH:4020, MATH:4060, and MATH:4750		3-4

Chemistry Subtrack

The physical sciences specialization with a chemistry subtrack requires the following five courses.

Course #	Title	Hours
Both of these:		
MATH:3600	Introduction to Ordinary Differential Equations	3
CHEM:3250	Inorganic Chemistry	3
Three of these:		
CHEM:3110	Equilibria and Electrochemistry	3
CHEM:3120	Spectroscopy and Separations	3
CHEM:4430	Principles of Physical Chemistry	3
CHEM:4431	Chemical Thermodynamics	3
CHEM:4432	Quantum Mechanics and Chemical Kinetics	3
CHEM:4480	Introduction to Molecular Modeling	3
CHEM:5114	Chemical Systems Modeling	3
At most one of these:		
CHEM:3430	Analytical Measurements	3
CHEM:3440	Physical Measurements	3
CHEM:4450	Synthesis and Measurement	3

Physics Subtrack

The physical sciences specialization with a physics subtrack requires the following four courses. If students complete both MATH:3720 and MATH:3770, one may count toward core courses and the other toward this subtrack.

Course #	Title	Hours
Two of these:		
PHYS:3710	Intermediate Mechanics	3
PHYS:3730	Statistical Physics	3
PHYS:3741	Introduction to Quantum Mechanics I	3
PHYS:3742	Introduction to Quantum Mechanics II	3
PHYS:3811	Electricity and Magnetism I	3
PHYS:3812	Electricity and Magnetism II	3
One of these:		
MATH:3600	Introduction to Ordinary Differential Equations	3
MATH:3800	Introduction to Numerical Methods	3
MATH:4200	Complex Variables	3
One of these, which will not count toward the mathematics electives:		
MATH:3720	Introduction to Abstract Algebra	4
or MATH:3770	Foundations of Analysis	
MATH:3900	Introduction to Mathematics Research	3
Mathematics course (prefix MATH) numbered MATH:4000-MATH:5899, excluding MATH:4010, MATH:4020, and MATH:4120		3-4
Physics course (prefix PHYS) taken for at least 3 s.h. and numbered PHYS:3000-PHYS:4998, excluding PHYS:3756, PHYS:3850, PHYS:4750, and PHYS:4990		

Program C: Core Courses

Students complete the following core mathematics courses.

Course #	Title	Hours
One of these sequences:		
MATH:1850 & MATH:1860	Calculus I and Calculus II	8
MATH:1550 & MATH:1560	Engineering Calculus I and Engineering Calculus II	8
One of these groups:		
MATH:2700 & MATH:2850	Introduction to Linear Algebra and Calculus III	8
MATH:2550 & MATH:2560 & MATH:3550	Engineering Matrix Algebra and Engineering Differential Equations and Engineering Vector Calculus	8
One of these:		
MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis	4

If students complete both MATH:3720 and MATH:3770, one may count toward core courses and the other toward the elective requirement described below.

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

Program C: Electives

Students choose at least eight electives beyond the core courses, including four mathematics elective courses (12-16 s.h.), at least two of which must be upper-level math courses numbered MATH:3900 or numbered 4000 or above. Mathematics elective options include mathematics courses (prefix MATH) numbered MATH:3600–MATH:5810, excluding MATH:3700, MATH:3996, MATH:3997, MATH:4010, MATH:4020, and MATH:4120. Only one of MATH:2560 or MATH:3600 may be counted toward the major requirements.

All electives must be offered for 3–4 s.h. The individualized area of specialization should be in a subject that is math-related and should demonstrate a progression of learning in that discipline. At least some of the proposed electives must be upper-level for that course subject. Students must propose their plan of study before they begin their final year. Individualized plans of study must be approved by the Department of Mathematics.